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Communication and Public Health Challenges in Europe

Specialised Journalism, Sources and Media Coverage
in Times of Anti-Vaccine Lobby

D O C T O R A L   T H E S I S

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Communication and Public Health Challenges in Europe

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To my family

International Doctorate Mention

This Doctoral Thesis has met the following requirements to receive the special mention as "International Doctorate".

The PhD candidate has conducted a **research stay** abroad:

- Research institution: Université Bordeaux Montaigne
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- Place: Bordeaux, France
- Period: 8th January 2018 – 8th April 2018
- Superviser: Prof. Jean-Jacques Cheval

Most of the thesis is **written in the English language** which is commonly used by the scientific community, and the PhD oral defense is done in both Spanish and English languages.

This PhD thesis has receive a **positive endorsement** by the following experts:

- Dr. Angeliki Gazi, ass. professor, Department of Communication, Media and Culture, Panteion University of Social and Political Sciences, Greece.
- Dr. Malgorzata Kolankowska, lecturer and researcher at the Institute of Journalism and Social Communication, University of Wroclaw, Poland.

Finally, a researcher based in a foreign organization has been a **Jury Member.**

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The greatest challenge to any thinker is stating the problem

in a way that will allow a solution

- Bertrand Russell

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Abbreviation list

A/H1N1	Subtype of influenza A virus
ACIP	Advisory Committee on Immunization Practices (CDC)
AEP	Spanish Association of Pediatrics
CA	Content analysis
CDC	Centers for Disease Control and Prevention
CINAHL	Cumulative Index to Nursing and Allied Health
CPS	Carmen Peñafiel Saiz
CSO	Carlos Santamaría Ochoa
DCM	Daniel Catalan Matamoros
DTaP	Diphtheria, tetanus and pertussis
DTCA	Direct-to-consumer advertisements
ECDC	European Centre for Disease Prevention and Control
EEA	European Economic Area
Hib	Haemophilus influenza type B
HIV	Human Immunodeficiency Virus
HPV	Human papilloma virus
IBSS	International Bibliography of Social Sciences
IL	Illinois
LILACS	Latin American and Caribbean Health Sciences Literature
MA	Massachusetts
MESH	Medical subject heading
MMR	Measles, mumps, and rubella
NACI	National Advisory Committee on Immunization (Canada)
NGO	Non-governmental organization
OTC	Over-the-counter
QUM	Quality use of medicines
RCT	Randomised Controlled Trial
SESPAS	Spanish Society of Public Health and Health Administration
STD	Sexually transmitted disorder
STI	Sexually transmitted infection
TV	Television
UAE	United Arab Emirates
UK	United Kingdom
US, USA	United States of America
WA	Washignton
WHO	World Health Organization

Abstract

This doctoral thesis lays under the field of health communication, and carries the European perspective where this research field is becoming highly recognised. The media are one of the leading sources of information about medicines for the public, to the extent that media sources are today more significant than health professionals in learning about new medicines and their effects. Among all types of medicines, vaccines represent one of the greatest scientific achievements in the battle against serious infectious diseases, improving quality of life and life expectancy worldwide. However, the public is not always aware of the important role of vaccines in preventing diseases mainly because lack of information, fake news, and the anti-vaccine lobby which may impact mistrust in vaccines. During the last decade, immunization uptake has decreased in some countries and new outbreaks of vaccine-preventable diseases have been declared, which has led eleven European countries to adopt mandatory childhood vaccination. In this regard, previous research has established that the media has been considered an important tool for increasing awareness, confidence and trust about vaccines, as well as motivating the public to make important decisions about their health care. However, research on public communication of vaccines is still limited regardless the importance of this scientific field in public health. The general objective of this PhD thesis was to obtain knowledge and insight concerning public communication of medicines and to determine how is media coverage of vaccines in the media reporting so that best practices are identified and recommendations are suggested. The specific objectives of this thesis are: a) Understand the field of health communication and identify research gaps in the field of public communication of medicines and vaccines; b) Examine newspaper coverage of vaccines to understand the media agenda in Spain; c) Identify journalists' sourcing to understand the extent of sources in newspaper coverage of vaccines; d) Analyse specific patterns among health journalists, and assesses whether these differ from those among generalists; e) Explore the visual content in the press coverage of vaccines; f) Analyse the association of media coverage about vaccines and immunization rates. This Thesis followed a quantitative and

qualitative method based on a set of observational studies. First, literature and systematic reviews on the field of public communication of medicines and vaccines were conducted. Second, taking into account identified research gaps, a content analysis of vaccine related was conducted in relation to the coverage in major newspapers in Spain during the period 2012 – 2017. Results revealed that previous research has mainly analysed media from USA and other English speaking countries. Our analysis in the Spanish media showed that the tone towards vaccination switched from negative to positive and neutral, showing how journalists and the media support vaccination. Sources from the government, clinician associations and companies were the most frequent. There is a need to use a more variety of sources including different perspectives in vaccine media coverage. In addition, health specialised journalists used more scientific sources, and wrote less opinion but more feature articles than generalist journalists. Visual content and imagery was frequent, especially the use of photographs under the frames 'human interest' and 'conflicts'. Finally, a significant inverse correlation was found between childhood immunization rates and the negative tone in media coverage about vaccines. The aforementioned studies shed light on key patterns about the media coverage of vaccines and journalistic practices. The study shows how journalists have become more aware about vaccines as an important public health challenge, and reflect about the relevance of the health journalism specialization to ensure objectivity and accurate vaccine media coverage. As communication strategies and media relations should be part of any vaccination program, collaboration between health professionals with the media and communication experts is required.

Resumen de la Tesis Doctoral

Introducción

Esta Tesis Doctoral se encuentra enmarcada en la especialidad de Comunicación en Salud. Este ámbito de conocimiento está actualmente en auge en Europa debido a su demostrada importancia en salud pública para el logro de sus objetivos y éxito en sus acciones tales como en campañas de prevención de enfermedades, cambio de creencias y conductas hacia otras más saludables, la gestión de brotes epidémicos y crisis sanitarias, etc. Desde esta perspectiva, se estudia la comunicación pública de medicamentos debido a la gran importancia que éstos tienen en nuestra sociedad actual y cómo la comunicación contribuye al uso prudente y a la mejora de la efectividad de estos productos sanitarios. Como estudio de caso, se ha analizado los contenidos sobre vacunas publicados en medios de comunicación debido a que actualmente constituyen un reto de salud pública en Europa motivado por la pérdida de confianza en su administración y la consiguiente bajada de las tasas de inmunización. Este hecho ha suscitado la alerta de los ministerios de salud de los gobiernos europeos así como de las organizaciones internacionales que operan en Europa en el área de salud pública como son la Comisión Europea desde el Centro Europeo de Prevención y Control de Enfermedades, así como la Oficina de la Región Europea de la Organización Mundial de la Salud. En este sentido, los medios de comunicación juegan un papel importante en relación a qué y cómo publican sobre vacunas, ya que la información publicada por los medios es, en muchas ocasiones, la primera fuente de información sanitaria de la población lo que puede influir en las decisiones que adopten sobre su salud.

El desarrollo de esta Tesis se ha basado en la realización de 10 estudios que se encuentran conectados mediante un hilo argumental y conceptual que comienza revisando las bases en investigación sobre la temática a estudiar, y continúa con

una serie de estudios observacionales para avanzar en esta área de la comunicación. El objetivo principal de esta Tesis es avanzar en el conocimiento de la comunicación en salud analizando las características de la comunicación pública de medicamentos mediante el estudio del caso sobre las vacunas.

Metodología

La metodología de investigación corresponde a un modelo mixto de diseño cuantitativo y cualitativo, de carácter observacional. A continuación se muestran los diferentes enfoques metodológicos que se han desarrollado:

a) La primera fase se basó en el análisis de la evidencia científica existente en torno a la comunicación pública de medicamentos y vacunas. Para ello, en primer lugar se procedió a realizar una revisión de la literatura sobre la investigación previa sobre periodismo en salud para analizar la bibliografía existente en relación a los públicos, formatos y efectos que pueden producir los contenidos sobre salud en los medios de comunicación. Posteriormente se usó la metodología de revisión sistemática para analizar la evidencia científica existente a nivel internacional sobre la comunicación pública de medicamentos, vacunas así como sus mensajes en los medios. Se realizaron búsquedas en bases de datos internacionales: PubMed (incluyendo MEDLINE), Scopus, International Bibliography of Social Sciences (IBSS), the Cumulative Index to Nursing and Allied Health (CINAHL) and the Latin American and Caribbean Health Sciences Literature (LILACS). Se analizaron los artículos publicados en los últimos diez años.

b) En base a los hallazgos obtenidos en las revisiones previas, y para avanzar en el conocimiento científico de esta área, se utilizó la metodología de análisis de contenido para determinar las características de la cobertura sobre vacunas en los medios de comunicación así como su posible relación con la variación de las tasas de inmunización. Para ello, se analizaron 131 contenios publicados sobre vacunas durante cinco

años (2012-2017) en las versiones impresas de los rotativos *El País* y *El Mundo,* en base a su amplia circulación en España. En cada artículo se codificaron las siguientes variables: titular, texto del artículo, género (noticia, reportaje, opinión, etc.), fecha de publicación, autor, tipo de vacuna, número de palabras, tono hacia la vacunación (positivo, neutro o negativo), encuadre (interés humano, económico, conflicto, moralidad y responsabilidad), fuentes, contenido visual (fotografía, infografía, tabla, mapa, etc.) y tasas de inmunización.

Resultados

A continuación se describen los resultados más significativos de cada uno de los estudios que forman el corpus principal de la presente Tesis Doctoral.

Estudio 1. Periodismo en salud: análisis de los públicos, formatos y efectos.
Este estudio muestra cómo la información sobre salud es un tema de interés que atrae audiencias y que cada vez es más demandado por la sociedad. Además, los estudios muestran cómo los medios de comunicación se están convirtiendo en la principal fuente de información sobre salud, incluso por delante de los propios profesionales sanitarios, lo que otorga a los medios una notable influencia sobre la salud pública. El estudio describe los diferentes públicos de la información sobre salud, los formatos mediáticos de esta información, así como sus efectos en salud pública.

Estudio 2. El uso de los medios tradicionales para la Comunicación pública de medicamentos: una revisión sistemática de características y resultados.
Se identificaron 57 estudios que analizaban la comunicación pública sobre medicamentos. De éstos, 42 estudiaron periódicos, 9 televisión y 6 la radio y una combinación de medios. El método de 'análisis de contenido' fue el más usado (n = 34), seguido de encuestas o entrevistas (n = 14) y estudios experimentales (n = 9). Los temas más frecuentes fueron publicidad, concienciación pública y administración sanitaria, y los fármacos más estudiados fueron las vacunas. Los estudios que examinaron los medios de EEUU eran los más frecuentes, seguidos

de Canadá y Reino Unido. El estudio describe implicaciones teóricos y prácticas de estos resultados para investigaciones futuras.

Estudio 3. Cómo es la Comunicación de las vacunas por los medios tradicionales: una revisión sistemática.

Teniendo en cuenta la importancia de los medios de comunicación en la percepción y actitudes hacia la vacuna, se realizó una revisión sistemática sobre los estudios que habían analizado la cobertura de las vacunas por los medios de comunicación. Se analizaron 24 estudios que mostraron que la vacuna más estudiada es la del Virus del Papiloma Humano (62%), el 87% analizó peródicos y el 62% examinó medios de Norteamérica. El 75% de los estudios encontraron mensajes negativos sobre vacunas y el 83% identificaron información incorrecta. Esta revisión propone una agenda para la futura investigación en la comunicación pública sobre vacunas.

Estudio 4. Análisis de los mensajes sobre vacunas en la prensa, televisión y radio: características y carencias en la investigación previa

Estudios previos han determinado cómo los medios construyen y encuadran mensajes sobre vacunas. El objetivo de esta revisión fue examinar 27 estudios que investigaron los mensajes sobre vacunas en los medios de comunicación. Los resultados revelaron que el 63% (n = 17) de los estudios investigaron la vacuna del virus del papiloma humano, 93% (n = 25) estudiaron periódicos, y 56% (n = 15) analizaron medios de Norteamérica. Los mensajes negativos sobre vacunas fueron más frecuentes que los positivos (n = 8 versus n = 5). Las categorías encontradas de estos mensajes se centraron en la 'calidad de la información', 'fuentes de información' y 'costes'. Todos los estudios encontraron mensajes incorrectos sobre vacunas o vacunación. Este estudio ha identificado carencias en la investigación sobre los mensajes de las vacunas. Las implicaciones prácticas son discutidas.

Estudio 5. La agenda setting en tiempos de lobbies antivacunas: un análisis de contenido en periódicos nacionales en España.

Partiendo de los estudios previos se consideró la necesidad de realizar los siguientes estudios en relación a la cobertura sobre vacunas en medios de comunicación de España (2012 – 2017) debido a que la mayoría de los estudios previos realizados habían examinado medios de EEUU u otros países anglosajones. En este primer estudio, se investigaron las características generales de la cobertura sobre vacunas en prensa escrita en base a la teoría de la agenda setting. Los resultados revelaron numerosos debates sobre brotes epidémicos, avances en investigación, así como algunas crisis relacionadas con la distribución y disponibilidad de las vacunas. Artículos con tono positivo y neutro hacia la vacunación aumentaron significativamente durante el periodo de estudio, mientras que aquellos con tono negativo permanecieron sin cambios observando una reducción de artículos alarmistas. Implicaciones teóricas y prácticas sobre la comunicación son discutidas.

Estudio 6. Los medios y la desconfianza de las vacunas: un análisis de contenido de titulares de prensa.

La desconfianza en las vacunas constituye un serio problema de salud en la actualidad. Los medios pueden contribuir a mejorar las creencias sobre las vacunas y a un uso efectivo de los servicios de salud. Los resultados del análisis de los titulares de la cobertura en prensa escrita en España sobre vacunas revela que los titulares con tono positivo fueron más frecuentes que los neutrales o negativos, así como un aumento significativo de estos titulares durante el periodo de estudio. Los encuadres más frecuentes fueron 'interés humano' y 'conflicto', y las palabras más usadas se agruparon en las siguientes categorías: a) actores relacionados con la vacunación; b) vacunas específicas; c) acciones relacionadas con la vacunación; y d) avances en investigación. Los hallazgos de esta investigación pueden contribuir a la amplia tarea de mejorar las prácticas de los medios en tiempos de lobbies antivacunas.

Estudio 7. Fuentes en periodismo especializado. Un análisis de contenido de prensa escrita en tiempos de lobby antivacuna.

La relación entre los periodistas y sus fuentes es relevante porque aspectos como el enfoque, el encuadre y la calidad informativa puede depender de un uso correcto de las fuentes. Mediante el análisis en profundidad de las fuentes utilizadas en la cobertura sobre vacunas en prensa española se encontró que las fuentes más frecuentes fueron aquellas correspondientes a políticos u otros representantes del gobierno, asociaciones profesionales y empresas científicas. Otras un poco menos frecuentes, fueron universidades, revistas científicas y profesionales de la salud. Sin embargo, las ONGs y las asociaciones de pacientes fueron usadas en menos del 5% de casos. Además, más del 30% de artículos recurrieron a una única fuente o ninguna, lo que puede mostrar la información sobre vacunas desde una única perspectiva y no contrastada.

Estudio 8. La especialidad importa. Análisis de la cobertura sobre vacunas por los periodistas sanitarios.

Este estudio analiza la práctica profesional de los periodistas especializados en salud y las diferencias con periodistas generalistas en relación a la cobertura sobre vacunas. El 52% de artículos analizados fueron escritos por periodistas especializados en salud que se diferenciaron significativamente de los generalistas en que escribieron más reportajes, menos artículos de opinión, usaron una perspectiva neutral más frecuentemente y recurrieron a más fuentes científicas, especialmente aquellas de asociaciones profesionales y revistas científicas. Estos resultados aportan evidencia al valor añadido de la especialidad en periodismo de salud, e identifica algunos aspectos que pueden ayudar a mejorar la profesión periodística y la cobertura de temas sobre salud.

Estudio 9. Análisis del contenido visual de la cobertura sobre vacunas en prensa escrita.

Las imágenes en los medios son recursos esenciales para reforzar la atención, la comprensión, el recuerdo de información e incluso mejorar la adherencia en tratamientos. Este estudio analizó el contenido visual que aparece en los articulos sobre vacunas para identificar patrones clave que pueden influir en la

actitud de la audiencia hacia la vacunación. En el 56% de artículos se utilizaron imágenes que se situaban más frecuentemente en el área superior y ocupando casi un tercio del espacio de la página. La fotografía fue el recurso visual más usado por los periodistas y el encuadre 'interés humano' y 'conflicto' fue el más frecuente. Los temas predominantes que mostraban las imágenes fueron la acción de la vacunación, el recipiente de la vacuna, investigación y diferentes aspectos biológicos de las vacunas. Para garantizar un uso apropiado y efectivo de imágenes en la cobertura sobre vacunas, se recomienda colaboración entre científicos o profesionales de la salud con diseñadores o responsables editoriales.

Estudio 10. Explorando la relación entre la cobertura de la prensa sobre vacunas y las ratios de inmunización en España.

Once países europeos han establecido la vacunación obligatoria. Falta de información y noticias falsas son consideradas las razones principales influyentes en la caída de las tasas de inmunización. Este estudio analizó la correlación existente entre las tasas de inmunización infantil en España y la cobertura sobre vacunas en prensa nacional. Los resultados mostraron una correlación significativa e inversa entre la cobertura con tono negativo hacia la vacunación y las tasas de inmunización infantil, por lo que, a menor número de artículos negativos sobre vacunas encontramos una mayor tasa de inmunización ($r = -.771$, $p < .05$). Otro dato relevante fue que durante los años 2016 y 2017, aunque hubo menor cobertura sobre las vacunas, las ratios de inmunización se incrementaron. Estos resultados amplían el conocimiento sobre la posible influencia de los medios de comunicación sobre la vacunación, y por consiguiente, se recomienda que los medios sean considerados como actores esenciales en el diseño de las campañas de inmunización.

Discusión y conclusiones

Esta Tesis Doctoral ha abordado uno de los ámbitos de salud pública que es considerado un gran reto en la actualidad –la comunicación pública sobre vacunas, debido a cierto nivel de desconfianza en los programas de

inmunización por algunos grupos de la población. Los principales hallazgos nos dirigen a las siguientes conclusiones que se detallan a continuación:

a) La comunicación, y específicamente el periodismo, representan una herramienta esencial en salud pública que debe ser utilizada en los programas de prevención y control de enfermedades. Por ello, en numerosos de los estudios desarrollados en esta tesis doctoral se recomienda mayor colaboración entre los profesionales de la salud pública con aquellos de los medios de comunicación.

b) La mayor parte de la investigación en comunicación pública sobre medicamentos, y vacunas específicamente, se ha realizado en EEUU, aspecto que limita el conocimiento existente a dicho ámbito geográfico y socio-cultural. Estos estudios previos han encontrado mayoritariamente información incorrecta sobre vacunas y mensajes negativos. Este es un dato relevante ya que puede contribuir al aumento de la desconfianza y desinformación en la ciudadanía.

c) En España, en 2012 se encontró mayor número de artículos con tono negativo hacia la vacunación en prensa escrita. Sin embargo, de 2013 a 2017, los artículos con tonos positivo y neutral aumentaron de manera significativa y fueron más frecuentes, mientras que los artículos con tono negativo permanecieron sin alteración, con una reducción de mensajes alarmistas. Esto nos indica cómo los periodistas han recibido una mejor formación en el ámbito de la vacunación, o que han sido persuadidos por la administración sanitaria para cambiar el tono de la vacunación en los medios.

d) Predomina el uso de fuentes políticas, asociaciones profesionales y empresas científicas en la cobertura sobre vacunas. El contraste de la información mediante el uso de dos o más fuentes, así como incrementar el uso de revistas científicas y fuentes ciudadanas, constituyen áreas de mejora en la práctica periodística.

e) La mitad de la cobertura sobre vacunas fue realizada por periodistas especialistas en salud. Su trabajo difiere al realizado por los periodistas generalistas mostrando cómo la especialidad en salud ofrece un valor añadido en la cobertura sobre las vacunas aportando mayor rigurosidad científica, objetividad y profundidad en los temas tratados.

f) El uso de imágenes es muy común en la cobertura sobre vacunas, siendo la fotografía el recurso visual más usado. Teniendo en cuenta el importante rol del contenido visual en los medios de comunicación y la variedad de recursos disponibles para aumentar la efectividad del mensaje, se recomienda una mayor colaboración entre diseñadores gráficos o responsables editoriales con científicos o profesionales de la salud.

g) Los encuadres más frecuentes, tanto en los titulares como en el cuerpo de los artículos y en el contenido visual fueron el de 'interés humano' y 'conflicto'. Esto indica cómo los periodistas adaptan los contenidos al público mostrando aspectos sociales y las aplicaciones que pueden tener los avances sobre las vacunas en las personas. Además, los conflictos sobre vacunas, como por ejemplo un brote epidémico o un problema de la disponibilidad y provisión de vacunas, suponen conflictos que obtienen altos niveles de visibilidad por la prensa.

h) Nuestro estudio ha mostrado una correlación significativa e inversa entre los artículos con tono negativo y la inmunización infantil. Este hallazgo resulta importante ya que aporta evidencia sobre el posible efecto que los medios de comunicación pueden ejercer sobre la población. En este caso, nuestro estudio indica que cuanta menor cobertura periodística hay sobre las vacunas con tono negativo, se produce una mayor tasa de vacunación. Este dato refleja la importancia de incluir la comunicación como una herramienta esencial en las campañas de inmunización.

Dado el impacto en la sociedad que conlleva una comunicación efectiva en salud, esta Tesis ofrece recomendaciones y sugerencias específicas tanto a la administración sanitaria como a los medios de comunicación para la mejora de

la situación actual. Finalmente, y en base a estas conclusiones, esta Tesis propone futuras líneas de investigación encaminadas a profundizar en el ámbito de la comunicación pública de medicamentos y, especifícamente, vacunas. Por ejemplo, se sugiere ampliar la investigación a otros formatos tales como televisión e Internet, así como el análisis de redes sociales en las cuales no existe el filtro profesional del periodista. Además, se requiere ampliar dicha investigación hacia otros países para examinar posibles diferencias y similitudes que nos ayuden a definir líneas de actuación, recomendaciones y guías de buenas prácticas en una perspectiva europea.

Scientific publications

This PhD thesis is based on the following peer-reviewed papers:

Study	Headline	Scientific journal	Index*	Status**
1	**Journalism in Healthcare. Analysis of audiences, formats and effects.**	Panacea	SJR – Q3	Published
2	**The Use of Traditional Media for Public Communication about Medicines: A Systematic Review of Characteristics and Outcomes**	Health Communication	SJR – Q1 JCR – Q2	Published
3	**How is communication of vaccines in traditional media: a systematic review**	Perspectives in public health	SJR – Q3 JCR – Q3	Published
4	**Message analyses about vaccines in the print press, television and radio: characteristics and gaps in previous research**	Journal of Communication in Healthcare	SJR – Q2	Under review – 4th round
5	**The agenda setting in times of anti-vaccine lobbies: A content analysis of national newspaper reporting in Spain**	Western Journal of Communication	SJR – Q1	Under review – 1st round
6	**Media and mistrust of vaccines: a content analysis of press headlines**	Revista Latina de Comunicación Social	SJR – Q2	Under review – 1st round
7	**Sourcing in specialised journalism. A content analysis of print media in times of anti-vaccine lobby**	Journalism Studies	SJR – Q1 JCR – Q2	Under review – 1st round
8	**Specialty matters. Analysis of health journalists' coverage about vaccines**	Profesional de la Información	SJR – Q1 JCR – Q2	Accepted for publication
9	**A visual content analysis of vaccine coverage in the print media**	Human vaccines & Immunotherapeutics	SJR – Q1 JCR – Q3	Accepted for publication
10	**Exploring the relationship between newspaper coverage of vaccines and childhood immunization rates in Spain**	Vaccine	SJR – Q1 JCR – Q2	Under review – 1st round

* Index is taken from the rankings published by SJR: Scimago Journal Rank (Scopus) and JCR: Journal Citation Report (Web of Science). ** Status at 12th February 2019.

General Introduction

Communication is an integral part in the effective public health response to the continuing threat posed by communicable diseases in European Union (EU) and European Economic Area (EEA) Member States (ECDC, 2014). A well-functioning society is dependent upon having a well-informed population. Individuals often seek information to help them achieve better health and wellbeing in the mass media. This is considered a very relevant fact since the media can influence health beliefs and can promote health behaviour change by both, the amount and type of information that is presented (Fishman & Casarett, 2006). Indeed, the media are one of the leading sources of information about health for the public, to the extent that these media sources are more significant than health professionals in learning about health and increasing awareness (Song et al., 2016; Anderson, Meissner, & Portnoy, 1989; Hughes et al., 2009). For example, health professionals, who prescribe, counsel, and inform on medicines, tend to focus much more on the cellular and organ level effects of the medicines, resulting in prescription information for patients that is dense and complex (Kish-Doto et al., 2014). They often do not provide information that the patient or consumer needs, such as descriptions of the effects of medicines and the impact of medicines on their lives resulting in increasing the information seeking needs of patients (Montagne, 2001).

My dissertation lays under the field of health communication, and it carries the European perspective where this research field is becoming highly recognised. In this General Introduction I will describe the framework and discuss the significance rationale in the context of current research in the field of health communication. I will present theoretical and empirical research on risk communication to describe best practices and provide insights into how we can improve trust and confidence in medicines and, specifically, in vaccines.

Understanding media coverage of health topics is a basic prerequisite for making effective health communication practice and research. As most people do not

have any direct contact with science or scientists (Priest, 2013), the media are crucial in keeping the public informed about scientific issues taking into account that the media is the only source about health and science for many people (Riobó, 2016; Yanovitzky & Blitz, 2000). The effects of the media in the population are well known and they have been investigated in relation to beliefs and behaviours change (Fishman & Casarett, 2006). Previous studies have shown that the beliefs held by a person about medicines play an integral part in influencing medical decisions (Duggan et al., 2014; Fang, Panguluri, Machtinger, & Schillinger, 2009). Studies have also reported that health beliefs are potentially important mediators of successful self-management of health conditions (Federman et al., 2013). In addition, the media allow citizens to stay informed so that they can participate in the public debate regarding health issues (Cacciatore et al., 2012; Hinnant, Len-Ríos, & Oh, 2012). However, if misused or exploited, the media can negatively influence the general population's health beliefs and behaviours (Odone & Signorelli, 2016).

In this regard, journalists have a great responsibility in the scientific field, because through their routine coverage of scientific studies, news media are a key intermediary in translating research for the public, patients, policymakers and clinicians (Viswanath et al., 2008). Therefore the media discourse on medicines is an important research field to determine how medicinal information is communicated to a mass audience.

The media coverage of vaccines

Vaccines have been one of the major developments in the history of mankind. During the last century vaccination around the world eliminated most of the diseases that used to cause high mortality rates (Rappuoli, Mandl, Black, & De Gregorio, 2011). In recent decades, the incidence of polio, measles, mumps, rubella, Haemophilus influenzae type b, hepatitis, and varicella (chicken pox) has greatly declined thanks to vaccination programs (Shinefield et al., 2006). Today, vaccines represent one of the greatest scientific achievements in the battle against serious infectious diseases, improving quality of life and life expectancy

worldwide. Many countries have made tremendous progress in vaccination programs. Although vaccine effectiveness and safety are clear for the scientific community, today vaccine adherence is an increasingly challenging public health issue.

Parental acceptance of routine childhood immunization is essential to protecting children's health (Kennedy, LaVail, Nowak, Basket, & Landry, 2011). But maintaining that acceptance can be difficult, especially because the success of immunization programs has resulted in new generations of parents who have little or no first-hand experience with most of the diseases that are preventable by vaccination (Kennedy et al., 2011). In addition, some events involving vaccines have diminished trust. For example, in 1998 a scientist claimed there might be a link between the MMR vaccine and autism. His claims received significant media attention, and vaccination rates fell in many countries, although many scientific experts asserted that there was no scientific evidence that the MMR vaccine played any part in the aetiology or triggering of autism (Boyce, 2006). These concerns have also been raised by the former World Health Organization (WHO) Director General Margaret Chan who expressed anxieties over what she called a 'worrisome' public mistrust of vaccines (Margaret Chan, 2011). A clear example can be found in measles, which is one of the leading causes of death among young children even though a safe and cost-effective vaccine is available. According to the World Health Organization (WHO, 2017b), in 2015 there were 134,200 measles deaths globally—about 367 deaths every day, or 15 deaths every hour. Scientists have argued that declining numbers of vaccinated persons is correlated with the upsurge of a measles cases (Coleman, 2018). We can find another example in children who died of influenza during the 2012-2013 season, most of whom were unvaccinated (Hendrix et al., 2014).

In order to combat this non-scientific information, public health campaigns have disseminated evidence about vaccine effectiveness and safety, but some parents are not rational consumers of science information, they are emotional beings (Bricker & Justice, 2018). In this regard, the science will be less likely to achieve acceptance, at least by those who are already suspicious of scientific consensus

(Coleman, 2018). In fact, these events against vaccines have stimulated lack of confidence in vaccines which is now considered a threat to the success of vaccination programs, and this is believed to be responsible for decreasing vaccine coverage and an increasing risk of vaccine-preventable disease outbreaks and epidemics (Dubé et al., 2013). As a result, vaccine uptake is decreasing in Europe and in some countries the level is close to the minimum required immunization completion rates of 80% – 90%, such as in Italy, France and Portugal (Carrillo-Santisteve & Lopalco, 2012). Now, eleven European countries have mandatory vaccinations and others are considering similar measures (Bozzola et al., 2018).

The vaccine media and social debate has been raging for many years. Vaccines have had a long history of controversies, raising concerns amongst policy makers, the media and parents about issues such as vaccine safety and the increasing complexity of immunisation schedules (Kennedy et al., 2011). The media have been considered an important tool for communicating information about vaccines and increasing awareness and motivating the public (Casciotti, Smith, Tsui, & Klassen, 2014) to make important decisions about their health care (Mark Levitan, 2011). Traditional media coverage and the rapid growth of the Internet and social media such as Twitter and Facebook have made it easier to find and disseminate immunization-related concerns and misperceptions (Kennedy et al., 2011). In relation to this, vaccine uptake has been reported to vary by media coverage (Ahmed, Quinn, Hancock, Freimuth, & Jamison, 2018; Meyer et al., 2016; Sagy, Novack, Gdalevich, & Greenberg, 2018; Smith, Ellenberg, Bell, & Rubin, 2008) and by the use of mass media (Jung, Lin, & Viswanath, 2015; Sohn, Lin, & Jung, 2018; Tran et al., 2018).

Consequently, vaccine adherence is a growing public health challenge. In this regard, in the wake of health scares, government and health organisations have launched campaigns to restore faith in current vaccine policies. The proponents of health scares, however, are hard to quell and seem to have messages that 'speak better' to those unconvinced of the safety of vaccines (Rundblad, 2015). Messages about vaccines published by a journalist may impact public perception

of health preventive measures and influence decisions regarding the public's own health. Indeed, the media have been shown to contribute towards harmful health behaviours, such as the smoking advertising and product placement in movies and on television, where the media are considered to act as sources for observational learning (Hilton, Hunt, Langan, Bedford, & Petticrew, 2010a). In the case of vaccines, there has been widespread uncertainty regarding the exact science—particularly when the media tries to provide a 'balanced' view, giving at least equal space and time to anti-vaccinationists even though more than 99% of informed medical and health-related professionals fully support the vaccine (Taylor, 2006). A basic principle in journalism is applied here: when the media covers information on vaccines, journalists usually cover multiple sides of an issue and provide insight by focusing on balance (Clarke, Dixon, Holton, & McKeever, 2015). These topics are embraced by the principle of impartiality, and it has been argued that the best way to explore the extent to which news coverage is broadly balanced is on the overall spectrum of different views or perspectives. However, some critics have been done to this model by science communication scholars as strong scientific data and non- or poor-evidence based messages can't be equally balanced (Elías, 2015). In this regard, a study (Petousis-Harris, Goodyear-Smith, Kameshwar, & Turner, 2010) revealed that most media 'balance' given to immunisation relies on 'he said, she said' arguments using quotes from opposing spokespersons with a failure to verify the scientific validity of both the material and the source.

Justification

Based on the previous framework, the present dissertation includes a total of 10 studies which are interlinked in order to deepen in the phenomenon of public communication of medicines and understand how the media coverage of vaccines is made by journalists as well as its potential effects in vaccination uptakes.

Today, health information is a relevant topic that brings the audience's attention, being more and more demanded by the society. The media are becoming the first

information source for health questions, even on top of health professionals, giving the media a predominant role on public health. In study 1, I will present this field of health communication and health journalism referring to relevant literature in relation to the different targets of media coverage of health topics, the characteristics of the variety of formats that are used to disseminate health to society, and finally the media effects on public health will be explored.
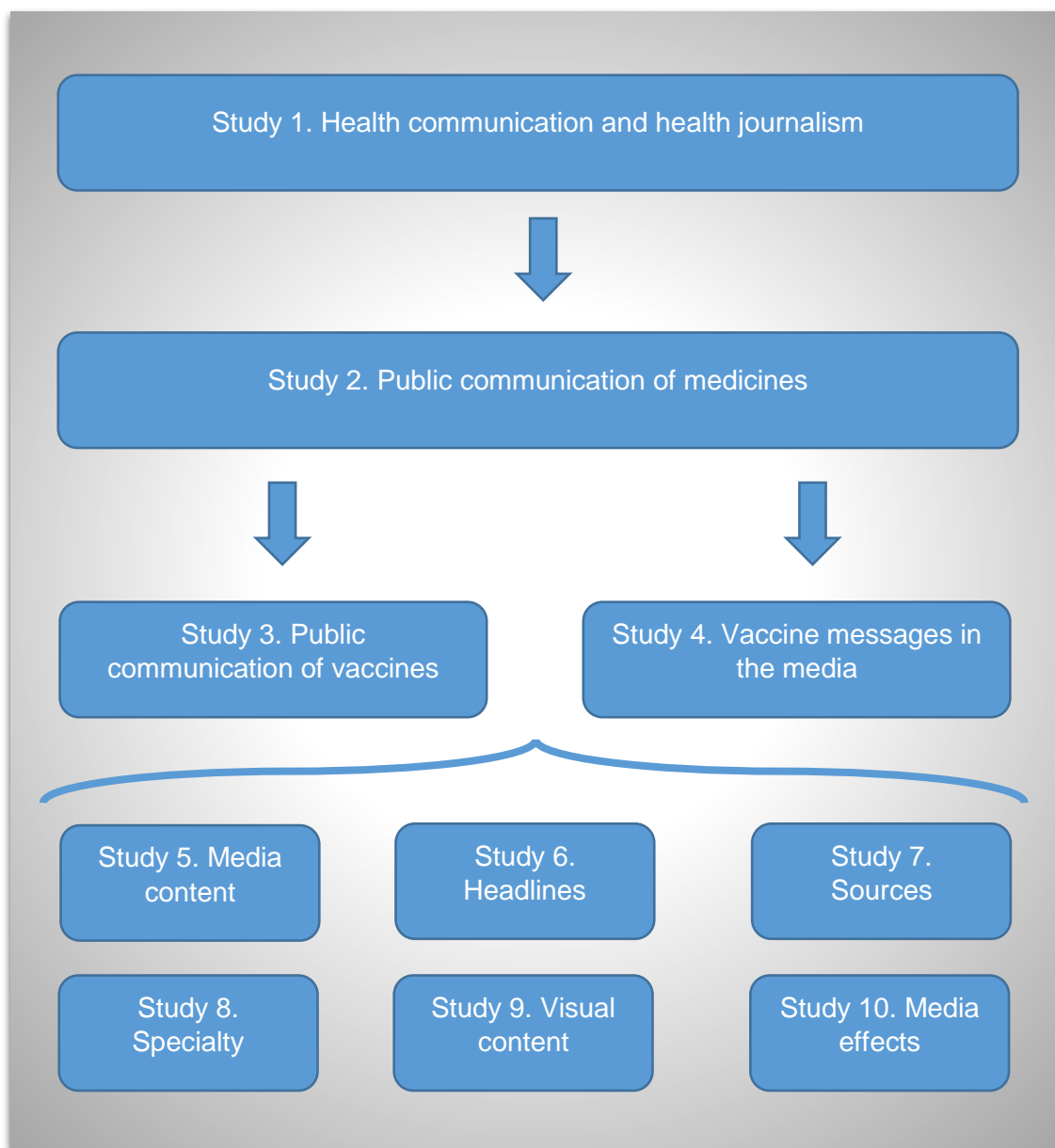
Figure 1. Flow diagram of the 10 studies included in the dissertation

In relation to medicines, past surveys have indicated that media sources are the most frequent sources from which to choose. Therefore, the media content

analysis of health coverage becomes an important topic for its potential influence in people's beliefs and behaviours. In the last decade, health communication researchers have analyzed the relationship between medicines and the media, describing the types of medicinal products, types of media and research methodologies. In fact, the media discourse on medicines is an important element of how medicinal information is communicated to a mass audience (Clarke, 2011). In study 2, I will review the previous studies about public communication of medicines to understand existing research and identify gaps where further research might be needed.

Considering that vaccines are one of the most powerful discoveries in the history of mankind and, however, the vaccine media debate has been raging for many years, I focused the following studies on the field of public communication of vaccines. Therefore, in the study 3, I conducted an overall systematic review to understand existing research on media coverage of vaccines and explore what, where and how scholars had conducted studies in this field. The study 4 expands from the previous study by adding the focus analysis on the vaccine messages in the media.

As a result of these first 4 studies, having presented the foundations of the existing literature and building a solid basis to guide further research, the upcoming studies, from study 5 to study 10, follow empirical methods to deepen in the field of media coverage of vaccines and meet research gaps in the field. In the study 5, I present an overall content analysis of media coverage about vaccines built from the agenda setting theory which has been developed in the field of public health (Kozel et al., 2003). From this perspective, this theory may help us understand how the media shapes the public awareness of vaccines, as well as which are the most important vaccine topics for society to think about. As, nowadays, trust in vaccines is becoming a public health challenge, the analysis of media content about vaccines becomes especially relevant.

In the study 6, I analysed headlines and lead paragraphs of vaccine-related articles considering than far more media consumers read headlines only than full-

text articles (Dor, 2003). Headlines are the most visible ones especially in the Internet era when headlines are tweeted and shared by millions of people daily. In newspapers, the relevance of headlines is magnified by the fact that they are composed by editors rather than by reporters seeking to attract readers while still appointing into their prior beliefs and expectations. Headlines are thus shaped by non-specialist editors with non-specialist readers in mind and are consequently more likely to reflect prevailing societal beliefs (Bleich, Stonebraker, Nisar, & Abdelhamid, 2015). Therefore, headlines differ in significant ways from the full text of the article and have an independent impact on readers' perceptions of events (Ifantidou, 2009). This is the reason why this study builds from the previous one and expands the knowledge about media coverage of vaccines.

The study 7 focused on the journalistic sources that were used in the media reporting of vaccines. In communication research, the study of news sources is inextricably linked to questions of agenda-setting (*what*) and framing (*how*) (Stroobant, De Dobbelaer, & Raeymaeckers, 2018). Thus, the study of source structures, relationships and activities remains central to understanding news content (Tiffen et al., 2014). Although journalism is a source-driven practice, the amount of research on sourcing is relatively limited (van der Meer, Verhoeven, Beentjes, & Vliegenthart, 2017), especially regarding specialised journalism. A broad analysis of sourcing patterns is thus crucial to understand how news coverage is constructed and to confirm whether the public can make informed decisions about vaccine uptake using the media. So I searched to explore and describe this phenomenon and provide a starting point in understanding general sources patterns in specialised journalism.

The study 8 focuses on the specialty of science journalism which is considered a minor specialty within the profession (Fedler, Counts, Carey, & Santana, 1998) when compared to others such as history, law, international, economics and politics. It is an interesting time to study health journalism nowadays, since it has experienced important changes in the last decade. Health journalism has fallen victim to the overall problems facing journalism, which have been exacerbated by the global economic downturn in 2008 (Bristol & Donnelly, 2011). As a result,

there is an increasing international tendency for health journalists to be replaced with generalists to cover health issues (Len-Ríos et al., 2009) and those who write about a broad range of topics, from full-time health/science journalists to general-assignment journalists. Health news articles have been questioned by public health officers for incorrect, misleading, careless or unfair coverage (Amend & Secko, 2012). Thus, whether there is a difference in journalistic performance between health-specialists and generalists is a very pertinent research question, especially nowadays, when media organisations are replacing specialists with generalists.

The study 9 focused on the visual content of media reporting on vaccine. The visual imagery is an essential element in the media and its importance is broadly recognised in the field of health communication (Chang, 2013; López-Villafranca, 2016). It has been recognised that publishing photographs next to text can markedly increase attention, recall of health information, improve comprehension and can even change adherence to health instructions (Houts, Doak, Doak, & Loscalzo, 2006). As the analysis of vaccine-related images has received little attention, we believe that the analysis of the visual content about vaccines is pertinent and relevant in this research field.

Finally, I aimed to explore the association of media coverage and childhood immunization rates. Vaccine uptake has been reported to vary by media coverage (Ahmed et al., 2018; Meyer et al., 2016; Sagy et al., 2018; Smith et al., 2008) and by the use of mass media (Jung et al., 2015; Sohn et al., 2018; Tran et al., 2018). The study 10 analyses this association in other geographical area and other vaccine types than previous research.

Objectives

The general objective of this PhD thesis was to obtain knowledge and insight concerning public communication of medicines and to determine how is media coverage of vaccines in the media reporting so that best practices are identified and recommendations are suggested.

The specific objectives read as follows:

a) Understand the field of health communication and identify research gaps in the field of public communication of medicines and vaccines.

b) Examine newspaper coverage of vaccines to understand the media agenda in Spain.

c) Identify journalists' sourcing to understand the extent of sources in newspaper coverage of vaccines

d) Analyse specific patterns among health journalists, and assesses whether these differ from those among generalists.

e) Explore the visual content in the press coverage of vaccines.

f) Analyse the media effects by the association of media coverage and immunization rates.

Overview of methods

This Thesis followed a quantitative and qualitative method based on a set of observational studies.

Systematic review

First, literature and systematic reviews on the field of public communication of medicines and vaccines were conducted. Conclusions based on systematic reviews are considered the top of the hierarchy of evidence (Moe et al., 2007). In addition, there is a rising challenge for busy policy makers and clinicians to keep on top of the evidence base of any given topic and it is not feasible for them to read multiple individual studies. Moreover, differences in scope, methods of analysis, results, and quality of studies can cause great confusion and make it difficult for policy makers to access the level of evidence, and for researchers to know where gaps in the evidence exist. Given the explosion of scientific literature, and the fact that time is always scarce, review articles play a vital role in decision making in evidence-based practice. Given that most decision makers do not have the time to track down all the original articles, critically read them, and obtain the evidence they need for their questions, systematic reviews may be their best source of evidence (Ganeshkumar & Gopalakrishnan, 2013). Therefore the popularity of systematic reviews has increased. With these regards, systematic reviews are an efficient way to gather and summarize in a single source the best available evidence on the characteristics and effectiveness of interventions (Ioannidis, 2009). They serve as a useful starting point for decision makers to unpack the evidence towards finding solutions to improve practice and identify areas where new research is needed.

Overall, the three systematic reviews conducted in this dissertation (studies 2 – 4) followed the PRISMA statement for systematic reviews (PRISMA-P Group et al., 2015). The reviews included the studies published during the last 10 years, in

any language (except in study 2) and by searching in the following international databases: PubMed (Medline), Scopus, the International Bibliography of Social Sciences (IBSS), the Cumulative Index to Nursing and Allied Health (CINAHL) and the Latin American and Caribbean Health Sciences Literature (LILACS).

Regardless of their methodological quality, the studies had to meet the following inclusion criteria: (1) conduct a content analysis of publications made in print media, radio or television; (2) address traditional media coverage; (3) report original qualitative or quantitative data examining media coverage. Systematic reviews, abstracts, dissertations, single case reports, editorials, commentaries, conference abstracts, non-research articles, and studies that focused on digital mass media such as websites or social networks were excluded. Articles analysing advertisements on vaccines in the media were also excluded.

We synthesized data qualitatively. Findings from mapping and analysis were recorded in data extraction tables and summarized as narrative answers to the research questions. Regarding the quality assessment of studies, we followed the 'Joanna Briggs Institute Critical Appraisal Checklist for Qualitative Research' (Lockwood, Munn, & Porritt, 2015) in studies 3 and 4.

Content analysis

Second, taking into account identified research gaps, quantitative and qualitative content analyses of vaccine media coverage were conducted as a method in the empirical studies. Content analysis is a research method that uses a set of categorization procedures to systematically and objectively identify specific characteristics within a text (Meyer et al., 2016). Traditionally, content analysis has been used as a descriptive tool to identify characteristics of messages (Iyengar & Simon, 2000).

As previous research has been mostly focused on media from United States and other English speaking countries such as Canada and Australia, we observed the research gap in this field in other continents such an in Europe. Thus, an analysis

of national newspaper coverage of vaccines was conducted in Spain from October 1 2012 to October 1 2017. The analysis period began in 2012, coinciding with the publication of the WHO Global Vaccine Action, which was a Plan approved in the 65th World Health Assembly (World Health Organization, 2012), in which, for the first time, it was recognized that: a) some reasons for hesitancy are undoubtedly amenable to improved communication designed to counteract growing anti-vaccination lobby groups and to increase understanding of the value of vaccines or of the danger of diseases, b) governments should engage in dialogue with communities and media and use effective communication techniques to convey messages about vaccines and to address safety concerns, and c) the media should understand the benefits of, and concerns about, immunization in order to accurately report on and effectively promote immunization programs. Moreover, during 2012, Europe experienced significant vaccine preventable diseases outbreaks, such as the measles outbreak in UK, caused by a dip in MMR vaccination rates (Gander, 2017) and the anti-vaccination lobby activities in some European countries during the same year (European Social Policy Network, 2016).

The online database Mynews was used to search the two paid general newspapers with the highest circulation rates according to the General Media Study in Spain (AIMC, 2017). Mynews is a professional media agency that inspects all national daily newspapers and provides copies of all articles. The newspapers *El Pais* and *El Mundo* were selected because both are flagship national newspapers in Spain (*El Pais* with a 1.080 and *El Mundo* with a 0.662 million daily readership rate). Today, both newspapers are generally regarded as liberal, but in the past *El Pais* was viewed as ideologically left-center and *El Mundo* as right-center. The databases were searched using the following search string in the Spanish language [vacuna* OR inmuniza*] that should be present in the headlines and subheadlines in order to reach articles with a full focus on vaccines or vaccination, and to avoid unrelated contents or 'noise' as for example the term 'vaccine' is largely used as a metaphoric meaning such as "Brexit, more vaccine and less infection" (*El Pais*, 17.07.2016). The article types selected were news articles, features, short articles, opinion articles (including editorials and

letters to the editor), interviews, biographies and obituaries. While the word "article" is used throughout the studies, it should be recognized that this includes the other article types just mentioned. Duplicate articles and those using the term "vaccine" with a metaphoric meaning were excluded.

I conducted the content analysis by using a standardized data-collection instrument to record the type of article (news article, feature, opinion article, etc.), publication date, author, vaccine type, words number, space occupied, tone, frames and sources. Aligned to previous research (Hilton, Hunt, Langan, Bedford, & Petticrew, 2010), the tone was employed primarily to assess whether, from a public health perspective, vaccine was being supported or advocated. For coding 'tone' we followed a previous study (Tsuda et al., 2016) where positive tone was coded if they focused on benefits, such as disease prevention, neutral if they were not in favour or against vaccination, and negative if they focused on risks, such as adverse events and discouragement of the vaccination. The frames were also coded following a deductive method. The following five news frames that have been identified in previous studies were thus deductively investigated (Semetko & Valkenburg, 2000): conflict, human interest, economic consequences, morality and responsibility. A source was identified as a person or institution from which reporters derived story information. The sources were classified, according to the affiliation of the individual, in the following categories: "government scientific organisations", such as the National Regulatory Medicines Agency and the National Health Institute Carlos III; "government organisations", such as the Ministry of Health (minister, state health secretary, etc.), the health regional administrations, and international organisations; "scientific companies", including the pharmaceutical and health technology sectors; "university scientists", including researchers affiliated with any university or research centre; "clinicians", including any health professional working at any healthcare centre; "scientific journals", including any scientific peer-reviewed publication; "media", such as a press agency or a media channel; professional associations, including any organisations composed of health professionals as members, such as the Spanish Association of Pediatrics (AEP, for its Spanish acronym), and the Spanish Society of Public Health and Health Administration (SESPAS, for its

Spanish acronym); "consumer groups", including representatives from patients or users' associations; "NGOs", including any non-governmental organisation used as a source. The category "other" was used when a source was not able to be included in any of these categories.

Each article was read and re-read, looking for key words, metaphors, phrases and sentences related to whether vaccination was presented in a positive, neutral or negative perspective, as well as to identify the frames. After the first reading and coding, the next step was to identify the connotative or latent meaning of the text. In addition, the main theme of each news article was coded in order to contextualize the data. This process of coding enabled us to move beyond the surface meaning of the stories to their underlying meaning.

In order to ensure reliability in coding, data was coded by a second coder (CSO). After coding was completed, changes were made to the coding scheme to reflect any disagreements that had been identified and all discrepancies were resolved with the support of a third researcher (CPS) when necessary. Then, articles were imported to QSR NVivo 11 plus and coded using the aforementioned variables. This program allows for the categorization and identification of code frequencies. Then, data was further analyzed using Excel (Microsoft Corporation, Redmond, WA, USA) and SPSS 24th edition (SPSS Institute, Inc., Chicago, IL, USA). These programs were used to conduct the data descriptive analyses and to find p values so as to check the significance of results. Chi-Square and Goodness of Fit analyses were employed to determine whether the category distribution significantly differed from an expected even distribution. In addition, t-test analyses were conducted when possible. Bivariate correlation and the Spearman *rho* test of statistical significance were also performed, when the data under analysis were nonparametric.

Finally, study 10 also used data related to immunization rates that were published by the Ministry of Health in Spain (Ministerio de Sanidad, 2017). Vaccination rates for each year from 2012 to 2017 show the average rates of the following vaccines: first dose of Poliomyelitis, DTaP (diphtheria, tetanus and pertussis), Hib

(haemophilus influenza type B), Hepatitis B, MMR (measles, mumps and rubella), and all doses of HPV (human papilloma virus). These vaccination rates were associated to the media coverage and the tone used in this vaccine media reporting. The analysis of correlation between vaccination rates and the vaccine articles in the media was calculated using a one-year time lag in recognition of the delayed impact that media reporting might have had on people's behaviours towards vaccination (Meyer et al., 2016).

Study 1. Journalism in Healthcare. Analysis of audiences, formats and effects

Reference: Catalan-Matamoros, D. (2015). Periodismo en salud: análisis de los públicos, formatos y efectos (Journalism in Healthcare. Analysis of audiences, formats and effects). *Panacea*, *16*(42), 217–224.

Resumen

La información sobre salud es un tema de interés que atrae audiencias siendo cada vez más demandada por la sociedad. Los medios de comunicación se están convirtiendo en la principal fuente de información para los temas de salud, incluso por delante de los profesionales sanitarios, lo que otorga a los medios una notable influencia sobre la salud pública. Por ello, el objetivo es analizar los diferentes públicos de la información sobre salud en los medios, los formatos en los que la información es enviada a la sociedad, y los efectos que los medios realizan sobre la salud pública.

Abstract

Health information is a relevant topic that brings the audience's attention, being more and more demanded by the society. The media are becoming the first information source for health questions, even on top of health professionals, giving the media a predominant role on public health. Therefore, the objective is to analyse the different publics on health information in the media, the formats that are used to disseminate health to society, and the influence that media may produce on public health.

Palabras clave

Keywords

Introducción

La salud ha sido siempre un don querido y deseado, pero hasta los años ochenta del siglo pasado, el periodismo sanitario no tenía entidad ni espacios propios en los medios (Casino, 2003). En la actualidad, la salud, o más bien la falta de salud, es un tema habitual en la comunicación pública, pues ha protagonizado, y lo continúa haciendo, sucesos de gran relevancia social (Martín-Algarra, 1996): epidemias, brotes de enfermedades desconocidas, la muerte y sus causas, etc.

Los medios de comunicación tienen un papel importante en la salud ya que son utilizados como fuentes principales de información, y en muchas ocasiones incluso por delante que el profesional de la salud. Por ello, la salud es un tema de interés que atrae a la audiencia concienciada de la importancia de realizar hábitos de vida saludables para adquirir mejor calidad de vida y bienestar (Elías, 2008). En este sentido, el Informe Quiral (2001)[1] ha analizado los contenidos sanitarios en la prensa española durante la última década. A pesar de esta importancia e interés creciente, aún se siguen encontrando contenidos sesgados de baja calidad y agudeza científicas. Esta ambivalencia es el eje principal de muchos estudios e investigaciones: *la comunicación ¿sana o enferma a la sociedad?.* Los contenidos sobre salud publicados en los medios pueden ayudar a controlar una enfermedad contagiosa, al mismo tiempo que puede alentar la práctica de hábitos dañinos, tales como el consumo de comida basura, tabaco, alcohol, etc. Por otro lado, los medios desarrollan frecuentemente, de manera inconsciente y como parte de la sociedad que son, falsas creencias, estereotipos y estigmas. Por ejemplo, es habitual titulares como el siguiente: «Un esquizofrénico desata el terror al apuñalar a varias personas en un centro comercial». Por estos motivos, el estudio de los contenidos sobre salud en los medios es necesario debido a la influencia que éstos tienen sobre la salud y el bienestar de la sociedad.

Desde un punto de vista global, organismos internacionales como la Organización Mundial de la Salud (OMS) y el Banco Mundial están reflexionando

sobre la creciente importancia de los medios en la salud de la sociedad actual. Hace ya unos años, se alertó del continuo aumento del uso de los medios de comunicación como la principal fuente de información para los temas de salud (Organización Mundial de la Salud, 2007). Puede ser preocupante que el profesional sanitario ya no constituya la única fuente de información para los ciudadanos, y en muchas ocasiones ni siquiera la fuente principal. La sociedad actual utiliza cada vez más los medios tradicionales e internet para informarse sobre enfermedades, tratamientos y estilos de vida saludables y, a menudo, recopilan información antes de acudir al médico. Incluso los mismos profesionales sanitarios también acuden en numerosas ocasiones a los medios para informarse sobre salud (Gupta & Sinha, 2010)*.* Un estudio (MSL Group, 2012) reveló que el 72% de los pacientes recurre a Internet para buscar información sobre temas de salud y que las fuentes más consultadas en la red son los foros 42%, Google 41% y Wikipedia 27%.

Por todas estas razones expuestas, nos encontramos ante una emergente demanda y necesidad de información sobre salud veraz, relevante, rápida e imparcial en los medios de comunicación. Por ello, el objetivo de este artículo es profundizar en los públicos de la información sobre salud de los medios de comunicación, en los formatos diferentes en los que se publica la información sobre salud en los medios, y en los efectos que los medios pueden producir sobre la salud pública.

Metodología

En el artículo partimos de la definición de *Comunicación en Salud* (Organización Mundial de la Salud - OMS, 1998) como «el estudio y la utilización de estrategias de comunicación interpersonal, organizacional y mediática destinadas a informar e influir en las decisiones individuales y colectivas propicias para la mejora de la salud». Basándonos en esta definición, el contenido se articula en el análisis de estrategias de comunicación en salud mediante una exhaustiva investigación documental y conceptual realizada. Se llegará a conclusiones que nos hacen posible demostrar en este trabajo que la Comunicación en Salud es un concepto

ambivalente y que produce efectos en la salud pública. Una vez aclarado este marco conceptual se pasará así a contestar a la hipótesis principal que propone esta investigación: ¿cuáles son los públicos sobre la salud en los medios de comunicación?, ¿qué características tienen los diversos formatos de la información sobre salud en los medios?, ¿qué influencia y efectos pueden producir los medios de comunicación en la salud de la sociedad?. Estas preguntas y algunas más obtendrán respuesta en el análisis e investigación de este artículo.

Los públicos de la información sobre salud en los medios de comunicación

Los contenidos de salud publicados por los medios de comunicación corresponden principalmente a cuatro grandes públicos: la población general, las administraciones públicas, la industria y los profesionales de la salud.

Población general

La *población general* es el consumidor mayoritario de los contenidos sobre salud publicados por los medios. La preocupación por la salud ha sido puesta de manifiesto por numerosas investigaciones sociales y corroborada por el Barómetro Sanitario[2] tal y como se puede observar en la tabla 1. Según otro Barómetro de 2015 (IndexLife, 2015)[3], la principal preocupación por la población española es el miedo a perder el trabajo, la vivienda y la pensión, además de la salud. Esta demanda ha quedado patente en los últimos años ya que, según Camacho-Markina *et al.* (2012), los estudios que hacen las empresas de comunicación para conocer las preferencias de las audiencias reflejan este creciente interés por la información sobre salud recibida desde los medios.

Tabla 1. Áreas de interés para la ciudadanía.

¿Cuál de las siguientes áreas considera de mayor interés para los ciudadanos?						
	2005	2006	2007	2008	2009	2010
Defensa	0,8	1,2	1,0	0,9	1,1	1,1
Educación	19,5	18,8	20,1	20,2	21,1	22,7
Salud	30,3	28,3	28,3	28,1	29	29,2
Vivienda	20,1	20,1	20,3	20,3	17,2	13,5
Pensiones	10,4	9,7	10,1	11,6	11,3	14,1
Transportes	0,6	0,7	0,9	0,7	0,8	0,8
Seguridad ciudadana	10,0	13,1	11,7	10,1	9,7	7,8
Otras áreas Servicios Sociales	3,6	4,1	3,5	4,1	5,4	5,7
NS - NC	4,7	4,0	4,1	4,1	4,3	5,2

Fuente: Barómetro Sanitario, 2010

La administración pública

La *administración pública* acude a los medios para reclamar apoyo, atención y difundir campañas preventivas y de promoción de hábitos saludables. Cada cierto tiempo es común ver en los medios campañas de prevención de las enfermedades de transmisión sexual, de accidentes de tráfico, de vacunación de la gripe estacional, etc. Los Ministerios de Salud, las Delegaciones de Salud de las Comunidades Autónomas, e incluso los organismos internacionales[4], son las administraciones públicas encargadas de planificar y poner en marcha las campañas de salud en los medios de comunicación en el ámbito de la salud pública. Además, las administraciones públicas son las encargadas de velar y proteger la salud de la ciudadanía, y ello conlleva al control y vigilancia de la información sobre salud que se emite a través de los medios. En numerosas ocasiones, los medios han sido víctimas de casos de *publicidad encubierta* en los que a través de una noticia se persigue la venta de medicamentos o de algún producto ortopédico. En estos casos la información es manipulada para estimular las compras –por ejemplo, el popular reportaje sobre *tapentadol* en El País en 2009[5]. Para ello, la administración ha desarrollado diversas leyes que protegen

a la población de los medios. A continuación se muestra la normativa legal en relación al uso comercial de los medios sobre temas de salud.

La industria

La *industria*, especialmente la farmacéutica, utiliza los medios con fines comerciales. De acuerdo con estimaciones realizadas por Gagnon y Lexchin (2008), aproximadamente el 24% de la facturación de las compañías farmacéuticas en los Estados Unidos son invertidos en la promoción de los medicamentos a los profesionales de la salud y usuarios. Este porcentaje es el doble de lo que se invierte en investigación y desarrollo de nuevos fármacos. En relación a la comunicación sobre salud por parte de los laboratorios farmacéuticos se debe diferenciar entre *publicidad* e *información* ya que son dos términos que en este campo suelen ser confundidos. La *publicidad*, según define la Directiva 2001/83/CE, es aquella destinada a promover la prescripción, la dispensación, la venta o el consumo de fármacos. En España, la legislación actual prohíbe la publicidad de medicamentos con receta dirigida al consumidor final (Vilajoana-Alejandre & Sivera-Bello, 2008). Por ello, la industria sanitaria focaliza sus esfuerzos de inversión para obtener una mayor cuota de mercado a través de la multi-canalidad y cada día prospeccionan más vías de promoción debido a la cada vez más variedad de medios a su disposición. Por otro lado, la *información*, tal y como recoge la propia Ley General de Sanidad (Ley 14/1986) es un derecho del paciente que le permite poder participar de forma directa en las decisiones relacionadas con la salud. La industria hace uso de dicha Ley para realizar publicaciones y actos dirigidos a informar sobre sus avances para conseguir hábitos de vida saludable u otras pautas de salud pública.

En relación a la publicidad de medicamentos, productos de naturopatía, ortopedia, etc., y debido al terreno resbaladizo que puede suponer la publicidad de productos sanitarios u otros que dañen la salud – tabaco y alcohol, los países han desarrollado normativas legales concretas. De esta forma, España aprobó la Ley General de la Comunicación Audiovisual en 2010 (Ley 7/2010, de 31 de marzo). El apartado 3 del artículo 18 dice: «Está prohibida la comunicación

comercial que fomente comportamientos nocivos para la salud». Así se prohíbe toda comunicación relativa al tabaco y se limita en gran medida la relativa a bebidas con alcohol. Estas normativas contribuyen a avanzar en la divulgación *saludable* de los medios de comunicación aunque aún queda camino por recorrer en algunos aspectos, por ejemplo en la publicidad de la comida basura.

Los profesionales de la salud

Además de los públicos anteriores, también existe el de *profesionales de la salud* quienes utilizan los medios de comunicación especializados sobre salud para la búsqueda de información. Estos medios especializados incluyen a las revistas científicas –por ejemplo: *Lancet*, *Revista Española de Salud Pública*, *Gaceta Sanitaria*, etc., a los portales webs especializados, a la prensa corporativa especializada dirigida a los profesionales de las diferentes especialidades de la salud, etc. Sin embargo, en la última década se ha podido observar que los profesionales de la salud están comenzando a hacer uso de los medios de comunicación generales para la búsqueda de información (Gupta & Sinha, 2010)*.* De hecho, las secciones sobre salud de la prensa de carácter generalista, o los portales dirigidos a pacientes de diversos problemas de salud son cada vez más visitados por los propios profesionales en búsqueda de información.

Los formatos de la información sobre salud en los medios

El análisis de los formatos de la información sobre salud en los medios se ha desarrollado fundamentalmente por la metodología de análisis de contenido. El estudio de los contenidos sanitarios en los medios de comunicación nos permite entender qué y cómo se publica sobre salud, es decir, qué tipo de formatos son más usados, qué género periodístico es utilizado, qué tipo de gráficos o tablas acompañan al texto, etc. El análisis de contenido es el método más utilizado en investigación de los medios (Gupta & Sinha, 2010) e incluye herramientas tanto cualitativas como cuantitativas. A continuación se presentan algunas investigaciones relevantes que han analizado varios formatos y cómo la salud es transmitida en formatos diferentes.

La Radio

Los mensajes de salud se pueden divulgar por la radio de diferentes maneras: avances y novedades en salud se pueden retransmitir en la sección diaria de noticias, pero también, numerosas radios acogen espacios dedicados a temas sanitarios, variando en duración desde algunos minutos a una hora o más (Cano, 2004). Estos espacios se suelen presentar en formato de charlas-debate con profesionales sanitarios y pacientes, o entrevistas.

Gupta & Sinha (2010) revelaron que las radios nacionales emiten de media entre 40 y 50 contenidos de salud diariamente. De éstos, 20-25 fueron publicidad de centros clínicos y hospitales, 7-10 fueron sobre cosméticos y productos naturales, y 9-13 fueron medicamentos. Hubo aproximadamente 7-9 mensajes relacionados con la salud para temas diferentes como higiene, cuidados maternales e inmunización de los niños.

Un estudio realizado en radios españolas (Perelló & Muela, 2011) investigó la publicidad engañosa de productos relacionados con la salud y cuantificó los mensajes que proponen beneficios saludables. Los resultados mostraron que las cuñas con publicidad engañosa relacionada con la salud suponen el 15,81% del total de publicidad emitida por radio y que la categoría de salud representa el 69,09 de las alegaciones ilícitas. Los autores denuncian las limitaciones y contradicciones del sistema de supervisión y evaluación de la publicidad engañosa en España.

En Brasil (Veloso-Traveira, Leite de Assis, Passos-Guimaraes, & Delgado-Fagundes, 2013) se mostró que la radio es la segunda fuente más utilizada de la información para los brasileños –83,5% de la población, sólo superada por la televisión que es vista por 99,3% de los encuestados. Estos datos indican la importancia de la radio para difundir información a la población por lo que se ideó una intervención basada en la comunicación con el objetivo de apoyar las acciones realizadas sobre el uso racional de los medicamentos y alimentación

saludable a los comunicadores de radio, los estudiantes y las comunidades académicas.

Otro estudio analizó un programa de radio emitido en una comunidad rural de Bolivia (Vásquez-Ochoa, 2012). Este programa de radio se centró en la salud pediátrica y produjo interesantes cambios de conducta en el público: manejo racional de medicamentos, manejo de la fiebre, la importancia de realizar las vacunaciones, seguridad alimentaria, uso racional del Servicio de Urgencias, lactancia materna, primeros auxilios y autocontrol del asma. Sin embargo, el mayor impacto del programa de radio se realizó sobre el maltrato infantil y castigo físico.

La radio es el medio de comunicación más popular en las zonas rurales y de recursos limitados, y muchas veces es el único medio accesible. Se trata de un medio barato y de fácil instalación, facilitando la difusión de campañas de salud que tengan presupuestos limitados. Además, como se puede observar en los estudios anteriores, la radio es un medio que puede ser idóneo para planificar campañas de salud en ciertas comunidades tales como las rurales, o aquellas en las que el acceso a los medios sea limitado.

La Televisión

El soporte audiovisual de la televisión, su fascinación e implantación mayoritaria la hacen no ya necesaria sino indispensable en numerosas intervenciones de salud pública, fundamentalmente en un modelo de promoción que actúe sobre los estilos de vida y el medio ambiente. En las secciones fijas sobre salud que aparecen en los programas televisivos se persigue el trabajo en torno a la promoción de la salud. De hecho numerosos canales de televisión han incluido programas, normalmente en franjas horarias matinales, en los que periodistas y profesionales de la salud realizan coloquios y recomendaciones sobre cómo mejorar la salud, prevenir enfermedades y tratarlas. En estos programas de televisión, las audiencias viven el acceso a los mensajes televisivos de forma emotiva más que racional, algo que puede chocar con algunos de los requisitos

sobre la difusión de contenidos de salud, los cuales deben estar basados en datos objetivos, racionales o basados en la evidencia científica. Pero un equilibrio entre los dos, puede hacer de la televisión un buen medio para el cambio de actitudes. Como señaló Morón Marchena (1995), la televisión facilita las modificaciones de actitudes, y la creación de hábitos y valores.

Además de los espacios comentados anteriormente, la televisión también emite contenidos de salud en formato de publicidad de medicamentos, productos de naturopatía, ortopedia, etc. Como ya se comentó en el apartado *3.3. La Industria*, debido al terreno resbaladizo que puede suponer la publicidad de productos sanitarios u otros que dañen la salud –tabaco, alcohol, los países han desarrollado normativas legales específicas para controlar y proteger a la población de posibles intereses ocultos. De hecho, la industria farmacéutica es uno de los colectivos que más invierte en publicidad televisiva.

Un estudio reciente publicado por Nasser-Laaoula (2012) analizó los espacios comerciales de dos canales de televisión de ámbito nacional en España. Su estudio reveló que aproximadamente el 10% de la publicidad en la franja horaria *Prime Time* corresponde a bebidas alcohólicas. El análisis más detallado de estos anuncios muestra que se relaciona el consumo de alcohol con virilidad, éxito social/sentimental, felicidad y mejor situación social entre otros. También se ha estudiado el trato que la televisión le da a la mujer (Antezana-Barrios, 2011; Semir & Revuelta, 2006), y a otros segmentos de la población. A continuación, veamos en profundidad algunos estudios dirigidos a la población infantil.

Una publicación realizada en Argentina (Liceus, 2013) muestra la influencia de la televisión en los niños, en su desarrollo y sus relaciones. Se ha planteado que la televisión, al ser un medio de socialización, muestra las realidades de la vida a los niños. Añade que con su uso ha modificado la naturaleza de la infancia y en algunas ocasiones no sabe diferenciar entre la fantasía presentada en la televisión y la realidad.

Dos estudios recientes (García Redondo & Hita García, 2012; Rubio-Hernández, 2011) han analizado los anuncios de televisión dirigidos a población infantil. Ambos estudios desvelaron que más del 50% de los juguetes son juegos de mesa, videojuegos y muñecas que promueven una actividad sedentaria por parte del niño. Estos juegos potencian el rol social e intelectual del niño, pero no fomentan la actividad física. Éste podría ser uno de los factores causantes de la obesidad infantil, que actualmente es uno de los mayores problemas de salud pública y que ha sido definida por la OMS (2010) como la epidemia del s. XXI.

Prensa escrita

La prensa constituye una fuente importante de acceso a la información de salud sobre riesgos y puede influir en la utilización de servicios sanitarios (Brittle & Zint, 2003). El periódico es el medio que goza de una mayor credibilidad, y puede publicar noticias y avances de salud con más profundidad que la televisión o la radio, y con más rapidez que los magazines (Great Britain, 1988). Además, los contenidos de salud y las secciones especializadas en ciencia y/o salud en la prensa escrita están aumentando año tras año, que a partir de las ediciones publicadas en internet ha pasado a tener mayor circulación (Gema Revuelta & de Semir, 2006). Sin embargo, la calidad de las noticias publicadas en periódicos no es óptima (Biondo & Khoury, 2005). Veamos algunos análisis de contenidos de salud en prensa diaria.

Un estudio realizado en España (Gema Revuelta & de Semir, 2006) analizó los contenidos de salud en prensa escrita durante 10 años revelando que, aunque se ha tratado temas de salud muy diversos, la información en realidad se concentra en unas pocas cuestiones más mediáticas, que son las que marcan a su vez la agenda social. Por otra parte, indicó que el género periodístico más utilizado es el informativo. Además, los investigadores añadieron que la sección de cartas al director puede ser utilizada de forma estratégica por los lectores para llegar a los responsables políticos del sistema sanitario.

Un estudio realizado en España (Rodríguez-Arrastía & Romero-Padilla, 2012) analizó la publicidad sanitaria en la prensa nacional. Los resultados muestran que la publicidad de los medicamentos es la más frecuente en el medio impreso y se muestra constante durante la semana. Sin embargo, existe un repunte de contenidos el domingo, apoyado por *ganchos* como obsequios para llamar la atención del lector. Los investigadores señalan que la publicidad se dirige equitativamente a públicos de ambos sexos y usan estereotipos para que el lector se pueda sentir identificado con el anuncio.

Un estudio realizado en varios periódicos nacionales de España (Muñoz-Álvarez, 2011) desveló que casi el 2% del espacio total de los periódicos fue dedicado a salud. Únicamente la mitad de los contenidos de salud incluyó las referencias utilizadas, siendo un aspecto negativo que muestra la falta de especialización en ciencia y salud de los periodistas que escribieron dichos contenidos.

Otro estudio que analizó la prensa nacional de Suecia (Catalán Matamoros, Axelsson & Strid, 2007) reveló que el 2,4% del espacio del periódico se dedicada a temas sobre salud. Los resultados indicaron que las fuentes de información más utilizadas por los periodistas fueron científicos, académicos y políticos. El estudio opina que el uso de los políticos como fuente de información podría incrementar el riesgo de conflictos de intereses en las noticias de salud. Añadió que es necesaria la realización de estudios para evaluar la calidad de los contenidos de salud en los medios.

También se han realizado estudios en prensa local, la cual tiende a hacer un mayor énfasis a aspectos culturales y étnicos de su área geográfica. Un estudio realizado en la prensa de Almería (Hernández-García, 2011) encontró que casi el 7% de los espacios de la prensa eran dedicados a salud. Esto supone casi 3 veces más que los estudios presentados anteriormente realizados en España y Suecia, por lo que podría avanzar que la prensa local muestra un mayor interés por los contenidos sobre salud.

Internet

Internet resulta ser un medio muy innovador y con unas características muy favorables para la temática científica y por consiguiente sobre salud (Semir & Revuelta, 2006). Internet ha revolucionado el acceso de la población a la información sobre salud y a la relación entre los usuarios de los servicios de la salud con sus profesionales. Muchos pacientes consultan sus síntomas y problemas de salud antes de visitar el hospital y otros participan compartiendo sus experiencias en foros de pacientes, lo que les ayuda a sobrellevar la enfermedad. Este fenómeno se puede encuadrar en el marco del *periodismo ciudadano*, aspecto que merece futuras investigaciones. Según Albert Novell – presidente del Foro Español de Pacientes, internet produce que la población tome un papel más activo en la toma de decisiones sobre su propia salud, especialmente en el diagnóstico, tratamiento y seguimiento.

La interacción entre los pacientes y la propia prensa también ha sido influida por la era internet. La red está dando más voz al sector civil, tales como ONG's y asociaciones de pacientes. Los periodistas, cada vez más, consultan con webs de asociaciones de pacientes y contactan con foros de salud (Gema Revuelta & de Semir, 2006). Los diferentes actores de los sistemas de salud tienen en internet un espacio de información, un medio de comunicación, una herramienta para la provisión de servicios y, por último, un campo de actuación en salud pública. Estas posibilidades, con un enorme potencial de transformación de la práctica asistencial basada en los intercambios inmateriales de información, se han sintetizado en cinco grandes áreas de estudio: la calidad de la información sobre salud disponible en internet, el uso de esta información, los efectos de internet en la relación entre profesional sanitario y paciente, las comunidades virtuales y los grupos online de ayuda mutua y, finalmente, la prestación online de servicios de salud basados en la información (Lupiáñez-Villanueva, 2011).

A pesar de que internet es el medio de comunicación más joven con el que contamos actualmente, ya se han publicado numerosos estudios sobre los contenidos de salud en la red. Muchos han analizado la calidad de las páginas

webs dedicadas a salud. Trabalón-Flores (2012) estudió las páginas sobre hipertensión arterial en países de habla hispana, las cuales a pesar de mostrar una buena calidad, mostraron carencias en relación a la existencia de política editorial y a la transparencia de las fuentes de financiación. Otro estudió, que analizó las páginas web sobre el Virus del Papiloma Humano (Arcos-García, 2012), reveló que existe mucha controversia sobre la información que se muestra sobre la vacuna. El estudio mostró como numerosas páginas webs están financiadas por la industria farmacéutica o clínicas privadas donde se aplica la vacuna, por ello, en estos casos, la información podría estar sesgada u orientada a intereses comerciales.

Los contenidos sobre salud en los medios: Influencia y efectos en la población

Los teóricos coinciden en las principales funciones que el periodismo científico debe ejercer en la sociedad actual y las sintetizan en tres (Costa Sánchez, 2008): Informar –dar a conocer los hechos, interpretar y explicar –dotar de sentido a los nuevos descubrimientos, y controlar –ejercer cierta supervisión puesto que la investigación científica forma parte de las políticas públicas.

Las influencias de los medios de comunicación en la sociedad han sido estudiadas bajo diferentes marcos teóricos (Gemma Revuelta, Alonso, Tomás, Guerrero, & Rohlfs, 2004). Mauro Wolf, en su obra «Los efectos sociales de los media» destaca, entre otros, los siguientes mecanismos de influencia: a. la dependencia de la sociedad respecto a los medios como sistema de información sobre cualquier ámbito –incluida, por tanto, la información de salud; b. el efecto de los medios en el establecimiento de la agenda pública, o la lista de temas que son prioritarios para una determinada sociedad en un momento concreto; c. la influencia en las representaciones sociales de la realidad –p. ej., con la recreación de ciertos estereotipos y roles sociales, y d. los efectos sobre la creación de la «opinión pública», al difundir, por una parte, determinadas opiniones y, por otra, por ser uno de los sistemas utilizados individualmente a la hora de percibir cuál es la opinión de la mayoría –poll-taker.

Por otra parte, los medios han sido también criticados por crear confusión y promover comportamientos insanos –ej. alimentación hipercalórica, consumo de alcohol, tabaco, etc.. Por lo tanto, los medios de comunicación no sólo no ejercen una tarea promotora de la salud, sino que, ya sea por los condicionamientos económicos de su dependencia de la publicidad, los medios son en muchos casos difusores de confusión y promotores de comportamientos y actitudes insanas.

La eficacia de los medios de comunicación en la promoción de hábitos de vida más saludables, especialmente en la tarea de erradicar los comportamientos perjudiciales, no está probada. Por lo general, parece aceptarse que los medios no son el instrumento más adecuado para esa tarea y sí para la diseminación de información sobre sustancias y comportamientos dañinos para la salud, sobre modos de detección precoz de las enfermedades, etc. Pero sin lugar a dudas, el aumento de información sobre un tema determinado de salud es un elemento imprescindible para el cambio de actitudes. Por lo que desde este punto de vista, los medios pueden estar ligados con el cambio de conductas hacia otras más saludables.

El aumento de información que produce los medios se puede ver disminuido según se presente la noticia. Cuando falta claridad y abunda los términos técnicos, difícilmente comprensibles por el público general, se limita la recepción de la información, además de mostrar la incapacidad expresiva del periodista. Por lo tanto, el rol específico de los medios en relación al cambio de conducta se basa en facilitar el aumento de información, aspecto clave en el cambio de conductas. De esta manera, queda aclarado que los medios, como instrumentos de comunicación, pueden obviamente influir sobre las conductas y actitudes de sus públicos. La eficacia de los medios de comunicación en la promoción de la salud depende de que difundan información exacta y actualizada de manera simple y convincente para que el público general la comprenda y actúe de acuerdo con ella. Esto no siempre es tarea fácil, y supone un esfuerzo por parte del periodista para elaborar mensajes simples pero efectivos.

Para poder conseguir cambios de conducta, las campañas realizadas en los medios deben ir acompañadas de otras intervenciones tales como actividades educativas y persuasivas, como por ejemplo, consultas clínicas en atención primaria, subida de impuestos del tabaco y alcohol para la prevención del tabaquismo, adecuación del mobiliario escolar para la prevención de los problemas de espalda, etc. Esto es lo que lleva a proponer lo siguiente como modelo ideal para conseguir cambios de conductas: la combinación de estrategias efectivas de comunicación unidas a otras intervenciones más personalizadas, y otras de ámbito social y legislativo.

Reflexiones finales

A modo de reflexión, se ha mostrado como el objetivo del periodismo en salud debe basarse en conseguir una sociedad más sana, más consciente de la importancia de la salud, más conocedora de lo que debe hacer para mantenerla e incrementarla y más proclive a los comportamientos que puedan hacer a los individuos sentirse mejor.

Este artículo ha reflejado cómo el periodismo sobre salud puede aportar importantes beneficios a la sociedad, pero también pueden comportar efectos negativos, si las informaciones no son tratadas con el suficiente rigor y la calidad necesaria en un tema tan crucial para el bienestar de una sociedad como es su propia salud. Por ello, es necesario profundizar en este campo para identificar prácticas periodísticas que puedan producir efectos negativos en la salud de la sociedad, y también identificar otras prácticas que promuevan la mejora de la salud en la sociedad para compartirlas en otras comunidades. En este sentido, sería importante la realización de análisis de contenidos sobre salud para vigilar el buen uso de los medios de comunicación. Los análisis de contenidos sanitarios son una buena metodología para comprender lo que consume el público sobre salud. Sin embargo, como se ha podido comprobar en este artículo, dichos análisis son fundamentalmente de carácter cuantitativo. Estudios basados en la recepción y comprensión de dichos contenidos por parte del público son escasos

y podría ofrecernos información muy valiosa que ayudarían a seguir mejorando los contenidos sanitarios en los medios.

Además, otro aspecto a destacar es que la comunicación en salud debe ser el fruto de una colaboración entre profesionales de la salud y la comunicación. Unos tienen los conocimientos científicos y otros conocen los mecanismos para conseguir que esos conocimientos sean comprendidos de forma efectiva por el público general. Los equipos transdisciplinares son necesarios para la elaboración de planes de comunicación efectiva en salud.

La ambivalencia de los medios en el ámbito de la salud ha quedado demostrada. Los medios pueden sanar o enfermar a la sociedad, según sea el objetivo o los intereses que promuevan los contenidos publicados. Una mayor concienciación por parte de los profesionales de la salud, del periodismo, y de la sociedad en general puede evitar y prevenir estos efectos dañinos para beneficiarse de todo los aspectos positivos que los medios ofrecen para mejorar la salud pública.

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Notas

[1] El Informe Quiral es un estudio de investigación realizado conjuntamente por el Observatorio de la Comunicación Científica de la Universidad Pompeu Fabra sobre un tema de salud determinado. Anualmente se presenta un Informe Quiral, que pueden ser descargados desde http://www.fundaciovilacasas.com/es/salud-iinforme-quiral/

[2] El Barómetro Sanitario es producido por el Ministerio de Sanidad, Servicios Sociales e Igualdad de España y tiene como objetivo conocer la opinión de los ciudadanos para tomar en consideración sus expectativas, como elemento importante para establecer las prioridades de las políticas de salud.

[3] Este Barómetro es una iniciativa conjunta del Instituto de Prospectiva Internacional –IPI, el Grupo Cofares y la Agencia EFE; se trata de un instrumento de investigación social basado en varios paneles que mide el estado de ánimo de la sociedad, así como sus principales preocupaciones e inquietudes.

[4] Las Naciones Unidas, a través de la Organización Mundial de la Salud, y la Comisión Europea, a través del Centro Europeo de Prevención y Control de

Enfermedades, son los organismos internacionales que más frecuentemente realizan campañas en los medios de los países Europeos.

[5] El 22/12/2009, El País público el reportaje titulado «El Dolor como quinto signo vital» en el que anunciaba que el nuevo fármaco Tapentadol revolucionaría el tratamiento del dolor crónico –Enlace: http://www.elpais.com/articulo/sociedad/dolor/quinto/signo/vital/elpepisoc/20091222elpepisoc_8/Tes. Después de un análisis exhaustivo se descubrió que este reportaje era un caso de publicidad encubierta. El País pidió perdón a sus lectores el 17/01/2010 mediante el siguiente reportaje «Avances médicos e Intereses ocultos» –Enlace: http://www.elpais.com/articulo/opinion/Avances/medicos/intereses/ocultos/elpepiopi/20100117elpepiopi_5/Tes).

Study 2. The use of traditional media for public communication about medicines: A systematic review of characteristics and outcomes

Reference:

Catalan-Matamoros, D., & Peñafiel-Saiz, C. (2017). The Use of Traditional Media for Public Communication about Medicines: A Systematic Review of Characteristics and Outcomes. *Health Communication*, 1–9. https://doi.org/10.1080/10410236.2017.1405485

Abstract

A systematic review was conducted to identify, appraise and synthesize data from original research investigating the use of traditional media for public communication about medicines. Databases were searched for studies conducting quantitative or qualitative analyses between the years 2007-2017. Data extraction and assessment of the quality of the resulting studies was conducted by one reviewer and checked for accuracy by a second reviewer. A total of 57 studies met the inclusion criteria. Studies were grouped as follows: 'newspapers and other print media' (n = 42), 'television' (n = 9) and 'radio and a combination of media' (n = 6). Content analysis (n = 34) was the most frequent research design, followed by surveys or interviews (n = 14) and RCTs (n = 9). Advertising, public awareness and health administration were the most common themes, and the medicines most analyzed were vaccines, especially HPV and influenza. Studies conducted in the US were the most frequent, followed by other high-income countries such as Canada and the United Kingdom. The lack of consistent studies of the effects of media campaigns stresses the importance of the use of standardized research methodologies. Theoretical and practical implications of the findings for further research are discussed.

Introduction

Individuals often seek information about beneficial medicinal products to help them achieve better health and wellbeing. Health professionals, who prescribe, counsel, and inform on medicines, tend to focus much more on the cellular and organ level effects of the medicines, resulting in prescription information for patients that is dense and complex (Kish-Doto et al., 2014). They often do not provide information that the patient or consumer needs, such as descriptions of the effects of medicines and the impact of medicines on their lives; this results in increasing the information seeking needs of patients (Montagne, 2001).

When seeking medication information, patients have a number of sources from which to choose. Past surveys of patient information seeking have indicated that media sources are more important than health professionals in learning about new medicines and their effects (Song et al., 2016). In fact, the media are one of the leading sources of information about medicines for the public. This review focuses on traditional media including television, radio, print press, etc. Although the growth of online media, traditional media are not dead and still play an important role in the communication landscape (Belch & Belch, 2014). In fact, traditional media have been in existence for long and are still a main medium of communication in many regions of the World. For example, in India traditional media yet occupy an important role in the delivery of messages to a large number of people (Mathiyazhagan, Kaur, Ravindhar & Devrani, 2015).

The effects of the media in the population are well known. The amount and the type of information presented in the media can shape beliefs, attitudes and perceived norms, which, in turn, influence behaviors (Fishman & Casarett, 2006) and impact the decisions not only of patients, but also of health care providers and policy makers (Weeks & Strudsholm, 2008). Previous studies have shown that the beliefs held by a person about medicines play an integral part in influencing medical decisions (Duggan et al., 2014; Fang, Panguluri, Machtinger, & Schillinger, 2009). Studies have also reported that health beliefs are potentially

important mediators of successful self-management of health conditions (Federman et al., 2013).

In the last decade, health communication researchers have analyzed the relationship between medicines and the media, describing the types of medicinal products, types of media and research methodologies. Media discourse on medicines is an important element of how medicinal information is communicated to a mass audience (Clarke, 2011).

To our knowledge, beyond the original studies, only one systematic review has been conducted investigating the role of the media in medicines (Gollust, LoRusso, Nagler, & Fowler, 2016). However, this study was limited to news media on the human papillomavirus (HPV) vaccine uptake in the United States (US), and included only 13 content-analysis articles published from 2006 to 2011. In contrast, our systematic review intends to expand the review towards all types of medicines, methodologies and world regions. We also intend to update the publication period. To achieve this goal, we conducted a systematic review to identify, appraise and synthesize data from research investigating the use of media for public communication about medicines.

Method

Search strategy

We searched databases PubMed (Medline), Scopus and the International Bibliography of Social Sciences (IBSS). Search strategies combined two types of terms: media terms (e.g., television, radio, newspaper) AND medicine terms (e.g., drug, medication, pill, prescription); see search strategy in table 1. Papers that were written in English and published between January 1 2007 and January 1 2017 were included. We chose the time period from 2007 in order to only analyze publications made after the publication of the World Health Organization guidelines on the safety of medicines, in which the mass media were recognized as a key element (World Health Organization, 2006).

Table 1. Search strategy in PubMed		
	Search terms	*Items found*
#1	Search [Title] **mass media OR communications media OR television OR radio OR newspaper OR print OR magazine OR journal OR book OR pamphlet OR cinema OR movie OR news** Filter: 2007/01/01 - 2017/01/01	17942
#2	Search [Title] **medicine* OR drug* OR pharma* OR medication OR pill* OR prescription OR prescribe* OR vaccine* OR antibiotic* OR medicament* OR medicinal OR suppositories OR tablet* OR syrup** Filter: 2007/01/01 - 2017/01/01	4438
#3	Search **#1 AND #2** Filter: English language	497

Regardless of their methodological quality, the studies had to meet the following inclusion criteria: (1) describe a mass media intervention using radio, television, newspapers or any other media such as movies, pamphlets, etc.; (2) address medicines in general or specifically, such as antibiotics, vaccines, etc.; (3) report original qualitative or quantitative data examining the media coverage of medicines. Reference lists of key articles were manually searched to identify further relevant studies. Systematic reviews, abstracts, dissertations, single case reports, editorials, commentaries, conference abstracts, non-research articles and studies focused on digital mass media, such as the Internet or social networks, were excluded.

The flow diagram in Figure 1 outlines the screening processes applied to the 612 articles identified by the literature searches, which were subsequently screened for duplication and relevance. Of those, 124 full-text articles were considered relevant and were assessed for eligibility. This ultimately led to the inclusion of 57 studies for further analysis. A total of 67 full-text articles were excluded after careful review. The specific reasons for exclusion can be found in Figure 1.

Figure 1. Prisma flow diagram

Identification

Records identified through database searching
(n = 612)
Pubmed (n=497)
Scopus (n=68)
IBSS (n=47)

Additional records identified through other sources
(n = 0)

Records after duplicates removed
(n = 585)

Screening

Records after screening titles and abstracts
(n = 124)

Titles/abstracts excluded
(n = 461)

Eligibility

Records after screening full-text articles
(n = 57)

Articles excluded after full-text review
(n = 67)
Reasons for exclusion:
- Not on medicines (n=25)
- Opinion article (n=29)
- Review (n=5)
- No mass media use (n=4)
- Internet (n=2)
- Research project (n=1)
- Other languauges (n=1)

Included

Studies included
(n = 57)

Coding

The review team developed a coding form designed to capture descriptive information on the included studies. The variables analyzed were: country, media type, major theme, medicine type, objectives, design, outcome measures, sample size, main outcomes, conclusions and quality assessment.

The articles were reviewed by the first author who was trained to capture the relevant data. For inter-rater reliability, the second author independently coded a random selection of 10% of the studies (n = 58). The Cohen kappa inter-rater agreement coefficient (Cohen, 1960) , which adjusts for the proportion of agreements that takes place, was evaluated using the guidelines outlined by Landis and Koch (1977), where the strength of the kappa coefficient is as follows: 0.01-0.20 slight; 0.21-0.40 fair; 0.41-0.60 moderate; 0.61-0.80 substantial; 0.81-1.00 almost perfect. The analysis provided an inter-rater reliability of 94% agreement and a kappa coefficient of 0.71. Therefore, the inter-coder reliability was substantial. All discrepancies between coders were resolved through discussion.

Data Synthesis and Analysis

We synthesized data qualitatively, dividing studies into major themes and medicine types. We did not have a sufficient number of studies with similar topics or methodologies to consider meta-analysis. Overall, the aims, data collection methods, samples and settings were sufficiently described in the studies. Evidence appraisal was conducted following the guidelines of the Scottish Intercollegiate Guidelines Network (SIGN), which rates the quality or certainty of the evidence (Harbour, Lowe, & Twaddle, 2011). In brief, each paper identified as relevant was appraised. The authors agreed on a methodological quality rating using the methodology and hierarchy of study types. The hierarchy of study types was as follows: level 1 evidence, systematic reviews, meta-analyses, and randomized controlled trials (RCTs); level 2, non-randomized intervention studies, observational and cohort studies; level 3, surveys and quasi-experimental studies; level 4, expert opinion. To aid interpretation of findings, we emailed some study authors to obtain additional details about some of the studied interventions.

Results

We attempted to code the included papers on a number of features that the literature suggests may be relevant to describe the papers, such as country, media type, major theme, medicine type, etc. For a summary of characteristics of the 57 studies see 'online supplementary table 1', and for outcomes and conclusions see 'online supplementary table 2'.

Since the studies include analyses of a wide range of media types, we have decided to group them according to the following categories representing the media types: 'newspapers and other print media' (n = 42), 'television' (n = 9), 'radio and a combination of media' (n = 6).

Newspapers and other print media

Frequency of types, countries and themes

Newspapers were the most frequent media type reported among the included studies. In total, 42% (n = 24) of all included papers studied medicines' contents in newspapers. Half of the analyses took place in the US (n = 12) while the remaining studies covered the following countries: United Kingdom (UK) (n = 5), Canada (n = 5), Australia (n = 3), Israel (n = 1), Panama (n = 1), India (n = 1) and China (n = 1). They focused on the following four major themes: a) 'medicines' (n = 18) where 'vaccines' (n = 13) were the most common ones which included analyses on 'HPV' (n = 8), 'autism' (n = 2), 'influenza' (n = 2) and 'measles, mumps and rubella vaccine' (MMR) (n = 1); b) 'administration' (n = 4), including analyses of contents such as the provision of licenses, pharmaceutical funding, medication errors and crisis communication; c) 'advertising' (n = 1); and d) 'public awareness campaigns' (n = 1).

Other print media included magazines (n = 6), pamphlets (n = 2), comics (n = 1), booklets (n = 1) and the combination of different print media (n = 2). Six studies did not specify the type of print media analyzed. These studies of other types of

print media were published in the US (n = 15), Canada (n = 3) and Iran (n = 1). In contrast to newspapers, the most frequent theme among these types of media was 'advertising' (55%, n = 10), including the following prescription and/or over-the-counter (OTC) drugs (n = 1 each): urological drugs, celiac disease drugs, chronic pain/heart attack/stroke drugs, diabetes drugs. Seven studies did not specify the type of drug.

Frequency of research methodologies

Concerning the research methodology that was employed by studies analyzing print media, we found that content analysis (n = 31) was most the frequent, followed by RCT's (n = 7), surveys (n = 4) and focus groups (n = 1). The analyzed material included 6,963 news articles for content analysis (Mean = 348.0 ± 408.9, range: 12-1,639), 11,140 participants in surveys or RCTs (Mean = 696.0 ± 1,087.1, range: 17-4,064), and 580 advertisements (Mean = 116.0 ± 119.5, range: 8-282). Other materials were also analyzed in single studies: 255 comments, 108 journal issues and 40 scientific articles. With regards to the quality appraisal, the quality of studies was very good, and was assessed as '1+' and '2+'.

Reported effects

Outcomes and conclusions showed effects of print media for the public communication of medicines. These effects were rather positive, especially in health education; however, some risks were also discussed by authors. The three main risks found in the eligible studies were: 1) disjoint between newspaper contents and information needed by consumers (St. John, Pitts, & Tufts, 2010), 2) news media widely covering the pharmaceutical industry, while consumers have minimal representation (Hartley & Coleman, 2008), and 3) lack of technical information in newspapers, and an information gap that might inhibit informed discussion and lead to entrenching of polarized social representations, as well as to the stigmatization of some users of post-exposure prophylaxis (PEP) after HIV

risk (Jaspal & Nerlich, 2016). Overall, these studies underscored the importance of enhancing collaboration between scientists, clinicians and journalists.

Second, only one study has shown that newspapers have been consistent with scientific publications (Sznitman & Lewis, 2015). In contrast, other studies concluded that scientific publications have poor media coverage. This can be illustrated by the following studies: 1) One study highlighted the under-representation of newspaper coverage of genomics medicine, despite the vast growth of articles in scientific journals within this knowledge domain (Zhao et al., 2014). 2) another study found that adherence is not well covered in the newspaper media, despite a significant presence in the scientific journals (Goodfellow, Almomani, Hawwa, & McElnay, 2013). 3) Perez, Fedoruk, Shapiro, and Rosberger (2016) found that the majority of articles (93%) mentioned that girls are eligible for the HPV vaccine, whereas only half (49%) mentioned male eligibility, although this information has been widely published in the scientific literature.

Third, media coverage of medicines has been shown to have a positive effect in the population. As an example, one study found that vaccination rates were positively related to the frequency of risk messages in newspapers, highlighting the important power of the media in decision-making (Meyer et al., 2016). Another study found that early provision of tailored immunization pamphlets on vaccines to new mothers may enhance their overall confidence in vaccines (Klein et al., 2009). Another study focused on advertising and concluded that emotional appeal may be effective for selling medication to women; however, it often does not completely inform consumers of potential risks (Mongiovi, Clarke Hillyer, Basch, Ethan, & Hammond, 2016). Importantly, another study found that information on the HPV vaccine in newspapers included fear-inducing messages (Abdelmutti & Hoffman-Goetz, 2010); clinicians need to be aware of this in order to alleviate fears that the public may experience about the HPV vaccine.

Finally, the quality of the content of drug coverage by newspapers has also been addressed. Guillaume and Bath (2008) found that the content and format of

articles between different information sources varied widely in the case of the MMR vaccine. These differences were attributed to the information source in which they were published (Heisler et al., 2014). Therefore, variability in these information sources provides a challenge to the public who seek health information in the media. Another study on the influenza A(H1N1) vaccine found that news articles rarely presented direct evidence to support statements that the vaccine was safe, effective and properly tested, and that known risks (such as potential allergic reactions and flu-like side effects) of the vaccine were rarely reported (Rachul, Ries, & Caulfield, 2011). Another study found that media coverage of the HPV vaccine was often incomplete, providing little context about cervical cancer or screening (Casciotti, Smith, Andon, et al., 2014). Content quality of drug advertising in print media has also been analyzed. For example, one study found sophisticated attempts both to educate and persuade readers, and concluded that it is important for consumers and prescribing physicians to read print advertisements critically so that they can make informed treatment choices (Gooblar & Carpenter, 2013). Another study found that news articles about medication research often fail to report pharmaceutical company funding, and frequently refer to medications by their brand names (Hochman, Hochman, Bor, & McCormick, 2008). Further, less than half of the articles on the HPV vaccine provided detailed health information (Quintero Johnson, Sionean, & Scott, 2011). An analysis of women's magazines revealed that advertisements place greater emphasis on directing readers to industry information resources than to physician discussions (Sokol, 2010). One study recommended that disease information and product information in drug advertisements should be distinct in terms of appearance, and not conjoined, in order to avoid confusion (Aikin, Sullivan, & Betts, 2016).

Television

Frequency of types, countries and themes

In total, 16% (n = 9) of all included papers described the use of television (TV) media for public communication about medicines. 100% of studies were

conducted in the US, and from these, one paper combined TV and print media, and another one combined videos and pamphlets. Eight studies were primarily coded under the major theme of 'advertising', and included the following medicine types: seasonal allergy and asthma drugs, statin drugs, other non-specified OTC and/or prescription drugs. The remaining study's major theme was 'antibiotics'.

Frequency of research methodologies

The research method most frequently used was surveys (n = 4), followed by content analysis (n = 3) and RCTs (n = 2). The analyzed material included 116,508 participants in RCTs and surveys (mean = 19,418.0 ± 42,906, range: 84-106,859), and 206 advertisements for content analyses (mean = 103.0 ± 91, range: 38-168). Regarding quality appraisal, the quality of studies was excellent and was assessed as '1+' and '2+'. One study scored '1++' (Aikin et al., 2017).

Reported effects

Outcomes and conclusions from the studies can be grouped into two categories, the effects on the public, and quality of the content. First, the effects of drug advertisements on the public were analyzed in several studies. Khanfar, Clauson, Polen, and Shields (2008) found that patient-initiated discussions with physicians regarding television-based direct-to-consumer advertisements (DTCA) on allergy and asthma medications resulted in a change of treatment in 39.1-44.0%- of respondents. Another study concluded that an animated video is highly effective for educating parents in an emergency department setting about the appropriate use of antibiotics, and resulted in long-term knowledge retention (Schnellinger et al., 2010). One study found that risk disclosures presented redundantly in both the visual and auditory modalities produced the highest recall and recognition, while visual only produced better performance than auditory only (Wogalter, Shaver, & Kalsher, 2014). Another study revealed that any visual aid, compared with no visual aid, elicited more accurate drug efficacy recall; further, using a bar chart was better for efficacy of recall than using a pictograph or a table (Sullivan et al., 2016).

The effects of statin drug advertisements have been analyzed by various studies. Exposure to statin advertisements increased the odds of being diagnosed with high cholesterol by 16-20%, and increased statin use by 16-22%, among both men and women ($p < 0.05$) (Aikin et al., 2017). Moreover, statin drug DTCA was associated with increased food guilt and exercise guilt (in a threshold pattern), providing new evidence that DTCA has the potential to influence emotional well-being (Kruger, Niederdeppe, Byrne, & Avery, 2015). Another study found that DTCA may promote over-diagnosis of high cholesterol and over-treatment for populations where risks of statin use may outweigh potential benefits (Niederdeppe, Byrne, Avery, & Cantor, 2013).

Second, in terms of quality of the content, one study found that potentially misleading claims are prevalent throughout consumer-targeted prescription and non-prescription drug advertising on TV (Faerber & Kreling, 2014). Another study found drug claims on tv had limited educational value and may oversell the benefits of drugs in ways that might conflict with promoting population health (Frosch, Krueger, Hornik, Cronholm, & Barg, 2007).

Radio and a combination of media

One study described a radio campaign promoting the quality use of both prescription and OTC medicines (Quality Use of Medicines; QUM) (ThuyTrinh, Stephenson, & Vajda, 2011). The campaign was conducted in Australia and data collection was performed by interviewing 600 adults. In the study, awareness of quality use of medicines was increased by 6%. The radio campaign was effective in increasing awareness and knowledge of QUM among seniors. However, the effectiveness of the campaign varied between language groups. According to the quality appraisal, the quality of this study scored '2+'.

Five studies described the use of a combination of media types for public communication about medicines. The types of medicines analyzed were vaccines (n = 3), specifically seasonal influenza and HPV, antibiotics (n = 1) and HIV drugs

(n = 1). All studies were conducted in the US, except for one in Italy. Three studies gathered data through a survey, one followed a descriptive observational design and another one conducted a non-randomized clinical trial. A combination of media has shown to be effective. In fact, one study concluded that various communication channels should be utilized to increase the influenza vaccination rate on a university campus (Shropshire, Brent-Hotchkiss, & Andrews, 2013). Capanna et al. (2015) found an important effect of a media event on anti-flu vaccination program adherence. This study reported a failure in communication and joint management of Public Health Institutions in Italy regarding efficacy and safety information of the flu vaccine. Another study revealed that a low-cost mass media campaign was associated with a reduction in antibiotic use in the community, and seemed to be mediated through decreases in rates of office visits among children (Gonzales et al., 2008). Moreover, the campaign seemed to be cost-saving.

Discussion

There are three main conclusions that can be drawn from this systematic review on the use of media for public communication about medicines. Although overlapping, it is useful to distinguish between conclusions about the available literature, conclusions about outcomes, and conclusions about the content quality of existing public communication campaigns.

Underrepresentation of publications from developing countries

First, the 57 studies reviewed here describe the use of media for public communication about medicines that took place during the last ten years. This includes studies from around the world, and which tackle a broad array of medicines. The majority of the studies included in this review originated from the US (n = 47), and in clearly lower proportions, from other high-income countries such as Australia, the UK, Canada and Italy. There could be several reasons for the lack of publications in low-income countries. According to Muula (2008) these include limited technical competency in scientific writing, lack of research, high

teaching burden which does not allow time for research and writing; and biases against low-income countries' authors by journals editors, editorial boards, and publishers from high-income countries. In addition, there is also a lack of funding from international funding agencies, which are largely from the developed nations, and many journals from low-income nations are not indexed in global databases (Marusić, Sambunjak, & Marusić, 2006) thus they can't be found through our systematic review. Another reason for the dominance of research in the US might be because of the established regulatory system for direct-to-consumer prescription drug advertising (DCTA). In fact, DTCA of prescription drugs is illegal in some countries as a health protection measure, but is permitted in the US and New Zealand (Mintzes, Morgan, & Wright, 2009). In contrast, the advertising of over-the-counter (OTC) products and dietary supplements to consumers is allowed in these countries and in others. Therefore there is an increasing need for analyses of public communication of medicines in low-income countries, because laws regarding public communication on medicines (i.e. advertising) are rarely implemented in these countries due to lack of commitment and resources on the part of the law enforcement departments (Byarugaba, 2004). In fact, according to our systematic review, the characteristics and outcomes of public communication of medicines in low-income countries is currently unknown.

Low frequency of publications analyzing other media beyond newspapers

According to our search findings, newspapers were the most analyzed media among the selected studies; only one study analyzed a radio campaign. This homogeneous analysis does not reflect the real mass media consumption by the public, instead it reflects the preferences in media research, where newspapers are most frequently sampled by social scientists, rather than other media such as television or radio (Teixeira et al., 2012). According to evidence appraisal, television scored the highest (1++) quality rating, including a high quality RCT study. However, the radio campaign scored 2+, calling for more RCT's in this type of media. Moreover, although other traditional mass media were included among the search terms, no results were obtained in some of them. This is the case for

'movies', where we did not find any analyses about the public communication of medicines. Movies impact viewers' perspectives and behaviors, and this entertainment medium also represents an opportunity for health education (Mgbako et al., 2014). Therefore, further research should focus on other potential media, such as radio and movies. Nevertheless, other studies analyzing the effects of communication strategies of medicines, which have not been gathered from our search strategy, have been published describing other media such as television. For example, the study conducted by Aikin et al. (2015) examined the exposure to a television ad for a fictitious prescription drug that appeared to offer benefits and risks superior to normative standards for asthma medication. This is further discussed in the section "Limitations of the review".

Types of medicines analyzed by the publications

Regarding the medicines analyzed by the studies included following our search criteria, vaccines were the most frequent. Immunization is the most cost effective public health discovery and one of the greatest medical achievements of the 20th century, saving more lives than any other health care intervention (Wiysonge, Waggie, Rhoda, & Hussey, 2009). The media have been used by both supporters and opponents of vaccines, especially where there is no state mandate for a particular vaccine, such as in the case of HPV and influenza. In the media, parents have been told that the vaccine is available, and have been advised of the risks of the disease it prevents, which may encourage parents to voluntarily vaccinate their child. But at the same time, vaccine critics are mobilized, well-funded and not going away (Lillvis, Kirkland, & Frick, 2014). In our study, HPV and influenza vaccines were the most frequently analyzed. Moreover, antibiotics were also frequent in the analyzes, reflecting the increasing number of international and national media campaigns aimed at promoting prudent antibiotic use among the public in order to combat one major health threat, antimicrobial resistance (Earnshaw et al., 2014).

Outcomes of media research of medicines

Regarding our second main conclusion about the outcomes of the media communications, it was not possible to distinguish among the effects of newspapers, television or radio due to the high heterogeneity in the selected studies. Outcomes appear to vary considerably according to the type of media, type of medicine and study design. We did not attempt to conduct pooled analyses of the effectiveness of mass media communications using the results from the RCTs due to heterogeneous interventions. This makes it difficult to draw substantive conclusions about mass media effects. In a previous literature review (West et al., 2013) analyzing if the presentation of quantitative risk and benefit information in drug advertising and labeling influences information processing, knowledge, and behavior, they found that presenting numeric and non-numeric information appears to be the best communication strategy in drug labeling and print advertising. In our systematic review, effects show that the visibility of medicines influences behavior, i.e., vaccine intake increases (Meyer et al., 2016). Surprisingly, a high number of studies analyzed drug advertising. Although one might think that arguments against drug advertising would predominate, the debate is actually quite balanced. According to some authors (Frosch & Grande, 2010; Ventola, 2011), opinions and data in support of drug advertising are as follows: a) informs, educates and empowers patients, b) encourages patients to contact a clinician, c) promotes patient dialogue with health care providers, d) strengthens a patient's relationship with a clinician, e) encourages patient adherence and compliance, f) reduces under-diagnosis and under-treatment of conditions, g) removes the stigma associated with certain diseases, h) encourages product competition and lower prices. However, critics also commonly voice arguments against it. Opinions and data opposing drug advertising are: a) persuades and misinforms patients, b) over-emphasizes drug benefits and does not educate, c) promotes new drugs before safety profiles are fully known, d) manufactures disease and encourages drug over-utilization, e) leads to inappropriate prescribing and use, f) strains relationships with health care providers, g) wastes appointment time, h) is not rigorously regulated, i) increases

costs. Our review shows potentially misleading claims prevalent throughout consumer-targeted prescription and non-prescription drug advertising on television (Faerber & Kreling, 2014). Another study found limited educational value of drug claims on television, which may oversell the benefits of drugs in ways that might conflict with health promotion (Frosch et al., 2007). In fact, Hochman et al. (2008) found that news articles reported in medication studies often fail to report pharmaceutical company funding, and frequently refer to medications by their brand names. Therefore, both supporters and opponents of drug advertising should agree that even though it might not be possible to severely curtail or ban medicine advertisements, measures should at least be undertaken to maximize the benefits and minimize the risks to consumers.

Finally, our last analysis was related to content quality. The content analyses performed in the articles included in the present study leaves room for further improvement. Studies have found that scientific research on medicines is poorly covered by the media, and that the news articles or advertisements were often incomplete, providing little context (Casciotti et al., 2014) or evidence-based information on risks or effectiveness (Rachul et al., 2011). One study found that news widely covers the pharmaceutical industry, while consumers have minimal representation (Hartley & Coleman, 2008). In light of this, the studies have highlighted the need to enhance collaboration between scientists, clinicians and journalists as an important part of overall communication efforts for disseminating knowledge about medicines to larger audiences. As such, Zhao et al. (2014) argued that science journalism can help evaluate the quantity and quality of information shared between traditional scientific expert communities and the broader public.

Limitations of the review

Although our review followed systematic review methods, some limitations need to be noted. First, our analysis focused only on original scientific studies that have been published, so it is not a comprehensive assessment of media coverage in general, only of what samples and approaches researchers have used in studies

published in peer-reviewed journals. Thus, we are limited in our synthesis to those media types that other researchers chose to include in their assessments. In fact, we found that television (n = 9) and radio (n = 1) were infrequently analyzed, compared to print media (n = 42). However, the highest quality appraisal was obtained on television according to SIGN. With these regards, SIGN has been used in our review for quality appraisal, but there are tools that provide other quality information such as the risk of bias of the selected studies which have not been included in our review. Moreover, we did not include the existing published studies that focused on online news or other digital media (such as social networks, i.e., YouTube, Facebook or Twitter) in our review. As we chose to only cover traditional mass media, this type of media have not been included in this systematic review. Since 88% of millennials also get their news from social media (Gollust et al., 2016), this is a major gap in the current study especially for this age group.

Second, this systematic review includes all types of research designs. Our findings indicate that media content analysis (n = 34) was the most frequent type of study design conducted by the authors. In this type of research, we can only speculate on the importance of the themes and messages covered, but we cannot claim that the patterns and themes seen in the news media have actually shaped public views or vaccination behaviors. RCTs examining media effects are required to make those causal assertions, and our review only included nine RCTs.

And last but not least important, undertaking systematic reviews implies significant limitations according to the search strategy followed, such as what search terms and databases have been selected. Although we tried to use large databases and include as many search terms as possible, we should acknowledge that this systematic review might not cover all scientific literature on public communication of medicines. For example, there could be more papers describing other types of media such as television or radio which were not gathered under our search criteria. However, we clearly found that research in

print media, especially newspapers, conducted in the US is the most frequent with regards to research on public communication of medicines.

In spite of these limitations, to our knowledge, this is the largest systematic review to date analyzing the use of media for public communication about medicines. Given the explosion of scientific literature, and the fact that time is always scarce, review articles play a vital role in decision making in evidence-based practice. Given that most decision makers do not have the time to track down all the original articles, critically read them, and obtain the evidence they need for their questions, systematic may be their best source of evidence (Ganeshkumar & Gopalakrishnan, 2013).

Conclusions

Our review identifies, appraises and synthesizes the results of 57 original studies, and provides a useful basis for researchers and policy makers. We have identified gaps in the current literature and an agenda for further research. The following directions for future work are suggested:

a) Conduct media analysis of medicine communications in low-income countries. Our study showed that the majority of the studies have been conducted in the US and other high-income countries. However, due to poor enforcement laws in low-income countries, this becomes a research priority to analyze how public communication of medicines is being implemented under other legal circumstances.

b) Analyze the public communication of medicines in a variety of media, such as radio, movies and television. Most of the studies included in this review analyzed print media only, which are most used in social sciences research as previously described. However, while other media are delivering contents about medicines, we do not know what and how such communication is being done.

c) Further examination of the effects of public communication about medicines through the media, for example, by RCTs. The majority of

existing studies conducted content analyses. It is acknowledged that RCTs can provide evidence levels and recommendation about public communication strategies, and deepen in the effects made in the population. However, these research designs might imply more resources which could be another barrier for implementing new research in low-income countries, as suggested earlier.

d) Review studies examining social networks and other types of digital media. Since our review was focused on traditional media, studies describing other popular new media which are widely used among large age groups should be also analyzed in the future.

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Online supplementary table 1. Characteristics of the selected studies

Authors	Country	Media type	Major theme	Medicine type	Objectives
Abdelmutti & Hoffman-Goetz, 2009	US and Canada	Magazines	Medicines (vaccine)	HPV	Describe the presentation and portrayal of risk messages by comparing the type and frequency of fright factors about HPV, cervical cancer, and the HPV vaccine in Canadian and U.S. national newspaper articles published shortly before and after the HPV vaccine was approved and implemented into policy
Abdelmutti & Hoffman-Goetz, 2010	US and Canada	Magazines	Medicines (vaccine)	HPV	Assess the discussion of risks, fear-inducing messages about HPV, cervical cancer, and the HPV vaccine
Aikin et al., 2017	US	Television	Advertising	Prescription drugs	Investigate the extent to which visual similarity matters between violative and corrective ads and the extent to which time delay matters between violative and corrective advertisement exposure
Aikin, Sullivan, & Betts, 2016	US	Print media	Advertising	Prescription drugs	Investigate the effects of adding disease information to DTC prescription drug print ads on consumer product perceptions and understanding
Capanna, Gervasi, Cibttini, Volpe, Spadea, Sgricia, Zaratti, Franco, 2015	Italy	Various media	Medicines (vaccine)	Seasonal influenza vaccine	Assess the vaccination adherence following the media event
Casciotti, Smith, & Klassen, 2014	US	Newspapers	Medicines (vaccine)	HPV	Understand media portrayal of vaccine-related controversy and potential influences on attitudes and acceptance

Casciotti, Smith, Andon, et al., 2014	US	Newspapers	Medicines (vaccine)	HPV	Examine print news coverage of School-Based HPV Vaccine Mandate
Casciotti, Smith, Tsui, & Klassen, 2014	US	Newspapers	Medicines (vaccine)	HPV	Examine U.S. news media messages related to sexuality and HPV vaccination
Clarke, 2011	US and UK	Newspapers	Medicines (vaccine)	Autism vaccine	This article takes a "behind the scenes" look at normative pressures (and potential normative conflicts) that may influence whether mobilizing information appears in coverage of health issues like the AVC
Clarke, Dixon, Holton, & McKeever, 2015	US	Newspapers	Medicines (vaccine)	Autism vaccine	Describe how journalists can cover multiple sides of autism vaccine and provide insight into where the strength of evidence lies by focusing on "evidentiary balance"
Faerber & Kreling, 2014	US	Television	Advertising	Prescription and OTC drugs	Compare claims in consumer-targeted television drug advertising to evidence, in order to evaluate the frequency of false or misleading television drug advertising targeted to consumers
Folsom, Fesperman, Tojuola, Sultan, & Dahm, 2010	US	Magazines	Advertising	Urological drugs	Investigate direct-to-consumer advertising (DTCA) of prescription drugs that are relevant to urological conditions
Francis et al., 2009	US	Booklets	Medicines (antibiotics)	Child respiratory	Establish whether an interactive booklet on respiratory tract infections in children reduces reconsultation for the same illness episode, reduces antibiotic use, and

				infections antibiotics	affects future consulting intentions, while maintaining parental satisfaction with care
Frosch, Krueger, Hornik, Cronholm, & Barg, 2007	US	Television	Advertising	Prescription drugs	Analyze the content of television DTCA messages to lay the foundation for future studies that examine the consequences of DTCA exposure
Gabe, Williams, & Coveney, 2017	UK	Newspapers	Medicines (other)	Hypnotics (sleeping drugs)	Explores UK people's responses and assesses the implications for the debate about the (de)pharmaceuticalisation of sleep
Gollust, Attanasio, Dempsey, Benson, & Fowler, 2013	US	Newspapers	Medicines (vaccine)	HPV	Examine how individual political orientation and exposure to media coverage can also shape awareness of the vaccine
Gonzales et al., 2008	US	Various media	Medicines (antibiotics)	Prescription drugs	Evaluate the impact of a mass media campaign "Get Smart Colorado" on public exposure to campaign, antibiotic use, and office visit rates
Gooblar & Carpenter, 2013	US	Journals and magazines	Advertising	Alzheimer drugs	Examine print advertisements for Alzheimer's disease drugs published in journals and magazines between January 2008 and February 2012, using an informational versus transformational theoretical framework to identify objective and persuasive features.
Goodfellow, Almomani,	US, UK	Newspapers	Public awareness	Prescription drugs	Investigate what has been communicated to the public in the UK and US in terms of the frequency, content and context of the information provided

Hawwa, & McElnay, 2013					
Guillaume & Bath, 2008	UK	Newspapers	Medicines (vaccine)	MMR (measles, mumps and rubella) vaccine	Provide an interesting insight into the role of mass media as an information source during health scares
Hartley & Coleman, 2008	US	Newspapers	Advertising	Prescription and OTC drugs	Assessment of the relative prominence of power in print news media coverage of the DTC advertising phenomenon
Heisler et al., 2014	US	Print media	Medicines (other)	Diabetes drugs	Compare outcomes between community health worker (CHW) use of a tailored, interactive web-based tablet-delivered tool (iDecide) versus use of print educational materials
Hinchcliff et al., 2012	Australia	Newspapers	Administration	Prescription drugs	Investigate the frequency, style and reliability of newspaper reporting of medication errors
Hochman, Hochman, Bor, & McCormick, 2008	US	Newspapers	Administration	Generic drugs	Assess the reporting of pharmaceutical company funding and generic medication name use in news articles about medication studies and determine the views of newspaper editors about these issues
Huh, Suzuki-Lambrecht, Lueck, & Gross, 2015	US	Print media	Advertising	Milivax, fictious drug for celiac disease	Compare the cognitive effects of DTC prescription drug advergames, websites, and print ads

Jaspal & Nerlich, 2016	UK	Newspapers	Medicines (other)	Post-exposure prophylaxis (PEP) after HIV risk	To examine emerging social representations of PEP
Kahle et al., 2009	US	Various media	Medicines (other)	HIV drugs	Evaluate the effect of a press release about HIV drugs among MSM in the Seattle area
Katz et al., 2014	US	Comics	Medicines (vaccine)	HPV	Describe the development and initial feedback about an HPV vaccine comic book for young adolescents
Khanfar, Clauson, Polen, & Shields, 2008	US	Television	Advertising	Seasonal allergy and asthma drugs	Explore the influence of television-based DTCA on treatment changes in patient-initiated medication use
Kheirandish, Rashidian, & Bigdeli, 2015	Iran	Newspapers, weeklies and magazines	Administration	Prescription and OTC drugs	Assess the impacts of recent sanctions imposed by the Central Bank of Iran in 2012 on access to medicines in Iran
Klein et al., 2009	US	Pamphlets	Medicines (vaccine)	Vaccines for newborns	Compare the response to a new vaccine information pamphlet with the current CDC Vaccine Information Statements among recently delivered mothers who were screened to identify those with concerns about immunzation
Kruger, Niederdeppe, Byrne, & Avery, 2015	US	Television	Advertising	Statin drugs	Tests the relationship between estimated exposure to DTCA for statin drugs, which often feature mixed messages about the efficacy of diet and exercise in reducing risk of cholesterol and heart disease, and guilty feelings regarding food and exercise
Mastin, Andsager,	US	Magazines	Advertising	Prescription drugs	Identify and quantify the race, gender, and age of all models featured in four magazine genres' DTCA

Choi, & Lee, 2007					
Meyer et al., 2016	Canada	Newspapers	Medicines (vaccine)	Seasonal influenza vaccine	Examine, for the first time, the role of newspaper coverage in shaping the public response to seasonal flu vaccine campaigns
Mongiovi, Clarke Hillyer, Basch, Ethan, & Hammond, 2016	US	Magazines	Advertising	Prescription and OTC drugs	Both enumerate and assess the DTCA and OTCA in women's fashion magazines and address differences found in magazines marketed to non-Hispanic White, Black, or Latina women and assessed the presence of marketing appeals, products marketed specifically to women, and legally required content for advertisement of prescription and OTC medications
Mullins, Coomber, Broun, & Wakefield, 2013	US	Various media	Medicines (vaccine)	HPV	Assess the effect of three mass media campaigns to promote cervical screening on the rate of cervical screening tests in the Australian state of Victoria, after HPV vaccine became available
Niederdeppe, Byrne, Avery, & Cantor, 2013	US	Television	Advertising	High colesterol and statin drugs	Determine the relationship between estimated exposure to DTCA for statin drugs and two clinical variables: diagnosis with high cholesterol and statin use
O'Donoghue et al., 2016	US	Print media	Advertising	Prescription drugs	Investigate how laypersons perceive the Food and Drug Administration (FDA) approval process, FDA authority, and the presentation of composite scores in direct-to-consumer (DTC) prescription drug print ads
O'Donoghue, Sullivan, & Aikin, 2014	US	Print media	Advertising	Gilarix, fictious drug for chronic	Examine the effect of adding placebo rates and framing to DTCA

				pain, heart attack or stroke	
Perez, Fedoruk, Shapiro, & Rosberger, 2016	Canada	Newspapers	Medicines (vaccine)	HPV	Investigate what information Canadian newspapers relayed to the public following the January 2012 NACI male recomendation and how this content was framed and depicted
Quintero Johnson, Sionean, & Scott, 2011	US	Newspapers	Medicines (vaccine)	HPV	Explore the frequency of cancer prevention and sexually transmitted infection prevention message frames used to describe the HPV vaccine, the extent to which journalists relied on official sources, and the presence of personal examples
Rachul, Ries, & Caulfield, 2011	Canada	Newspapers	Medicines (vaccine)	Influenza A(H1N1) vaccine	Examine print news reports concerning the A/H1N1 vaccine in Canada with the objective of exploring media coverage content, including discussion and/or mention of reasons and evidence for/or against being vaccinated or risks associated with the A/H1N1 virus and vaccination
Rachul, Toews, & Caulfield, 2016	US and Canada	Newspapers	Medicines (other)	Cystic fibrosis drugs	Examine how policy issues associated with rare diseases and orphan drugs are being represented in the popular press
Robertson, Walkom, Bevan, & Newby, 2013	Australia	Newspapers	Medicines (vaccine)	HPV and Trastuzumab	Examine the timing and content of Australian newspaper reports of medicines in relation to Pharmaceutical Benefits Advisory Committee (PBAC) decisions

Schnellinger et al., 2010	US	Videos and pamphlets	Medicines (antibiotics)	Prescription drugs	Create an animated video to teach parents about the appropriate use of antibiotics and compare the knowledge of parents who were provided with the American Academy of Pediatrics pamphlet
Shropshire, Brent-Hotchkiss, & Andrews, 2013	US	Various media	Medicines (vaccine)	Seasonal influenza vaccine	Describe the effectiveness of a mass media campaign in increasing the rate of college student influenza vaccine obtainment
Singh et al., 2016	US, UK, Canada, India, Australia	Newspapers	Medicines (antibiotics)	Prescription drugs	Examine whether the word "evolve," sometimes considered controversial by the general public, is frequently used in the popular press
Sokol, 2010	US	Magazines	Advertising	Prescription drugs	Examine the prevalence and content of pharmaceutical ads in demographically different women's magazines
St. John, Pitts, & Adams Tufts, 2010	US	Newspapers	Medicines (vaccine)	HPV	Explore how both the news media and parents framed and responded to the newly-mandated HPV vaccine
Sullivan et al., 2016	US	Television and print media	Advertising	Prescription drugs	Determine whether visual aids help people recall quantitative efficacy information in direct-to-consumer (DTC) prescription drug advertisements, and if so, which types of visual aids are most helpful
Sznitman & Lewis, 2015	Israel	Newspapers	Administration	Canabis	Examine the framing of CTP in Israeli media coverage and the association between media coverage and trends in the provision of CTP licenses in Israel over time

The PLOS ONE Staff, 2014	Canada	Print media	Advertising	Prescription and OTC drugs	Determine whether a difference exists in the current level of pharmaceutical advertising in print general medical journals, in relation to the revenue generated from print pharmaceutical advertising
Thompson, Goldszmidt, Schwartz, & Bashook, 2010	Canada	Pamphlets	Medicines (other)	Methotrexate	Compare prose and pictorial-based information pamphlets about the medication methotrexate in the domains of free recall, cued recall, comprehension and utility
ThuyTrinh, Stephenson, & Vajda, 2011	Australia	Radio	Public awareness	Prescription and OTC drugs	Evaluate the effectiveness of a radio campaign in promoting the quality use of medicine (QUM) among Italian, Mandarin and Cantonese-speaking seniors
Turner, Boudewyns, Kirby-Straker, & Telfer, 2013	Panama	Newspapers	Administration	Diethylene glicol (Cough syrup)	Evaluate the crisis messages employed by the mainstream media and the government during the 2006 diethylene glycol (DEG) poisoning crisis in Panama
Wogalter, Shaver, & Kalsher, 2014	US	Television	Advertising	Prescription drugs	Examine presentation modality factors affecting the communication of the risk disclosures in DTC prescription drug television commercials
Zhao et al., 2014	China	Newspapers	Medicines (other)	Genomics drugs	Characterize the number of articles related to GM and analyze content published by the eight major Chinese newspapers

Online supplementary table 2. Outcomes and conclusions of the selected studies

Authors	Design	Outcome measures	Sample size	Main outcomes	Conclusions	Quality ass.
Abdelmutti & Hoffman-Goetz, 2009	CA	Bennett's checklist of fright factors which affect public perception of risk. The tree nodes were "HPV", "Cervical Cancer", and "HPV vaccine", with the fright factors as the sub-nodes	15 articles	Significant differences between countries were found in the number of articles containing fear messages about human papillomavirus, cervical cancer, and the human papillomavirus vaccine. Educational level of readability was higher than recommended for the public, and the emotional tone of the articles became progressively negative over time.	Public discussion of some elements of the human papillomavirus vaccine message that could cause alarm or worry for women may need to be addressed within political and cultural contexts.	2+
Abdelmutti & Hoffman-Goetz, 2010	CA	Bennett's checklist of fright factors which affect public perception of risk. The tree nodes were "HPV", "Cervical Cancer", and "HPV vaccine", with the fright factors as the sub-nodes	15 articles	Risk messages about HPV and cervical cancer focused on threatening illness or injury. Reporting on the HPV vaccine emphasized it being poorly understood by science. News magazine articles on the HPV vaccine and cervical cancer included fear-inducing messages.	Cancer educators need to be aware of media reporting in order to alleviate fears that the public may experience about the HPV vaccine.	2+
Aikin et al., 2017	RCT	Exposure to a particular format and timing of a corrective ad. Also,	6454 adults	Adjusting for potential confounders, we estimate that exposure to statin ads increased the odds of being diagnosed with high cholesterol by 16 to 20 %, and	These results extend previous research to a new health condition	1++

		violative claim believability, perceptions of the violative advertising, perceived drug efficacy and risk, perceived comparative efficacy and risk, free recall of drug benefits and risks, and behavioral intentions toward the drug.		increased statin use by 16 to 22 %, among both men and women (p<0.05). These associations were driven almost exclusively by men and women at low risk for future cardiac events. There was also evidence of a negative association between DTCA exposure and statin use among high-risk women (p<0.05)	and hold implications for regulatory policy.	
Aikin, Sullivan, & Betts, 2016	Survey	Risk and benefit memory, perception, and behavioral intention	4064 adults	Exposure to disease information as part of DTC prescription drug ads can promote the impression that the drug addresses consequences of the condition that are not part of the drug's indication.	To avoid confusion, disease information and product information should be distinct in terms of appearance and not conjoined	2+
Capanna, Gervasi, Cibttini, Volpe, Spadea, Sgricia, Zaratti, Franco, 2015	Survey	Flu vaccine distribution, adherence at campaign startup, media event effects, coverage projection in ≥ 65 years population	12 LHU coordinators	7/12 (50%) predicted a coverage rate of at least 50%; 3/12 (25%) referred a coverage rate around 40-45%; 2/12 (17%) predicted a reduction of 5-10% less than the previous season. Indeed, a mean 49.1% vaccination coverage in the elderly has been reported by the Regional Authority highlighting a reduction of 10% less than the 2013/14 season coverage.	An important effect of media event on anti-flu vaccination program adherence has been evidenced, with a failure in communication and joint management of Public Health Institutions in Italy about efficacy and safety information of flu vaccine.	2+

Casciotti, Smith, & Klassen, 2014	CA	Characteristics of media coverage of the HPV vaccine, relationships between conflict and pro-vaccine tone and specific story characteristics	447 news and opinion pieces	Most articles were positive (pro-vaccine) in tone, prompted by research/scientific advancement or legislative activities. 66% of all stories were conflict containing. Fewer articles from 2005–2006 and 2008–2009 contained conflict than those from 2007, suggesting a peak period of concern, followed by gradual acceptance of the HPV vaccine. Legislative activities and content related to sexual activity were sources of conflict in HPV vaccine media messages.	Health communication strategies can be improved by understanding and addressing potential sources of conflict in news coverage of public health initiatives.	2+
Casciotti, Smith, Andon, et al., 2014	CA	Topics, key stakeholders and sources, tone, and the presence of conflict.	234 articles	Media coverage was often incomplete, providing little context about cervical cancer or screening. Skepticism and autonomy concerns were common. Messages reflected conflict and distrust of government activities, which could negatively impact this and other youth-focused public health initiatives.	If school health professionals are aware of the potential issues raised in media coverage of school-based health mandates, they will be more able to convey appropriate health education messages, and promote informed decision-making by parents and students.	2+
Casciotti, Smith, Tsui, & Klassen, 2014	CA	Ethical issues, behaviors, stakeholders, social influencers, government, HPV vaccine and cancer characteristics	447 articles	Articles discussed vaccination in the context of abstinence-only versus comprehensive sexual health education; cited research findings to support vaccination or sex education; argued against connecting vaccination to promiscuous behavior; but included fear-inducing messages.	Media messages tended to support government and parental involvement in sex education, and dismiss concerns linking vaccination to sexual activity, while also presenting the vaccine as lifesaving.	2+

Clarke, 2011	CA	Mobilizing risk information (individual-level)	279 articles	Mobilizing information (at least one of four examples) was present in only 16% of articles, compared to 38% that mentioned accountability messages (at least one of two examples). US newspapers were significantly more likely to mention at least one mobilization example. 11% discussed both.	Although only 11% discussed both, articles were more likely to discuss certain mobilizing and accountability examples together.	2+
Clarke, Dixon, Holton, & McKeever, 2015	RCT	Mediating variable, moderating variable, dependent variable.	197 participants	Results suggest that evidentiary balance shapes perceived certainty that vaccines are safe, effective, and not linked to autism through the mediating role of a perception that scientists are divided about whether a link exists.	Deference toward science, moreover, moderates these relationships under certain conditions. We discuss implications for journalism practice and risk communication.	1+
Faerber & Kreling, 2014	CA	Claim iteration, mode of communication, duration and placement.	168 ads	Of the most emphasized claims in prescription ($n = 84$) and nonprescription ($n = 84$) drug advertisements, 33 % were objectively true, 57 % were potentially misleading and 10 % were false. In prescription drug ads, there were more objectively true claims (43 %) and fewer false claims (2 %) than in nonprescription drug ads (23 % objectively true, 7 % false). There were similar numbers of potentially misleading claims in prescription (55 %) and nonprescription (61 %) drug ads.	Potentially misleading claims are prevalent throughout consumer-targeted prescription and nonprescription drug advertising on television. These results are in conflict with proponents who argue the social value of drug advertising is found in informing consumers about drugs.	2+
Folsom, Fesperman, Tojuola, Sultan, &	CA	Type of advertisement, claims of effectiveness, references of research studies, inducements,	8 ads	All advertisements were disease-specific and targeted patients with benign prostatic hyperplasia-related symptoms (n = 3), incontinence (n = 3), or erectile dysfunction (n = 2). The median number of claims made	DTCA of prescription drugs for urological conditions are found in select journals and focus on few highly prevalent conditions. None of	2+

Dahm, 2010		and use of tables, figures, and pictures		per DTCA was 3 (range, 2-6). None of the claims made were supported by research data, as presented in tables or figures, or referenced peer-reviewed publications. The most common types of appeals addressed symptom control (8/8), lifestyle improvement (7/8), effectiveness (4/8), and dependability (3/8), while none addressed drug safety.	the advertisement claims identified in this study were supported by research data. There seems to be significant room for improvement in the quality of information provided by urological advertisements.	
Francis et al., 2009	RCT	The proportion of children who attended a face-to-face consultation. Secondary outcomes included antibiotic prescribing, antibiotic consumption, future consulting intentions, and parental satisfaction, reassurance, and enablement.	558 children	Reconsultation occurred in 12.9% of children in the intervention group and 16.2% in the control group (absolute risk reduction 3.3%, 95% confidence interval -2.7% to 9.3%, P=0.29). Using multilevel modelling (at the practice and individual level) to account for clustering, no significant difference in reconsulting was noted (odds ratio 0.75; 0.41 to 1.38). Antibiotics were prescribed at the index consultation to 19.5% of children in the intervention group and 40.8% of children in the control group (absolute risk reduction 21.3%, 95% confidence interval 13.7 to 28.9), P<0.001). A significant difference was still present after adjusting for clustering (odds ratio 0.29; 0.14 to 0.60). There was also a significant difference in the proportion of parents who said they would consult in the future if their child developed a similar illness (odds ratio 0.34; 0.20 to 0.57). Satisfaction, reassurance, and parental	Use of a booklet on respiratory tract infections in children within primary care consultations led to important reductions in antibiotic prescribing and reduced intention to consult without reducing satisfaction with care.	1+

				enablement scores were not significantly different between the two groups.		
Frosch, Krueger, Hornik, Cronholm, & Barg, 2007	CA	Factual claims about the target condition, how they attempt to appeal to consumers, and how they portray the medication and lifestyle behaviors in the lives of ad characters.	38 ads	Most ads (82%) made some factual claims and made rational arguments (86%) for product use, but few described condition causes (26%), risk factors (26%), or prevalence (25%). Emotional appeals were almost universal (95%). No ads mentioned lifestyle change as an alternative to products, though some (19%) portrayed it as an adjunct to medication. Some ads (18%) portrayed lifestyle changes as insuffi cient for controlling a condition. The ads often framed medication use in terms of losing (58%) and regaining control (85%) over some aspect of life and as engendering social approval (78%). Products were frequently (58%) portrayed as a medical breakthrough.	Despite claims that ads serve an educational purpose, they provide limited information about the causes of a disease or who may be at risk; they show characters that have lost control over their social, emotional, or physical lives without the medication; and they minimize the value of health promotion through lifestyle changes. The ads have limited educational value and may oversell the benefits of drugs in ways that might conflict with promoting population health.	2+
Gabe, Williams, & Coveney, 2017	CA	Topics in the data, disposition of the poster (favourable or hostile), frequency counts.	255 comme nts and 51 individu als in 12 focus groups	Four thematic responses were identified: bad science/journalism, Hobson's choice, risk assessment and challenging pharmaceuticalisation. Most people claimed that the story did not worry them, even if they stated that they were using sleeping pills, and that focus group members generally appeared to respond in terms of their pre-existing views of hypnotics. The way in which lay expertise was drawn on in responding to the coverage was one of the most striking findings of the	Overall, the case study cautions against making strong claims about the power of the media to legitimate de-pharmaceuticalisation. While the media may have such a role, this is in the main only for those who are receptive to such a message already.	2+

				study. People referred to their own or others' experience of taking hypnotics to recognise the legitimacy of taking them or to weigh up the risks and benefits, as reflexive users.		
Gollust, Attanasio, Dempsey, Benson, & Fowler, 2013	Survey	HPV vaccine awareness, gender, age, education, race, household income, household size, rural vs metropolitan area, target group for HPV vaccine. Political ideology and media exposure.	1216 adult respondents	Younger people, women, and those with more education were significantly more likely to be aware of the vaccine. Exposure to news media was associated with higher HPV vaccine awareness. Whereas liberals and conservatives were both more aware of the vaccine compared with moderates, the data are suggestive that liberals were more sensitive to news coverage.	Individual-level political identities and their interaction with the informational environment may be important factors to consider in evaluating the determinants of individuals' attitudes and behaviors related to politically charged women's health issues.	2++
Gonzales et al., 2008	NCT	Antibiotics dispensed per 1000 persons or managed care enrollees, and the proportion of office visits receiving antibiotics measured during 10 to 12 months before and after the campaign.	2,73 million persons	After the mass media campaign, there was a 3.8% net decrease in retail pharmacy antibiotic dispenses per 1000 persons (P = 0.30) and an 8.8% net decrease in managed care-associated antibiotic dispenses per 1000 members (P = 0.03) in the mass media community. Most of the decline occurred among pediatric members, and corresponded with a decline in pediatric office visit rates. There was no change in the office visit prescription rates among pediatric or adult managed care members, nor in visit rates for complications of acute respiratory tract infections.	A low-cost mass media campaign was associated with a reduction in antibiotic use in the community, and seems to be mediated through decreases in office visits rates among children. The campaign seems to be cost-saving.	1-

Gooblar & Carpenter, 2013	CA	Information, charts, benefit and side effect language, and persuasive appeals embedded in graphics and narratives	29 ads	Mixture of informational and transformational features. Charts used infrequently, but when they appear the accompanying text often exaggerated the data. Benefit statements covered an array of symptoms, drug properties, and caregiver issues. Side effect statements used positive persuasive appeals. Graphics and narrative features emphasized positive emotions and outcomes.	Sophisticated attempts both to educate and to persuade readers. It is important for consumers and prescribing physicians to read print advertisements critically so that they can make informed treatment choices.	2+
Goodfellow, Almomani, Hawwa, & McElnay, 2013	CA	Adherence linked to a medicine or disease, benefits of adherence and/or the harms of non-adherence, barriers or facilitators to adherence and the main source of adherence information. Aarticle slant.	181 from UK and 181 from US	There was a large increase in the number of scientific articles on medication adherence in PubMed® over the study period, however, this was not reflected in the frequency of newspaper articles published on medication adherence. UK newspaper articles were significantly more likely to report the benefits of adherence (p = 0.005), whereas US newspaper articles were significantly more likely to report adherence issues in the elderly population (p = 0.004) and adherence associated with diseases of the central nervous system (p = 0.046). The most commonly reported barriers to adherence were patient factors. HIV/AIDS was the single most frequently cited disease (reported in 20% of newspaper articles). Poor quality reporting of medication adherence was identified in 62% of newspaper articles.	Adherence is not well covered in the newspaper media despite a significant presence in the medical literature. The mass media have the potential to help educate and shape the public's knowledge regarding the importance of medication adherence; this potential is not being realised at present.	2+

Guillaume & Bath, 2008	CA	Named and unnamed individuals, incidents, issues and themes.	227 articles	The analysis showed that the content and format of articles between different information sources varied widely.	These differences can be attributed to the information source in which they are published, but the variability in the content of these information sources provides a challenge to parents who were shown to be using the mass media as an information source.	2+
Hartley & Coleman, 2008	CA	Prevalence of sources/countervailing, potency of those sources/countervailing powers, which of sources/countervailing powers are critics, moderates or promoters of DTC advertising	216	The study finds that 'corporate sellers' (pharmaceutical industry) are accorded more prominence in news coverage than are providers, consumers, corporate purchasers, or state players and that DTC critics, in particular, have minimal representation.	Findings point toward two modifications for countervailing powers theory: (1) an incorporation of the role of academic/research organizations, and (2) a consideration of the universe of possibilities with respect to each of the countervailing powers.	2+
Heisler et al., 2014	RCT	Primary outcomes were changes in knowledge about anti-hyperglycemic medications, patient-reported medication decisional conflict, and	188 adults	94% of participants completed three-month follow-up. Both groups improved across most measures. iDecide participants reported greater improvements in satisfaction with medication information (helpfulness, p=.007; clarity, p=.03) and in diabetes distress compared to the print materials group (p<0.001). There were no differences between groups in other outcomes.	Most outcomes were similarly improved among participants receiving both types of diabetes medication decision-making support. Longer-term evaluations are necessary to determine whether the greater improvements in satisfaction	1+

		satisfaction with antihyperglycemic medication information.			with medication information and diabetes distress achieved in the iDecide group at three months translate into better longer-term diabetes outcomes.	
Hinchcliff et al., 2012	CA	Newspaper source, article type, article topic, leading news actors, identified causes and solutions of medication errors and cited references.	92 articles	News items were the most frequent type of articles ($n = 73$), with the majority ($n = 55$) primarily focused on broader hospital problems. Government representatives, advocacy groups, researchers, health service staff and private industry groups were prominent news actors. A shortage of hospital resources was identified as the central cause of medication errors ($n = 38$), with efficient error reporting systems most frequently identified as a solution ($n = 25$). Government reports were cited on 39 occasions, with peer-reviewed publications infrequently cited ($n = 4$).	Australian newspaper reporting of medication errors was relatively limited. Given the high prevalence of errors and the potential role consumers can play in identifying and preventing errors, there is a clear argument for increasing public awareness and understanding of issues relating to medication safety.	2+
Hochman, Hochman, Bor, & McCormick, 2008	CA	News articles indicating when studies have been pharmaceutical company-funded and the percentage that refer to medications by their generic vs brand names. Also the	306 news articles and 93 newspaper editors	Of the 306 news articles about medication research identified, 130 (42%; 95% confidence interval [CI], 37%-48%) did not report that the research had received companyfunding. Of the 277 of these articles reporting on medications with both generic and brand names, 186 (67%; 95% CI, 61%-73%) referred to the study medications by their brand names in at least half of	News articles reporting on medication studies often fail to report pharmaceutical company funding and frequently refer to medications by their brand names despite newspaper editors' contention that this is not the case.	2+

		newspaper editors who indicate that their articles report pharmaceutical company funding; the editors who indicate that their articles refer to medications by generic names; and the newspapers with policies about these issues.		the medication references. Eighty-two of the 93 (88%) newspaper editors who responded to our survey reported that articles from their publications always or often indicated when studies had received company funding (95% CI, 80%-94%), and 71 of 92 (77%) responding editors also reported that articles from their publications always or often referred to medications by the generic names (95% CI, 67%-85%). However, only 3 of 92 newspapers (3%) had written policies stating that company funding sources of medical studies be reported (95% CI 1%-9%), and 2 of 93 (2%) newspapers had written policies stating that medications should be referred to by their generic names (95% CI 1%-8%).		
Huh, Suzuki-Lambrecht, Lueck, & Gross, 2015	RCT	Memory decay, delay memory, immediate recall, multiple memory	147 consumers	Consumers' memories of the advertised drug brand and information about the drug and the disease it treats was the lowest in the advergame condition and highest in print. For the content elements that were centrally integrated into the advergame, however, consumer recall was the highest in the advergame condition. In addition, differential memory decay was found across media types.	Memory decay was greater in the print ad condition than the other media conditions.	1+

Jaspal & Nerlich, 2016	CA	Essential qualities, units of meaning and rhetorical techniques: inter alia general tone, particular forms of language, comparisons, categorisations and emerging patterns in the data, as well as any potentially idiosyncratic interpretations of the data until consensus was reached.	61 articles	There were two major social representations of the use of PEP for HIV prevention amongst gay and bisexual men: a positive social representation of PEP as a relatively straightforward solution, where PEP is metaphorically framed as the 'morning-after pill', and a more negative social representation of PEP as posing risks and yielding uncertain outcomes. A third social representation for the use of PEP amongst public health care workers, where PEP is represented as needed and deserved. The positive representation generally consisted of anecdotal statements, while the negative representation was substantiated by 'expert' and layperson voices, rendering the latter more akin to a hegemonic representation of PEP.	There is a lack of technical information in all newspapers, and an information gap that might inhibit informed discussion and lead to entrenching polarised social representations and to the stigmatisation of some users of PEP.	2+
Kahle et al., 2009	Survey	Media report reminding, HIVtesting, Sexual behaviors of interest, use of methamphetamine or sexual intercourse with a partner who had been using methamphetamine.	325 participants	Among 325 participants, 57% heard or saw messages related to the press release. Of these, 87% remembered 1 or more key points, but only 5% remembered key prevention messages. Ninety-eight percent of participants thought it was important for the health department to get the message out about drug-resistant HIV.	The press release was found to be a useful and well-received method to inform the public about an HIV drug-resistant cluster. Low retention and nonprominent coverage of key prevention messages suggests that health departments using press releases as a prevention tool need to carefully consider placement and	2+

					emphasis of those messages in a press statement.	
Katz et al., 2014	Survey	Items addressing HPV knowledge, HPV vaccine attitudes, and about the content of the comic book	20 parents and 17 adolescents	After reading the comic book, HPV knowledge improved (2.7 to 4.6 correct answers on a 0–5 scale; p<0.01) and more positive attitudes toward HPV vaccination (p<0.05) were reported among parents.	Parents confirmed that the comic book's content was acceptable and adolescents liked the story, found it easy to read, and thought the comic book was a good way to learn about being healthy.	2+
Khanfar, Clauson, Polen, & Shields, 2008	Survey	Patient perceptions and behaviors regarding television-based DTCA of prescription medications, demographic information	427 individuals	Of the 402 respondents (94.1%) who stated that they had seen DTCA for seasonal allergy medication, 50 (12.4%) said they had discussed the advertised medication with their physician and 22 of those discussions (44.0%) resulted in a change in treatment. 342 respondents (80.1%) stated that they had viewed DTCA for prescription asthma medications, and 23 of those respondents (6.7%) said that they had discussed the brand of asthma medication viewed on television with their physician. Those discussions resulted in a change in treatment for 9 respondents (39.1%).	Within this limited, self-reported, survey sample, patient-initiated discussions with physicians regarding television-based DTCA of allergy and asthma medications resulted in a change of treatment in 44.0% and 39.1% of respondents, respectively.	2+
Kheirandish, Rashidian, & Bigdeli, 2015	CA	Media content that mentioned "shortage of medicines", "medicines related issues" and	371 articles	The number of news media related to medicines substantially increased in the study period: 30 (8%), 161 (43%) and 180 (49%) were published in 2011, 2012 and 2013, respectively. While 145 (39%) of media items	Clear increase in the number of news media reporting a shortage in Iran after the sanctions. In 2013, there were accompanying increases in the number of news media reporting	2+

		"improved availability or no shortage"		referred to the shortage of medicines, 97 (26%) reported no shortage or alleviating of concerns.	alleviation of the shortages of medicines. The analysis provides evidence of negative effects of the sanctions on access to medicines in Iran.	
Klein et al., 2009	RCT	preferences of mothers	226 mothers	Among those mothers reviewing both, 61% preferred the new pamphlet for its visual appeal ($P < 0.0001$) and ease of understanding ($P = 0.005$). Overall, mothers expressed increased confidence and fewer concerns regarding multiple injections after reviewing the pamphlet. However, older, more-highly educated mothers were less likely to report improved vaccine confidence after reviewing either the pamphlet or the VIS. Mothers in all three groups stated a preference for receiving the vaccine information during pregnancy or prior to the actual immunization visit.	Early provision of tailored immunization material along with the VIS to new mothers may enhance their overall confidence in vaccines and that additional strategies targeted toward certain mothers may be needed.	1+
Kruger et al., 2015	Survey	Exposure to DTCA for statin drugs	106859 adults	Increased potential exposure to statin DTCA was associated with increased food guilt (in a dose-response pattern) and exercise guilt (in a threshold pattern).	This study provides new evidence that DTCA has potential to influence emotional well-being as well as direct behavioral responses emphasized in previous academic research.	2++
Mastin, Andsager,	CA	Drug purpose, race/ethnicity of models, and gender of models	282 ads	Black magazines were more likely to contain ads featuring Black models only than were other genres, which had more DTCA picturing White models only.	Implications for targeted use of magazine genres as a means of	2+

Choi, & Lee, 2007				Health conditions the drugs were intended for varied by genre and over time, with STD drugs appearing primarily in Black magazines, and DTCA for heart disease not published in Black magazines, despite cardiovascular diseases being the No. 1 cause of death for Blacks (and Whites). Women's magazines featured DTCA for a wide variety of drugs, reinforcing their roles as caretakers, with proportionally few ads for women's health.	providing health information to specific populations are discussed.	
Meyer et al., 2016	CA	Articles were deductively coded to quantify the risk messages about getting the seasonal flu vaccine	1246 articles	Vaccination rates were positively and significantly related to the frequency of risk messages in newspaper coverage (r = .691, p < .05). The most commonly identified risk messages related to the flu vaccine being ineffective, the flu vaccine being poorly understood by science, and the flu vaccine causing harm.		2+
Mongiovi, Clarke Hillyer, Basch, Ethan, & Hammond, 2016	CA	Target audience, health condition, product availability, message appeal, target to females, and mention of potential side effects and benefits	60 ads	58.3% for prescription products. In magazines targeted to non-Hispanic Whites, >65% of advertisements were for OTC medications whereas 80% of advertisements found in Black/Latina magazines were for prescription medications. The rational appeal was used most commonly in non-Hispanic White magazines. Emotional appeal was featured more often in prescription advertisements magazines compared to OTC.	Although emotional appeal may be effective for selling medication to women, it often does not completely inform consumers of potential risks.	2+

Mullins, Coomber, Broun, & Wakefield, 2013	Obs ervat ional	Rate of weekly cervical screening tests	3 media campai gns analyse d	The 2007 and 2009 media campaigns significantly increased the number of cervical screening tests per week. The 2007 campaign had a significant impact on lapsed screeners (>36 months since last test), overdue screeners (28-36 months since last test), and women never previously screened. The 2009 campaign significantly increased screening tests for overdue screeners, and the 2010 media campaign was associated with a significant increase in screening tests for lapsed screeners.	A well-researched and carefully pretested television advertising campaign with accurate, actionable messages can elicit appropriate screening behaviour among some of the appropriate groups even in a changed environment of complex, and potentially competing, messages.	2+
Niederdep pe et al., 2013	Surv ey	Levels of exposure to statin DTCA, based on ad appearances and TV viewing patterns; selfreports of whether a respondent has been diagnosed with high cholesterol, and whether a respondent took a statin in the past year.	106685 adults	Exposure to statin ads increased the odds of being diagnosed with high cholesterol by 16 to 20 %, and increased statin use by 16 to 22 %, among both men and women (p<0.05). These associations were driven almost exclusively by men and women at low risk for future cardiac events. There was also evidence of a negative association between DTCA exposure and statin use among high-risk women (p<0.05)	This study provides new evidence that DTCA may promote over-diagnosis of high cholesterol and over-treatment for populations where risks of statin use may outweigh potential benefits.	2+
O'Donogh ue et al., 2016	Focu s grou ps	Perceived efficacy likelihood, perceived efficacy magnitude, perceived risk likelihood,	38 in focus groups, and	Results showed that knowledge of FDA approval and authority was mixed, with several misconceptions apparent. Many consumers were not familiar with the use of composite scores in a medical context or in	There are gaps in general knowledge about both FDA procedures generally and composite scores specifically.	2++

and survey		perceived risk magnitude, perceived clarity and trust in information	1629 survey	advertising and, in the 1st study, expressed distrust of the product and the ad after learning about how composite scores are used. In the 2nd study, receiving composite score information changed the perceived clarity of the ad but not the perceived risk or benefits. Implications for the presentation of complex medical information are discussed.		
O'Donoghue, Sullivan, & Aikin, 2014	RCT	Accuracy, perceived benefit, perceived risk, behavioral intention, numeracy, demographic and health characteristics	2000 panel members and 596 physicians	In study 1, participants who viewed placebo rates were able to recall them and use them to form certain perceptions. A mixed frame led to lower placebo rate recall and perceived efficacy. In study 2, overall, physicians preferred a placebo/single frame ad.	Adding placebo rates to DTC ads may be useful for consumers. The evidence does not support using a mixed frame.	1+
Perez, Fedoruk, Shapiro, & Rosberger, 2016	CA	Article information; epidemiological information; public policy information; article topic; article and title tone; and informant testimony	232 articles	The majority of articles (93%) mentioned that girls are eligible for the HPV vaccine, whereas only half (49%) mentioned male eligibility. While most articles associated HPV with cervical cancer (85%), fewer indicated its relation to other HPV-associated cancers (59%) or genital warts (52%). Most articles (60%) were positive or neutral (22%) in tone toward the HPV vaccine, while few had mixed messages (11%) or were negative (6%). Less than 5% of articles reported on issues of morality, suggesting that fears that the HPV	The Canadian public may thus be unaware of male eligibility and the importance of HPV vaccine for males. The collaboration of researchers, health care providers, and policymakers with journalists is critical in order to disseminate complete and accurate HPV and HPV vaccine information.	2+

			vaccine causes promiscuity have largely subsided. Notably, article tone toward male vaccination became progressively more positive over time. However, half of the articles did not mention the vaccine's approval for males, and articles tended to report HPV's relation to cervical cancer over other HPV-associated cancers.		
Quintero Johnson et al., 2011	CA	Characteristics of HPV, article frames, headline frames, personal accounts, sources	547 articles	Less than half of the articles provided detailed health information. Of the articles that contained a message frame, cancer prevention was most frequently employed. Government/political sources, medical doctors, and the Centers for Disease Control and Prevention (CDC) were the most commonly cited sources. Only 16% of all the articles we sampled featured personal accounts.	U.S. newspaper coverage lacked detailed information about both HPV and the HPV vaccine in spite of federal approval of the vaccine, legal mandates for the vaccine, and a widespread information campaign.	2+
Rachul, Ries, & Caulfield, 2011	CA	Information regarding date of publication, type of author and article format. Information on content, which included whether the news article provided reasons for and/or against getting the vaccine, The theme of the article was coded	234 articles	Reasons for getting vaccinated appeared in 71.8% of the articles, whereas only 18.4% provided reasons against getting vaccinated. Discussion of evidence to support claims for or against getting vaccinated appeared in only 27.8% and 6.8% of the articles, respectively. Risks associated with contracting the A/H1N1 virus were discussed in 49.6% of the articles and risks of the A/H1N1 vaccine were discussed in 12.4% of the articles.	Newspaper coverage in Canada was largely supportive of the A/H1N1 mass vaccination program. However, serious risks associated with contracting the A/H1N1 virus were also frequently discussed in the print media. The news articles rarely presented direct evidence to support statements that the vaccine was safe, effective and properly tested.	2+

		as descriptive, supporting the vaccine, questioning the vaccine, or presenting both sides.			Known risks (such as potential allergic reactions and flu-like side effects) of the vaccine were rarely reported.	
Rachul, Toews, & Caulfield, 2016	CA	Main frame, discussion of Kalydeco, including issues of drug development, patient access, and reimbursement, and overall tone.	203 articles	In Canadian newspaper coverage, 77.4% of articles were framed as human interest stories featuring individual patients seeking public funding for Kalydeco, yet only 7.5% mentioned any budgetary limitations in doing so. In contrast, U.S. newspaper coverage was framed as a financial/economic story in 43.1% of articles and a medical/scientific story in 27.8%.	Newspaper coverage varied significantly between Canada, where Kalydeco is predominantly a story about increasing patient access through full government funding, and the U.S., where Kalydeco is largely a financial story about the economic impact of Kalydeco.	2+
Robertson, Walkom, Bevan, & Newby, 2013	CA	Content for mentions of the medicine, PBS and medicine costs to the patient and the government and counting the numbers of articles	62 news	Of 79 eligible medicines, 62 had news reports. Most often reported were HPV vaccine (1230 stories), trastuzumab (410), pemetrexed (83), botulinum toxin (71), lapatinib (65), methylphenidate (57), atomoxetine (54), infliximab (49), rotavirus vaccine (45). Eighteen medicines had ≥20 news reports (total 2350 stories); nine of these cost more than AU$10,000 per course or year of treatment. For these 18 medicines, 31% of stories appeared in the six months prior to the PBAC meeting, 14% in the meeting month and 33% in the six months post-meeting. 38% of the stories had ≥3 medicine mentions, 37% referred to the PBS, 24% to	While there was no general trend to increased news reporting associated with PBAC meetings, some drugs did attract media attention. With more new and expensive drugs, decisions on public funding will become increasingly difficult. The media have an important role in enhancing public understanding of the issues around resource allocation. Specialist journalists, guidelines and checklists may help reporting.	2+

				cost to the patient, and 9% cost to Government.There was active patient lobby group campaigning in support of listing of infliximab and pemetrexed; the stories for ADHD were often more negative, referring to the dangers of the medicines and sometimes questioning the appropriateness of treatment and public subsidy. There was little discussion of the PBAC's evidence-based decision-making processes.		
Schnelling er et al., 2010	RCT	Proper antibiotic use survey to three groups: control, pamphlet and video.	84 particip ants	Scores improved significantly in the pamphlet and video groups compared with baseline. The video group's follow-up scores were not significantly different from the postintervention-survey scores (P = .32). The pamphlet-group scores at follow-up were significantly lower than the postintervention-survey scores (P = .002). The control group's scores were similar at all 3 time periods. The pamphlet group had significantly better scores than the control group after the intervention (P < .001). The video-group scores exceeded the control-group scores at all 3 time periods.	An animated video is highly effective for educating parents about the appropriate use of antibiotics in the emergency department setting and results in long-term knowledge retention. The results of this study provide a foundation to further evaluate the use of animated video in additional populations.	1+
Shropshire , Brent-Hotchkiss, &	Surv ey	What flu clinic media sources were visualized and if they encouraged them to obtain vaccination.	721 student s	Nearly a 30% increase was seen in flu vaccination rates in Fall 2011 over Fall 2010. The main campus Web site portal was the most visualized media source among students. The majority of responses indicated that the	Various communication channels should be utilized to increase influenza vaccination rate on a university campus. Use of mass media to influence college students	2+

Andrews, 2013				source of information visualized had a moderate to strong influence over their decision to get vaccinated.	to perceive, retain, and act on the message of obtaining the influenza vaccine did produce a noteworthy outcome.	
Singh et al., 2016	CA	How many articles included the term "evolve" and analyzed how this varied with newspaper, country, and time	1639 articles	An overall rate of 18% of article sused the term "evolve" but with significant variation among countries. UK newspapers had the highest rate (24%), more than doublé of those in India (9%), the country with the lowest rate. These frequencies were lower than those found in scientific papers from both evolutionary journals and biomedical journals. There were no statistically significant changes in frequency and no trends when "evolve" usage was compared against variables such as newspaper circulation, liberal/conservative bias, time, and state evolution acceptance in U.S. newspapers.	This study highlights the globally low usage of the word "evolve" in the popular press. Authors suggest this low usage may affect public understanding and acceptance of evolutionary concepts.	2+
Sokol, 2010	CA	Type of drug ad, health condition, target audience by age, use of persuasive elements, emphasis	201 ads	Magazines differed in the proportion of drug ads for different health conditions and target audience by age demographic. Use of persuasive elements varied by condition promoted (eg, mental-health drug ads more frequently used emotional appeals). Ads placed greater emphasis on direction to industry information resources than on physician discussions.	Prevalence of pharmaceutical advertising in women's magazines is high; continued surveillance is recommended.	2+

St. John, Pitts, & Adams Tufts, 2010	CA	Newspaper reports and information needed by families	145 articles	Disjoints between newspaper reports and information needed by families, leaving parents feeling skeptical about, frustrated with, and intolerant of the state directive.	This study discusses the implications of these gaps for parental healthcare decision-making and provides suggestions for constructing a more dialogic, community-based approach that can increase health literacy regarding the HPV vaccine.	2+
Sullivan et al., 2016	CA	Drug efficacy and risk recall, drug perceptions and attitudes, and behavioral intentions	2504 individuals	For print advertisements, a bar chart or table, compared with no visual aid, elicited more accurate drug efficacy recall. The bar chart was better at this than the pictograph and the table was better than the pie chart. For television advertisements, any visual aid, compared with no visual aid, elicited more accurate drug efficacy recall. The bar chart was better at this than the pictograph or the table.	Visual aids depicting quantitative efficacy information in DTC print and television advertisements increased drug efficacy recall, which may help people make informed decisions about prescription drugs. Adding visual aids to DTC advertising may increase the public's knowledge of how well prescription drugs work.	2++
Sznitman & Lewis, 2015	CA	Referring canabis as a medicine, an illicit drug or other	214 articles	In the majority of CTP news articles (69%), cannabis was framed as a medicine, although in almost one third of articles (31%) cannabis was framed as an illicit drug. The relative proportion of news items in which cannabis was framed as an illicit drug fluctuated during the study period, but was unrelated to linear or curvilinear trends in CTP licensing.	The relatively large proportion of news items framing cannabis as a medicine is consistent with growing support for the expansion of the Israel's CTP program.	2+

The PLOS ONE Staff, 2014	CA	Number of pages, concentration (ratio of pages of advertisements to journal content) of pharmaceutical advertisements	108 issues	The two Canadian journals sampled (CMAJ, CFP) contained five times more advertisements than the two American journals (JAMA, NEJM), and two British journals (BMJ, Lancet) (p, 0.0001). The estimated annual revenue from pharmaceutical advertisements ranged from £0.025 million (for Lancet) to £3.8 million (for JAMA). The cost savings due to revenue from pharmaceutical advertising to each individual subscriber ranged from £0.02 (for Lancet) to £3.56 (for CFP) per issue.	The volume of pharmaceutical advertisements differs between general medical journals. International and temporal variations suggest that there is an opportunity for all general medical journals to reduce the number of pharmaceutical advertisements, explore other sources of revenue, and increase transparency regarding sources of revenue.	2+
Thompson, Goldszmidt, Schwartz, & Bashook, 2010	RCT	Free recall, cued recall, comprehension of information and difference in overall aesthetic appearance and perception of utility.	100 participants.	No differences between picture and prose pamphlets in free recall, cued recall and comprehension wither immediately or after a 1-week interval. Immediate free recall of important information was 17-26%; free recall fell even lower to 7-16% after 1 week. The pictorial pamphlet was preferred over the prose-based pamphlet.	This study found no benefit in free recall, cued recall, or comprehension through the addition of pictograms to a simple prose-based medication pamphlet.	1+
ThuyTrinh, Stephenson, & Vajda, 2011	Interviews	Awareness level and questions about quality use of medicines.	600 adults	Awareness of QUM was increased by 6%.The mean number of correct answers regarding QUM increased from 5.2 before the campaign to 5.7 after the campaign (p<0.001). The proportion of people who had correct answers to six or more questions (out of nine) increased	The radio campaign was effective in increasing awareness and knowledge of QUM among seniors. However, the effectiveness of the	2+

				by 12% (p<0.001). The increase was largest among the Cantonese-speaking seniors (27%), followed by the Mandarin (8%) and Italian seniors (4%, p<0.001).	campaign varied between language groups.	
Turner, Boudewyn s, Kirby-Straker, & Telfer, 2013	CA	EPPM elements in messages	478 articles	The overall unit of analysis for this study was the article, but, for the EPPM constructs, the coders recorded the number of times each EPPM construct was mentioned within each article.	Panama newspapers tended to emphasize threat alone.	2+
Wogalter et al., 2014	Surv ey	Ability to recall and recognize information from the drug ads	180 particip ants	Risk disclosures presented either visually only or both visually and auditorily increased recall and recognition compared to no presentation. Risk disclosures presented redundantly in both the visual and auditory modalities produced the highest recall and recognition. Visual only produced better performance than auditory only. Simultaneous presentation of non-risk information together with risk disclosures produced lower recall and recognition compared to risk disclosures alone-without concurrent non-risk information.	Implications for the design of DTC prescription drug television commercials and other audio-visual presentations of risk information including on the Internet, are discussed.	2+
Zhao et al., 2014	CA	Coverage of genomics medicine	12 articles and 40 scientifi	Coverage of genomics medicine in these eight official government Chinese newspapers has remained low, with only 12 articles published per newspaper per year between 2000 and 2011. Between 2000 and 2011, over a 40-fold difference was observed in the number of	This study reports on the under-representation of newspaper coverage of genomics medicine in China, despite the vast growth of scientific articles in journals in this	2+

| | | | c articles | genomics medicine-related articles in PubMed, as compared to that in newspapers. The numbers of genomics-related articles among the eight major newspapers from 2000 to 2011 were significantly different (p=0.001). Commentary/mini reviews and articles about gene therapy for specific diseases were most frequently published in 2006 and 2011. "Cancer gene therapy", "new susceptibility gene locus", and "gene technology revolution" were the top three thematic strands addressed in the newspapers, even though their volume remained low. | knowledge domain. This underscores the need to enhance collaboration between scientists, medical professionals, and journalists as an important strand of overall communications efforts in disseminating genomic medicine knowledge to larger audiences. | |

Study 3. How is communication of vaccines in traditional media: A systematic review

Reference:

Catalan-Matamoros, D., & Peñafiel-Saiz, C. (2019). How is communication of vaccines in traditional media: A systematic review. *Perspectives in Public Health*, *139*(1), 34–43. https://doi.org/10.1177/1757913918780142

Abstract

Aim: Taking into account that a key determinant in public approval of vaccinations is how the media constructs and frames messages about vaccination programs, our aim is to review communication studies exploring media coverage of vaccines within traditional media venues.

Methods: Using a registered protocol (PROSPERO: 42017072849), a systematic review was conducted that searched in three international electronic databases (Pubmed, Scopus, and the International Bibliography of Social Science) for articles published between 2007 and 2017 following content-analysis methods. The characteristics and outcomes were systematically identified and described. The search yielded 24 eligible studies that were further analysed in the review.

Results: Media coverage of vaccines has been largely studied during the last decade. Findings revealed that 62% (n = 15) of studies analysed the human papillomavirus vaccine, 87% (n = 21) examined newspapers, and 62% (n = 15) examined North American media. In relation to media content analyses, 75% found negative messages on vaccines and 83% identified a lack of accurate information.

Conclusions: This systematic review suggests an agenda for further research. There is a significant need to analyse other types of traditional media beyond newspapers. Future studies should focus on other geographical areas such as low-income countries and on analysing visual materials and digital media. We found that negative messages and inaccurate information are common in media coverage on vaccines; therefore, further research focusing on these topics is needed. Officials in public health organizations should develop a close collaboration with the media to improve public communication on vaccines.

Keywords: Vaccination; Mass Media; Newspapers; Public Health; Journalism.

Introduction

The vaccine media debate has been raging for many years; immunizations have a long and complicated history of both saving lives and hurting them. Parental acceptance of routine childhood immunization is essential to protecting children's health.[3] But maintaining that acceptance can be difficult, especially because the success of immunization programs has resulted in new generations of parents who have little or no first-hand experience with most of the diseases that are preventable by vaccination.[3] In addition, some events involving vaccines have diminished trust. For example, in 1998 a scientist claimed there might be a link between the MMR vaccine and autism. His claims received significant media attention, and vaccination rates fell in many countries, although many scientific experts asserted that there was no scientific evidence that the MMR vaccine played any part in the aetiology or triggering of autism (Boyce, 2006). Therefore, vaccine adherence is becoming an increasingly challenging public health issue.

Media content published by journalists may impact public perception on preventive health measures and influence decisions on the public's well-being. In some cases the role of the media has been shown to contribute to promoting harmful health behaviours (Hilton, Hunt, Langan, Bedford, & Petticrew, 2010). It has been known that societal dynamics, including the introduction of new health practices, is partly mediated by mass media (Tulloch & Zinn, 2011). Given that communication via the media is a common practice, it is important to explore how the media represents vaccines. For example, a key determinant in the approval of vaccination with the public will be how the media constructs and frames messages about vaccination programs (Hilton et al., 2010).

Despite the growth of digital media, we have decided to focus our review on traditional media sources in order to narrow and synthesize this paper. 'Traditional media', according to previous studies (Lalazaryan, Rahimi, Zare-Farashbandi, & Zadeh, 2015; Vesa & van Heck, 2005), includes television, radio, newspapers, magazines, medical journals, books, pamphlets, and movies—or in other words, *any form of mass communication available before the advent of*

digital media (IGI Global, 2018). Moreover, traditional media sources are not dead and still play an important role in the communication landscape (Belch & Belch, 2014). In fact, traditional media outlets have been in existence for a long time and remain a central medium of communication in many regions of the world. Some examples of what sources report high newspaper readership levels (Statista, 2017) include *USA Today* (estimated daily readership of 9.6 million in 2017) and *The New York Times* (estimated readership 9.3 million in 2017). Moreover, in the US, traditional media outlets are accessed more than digital media: 6 hours and 16 minutes per day versus 5 hours and 50 minutes per day, respectively (eMarketer, 2017). In some countries like Sweden, newspapers are highly consumed by society (Catalan-Matamoros, Axelsson, & Strid, 2007). Therefore, this article conducts a systematic review to identify communication research regarding traditional media coverage of vaccines and describes their characteristics and outcomes. We addressed the following research questions in relation to the contents about vaccines in traditional media sources:

1. What countries have been assessed?
2. What communication channels have been analysed?
3. What vaccines have been analysed most frequently?
4. What are the most relevant measures and outcomes found in the selected studies?

Methods

This systematic review was registered with PROSPERO: CRD42017072849. The development of this systematic review was guided by the PRISMA statement (PRISMA-P Group et al., 2015; Shamseer et al., 2015). Literature search strategies were developed using medical subject heading (MESH) and text words related to mass media. Search strategies combined two types of terms: 'vaccine' (e.g., vaccine, vaccination, immunization) and 'traditional media outlets' (e.g., television, radio, newspaper; see search strategy in Table 1). We searched three databases: PubMed, which comprises more than 28 million citations for biomedical literature from MEDLINE, life science journals, and online books;

Scopus, which is considered the largest abstract and citation database of peer-reviewed literature from the science, technology, medicine, social sciences, and arts and humanities fields; and The International Bibliography of Social Sciences (IBSS), which is a central online resource for social science and interdisciplinary research including over two million bibliographic references to journal articles, books, and reviews. Papers that were written in English and published between January 1, 2007 and January 1, 2017 were included. We chose the time period from 2007 to search for studies made after the publication of the WHO guidelines on the safety of medicines, in which mass media was recognized as a key element (WHO, 2006). In addition, during this period there was a decrease in childhood vaccination rates, which may have been supported by some media debates on the safety of the human papillomavirus vaccine and the relationship between autism and the MMR vaccine.

Table 1. Search strategy in PubMed		
	Search terms	**Items found**
#1	Search [Title] **mass media OR communications media OR television OR radio OR newspaper OR print OR magazine OR journal OR book OR pamphlet OR cinema OR movie OR news** Filter: 2007/01/01 - 2017/01/01	18041
#2	Search [Title] **vaccine* OR vaccination* OR immunizat*** Filter: 2007/01/01 - 2017/01/01	59186
#3	Search **#1 AND #2** Filter: English language	108

Regardless of their methodological quality, studies had to meet the following inclusion criteria: (a) conduct a content analysis of publications made in a traditional mass media source such as radio, television, newspapers, or any other outlet such as movies; (b) address vaccines or immunization; and (c) report original qualitative or quantitative data examining the media coverage of vaccines. We searched content-analysis articles as this research method is considered the most frequent in media coverage research (Macnamara, 2005). Reference lists of key articles were manually searched to identify further relevant studies. Systematic reviews, abstracts, dissertations, single case reports, editorials, commentaries, conference abstracts, non-research articles, and studies that focused on digital mass media such as websites or social networks

were excluded. Articles analysing advertisements on vaccines in the media were also excluded.

The PRISMA flow diagram in Figure 1 outlines the screening processes applied to the articles identified by the literature searches that were subsequently screened for duplication and relevance using titles and abstracts. Of those, articles that were considered relevant were assessed for eligibility by reviewing full texts.

Figure 1. Prisma flow diagram
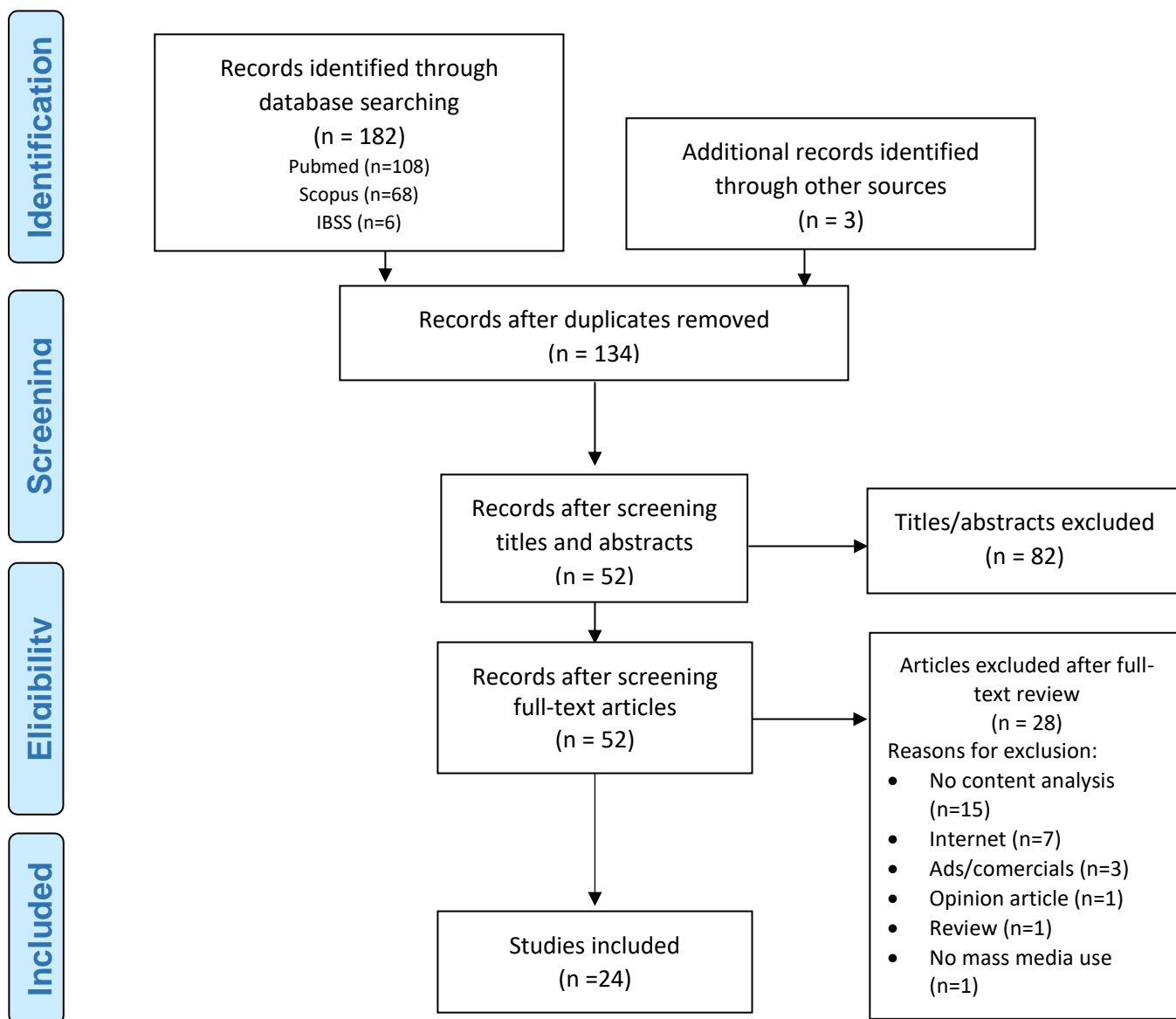
Literature search results were uploaded to Zotero to facilitate bibliographic source management. Following the removal of duplicates, two independent reviewers screened the titles and abstracts according to eligibility criteria. A third researcher was consulted when necessary. All researchers involved in the review were 'health communication' scholars educated in communication sciences and public health. All discrepancies between reviewers were resolved through discussion and full agreement was reached. We obtained full articles for all titles that appeared to meet the inclusion criteria or where there was an uncertainty. The appropriateness of the full-text papers was verified to check that they met the eligibility criteria.

The review team developed a coding form designed to capture descriptive information on the included studies. The variables were: country where the media were broadcasted, media type, vaccine type, objectives, main variables, sample size, main outcomes, and conclusions. We synthesized data qualitatively, dividing studies into vaccine types. Findings from mapping and analysis were recorded in data extraction tables and summarized as narrative answers to the research questions. We did not focus on media effects to consider a meta-analysis, and we did not conduct a quality assessment of studies since all met the inclusion criteria for following the same research methodology (i.e., content analysis). Overall, the aims, data collection methods, samples, and outcomes were sufficient well-described in the studies in terms of having a good understanding of the study and being able to identify relevant information to be included in our review.

Results

The screening processes identified 182 articles resulting from the literature search and were subsequently screened for duplication and relevance. In addition, three relevant articles (Hilton et al., 2010; Holton, Weberling, Clarke, & Smith, 2012; Kelly, Leader, Mittermaier, Hornik, & Cappella, 2009) were identified by manually searching in reference lists. After duplicates were removed, we

reviewed titles and abstracts from 134 articles. Of those, 52 full-text articles were considered relevant and assessed for eligibility. A total of 28 full-text articles were excluded after careful review. The specific reasons for exclusion can be found in Figure 1. This ultimately led to the inclusion of 24 studies for further analysis. For a summary of characteristics of the 24 studies, please see Table 2. For a summary of measures, outcomes, and conclusions, please see Table 3. Mentions and short descriptions of all analysed references have been included in Tables 2 and 3 where readers can search for deeper information beyond the one presented in our review. We summarized below the main findings for each of the four research questions

RQ1: What countries have been assessed?

Among the 24 studies, 15 studies analysed North American media, 11 from the US and four from Canada. Four studies analysed UK media and two studies analysed New Zealand media. The following countries' media were also analysed: Australia ($n = 1$), Japan ($n = 1$), Nigeria ($n = 1$), Romania ($n = 1$), and the United Arab Emirates ($n = 1$). The majority of studies analysed media from one single country; only two studies analysed media from more than one country (C. E. Clarke, 2011; Holton et al., 2012). Dr. Casciotti's team published the highest amount of articles during the period of analysis ($n = 3$). Dr. Casciotti's affiliation was with the Department of Health, Behaviour, and Society at the Johns Hopkins Bloomberg School of Public Health in Baltimore, MA (USA). This authorship finding is consistent with our finding that the US was the leading country investigating media coverage about vaccines.

RQ2: What communication channels have been analysed?

Print media, especially newspapers, were the most frequent media type reported among the included studies. In total, 96% ($n = 23$) of all studies reported print media, and of those, 87% ($n = 21$) explored coverage by newspapers. Other studies analysing print media were on magazines ($n = 1$), and a combination of media sources including newspapers, magazines, and videos ($n = 1$). Only one

study (n = 1) analysed coverage by television, and another study included a survey administered to individuals. The 24 studies comprised 8,628 units of media content analyses: 8,529 newspaper articles, 59 television and video broadcasts, and 40 magazine articles. The average study sample size was 152 units of analysis (SD = 479.34; $range$ 15–2,113). One study included a survey administered to 4,367 individuals. Most of the studies analysed media targeting general audiences or readerships. For example, studies made in the US frequently analysed large newspapers such as *USA Today* and *The New York Times*.

RQ3: What vaccines have been analysed most frequently?

The most common vaccine that was analysed in the selected studies was the human papillomavirus vaccine (HPV; 62%, n = 15). Three studies analysed the mumps, measles, rubella vaccine (MMR) and the controversy about its relationship to autism. Two studies analysed the influenza vaccine (seasonal and A/H1N1) and one article analysed the polio vaccine. Three articles did not analyse one specific vaccine.

RQ4: What are the most relevant measures and outcomes found in the selected studies?

In relation to the measures, all articles described the characteristics of media coverage quantitatively, such as the frequency of target contents, number of pages, word count, dates of publication, length, and so on. After this quantitative description of the sample, the main variables varied according to the aims of each study. Some common measures were sources of information, message characteristics (i.e., tone, controversy, risks, barriers, concerns, support to vaccination, health outcomes), completeness, and use of evidence concerning vaccination.

The outcomes that were found in each of the studies have been grouped as: 'messages analysis', 'accuracy and evidence-based information', and 'other

outcomes'. In relation to message analysis, 50% of the studies ($n = 12$) analysed messages in relation to vaccines. Of these, 83% of the studies ($n = 10$) found more negative messages than positive ones and mostly focused on vaccines being negative, ineffective, poorly understood by science, and causing harm. Seventeen percent ($n = 2$) of articles found positive messages in relation to vaccines and vaccination. Of these, one study found more messages supporting the vaccination of A/H1N1 than reasons against getting vaccinated (Rachul, Ries, & Caulfield, 2011). The other study found that most articles were positive in tone, prompted by research and scientific advancement or legislative activities (Casciotti, Smith, & Klassen, 2014).

In relation to accuracy and evidence-based information, these studies analysed whether public information on vaccines was based on scientific clinical trials or other scientific studies. Thirty-three percent of the studies ($n = 8$) analysed the accuracy and completeness of the information provided and if journalists provided evidence-based information. Of these, 75% ($n = 6$) found a lack of accuracy. More specifically, an article found that evidence-based information supporting claims for or against getting vaccinated appeared in only 27.8% and 6.8% of the articles, respectively (Rachul et al., 2011). Other studies found a lack of comprehensive information, inaccuracies, and detailed coverage of HPV and the HPV vaccine. Other studies identified numerous mistakes in both fact and logic predominantly used by anti-immunisation proponents but occasionally by health authorities (Petousis-Harris, Goodyear-Smith, Kameshwar, & Turner, 2010). One article found sources overwhelmingly supplied opinions rather than facts (Holton et al., 2012). One article found messages prompted by research and scientific studies (Casciotti, Smith, & Klassen, 2014).

Finally, the studies also focused on 'other outcomes'. Three studies identified sources that were used by journalists (Guillaume & Bath, 2008; Holton et al., 2012; Quintero Johnson, Sionean, & Scott, 2011). They found that the content and format of articles between different information sources varied widely, with government/political sources, medical doctors, and the US Centres for Disease Control and Prevention (CDC) being the most commonly cited sources. Only 16%

of all articles featured personal accounts. Two additional recent studies looked at the lack of vaccine information for the HPV vaccine targeting boys and men (Krakow & Rogers, 2016; Perez, Fedoruk, Shapiro, & Rosberger, 2016). The studies described that the majority of articles (93%) mentioned that girls are eligible for the HPV vaccine, whereas only half (49%) mentioned male eligibility. While most articles associated HPV with cervical cancer (85%), fewer indicated its relation to other HPV-associated cancers (59%) or genital warts (52%). One study stated that key political events might have functioned to overshadow the recommendation of the HPV vaccine for boys and men. Another study analysed the relationship between vaccination rates and media coverage of the flu vaccine (Meyer et al., 2016). Vaccination rates were positively and significantly related to the frequency of risk messages in newspaper coverage ($r = .691$, $p < .05$). Finally, a study (Clarke, 2011) found that the educational level required for best readability of the media content was higher than recommended for the general public.

Discussion

The present systematic review provides an overview of the communication research on traditional media coverage about vaccines. The objective of this study was to identify communication research on traditional media coverage in relation to vaccines and to describe the characteristics and outcomes. To our knowledge, this is the largest systematic review of media content analysis on vaccines, composed of 24 studies published during the last 10 years (since 2007) covering public communication of any type of vaccine by traditional media sources from any geographical region. There are some main findings that can be drawn from this systematic review.

First, the 24 studies tackle a broad array of vaccines. The majority of the studies included in this review originated from North America (11 from the US and four from Canada), and in clearly lower proportions from other high-income countries such as the UK, New Zealand. Australia, Japan, and the United Arab Emirates. Only two countries, that are actually not classified as high-income countries

according to the World Bank (World Bank, 2017) have been analysed. These were Nigeria and Romania. There could be several reasons for the lack of publications in low-income countries. These may include limited technical competency in scientific writing, lack of research, high teaching burden at universities (which does not allow time for research and writing), and biases against low-income countries' authors by journal editors, editorial boards, and publishers from high-income countries (Muula, 2008). In addition, there is also a lack of funding from international funding agencies, which are largely from developed nations, and many journals from low-income nations are not indexed in global databases (Marusić, Sambunjak, & Marusić, 2006); thus, they could not be found through our systematic review. A reason for the dominance of research in the US might be because of the established regulatory system for direct-to-consumer prescription drug advertising (DCTA). In fact, DTCA of prescription drugs is illegal in some countries as a health protection measure but is permitted in the US and New Zealand (Mintzes, Morgan, & Wright, 2009). The advertising of over-the-counter (OTC) products and dietary supplements to consumers is allowed in these countries and in others. Therefore, there is an increasing need for analyses of public communication about vaccines in other geographical groups such as low-income countries, because laws regarding this communication on medicines are rarely implemented in these countries due to lack of commitment and resources on the part of law enforcement departments (Byarugaba, 2004). According to our systematic review, the characteristics and outcomes of media coverage for vaccines in low-income countries is almost currently unknown from a research perspective.

Regarding the methodological approach of the selected studies, this systematic review showed a preference for conducting media coverage analyses in print media, including both newspapers and magazines. Bundling these two media sources into one category might be too general; however, we decided to do so, although we should highlight that newspapers were the most frequent media source among the analyses. Only one study examined TV coverage. This is consistent with a previous review (Gollust, LoRusso, Nagler, & Fowler, 2016) where newspapers were the most analysed media. However, this homogeneous

analysis does not reflect the real mass media consumption by the public. For example, US adults now spend 12 hours a day consuming media, from which print media represents only 25 minutes, TV represents 4 hours, and radio represents almost 1.5 hours (eMarketer, 2017). The dominance of print media in our sample reflects the preferences for media research: newspapers are most frequently sampled by social scientists over other media sources (Teixeira et al., 2012), as it could be more convenient to analyse printed information than other types of audio-visual media. Further research should focus on other potential traditional media sources beyond newspapers, such as radio and television.

Regarding the vaccines analysed by the studies that fulfilled our search criteria, the HPV vaccine was the most frequent. There is sizeable literature on HPV vaccines portrayal in the media. HPV infection is highly prevalent and sexually transmitted with a peak incidence in adolescents and young adults. Chronic HPV infections are the leading cause of cervical dysplasia and cervical cancer. Gardasil, a vaccine directed against HPV, generated both positive and negative media and public attention. Gardasil was implemented amongst unease about timing and rushed approvals, and questions about its long-term safety and efficacy was voiced by public and health officials (Abdelmutti & Hoffman-Goetz, 2010). Other types of vaccines reported on were the influenza vaccine (both seasonal and A/H1N1), the polio vaccine, and the MMR vaccine, but in clearly lower proportions. However, according to the WHO's global immunization coverage program (WHO, 2017a), there are other important vaccines with either very low media attention or that have not been analysed by social scientists. These are hepatitis B, meningitis A, pneumococcal diseases, rotaviruses, tetanus, and yellow fever. Further content analyses would be needed to explore media coverage of these other important vaccines.

Regarding the outcomes of the media coverage on vaccines, it is possible to draw attention to and address important questions raised in previous content analyses. In relation to messages, this was the most common outcome analysed by the selected studies. Most of the studies found negative messages about vaccines in the media; for example, media sources reported that the vaccine was poorly

understood by science, was not effective, and that it may cause harm (Meyer et al., 2016). In fact, this is not too surprising. According to Taylor (Taylor, 2006), journalists and editors want a good story and they often do not put much attention to public health. From our view, this is alarming given that the media remain an important source of health information (Vasterman, Yzermans, & Dirkzwager, 2005), and even health officials often view journalists as valuable channels through which to promote the benefits of immunization and communicate risk information (Leask & Chapman, 2002). However, the journalistic goal of ensuring an informed citizenry inevitably clashes with the goals of other actors such as health officials, owners of media companies, information sources, and advertisers. These journalistic goals include entertainment (reporting news that is interesting or exciting), profitability (reporting stories that generate revenue and maximize viewership), and favourability (reporting stories that reflect positively on owners) (Clarke, 2011). From a public health perspective, it is critical to provide comprehensive and transparent information in the media for the public to make informed decisions. Information about efficacy, details about the accrual of evidence regarding vaccine safety and efficacy, as well as subsequent implementation of vaccination policies may mitigate perceptions of risk by the public (Meyer et al., 2016). However, we should take into account media space constraints that pose challenges to extensive explanations. As previously stated, the analyses of media messages may be considered one of the most relevant areas in the research of public communication about vaccines. Thus, we recommend further research on this specific topic.

Level of accuracy and evidence-based information provided are other key outcomes. Health reporters in particular often rely on information from scientific sources when crafting stories because of the complex nature of many health issues (Holton et al., 2012). According to the selected studies, there is a lack of comprehensive information, inaccuracies, and errors of both fact and logic, concluding that journalists misrepresent the state of clinical evidence. It is particularly important to avoid the transmission of inaccurate information to prevent misinterpretation and wrong decisions about getting vaccinated. It has been considered a useful strategy (Meyer et al., 2016; Penta & Baban, 2014) to

improve communication between health officials and journalists. In fact, when the news media misinform the public, this leads to misperceptions of reality among their audience members and also impacts trust and credibility. Without trust and credibility, people will turn away from the media and consequently seek information from other suppliers (Karlsson, Clerwall, & Nord, 2017). A key challenge is how to be transparent about inaccuracies or mistakes by journalists to avoid fear and keep the readership trust.

Finally, only two studies looked at behaviour change through analysing the relationship between vaccination rates and media coverage (Kelly et al., 2009; Meyer et al., 2016); therefore, our systematic review did not draw conclusions about the effects of media among citizens due to the lack of studies analysing the relationship between media coverage and public behaviour. If in the future there are more studies, we recommend conducting pooled analyses of the effects of media coverage about vaccines.

Although our review followed systematic review methods, some limitations need to be noted and any interpretation of the results must take into account the restrictions of the study. First, the findings of the review can only present the distributions as they appear in the journals that were included in our search strategy. Any process involving the selection of journals has unavoidable limits. The inclusion of additional publications in the future is most likely to gradually change the image that has emerged here. Second, our analysis focused only on original scientific studies that have been published, so it is not a comprehensive assessment of media coverage in general. Our study only focused on what samples and approaches researchers have followed in their studies. For example, we are limited in our synthesis to vaccine coverage in other media types. We found that television ($n = 1$) and radio ($n = 0$) were infrequently or not analysed, compared to print media ($n = 21$). Moreover, we are concerned that media consumption today is not the same as before when people waited for their morning papers or sat down at an appointed time for the evening television news. More and more readers, viewers, and listeners are going online for their news. Television, newspapers, and radio are still here, but there is growing competition

(Alejandro, 2010). In our systematic review, we did not include studies analysing online social networks (i.e., YouTube, Facebook, or Twitter). Since 88% of millennials get their news from social media (Gollust et al., 2016), this is a limitation in the current study especially for this age group. Third, we only searched for content analyses studies as a research method. Here we can only speculate on the importance of the messages covered and the information quality, but we cannot claim that the patterns have actually shaped public views or vaccination behaviours. Randomised clinical trials (RCTs) examining media effects are required to make these causal assertions. In fact, according to Boyce (Boyce, 2006), there is a paucity of research examining journalistic materials and their impact on audience understandings. In spite of these limitations, to our knowledge this is the largest systematic review to date that analyses media coverage on vaccines. Given the explosion of scientific literature, and the fact that time is always scarce, review articles play a vital role in decision-making and evidence-based practice. Given that most decision-makers do not have the time to track down all the original articles, critically read them, and obtain the evidence they need for their questions, systematic reviews may be their best source (Ganeshkumar & Gopalakrishnan, 2013).

Finally, this systematic review includes some practical implications. In line with other authors (Clarke, 2011; Meyer et al., 2016), our systematic review does not suggest that journalists should become public health practitioners tasked with persuading people to be vaccinated. Rather, media can serve as a resource through which people become aware of an issue, aware of strategies to address this issue, and potentially motivated to take action depending on pre-existing attitudes and predispositions. To achieve this, our systematic review provides a useful basis and will be of interest to those in the health field as well as researchers and policy makers who are trying to communicate their message about vaccines to the public. Since the results of the literature review are consensual on the fact that media coverage of medicines is comprised of mostly negative messages and inaccurate information that could negatively impact public health initiatives, public health officials implementing vaccination programs should develop a close collaboration with journalists and the media. Thus, we

recommend future research on institutional communication (Calleja-Reina, Díaz Cerveró, & Vázquez Barrio, 2017; Moreda Sánchez, Martínez Pastor, & Vizcaíno Pérez, 2017) from public health authorities to journalists in order to identify its characteristics and areas for improvement, if any. The communication on the part of public health agencies to stakeholders and the public should also been analysed as it is considered vital (Longest & Rohrer, 2005). Another recommendation for future research should focus on online media reviews since they are key in rapidly spreading health messages to society. Finally, further research should also focus on the analysis of visual materials (i.e., photos, graphics, infographics, tables, etc.) included in newspaper articles especially because of the readership that mostly consume headlines and images.

Conclusions and public health implications

This systematic review shows that coverage of vaccines by traditional media sources is a topic that has been largely studied during the last decade. Most of the studies conducted content analyses in newspapers, and the HPV vaccine was the most frequent selected vaccine by the studies. Moreover, North American national media sources were the most frequent among those selected by researchers. We have identified gaps in the current literature and an agenda for further research. There is a strong need to conduct research on other types of media such as television and radio, address a wider variety of vaccine types, and explore other geographical areas such as low-income countries. We found that negative messages and inaccurate information are common in media coverage on vaccines. Public health officials who deal with vaccines should develop a close collaboration with the media to improve public communication on vaccines.

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Table 2. Characteristics of the selected studies

Authors	Country	Media type	Vaccine	Objectives
Abdelmutti & Hoffman-Goetz, 2010	Canada	Magazines	HPV	Assess the discussion of risks, fear-inducing messages about HPV, cervical cancer, and the HPV vaccine
Casciotti, Smith, & Klassen, 2014	US	Newspapers	HPV	Understand media portrayal of vaccine-related controversy, and potential influences on attitudes and vaccine acceptance
Casciotti, Smith, Andon, et al., 2014	US	Newspaper	HPV	Examine media coverage of HPV vaccine mandates during 2005-2009
Casciotti, Smith, Tsui, & Klassen, 2014	US	Newspapers	HPV	Examine U.S. news media messages related to sexuality and HPV vaccination
Clarke, 2011	US and UK	Newspapers	MMR	Look at normative pressures that may influence whether mobilizing information appears in media coverage
Cooper Robbins, Pang, & Leask, 2012	Australia	Newspaper	HPV	Establish a comprehensive picture of how Australian media portrayed HPV vaccine and its surrounding issues
Elbarazi, Raheel, Cummings, & Loney, 2016	United Arab Emirates	Newspapers	HPV	Explore the content and communication style of the UAE newspapers (both Arabic and English) before, during, and after the HPV vaccination program.
Goodyear-Smith, Petousis-Harris, Vanlaar, Turner, & Ram, 2007	New Zealand	Newspapers	Not specific	Analyze the content of written media in 2001 and 2003 throughout NZ in terms of vaccination and vaccine preventable diseases from a supporting, neutral, or opposing perspective; how vaccination and vaccine-preventable diseases are presented to their target audiences; and changes over time with possible influences on these changes

Guillaume & Bath, 2008	UK	Newspapers	MMR	Analyse the mass media coverage that the MMR (measles, mumps and rubella) vaccine received as a result of questions raised about its safety
Hilton, Hunt, Langan, Bedford, & Petticrew, 2010	UK	Newspapers	HPV	Examine the role the newsprint media have played in HPV advocacy by identifying key messages about the risks and benefits associated with HPV vaccination and HPV infection, and how these stories were constructed and framed for different readership groups
Holton, Weberling, Clarke, & Smith, 2012	UK, US and others	Newspapers	MMR	1) Analyze actors to which the news media attributed blame for the controversy along with sources used to do so; 2) explore coverage over time, taking into account potential changes in attribution; and 3) assess attributions of responsibility for addressing this issue and its effects, focusing on mobilizing information provided to readers
Hussain et al., 2011	US	Newspapers	Not specific	Identify and describe vaccine safety in US newspaper articles
Kelly, Leader, Mittermaier, Hornik, & Cappella, 2009	US	Newspapers and survey	HPV	Explore the nature of the coverage of HPV and whether knowledge about HPV was affected by this coverage
Krakow & Rogers, 2016	US	Newspapers	HPV	Examines a pivotal time period for public health in which the vaccine became officially recommended for boys and men and at the same time became the center of political controversies in the lead-up to the 2012 presidential campaign
Meyer et al., 2016	Canada	Newspaper	Seasonal flu	Identify the nature of the relationship between risk messages about getting the seasonal flu vaccine in newspaper coverage and the uptake of the vaccine
Olufowote, 2011	Nigeria	Newspapers	Polio	Understanding of the role of fragmentation in global health initiatives through analyses of 52 northern Nigerian newspaper reports of the 2003-2004 northern Nigerian stoppage of the Global Polio Eradication Initiative

Pen a & B ban, 2014	Romania	Newspapers, magazines and videos.	HPV	Explore the content and quality of HPV vaccine media coverage in Romania
Perez, Fedoruk, Shapiro, & Rosberger, 2016	Canada	Newspapers	HPV	Investigated what information about the HPV vaccine was relayed to the public, and how this content was portrayed following the 2012 male HPV vaccine recommendation
Petousis-Harris, Goodyear-Smith, Kameshwar, & Turner, 2010	New Zealand	Newspapers	Not specific	Explore New Zealand's four major daily newspapers' coverage of immunisation with regards to errors of fact and fallacy in construction of immunisation-related arguments
Quintero Johnson, Sionean, & Scott, 2011	US	Newspapers	HPV	Examine the news information presented about the HPV vaccine in major U.S. newspapers over the 19 months following its Food and Drug Administration (FDA) approval.
Rachul, Ries, & Caulfield, 2011	Canada	Newspapers	A/H1N1	Analyse Canadian newspapers' portrayal of the A/H1N1 vaccine including mention of risks and benefits of the vaccine and whether the article supported, questioned or was neutral about the vaccine.
St John, Pitts, & Tufts, 2010	US	Newspapers	HPV	Explore how both the news media and parents framed and responded to the newly-mandated HPV vaccine
Tsuda et al., 2016	Japan	Newspapers	HPV	Evaluate the characteristics of newspaper publications about human papillomavirus vaccination
Wallace & Ache, 2009	US	TV	HPV	Examine the content of human papillomavirus (HPV)-related vaccination information presented during nightly national television news broadcasts

Abreviations: A/H1N1: subtype of influenza A virus; HPV: Human Papilloma Virus; MMR: Mumps, Measles, Rubella (vaccine)

Table 3. Outcomes and conclusions of the selected studies

Authors	Main variables	Sample size	Main outcomes	Main conclusions
Abdelmutti & Hoffman-Goetz, 2010	*f* fright factors which affect public perception of risk (alarm, fear and anxiety)	15 magazine articles	Risk messages focused on threatening illness or injury. Reporting on the HPV vaccine emphasized it being poorly understood by science. News magazine articles on the HPV vaccine and cervical cancer included fear-inducing messages.	Cancer educators need to be aware of media reporting in order to alleviate fears that the public may experience about the HPV vaccine.
Casciotti, Smith, & Klassen, 2014	Characteristics of media coverage, relationships between conflict and pro-vaccine tone and specific story characteristics	447 newspaper articles	Most articles were positive in tone, prompted by research/scientific advancement or legislative activities. 66% of all stories contained conflict. Fewer articles from 2005–2006 and 2008–2009 contained conflict than those from 2007, suggesting a peak period of concern.	Legislative activities and content related to sexual activity were sources of conflict in HPV vaccine media messages. Health communication strategies can be improved by understanding and addressing potential sources of conflict in news coverage of public health initiatives.
Casciotti, Smith, Andon, et al., 2014	Topics, key stakeholders and sources, tone, and the presence of conflict	63 newspaper articles	Media coverage was often incomplete, providing little context about cervical cancer or screening. Skepticism and autonomy concerns were common. Messages reflected conflict and distrust of government activities, which could negatively impact this and other youth-focused public health initiatives.	If school health professionals are aware of the potential issues raised in media coverage of school-based health mandates, they will be more able to convey appropriate health education messages and promote informed decision-making by parents and students.

Casciotti, Smith, Tsui, & Klassen, 2014	Ethical issues, characteristics , government/state activities, health behaviors, stakeholder actions/interests, social reactions/attitudes/influ ences, major topics, additional descriptors, sources, story tone and conflict	49 newspaper articles	Articles discussed vaccination in the context of abstinence-only versus comprehensive sexual health education; cited research findings to support vaccination or sex education; argued against connecting vaccination to promiscuous behavior; but included fear-inducing messages.	Media messages concerning health behaviors related to HPV vaccination tended to support government and parental involvement in sex education, and dismiss concerns linking vaccination to sexual activity, while also presenting the vaccine as lifesaving.
Clarke, 2011	Mobilizing information, accountability information	15 newspaper articles	Significant differences between countries were found in the number of articles containing fear messages about human papillomavirus, cervical cancer, and the human papillomavirus vaccine. Educational level of readability was higher than recommended for the public, and the emotional tone of the articles became progressively negative over time.	Public discussion of some elements of the human papillomavirus vaccine message that could cause alarm or worry for women may need to be addressed within political and cultural contexts.
Cooper Robbins, Pang, & Leask, 2012	Main themes; completeness and accuracy of information; potential issues and concerns; phrasing, emphasis,	131 newspaper articles	Resulting themes were as follows: Australian pride in vaccine development; details and progress of the National Vaccination Program; vaccine safety; HPV vaccination's future; whether or not males could and=or should get the vaccine; issues related to sexual activity and the vaccine;	To fill gaps that are created by media representations of HPV vaccination, educational interventions should include information about HPV transmission and male vaccination and should promote adolescent involvement in decision making.

	and language used; and representation of experts.		and issues about decision making for acceptance of HPV vaccine.	
Elbarazi, Raheel, Cummings, & Loney, 2016	Frequency of HPV vaccine, types of sources, and headlines and message frames	79 newspaper articles	Five main themes: (i) "HPV Screening or Vaccination Programmes in the UAE" (N = 30); (ii) "Cervical Cancer Statistics in the UAE" (N = 22); (iii) "Aetiology of Cervical Cancer and HPVV Efficacy" (N = 12); (iv) "Cultural Sensitivity and Misconceptions Surrounding HPVV in School-Aged Females" (e.g., promoting promiscuity) (N = 8); and (v) "Cost-Effectiveness, Efficacy, and Safety" (N = 7).	The UAE media is raising public awareness about cervical cancer and specific governmental health initiatives such as the HPVV program. Governmental health authorities may want to consider collaborating with the UAE media. Improved parental and adolescent knowledge may lead to increased acceptance and uptake in the UAE society.
Goodyear-Smith, Petousis-Harris, Vanlaar, Turner, & Ram, 2007	Coding as supportive, neutral, or opposing immunization	2113 newspaper articles	Articles and perspectives in the media opposed to immunization were significantly more plentiful in 2001 than in 2003 (328=1,228; 27% vs. 34=885; 4% of all immunization media).	Overall positive trend toward reduction in alarmist anti-immunization messages in media. Strategies implemented by the Immunization Advisory Centre to counter misinformation may have contributed to reduction in anti-immunization messages.
Guillaume & Bath, 2008	94 content-based variables and key attributes such as word count and date of publication	227 newspaper articles	The content and format of articles between different information sources varied widely.	Differences can be attributed to the information source in which they are published, but the variability in the content of these information sources provides a challenge to parents who were shown to be using the mass media as an information source.

Hilton, Hunt, Langan, Bedford, & Petticrew, 2010	Key discourses around HPV vaccination and tone	344 newspaper articles	The newspapers were generally positive towards the new HPV vaccination and over the 4 years period the newsworthiness of the HPV vaccination programme increased. In 2008 two events dominated coverage, firstly, the introduction of the HPV programme in September 2008 and secondly, in August 2008 the diagnosis on camera of cervical cancer given to Jade Goody, a 27 year old mother of two, who gained fame and notoriety in the UK through her participation in several reality television shows.	The positive media coverage surrounding the introduction of the HPV vaccination programme is to be welcomed as it is likely to contribute towards influencing public perceptions about the acceptability and need for HPV vaccination. The focus on prevalence rates of HPV infection among women and on women's sexual behaviours, in relation to HPV vaccination 'encouraging' promiscuity, is an unhelpful aspect of media coverage.
Holton, Weberling, Clarke, & Smith, 2012	Attributions of blame for the controversy and its impacts on vaccination rates; sources that made these attributions; and solutions to address this issue.	281 newspaper articles	Over the course of the MMR-link controversy, the news media placed an increasing amount of blame on one individual— Wakefield. Sources primarily came from four areas: science/medical, nonprofit, family, and elected officials. News coverage explored causes of this issue without offering solutions, such as where to find more information on a connection from medical and public health sources (e.g., the CDC).	Findings emphasize how news media may attribute blame in health risk communication and how that ascription plays a potentially vital role in shaping public behavior.
Hussain et al., 2011	Source affiliations, data or statistics, data source(s), mention of vaccine safety in the headline, if the article suggested that the	1147 newspaper articles	The mean number of vaccine-safety articles per state was 26. Six (not mutually exclusive) topics were identified: vaccine-safety concerns (46%); vaccine policy (44%); vaccines are safe (20%); immunizations are required (10%); immunizations are not required (8%); and state/school exemption (8%). Three spikes in the number	Ongoing monitoring of news on vaccine safety may help the content and framing of vaccine-safety messages.

	number of immunizations is too much for children, and whether information was provided as a further resource. Also, if message from the article was positive, mixed or negative.		of newspaper articles about vaccine-safety issues were observed: in 1999 regarding rotavirus vaccine and in 2002 and 2003 regarding smallpox vaccine. Excluding articles that referred to rotavirus and smallpox vaccines, 37% of the articles had a negative take-home message.	
Kelly, Leader, Mittermaie r, Hornik, & Cappella, 2009	Primary topics about HPV vaccine, such as general information of the transmission, recommendation for cancer screening, and journalistic features.	222 newspa per articles, and survey to 4367 individu als	Twenty-three percent of stories did not mention the sexually transmitted nature of the disease and 80% left out information about the need for continued cervical cancer screening after vaccination. Exposure to health-related media content was significantly associated with knowledge about HPV, even controlling for baseline knowledge (OR = 1.62, 95% CI = 1.12– 2.35).	Changes in the volume of coverage over time were associated with knowledge about HPV, but the content analysis reveals that many of the stories were missing important information
Krakow & Rogers, 2016	Frequency, information about health outcomes, target populations, common barriers or concerns about, and	154 newspa per articles	The lack of comprehensive coverage of HPV and the HPV vaccine found in previous studies continued in this year. Results shed light on key political events that may have functioned to overshadow the recommendation of the HPV vaccine for boys and men.	The implications of this pattern of news coverage can inform public health efforts to address low rates of HPV vaccination uptake among boys and men in present day.

	inclusion of personal and political stories			
Meyer et al., 2016	Risk messages in newspaper content for each year of analysis, and vaccination rates	480 newspaper articles	Vaccination rates were positively and significantly related to the frequency of risk messages in newspaper coverage (r = .691, p < .05). The most commonly identified risk messages related to the flu vaccine being ineffective, the flu vaccine being poorly understood by science, and the flu vaccine causing harm.	Newspaper coverage plays an important role in shaping public response to seasonal flu vaccine campaigns. Public health officials should work alongside media to ensure that the public are exposed to information necessary for making informed decisions regarding vaccination.
Olufowote, 2011	Transcript line, theme, semantic relationship	52 newspaper articles	Beliefs in contemporary forms of Western control and abuse through global organizations, understandings of the "philanthropy" of the global organizations as self-serving and malevolent, and doubts about the polio vaccine product.	Globalization's tendency toward fragmentation suggests the formation of multiple groups and voices not only within nation-states but also within regions in nation-states.
Pen a & B ban, 2014	Emotional valence of the media material, vaccine label, information about HPV infection, cervical cancer and HPV vaccines and concerns	271 reports: 92 newspaper, 25 magazine, 32 video and 122 website	31.4% of the materials were neutral, 28% were negative or extremely negative, 17% were mixed, while 23.6% were positive towards the vaccine. The most dominant vaccine-related concerns were side effects and insufficient testing. Elementary information about the vaccine and HPV was constantly left out and sometimes inaccuracies were found. Negatively disposed reports were more likely to contain incorrect data about vaccine efficacy and less likely to provide comprehensive information about the vaccine and HPV-related diseases.	Educational interventions are greatly needed as a response to suboptimal and incomplete media coverage of HPV vaccination.

Perez, Fedoruk, Shapiro, & Rosberger, 2016	Article information; epidemiological information; public policy information; article topic; article and title tone; and informant testimony	232 newspaper articles	The majority of articles (93%) mentioned that girls are eligible for the HPV vaccine, whereas only half (49%) mentioned male eligibility. While most articles associated HPV with cervical cancer (85%), fewer indicated its relation to other HPV-associated cancers (59%) or genital warts (52%). Article tone toward male vaccination became progressively more positive over time.	The Canadian public may be unaware of male eligibility and the importance of HPV vaccine for males. The collaboration of researchers, health care providers, and policymakers with journalists is critical in order to disseminate complete and accurate HPV and HPV vaccine information.
Petousis-Harris, Goodyear-Smith, Kameshwar, & Turner, 2010	Errors of fact and logic	360 newspaper articles	Numerous errors of both fact and logic were identified, predominantly used by anti-immunisation proponents, but occasionally by health authorities. The proportion of media articles reporting exclusively fact changes over time during the life of a vaccine where new vaccines incur little fallacious reporting and established vaccines generate inaccurate claims. Fallacious arguments can be deconstructed and classified into a classical taxonomy including non sequitur and argumentum ad Hominem.	Most media 'balance' given to immunisation relies on 'he said, she said' arguments using quotes from opposing spokespersons with a failure to verify the scientific validity of both the material and the source.
Quintero Johnson, Sionean, & Scott, 2011	Frequency message frames used to describe the HPV vaccine, the extent to which journalists relied on official sources, and the presence of personal examples	547 newspaper articles	Less than half of the articles provided detailed health information. Of the articles that contained a message frame, cancer prevention was most frequently employed. Government/political sources, medical doctors, and the Centers for Disease Control and Prevention (CDC) were the most commonly cited sources. Only 16% of all the articles featured personal accounts.	U.S. newspaper coverage lacked detailed information about both HPV and the HPV vaccine in spite of federal approval of the vaccine, legal mandates for the vaccine, and a widespread information campaign. Implications for public health are discussed.

Rachul, Ries, & Caulfield, 2011	Examine discussion and/or mention of evidence concerning vaccination, risks of the A/H1N1 virus and the vaccine, and tone of article in regards to the vaccination program in Canada	234 newspaper articles	Reasons for getting vaccinated appeared in 71.8% of the articles, whereas only 18.4% provided reasons against getting vaccinated. Discussion of evidence to support claims for or against getting vaccinated appeared in only 27.8% and 6.8% of the articles, respectively. Risks associated with contracting the A/H1N1 virus were discussed in 49.6% of the articles and risks of the A/H1N1 vaccine were discussed in 12.4% of the articles.	Newspaper coverage in Canada was largely supportive of the A/H1N1 mass vaccination program. However, serious risks associated with contracting the A/H1N1 virus were also frequently discussed in the print media. The news articles rarely presented direct evidence to support statements that the vaccine was safe, effective and properly tested. Known risks (such as potential allergic reactions and flu-like side effects) of the vaccine were rarely reported.
St John, Pitts, & Tufts, 2010	Newspaper reports and information needed by families	Not available (corresponding author did not answer email)	Disjoints between news media framing and parental framing.	Implications of these gaps for parental healthcare decision-making are addressed and suggestions are offered for constructing a more dialogic, community-based approach that can increase health literacy regarding the HPV vaccine.
Tsuda et al., 2016	Tone of the article as positive, neutral or negative	1138 newspaper articles	Articles were more likely to include adverse reaction-related and authority-related keywords whereas articles that included efficacy-related keywords decreased significantly. Negative-Negative and Negative-Neutral articles became more frequent.	A sensational case report shaped the tone of negative media coverage as a catalyst, regardless of scientific statements from health authorities.

Wallace & Ache, 2009	Segment length, network, year of broadcast and presentation type. Air dates surrounding the development, efficacy, and controversy regarding HPV vaccination	27 news broadca sted on TV	During the 6-year period, a total of 27 HPV related vaccination news broadcasts aired. News broadcasts ranged from 10 to 250 seconds, lasting an average of close to 2 minutes (mean T SD, 127.0 T 66.1 seconds). Most broadcasts presented information pertaining to HPV and cervical cancer, information on vaccine labeling, impact of the vaccine, and raised issues or concerns about the vaccine. More than half (66.7%) of news broadcasts were directly related to 5 seminal events surrounding the development, efficacy, and controversy regarding HPV vaccination.	All 5 networks included within the Vanderbilt Television News Archive aired HPV vaccination content, with National Broadcasting Company and Columbia Broadcasting Company broadcasting most of the news stories during this time period. As compared with other medical-related information presented on national nightly television news during this time period, HPV vaccination received a modest amount of coverage.

Study 4. Message analyses about vaccines in the print press, television and radio: characteristics and gaps in previous research

Abstract

Background: Vaccines have attracted extensive media attention in recent years, owing in large part to now-discredited claims about safety. This media content can impact public perception of disease preventive measures and influence decisions. Previous studies have analysed how the media construct and frame messages about vaccination programs. Therefore, our objective was to review the studies analysing media messages about vaccines and describe the characteristics and research gaps thereof. Method: A review was conducted searching content analyses of media messages about vaccines in 5 international databases for articles published from 2007 to 2018 in television, radio and print media. Results: The search yielded 27 eligible studies; media messages about vaccines have been largely studied during the last decade. The findings revealed that 63% (n = 17) of studies analysed the HPV vaccine, 93% (n = 25) examined newspapers, and 56% (n = 15) examined North-American media. Negative messages were more frequent than positive ones in the studies (n = 8 *versus* n = 5). The media message analyses were related to the following categories: 'positive messages', 'negative messages', 'information quality', 'sources of information' and 'costs'. All studies found inaccurate messages about vaccines or vaccination. Conclusions: We have identified common characteristics and research gaps in the literature as few studies analysing vaccines messages in television and radio, different types of vaccines and geographical areas such as in low-income countries. Negative messages and inaccurate information are frequent in media messages about vaccines or vaccination. Practical implications are discussed.

Keywords: Vaccination; Media; Newspapers; Public Health; Controversies; Journalism; Mass Media; Communications Media.

Introduction

In recent decades, the incidence of polio, measles, mumps, rubella, Haemophilus influenzae type b, hepatitis, and varicella (chicken pox) has greatly declined thanks to vaccination programs (Shinefield et al., 2006). Today, vaccines represent one of the greatest scientific achievements in the battle against serious infectious diseases, improving quality of life and life expectancy worldwide. Many countries have made tremendous progress in vaccination programs. However, the public is not always aware of the important role of vaccines in preventing diseases. Indeed, despite the impact of vaccines on health and well-being, they have had a long history of controversies, raising concerns amongst policy makers, the media and parents about issues such as vaccine safety and the increasing complexity of immunisation schedules (Kennedy, LaVail, Nowak, Basket, & Landry, 2011). Recent news stories have covered topics related to vaccine-related fears, such as the link between autism and immunisation which has led to the decrease in disease frequency and the poor amount of vaccine uptake in childhood (DeStefano, Price, & Weintraub, 2013). Lack of confidence in vaccines is now considered a threat to the success of vaccination programs, and this is believed to be responsible for decreasing vaccine coverage and an increasing risk of vaccine-preventable disease outbreaks and epidemics (Dubé et al., 2013). For example, 105 children who died of influenza during the 2012-2013 season, most of whom were unvaccinated (Hendrix et al., 2014). The media have been considered as an important tool for communicating information, increasing awareness about vaccines and vaccination (Casciotti, Smith, Tsui, & Klassen, 2014; Gomes & Lopes, 2017), and for motivating the public to make important health care decisions (Mark Levitan, 2011). In fact, the media play a crucial role in channelling health-related information; they are powerful tools for delivering health education and promoting disease prevention. However, if misused or exploited, they can negatively influence the general population's health attitudes and behaviours (Odone & Signorelli, 2016).

Immunisation has a long and complicated history of both saving lives and creating fears, such as of the health problems that appeared in some adolescents after the uptake of the human papillomavirus vaccine (HPV) (Abdelmutti & Hoffman-Goetz, 2010). The media has covered the debate about this complexity over the last decades. Consequently, vaccine adherence is a growing public health challenge. In this regard, in the wake of health scares, government and health organisations have launched campaigns to restore faith in current vaccine policies. The proponents of health scares, however, are hard to quell and seem to have messages that 'speak better' to those unconvinced of the safety of vaccines (Rundblad, 2015). Messages about vaccines published by a journalist may impact public perception of health preventive measures and influence decisions regarding the public's own health. Indeed, the media have been shown to contribute towards harmful health behaviours, such as the smoking advertising and product placement in movies and on television, where the media are considered to act as sources for observational learning (Hilton, Hunt, Langan, Bedford, & Petticrew, 2010). The media of today are one of the main sources of health information for the public, a situation which is becoming more common. For example, media messages about the HPV vaccine (Gardasil) were cited as a main source of information, and vaccine uptake was associated with media use (Hughes et al., 2009).

To our knowledge, only three previous reviews have been conducted investigating the media coverage of vaccines (Gollust, LoRusso, Nagler, & Fowler, 2016; MacDonald, Cairns, Angus, & de Andrade, 2013; Rundblad, 2015). However, these studies were limited. Gollust et al. (Gollust et al., 2016) reviewed studies that focused on the HPV vaccine uptake in the US and included 13 content analysis articles published from 2006 to 2011. MacDonald et al. (MacDonald et al., 2013) focused on the promotional communication of the influenza vaccination from 2000 to 2011, including 22 studies from European countries. Rundblad (Rundblad, 2015) explored UK and Australian studies analysing child immunisation news. In contrast, our study intends to review previous studies analysing vaccine media messages that included all target populations, types of vaccines, locations and world regions. Our review searches

for papers that analysed media messages about vaccines in television, radio or print press. Despite the substantial growth of digital media, we decided to focus this review solely on print press, television and radio in order to look at the growing research in the field and to maintain a manageable scope for this review. In addition, these analysed media are still highly consumed by the public. For example, in India, print media and television still occupy an important role in the delivery of messages to a large number of people (Mathiyazhagan, Kaur, Ravindhar, & Devrani, 2015); in the US, non-digital media are still consumed more than digital media, with rates of 6 hours and 16 minutes per day versus 5 hours and 50 min per day, respectively (eMarketer, 2017).

Therefore, the aim of this study is to review and identify studies, describe their characteristics, identify research gaps and provide a deeper understanding of the field of media messages analyses about vaccines. In this regard, we addressed the following research questions:

> RQ1. What are the main characteristics of studies analysing media messages about vaccines?
>
> RQ 2. What are the main outcomes of media message analyses of vaccines?

Methods

The development of this study followed systematic review methods guided by the PRISMA statement (PRISMA-P Group et al., 2015; Shamseer et al., 2015). A protocol for the review was developed through consensus amongst the authors.

Search strategy

Literature search strategies were developed using medical subject heading (MESH) and text words related to mass media. Search strategies combined two types of terms: vaccine terms (e.g., vaccine, vaccination, immunisation) and traditional media terms (e.g., television, radio, newspaper); see search strategy

in Table 1. We searched in five databases: PubMed (including MEDLINE), Scopus, the International Bibliography of Social Sciences (IBSS), the Cumulative Index to Nursing and Allied Health (CINAHL) and the Latin American and Caribbean Health Sciences Literature (LILACS). Papers that were written in any language and published between January 1, 2007 and January 1, 2018 were included. The last search was done on March 3, 2018. We chose the time period from 2007 in order to search for studies made after the publication of the World Health Organization guidelines on the safety of medicines, as the mass media were recognised thereof as a key element in the issuance (WHO, 2006).

Selection of articles

Regardless of their methodological quality, the studies had to meet the following inclusion criteria: (1) conduct a content analysis of publications made in print media, radio or television; (2) address media message analyses of vaccines or vaccination; (3) report original qualitative or quantitative data examining media messages about vaccines. Reference lists of key articles were manually searched to identify further relevant studies. Systematic reviews, abstracts, dissertations, single-case reports, editorials, commentaries, conference abstracts, non-research articles and studies focused on digital mass media, such as websites or social networks, were excluded. Articles analysing advertisements on vaccines in the media were also excluded.

The PRISMA flow diagram in Figure 1 outlines the screening processes applied to the articles identified by the literature searches, which were subsequently screened for duplication and relevance using title and abstracts. Of those, articles that were considered relevant were assessed for eligibility by reviewing full texts.

Study records

Literature search results were uploaded to Zotero, which facilitates bibliographic source management. Following the removal of duplicates, two independent reviewers (DC, CS) screened the titles and abstracts according to eligibility

criteria. A third team member (CP) was consulted when necessary. All discrepancies between reviewers were resolved through discussion, and full agreement was reached. We obtained full articles for all titles that appeared to meet the inclusion criteria or where there was uncertainty. The appropriateness of the full-text papers was verified to check that they met the eligibility criteria.

Data extraction, synthesis and analysis

The review team developed a coding form designed to capture descriptive information from the included studies. The variables were: country where the media headquarters were located, media type, vaccine type, objectives, main variables, sample size, main outcomes, and conclusions. We synthesised the data, then findings from the mapping and analysis were recorded (data extraction Tables 2 and 3) and summarised as narrative answers to the research questions. Regarding the quality assessment of studies, we followed the 'Joanna Briggs Institute Critical Appraisal Checklist for Qualitative Research' (Lockwood, Munn, & Porritt, 2015).

Results

The database searches yielded 369 articles, which were checked for duplication and relevance according to the inclusion criteria. Additionally, three relevant articles (Hilton et al., 2010; Holton, Weberling, Clarke, & Smith, 2012; Kelly, Leader, Mittermaier, Hornik, & Cappella, 2009) were identified by manual search in reference lists. 235 articles were title and abstract reviewed, and 81 were considered for full-text review to be assessed for eligibility. Of those, 27 studies met the inclusion criteria and were included for further analysis in our study. Regarding the 54 remaining articles, the reasons for exclusion can be found in the PRISMA flow diagram (Figure 1). For a summary of the characteristics of the 27 studies, see Table 2. For a summary of media messages analyses in relation to study measures, outcomes and conclusions, see Table 3. Table 4 presents the quality assessment of the studies. Overall, the aims, data collection methods, samples and outcomes were successfully described in the studies. However, one

weakness was identified in 30% of studies (n = 8): there was doubt about whether the influence of the researchers of these studies was addressed, as inter-coder reliability analyses of the study samples were not included in the papers. Below we summarise the main findings for each of the two research questions.

RQ1. What are the main characteristics of the studies analysing media messages about vaccines?

Of the 27 studies, the majority (56%, n = 15) analysed messages about vaccines in North American media, 11 from the US and 4 from Canada. Four studies analysed UK media. Other countries studied were New Zealand (n = 2), Japan (n = 2), Spain (n = 2), Australia (n = 1), Nigeria (n = 1), Romania (n = 1) and the United Arab Emirates (n = 1). The majority of studies followed a national perspective, analysing the media of one country. Only two studies analysed media from more than one country (Clarke, 2011; Holton et al., 2012).

Newspapers (93%, n = 25) were the most frequent media type reported among the included studies. 8 studies did not specify the name of the newspapers analysed. Overall, top national circulating daily and quality newspapers were more frequent among the selected newspapers. For example, in the US, frequent titles were the Washington Post, USA Today, The Wall Street Journal and The New York Times.

Other print media were 'magazines' (n = 2). In total, print media represented the most commonly analysed media, making up 96% of studies (n = 26). One study analysed a combination of media, including newspapers, magazines and videos (n = 1). Only one study (n = 1) analysed television coverage.

The 27 studies looked at 9581 newspaper articles, 40 magazine articles and 59 videos (including national or local television news reports, educational videos and user-generated content). The average sample size was 359 units of analysis per study.

The articles focused on the analysis of the following types of vaccines: 'HPV – Human Papillomavirus Vaccine' (63%, n = 17), 'MMR – Mumps-Measles-Rubella vaccine' and the controversy about its relation to autism (11%, n = 3), 'influenza vaccine' (7%, n = 2), 'polio vaccine' (4%, n = 1) and 'smallpox vaccine' (4%, n = 1). Three articles did not analyse a specific vaccine, but overall vaccine coverage, including media coverage of a wide variety of types of vaccines, such as the new conjugate Pneumococcal Vaccine.

Regarding the objectives of the studies in relation to the media messages analyses, we found three main categories:

a) Risk messages analysis (n = 14). This was the predominant category. These studies analysed risk messages about vaccines from a variety of perspectives, such as whether messages covered controversies, safety issues, fear, or vaccine acceptance, and whether messages and arguments are supportive of, neutral or opposed to vaccination.

b) Message framing (n = 8). These studies analysed the specific frames of media messages about vaccines. The most common frames were about gender and sexuality issues in relation to the HPV vaccine, vaccination acceptance, vaccine stoppage, and mobilising messages.

c) General content analyses (n = 5). These studies performed content analyses of the messages about vaccines, describing them without a particular topic focus.

RQ 2. What are the main outcomes of media message analyses of vaccines?

According to the characteristics that were analysed in the messages, we found both types of variables: quantitative and qualitative ones. The most common quantitative variables were frequency of mentions of vaccine or vaccination, the number and types of sources cited in the articles, the word and character count, location and date of publication. With regard to qualitative variables and coding,

these were very diverse in relation to the study aims. Common qualitative variables were key messages, framing, tone, and specific story characteristics.

With regard to the qualitative analyses, we found a variety of message coding. A common coding was whether the messages were positive (or supportive), neutral, mixed or negative (or opposing) about vaccines or vaccination. Others were the quality of information, sources of information and vaccination costs. Therefore, we grouped the results in the following categories: 'positive messages', 'negative messages', 'information quality', 'sources of information' and 'costs'. Overall, 48% of the studies (n = 13) analysed the messages in relation to vaccines. Of these, 38% (n = 5) of articles found more positive messages in relation to vaccines and vaccination. 62% of the studies (n = 8) found more negative messages than positive ones, which mostly focused on vaccines being negative, ineffective, poorly understood by science, or linked to tragic personal stories.

Positive messages

Casciotti et al. (2014) found that the majority of the stories were either positive (46%) or mixed (36%) in tone, reflecting an overall pro-vaccine perspective in most of the stories. In that study, only 10% of stories were negative. Another study (Goodyear-Smith, Petousis-Harris, Vanlaar, Turner, & Ram, 2007) found an overall positive trend towards reduction in alarmist anti-immunisation messages in media in relation to vaccines. Hilton et al. (Hilton et al., 2010) found that messages were generally positive towards the new HPV vaccination and that the newsworthiness of the HPV vaccination programme increased. Pérez et al. (Perez, Fedoruk, Shapiro, & Rosberger, 2016) found that many articles about the HPV vaccine were positive in their overall tone (60.3%), some articles were coded as neutral (22%) or mixed (11.2%), and few were negative (6%). This study reported that HPV vaccination became progressively more positive each year. Finally, Ueda et al. (Ueda, Yokouchi, Onoda, & Ogihara, 2017) found 154 (70.3%) positive articles and 51 (23.3%) negative articles toward the HPV vaccination, overall.

Negative messages

The review yielded more articles with a predominance of negative messages in relation to media messages about vaccines, specifically eight versus five. In relation to studies analysing negative messages on vaccination, one study (Abdelmutti & Hoffman-Goetz, 2010) analysed alarm, fear and anxiety in relation to the HPV vaccine. The themes most often mentioned with respect to HPV were 'threatening death', 'illness' or 'injury'. 'HPV infection as being inescapable' and 'HPV vaccine poorly understood by science' were also oft-raised themes in the news articles. Therefore, this article concluded that fear-inducing risk messages about the HPV vaccine are frequently reported by the media. Another study (Meyer et al., 2016) also found fear-inducing risk messages about receiving the seasonal flu vaccine related to concerns 'that the vaccine is not effective', 'that the vaccine is poorly understood by science', and 'that the flu vaccine may cause harm'.

Hussain et al. (Hussain et al., 2011) analysed messages about all types of vaccines during a 10-year period. Overall, they found that 37% of the articles suggested that vaccines are not safe. Another study (Penta & Baban, 2014) about the HPV vaccine found that 31.4% of the messages were neutral, 28% were negative or extremely negative, 17% were mixed, and only 23.6% were positive towards the vaccine. The most dominant negative vaccine-related concerns were side effects and insufficient testing. Tsuda et al. (Tsuda et al., 2016) found that articles were more likely to include adverse reaction–related and authority-related keywords, whereas articles that included efficacy-related keywords decreased significantly. Negative-negative and negative-neutral articles became more frequent. Another study analysing news values in headlines about the HPV vaccine (Camaño Puig & Martí Jiménez, 2017) found that 'tragic personal stories" remained present during the period of analysis. The news values 'negative', 'deviation' and 'social impact' were also frequently present.

Another study (Cooper Robbins, Pang, & Leask, 2012) found that negative messages were more often correlated to safety topics in relation to the VPH vaccine, presenting fear-inducing messages thereof. Goodyear-Smith et al. (Goodyear-Smith et al., 2007) found something similar, as anti-immunisation media messages tended to focus on adverse-events. The same was found in the study by Ueda et al. (Ueda et al., 2017): negative messages were more likely to report side effects. However, this latest study found more positive than negative messages.

Information quality

Another frequent analysis in the studies was the information quality provided about vaccines and vaccination. In this regard, one study (Kelly et al., 2009) revealed that many of the stories were missing important information about the HPV vaccine, such as the sexually transmitted nature of the disease and the need for continued cervical cancer screening after vaccination. Another study (Meyer et al., 2016) found that elementary information about the HPV vaccine was constantly left out and that, sometimes, inaccuracies were found. One study (Penta & Baban, 2014) identified negatively disposed reports as being more likely to contain incorrect data about vaccine efficacy, as well as less likely to provide comprehensive information about the vaccine and HPV-related diseases. Quintero Johnson et al. (Quintero Johnson, Sionean, & Scott, 2011) found there to be a lack of detailed information about both the HPV and the HPV vaccine, in spite of US approval of the vaccine, legal mandates for the vaccine, and a widespread information campaign. Finally, Caciotti et al. (Casciotti, Smith, Andon, et al., 2014) revealed that media coverage was often incomplete, providing little context about cervical cancer or screening. The authors add that these controversial messages regarding mandates may negatively impact acceptance among undecided groups, undermining the vaccine's efficacy and potential for disease prevention.

On the other hand, a study (Petousis-Harris, Goodyear-Smith, Kameshwar, & Turner, 2010) found that articles reporting new vaccines were usually accurate.

However, the same study found that other articles, such as ones about the MMR vaccine, contained erroneous information. Another article also found this ambivalence (Guillaume & Bath, 2008), arguing that the content and format of messages between different information sources varied widely and that differences in media messages can be attributed to the information source in which they are published.

Mobilising messages have been also studied. Mobilising information, in theory, allow readers to act on existing attitudes and adopt health-protective or enhancing behaviors (Desilva, Muskavitch, & Roche, 2004). Clarke (Clarke, 2011) analysed mobilising versus accountability messages in relation to the HPV vaccine. Clarke's team found that these messages were present in only 16% of articles, compared to the 38% that mentioned accountability messages. Only 11% of articles mentioned both. The authors urge public health officials and the media to collaborate. In another study (Holton et al., 2012) of the MMR–autism link controversy, the news media received an increasing amount of blame for negative messages about vaccination. In 1998, The Lancet published an article by Dr. Andrew Wakefield which falsely linked MMR vaccination, bowel disease and autism, which facilitated a cascade of vaccine fear messages (Tsuda et al., 2016). News coverage explored the causes of this issue without offering solutions and mobilising messages, such as where to find more information on the connection between MMR and autism from medical and public health sources (Holton et al., 2012). Dr. Wakefield was discredited and The Lancet withdrew his article.

Sources of information

One study (Quintero Johnson et al., 2011) revealed that only 16% of articles featured personal accounts. St John et al. (St John, Pitts, & Tufts, 2010) found that messages were based almost entirely on discourse from experts, reflecting almost none of the discussion of parents, whose decisions ultimately affect the state-wide adoption of a vaccine. Another study (Goodyear-Smith et al., 2007) found that the majority of anti-immunisation media tended to focus on tragic

personal stories. On the other hand, positive messages about vaccines rely on authoritative institutional voices such as physicians, legislators and health advocacy organisations. Another study (Petousis-Harris et al., 2010) showed that most media 'balance' given to immunisation relies on 'he said, she said' arguments using quotes from opposing spokespersons with a failure to verify the scientific validity of both the material and the source. Finally, a study (Goodyear-Smith et al., 2007) described similar outcomes, as anti-immunisation media messages tended to focus on adverse events that tended to be found in letters to the editor, making emotional appeals and citing tragic personal stories. On the other hand, pro-immunisation media tend to be informative rather than opinion-based. This journalistic focus reveals a significant disconnect from the discourse within families (St John et al., 2010). This important finding has been revealed in studies analysing print media. However, in the only television study (Wallace & Ache, 2009), they found that, the formats of 12 broadcasts combined factual and personal information surrounding HPV and cervical cancer although most news stories presented information in an exclusively factual format (e.g., prevalence of HPV and cervical cancer, efficacy of HPV vaccination). Viewers were often thereby provided with a human or emotional perspective of HPV and cervical cancer.

Costs

Finally, the economic perspective in relation to the costs of vaccine has been found as another frequent topic in the media articles (Perez et al., 2016; St John et al., 2010). In this regard, one study suggests that media messages should report on the cost of not receiving cervical cancer vaccination, rather than only reporting the cost of the vaccine (Ueda et al., 2017).

Discussion

This review synthesises 27 studies analysing media messages about vaccines in print-media and television. Studies analysing vaccine messages in radio were not found. To our knowledge, this is the largest systematic review of media messages

on vaccines which has included content analyses studies since 2007 in any language, covering all types of vaccines from every geographical region of the world.

Analysing media messages about vaccines is important because mass media, as a persuasive source of information, might influence public risk perception and decisions about vaccination (Smith & Parrott, 2012). In addition, Dr. Goldberg stated that policy about vaccines is currently shaped by the media, instead of health science (Goldberg, 2011). Our review revealed some research gaps which can be synthesised as follows:

The type of media. The review searched for studies analysing print media, television and radio. Most of studies analysed print media, especially newspapers. This is consistent with a previous review (Gollust et al., 2016), where newspapers were the most analysed media. We did not find any study analysing radio and found only one study analysing television. Moreover, further reviews should explore other media that are relevant in the field. For example, the Research Vaccination Group (Vaccination Research Group, 2015) states that the primary media used to influence people concerning vaccination are public health publications, anti-vaccination websites, medicine-related television shows, and Web 2.0 interfaces. Moreover, the studies analysed general national media without engaging in further message analyses for specific target groups. As Bechini et al. (Bechini et al., 2017) claim, health communication may increase in effectiveness if implemented at different levels via specific languages and degrees of depth.

Geographical area. The majority of the studies included in this review originated from North America (11 from US and four from Canada), as well as, in clearly lower proportions, from Australia, Japan, New Zealand, Nigeria, Romania, Spain, the UK and the United Arab Emirates. Only two countries not classified as high-income countries, Nigeria and Romania (according to the World Bank, 2017), have been analysed. Therefore, another research gap in the field is the lack of studies in low-income countries, especially because laws regarding the media

communication of medicines are rarely implemented in these countries due to a lack of commitment and resources on the part of law enforcement departments (Byarugaba, 2004). Finally, a reason for the dominance of research in the US might be that the established drug regulatory system is highly studied and that many American researchers have a significant interest in health communication. In fact, a previous study (Kim, Park, Yoo, & Shen, 2010) analysing nationalities in the journal 'Health Communication', revealed that for 90.5% of studies the first authors were American. In other regions of the world, this research field is now growing, such as in Spanish-speaking countries, where this research field has experienced significant development over the last decade (Catalán-Matamoros, 2017; Terrón Blanco, Ramírez Leyva, Vialás Fernández, & Jacobetty, 2017). Therefore, we expect there to be more diversity in terms of the countries whose media are analysed over the coming years.

The type of vaccines. Only five types of vaccines were analysed: MMR, influenza, polio, smallpox and HPV. The majority of studies (17 of 27) analysed messages about the HPV vaccine. The other vaccines were analysed just once, except for MMR, which was analysed in three studies. This represents another research gap in the field, since there are many other vaccines that have not been specifically analysed, such as the following vaccine-preventable diseases among adults: hepatitis B, pneumococcal, shingles, tetanus and pertussis. This is consistent with the WHO statement about the low media attention surrounding some vaccine types (WHO, 2017a, 2017b). This statement could also support the hypothesis about the dominance of the HPV vaccine research that we found in our review. Indeed, there is a sizeable body of literature on the HPV vaccine's portrayal in the media. Chronic HPV infections are the leading cause of cervical dysplasia and cervical cancer. Gardasil, a vaccine directed against HPV, generated both positive and negative media and public attention. The public and health officers voiced doubts about its long-term safety and efficacy, and about that this vaccine was marketed despite it was implemented amongst unease about timing rushed approvals (Abdelmutti & Hoffman-Goetz, 2010).

Message analyses. Our review shows important outcomes in relation to the message analyses conducted by the included studies. Studies finding more negative messages about vaccines or vaccination were more frequent than those finding more positive messages. Indeed, journalists and editors search for good stories, and negative messages might be of more interest to society than positive ones (Taylor, 2006). Cooper Robbins et al. (Cooper Robbins et al., 2012) declared that it is naive to expect that the media's primary role is communicating scientifically accurate information. The media operate to report, to critique, and to attract and retain audiences. Representing conflict and stirring emotions will often serve such agendas. However, these declarations could be controversial since they collide with the journalists' ethical obligation to report factually, not simply to attract and retain audiences.

Some studies revealed a lack of information quality and accuracy in relation to the media messages about vaccines. Details about the accrual of evidence regarding vaccine safety and efficacy may mitigate perceptions of risk by the public (Meyer et al., 2016), although we should be realistic and take into account that media space constraints may pose challenges to extensive explanations. Health reporters in particular often rely on information from scientific sources when crafting stories because of the complex nature of many health issues (Holton et al., 2012). However, the studies found a lack of contextual information, mobilising and accurate messages, concluding that journalists may misrepresent the state of clinical evidence. In this regard, it has been considered a useful strategy (Meyer et al., 2016; Penta & Baban, 2014) to improve communication between health officials and journalists. It is particularly important to avoid the transmission of inaccurate information, especially given that it is not easy for a layperson to identify fake medical news (Catalan-Matamoros et al., 2016; Penta & Baban, 2014).

We should reflect on some limitations and bias that need to be considered. This review outcome does not cover all types of media, but only print media, television and radio, so it does not represent a comprehensive media assessment. For example, it does not include the digital media which are highly consumed in our

current society and could be a powerful media influence on attitudes and awareness about vaccines. Among the media that were analysed, our review found a dominance of the print press, with few studies analysing the coverage in television and none in radio. Therefore, the results of the current review are predominantly based on newspapers. In this regard, print news reporting continues to serve as the original source for much of what is reported later in other media, influencing a wider audience than just newspaper readers. Thus, it offers a valid 'snapshot' of the news environment of any given issue (Casciotti, Smith, Andon, et al., 2014). Third, we only searched for content analyses studies as a research method. Here, we can only speculate on the characteristics of the messages covered and the information quality, but we cannot claim that the patterns have actually shaped public views or vaccination behaviours.

Conclusions

This review provides a useful basis and will be of interest to professionals in the health communication field, as well as researchers and policy makers engaged in the preparation of public messages about vaccines. Our study shows that media message analyses of vaccines is a topic that has been studied frequently during the last decade. Most of the studies analysed messages in newspapers, and analysis of messages about the HPV vaccine was the most common focus amongst the studies. Moreover, North American media were selected most frequently by researchers. Negative media messages and a lack of quality information about vaccines were found most predominantly amongst the studies, so we suggest that public health officials and media professionals should develop a close collaboration to improve communication about vaccines. In addition, to address research gaps in the field of media message analyses of vaccines, further studies should analyse messages in television and radio, and messages about a greater variety of vaccine types; more research is also needed in other geographical areas, such as in low-income countries.

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Table 2. Characteristics of the selected studies

Authors	Country	Media type	Vaccine	Objectives
Abdelmutti & Hoffman-Goetz, 2010	Canada	Magazines	HPV	Uncover and evaluate the types of risk messages that underscore fear in reporting about HPV, cervical cancer and the HPV vaccine.
Camaño Puig & Martí Jiménez, 2017	Spain	Newspapers	HPV	Identify from a qualitative point of view, the news values in the headlines about vaccines
Casciotti, Smith, & Klassen, 2014	US	Newspapers	HPV	Investigate media messages about HPV in relation to controversies, potential influence on attitudes and vaccine acceptance
Casciotti, Smith, Andon, et al., 2014	US	Newspaper	HPV	Explore message framing around vaccine mandates in a subset of articles from 2007, and certain characteristics of thematic message frames
Casciotti, Smith, Tsui, & Klassen, 2014	US	Newspapers	HPV	Examine U.S. news media messages related to sexuality and HPV vaccination
Clarke, 2011	US and UK	Newspapers	MMR	Look at normative pressures that may influence whether mobilizing messages appears in media coverage in comparison with accountability messages using the autism-vaccine controversy as a case study
Cooper Robbins, Pang, & Leask, 2012	Australia	Newspapers	HPV	Conduct a content analysis of major Australian newspaper stories published from before the announcement of the National HPV Vaccination Program (analysis began from October 2006) through the completion of the catch-up vaccination program in December 2009, a 39-month period.

Elbarazi, Raheel, Cummings, & Loney, 2016	United Arab Emirates	Newspapers	HPV	Explore the content and communication style of the UAE newspapers (both Arabic and English) before, during, and after the HPV vaccination program.
Goodyear-Smith, Petousis-Harris, Vanlaar, Turner, & Ram, 2007	New Zealand	Newspapers	Not specific	Analyze the content of written media in terms of vaccination and vaccine preventable diseases from a supporting, neutral, or opposing perspective, and how vaccination and vaccine-preventable diseases are presented to their target audience.
Guillaume & Bath, 2008	UK	Newspapers	MMR	Analyse the mass media messages about the MMR vaccine as a result of questions raised about its safety
Hilton, Hunt, Langan, Bedford, & Petticrew, 2010	UK	Newspapers	HPV	Examine the role the newsprint media have played in HPV advocacy by identifying key messages about the risks and benefits associated with HPV vaccination and HPV infection, and how these stories were constructed and framed for different readership groups
Holton, Weberling, Clarke, & Smith, 2012	UK, US and others	Newspapers	MMR	1) Analyze actors to which the news media attributed blame for the controversy along with sources used to do so; 2) explore coverage over time, taking into account potential changes in attribution; and 3) assess attributions of responsibility for addressing this issue and its effects, focusing on mobilizing information provided to readers
Hussain et al., 2011	US	Newspapers	Not specific	Identify and describe discussions of vaccine safety in US newspaper articles to better understand news coverage about vaccine safety and US recommended vaccines and to determine if news coverage of vaccine safety has changed over time.
Kelly, Leader, Mittermaier, Hornik, & Cappella, 2009	US	Newspaper, TV and survey	HPV	Explore the nature of the coverage of HPV and whether knowledge about HPV was affected by this coverage

Krakow & Rogers, 2016	US	Newspapers	HPV	Examine media messages during a pivotal time period for public health in which the HPV vaccine became officially recommended for boys and men and at the same time became the center of political controversies in the lead-up to the 2012 presidential campaign
Martínez-Martínez, Tuells, & Colmenar-Jarillo, 2015	Spain	Newspapers	Smallpox	Analyze media messages about smallpox in the period 1999-2004
Meyer et al., 2016	Canada	Newspapers	Seasonal flu	Identify the nature of the relationship between risk messages about getting the seasonal flu vaccine in newspaper coverage and the uptake of the vaccine
Olufowote, 2011	Nigeria	Newspapers	Polio	Examine how northern Nigerian newspapers narrate the 2003–2004 vaccination stoppage and what the shared local and cultural factors were that colluded in undermining the GPEI
Pen a & B ban, 2014	Romania	Newspaper, magazines and videos.	HPV	Examine the tone of media materials toward HPV vaccination, and check if the media provide complete and accurate information.
Perez, Fedoruk, Shapiro, & Rosberger, 2016	Canada	Newspapers	HPV	Investigated what information about the HPV vaccine was relayed to the public, and how this content was portrayed following the 2012 male HPV vaccine recommendation
Petousis-Harris, Goodyear-Smith, Kameshwar, & Turner, 2010	New Zealand	Newspapers	Not specific	Examine the construction of immunisation-related arguments by describing and classifying errors of fact and fallacy.
Quintero Johnson,	US	Newspapers	HPV	Explore the frequency of cancer prevention and sexually transmitted infection prevention message frames used to describe the HPV vaccine, the extent to which journalists relied on official sources, and the presence of personal examples

Sionean, & Scott, 2011				
Rachul, Ries, & Caulfield, 2011	Canada	Newspapers	A/H1N1	Analyse Canadian newspapers' portrayal of the A/H1N1 vaccine including messages about risks and benefits of the vaccine and whether the messages supported, questioned or were neutral about the vaccine.
St John, Pitts, & Tufts, 2010	US	Newspapers	HPV	Looking at how the printed daily papers present what are the most pertinent aspects of the HPV vaccine and mandate. Explore how parents frame and respond to the state directive. Discuss the disconnects between news media and parental framing regarding the vaccine and points to health literacy implications for facilitating parental understanding
Tsuda et al., 2016	Japan	Newspapers	HPV	Evaluate the characteristics of media messages about human papillomavirus vaccination
Ueda, Yokouchi, Onoda, & Ogihara, 2017	Japan	Newspaper	HPV	Identify messages about cervical cancer vaccine in Japan's printed news media and determine their characteristics
Wallace & Ache, 2009	US	TV	HPV	Examine the messages of human papillomavirus (HPV)-related vaccination information presented during nightly national television news broadcasts

Abreviations: A/H1N1: subtype of influenza A virus; HPV: Human Papilloma Virus; MMR: Mumps, Measles, Rubella (vaccine); TV: Television; UAE: United Arab Emirates; UK: United Kingdom; US: United States.

Table 3. Outcomes and conclusions of the selected studies

Authors	What characteristics were analysed in the messages	Sample size	Messages main outcomes	Main conclusions about messages
Abdelmutti & Hoffman-Goetz, 2010	Fright factors were coded in the field of trigger alarm, fear, and anxiety: involuntary, inequitably distributed, inescapable by taking personal precautions, resulting from an unfamiliar or novel source, result from man-made sources, causing hidden or irreversible damage, pose particular danger to small children, pregnant women, or future generations, threaten a form of death, illness or injury arousing dread, damaging identifiable victims, poorly understood by science, and subject to contradictory statements from responsible sources.	15 magazine articles	There were more fright factors associated with HPV (49) and the HPV vaccine (43). There were fewer fright factor citations identified for cervical cancer (20). The fright factor cited most often with respect to HPV was that of threatening death, illness or injury; HPV infection as being inescapable was also raised often in the news articles. Similar to HPV, the fright factor identified most often for cervical cancer was that of threatening death, illness or injury. Across all categories, the single fright factor with the most citations was for the HPV vaccine as being poorly understood by science.	Fear-inducing risk messages about HPV, cervical cancer, and the HPV vaccine are frequently reported.
Camaño Puig & Martí Jiménez, 2017	News values in the headlines of the news published	246 newspaper articles	The most frequent news values in the headlines were: "utility and educational value", "continuity", "curiosity", "deviation", "personal drama", "social impact", "new", "magnity" and "negative".	The news value of "personal drama" remained presence during all period of analysis.

| Casciotti, Smith, & Klassen, 2014 | Characteristics of media coverage, relationships between conflict and pro-vaccine tone and specific story characteristics | 447 newspaper articles | The majority of stories were either positive (46%) or mixed (36%) in tone, reflecting an overall pro-vaccine perspective to most of the stories. Only 10% of stories were negative. The most frequent main topic was HPV/vaccine/cancer characteristics (64% of stories). Stories commonly mentioned: age of vaccination (73%), virus spread through sexual contact (63%), protection against specific HPV types (57%), populations other than young females are affected (52%), including adult women (42%) and males (20%). Many stories also discussed STIs (42%), morbidity/mortality of cervical cancer (41%) and vaccination schedules (3 shot series) (40%). Barriers to vaccination were less commonly mentioned: cost/cost-effectiveness (36%), unknowns surrounding vaccination (22%), newness (21%), safety (20%), possible side effects (17%), and duration of protection (10%). Additionally, less than a | Legislative activities and content related to sexual activity were sources of conflict in HPV vaccine media messages. Health communication strategies can be improved by understanding and addressing potential sources of conflict in news coverage of public health initiatives. |

			third of articles discussed risk and prevalence of HPV (32%) and fewer mentioned HPV may clear without treatment (16%).	
Casciotti, Smith, Andon, et al., 2014	Presence of background and contextual information about HPV, cervical cáncer, and the vaccine.	63 newspaper articles	Media coverage was often incomplete, providing little context about cervical cancer or screening. Skepticism and autonomy concerns were common. Messages reflected conflict and distrust of government activities, which could negatively impact this and other youth-focused public health initiatives.	Controversial messages regarding mandates may negatively impact acceptance among undecided groups, undermining the vaccine's efficacy and potential to decrease disease. Controversial topics and novel approaches to disease prevention are newsworthy, but the lack of focus on screening and context around cancer disparities may also be detrimental to the overall goal of reducing cervical cancer.
Casciotti, Smith, Tsui, & Klassen, 2014	Messages were analysed according the following coding frames: Ethical issues, characteristics , government/state activities, health behaviors, stakeholder actions/interests, social reactions/attitudes/influences, major topics,	49 newspaper articles	Articles discussed vaccination in the context of abstinence-only versus comprehensive sexual health education; cited research findings to support vaccination or sex education; argued	Media messages concerning health behaviors related to HPV vaccination tended to support government and parental involvement in sex

	additional descriptors, sources, story tone and conflict.		against connecting vaccination to promiscuous behavior; but included fear-inducing messages.	education, and dismiss concerns linking vaccination to sexual activity, while also presenting the vaccine as lifesaving.
Clarke, 2011	Mobilizing information, accountability information	279 newspaper articles	Mobilizing messages were present in only 16% of articles, compared to 38% that mentioned accountability messages (at least one of two examples). US newspapers were significantly more likely to mention at least one mobilization example. Finally, although only 11% discussed both, articles were more likely to discuss certain mobilizing and accountability examples together.	Journalists may perceive a conflict between providing mobilizing information on one end and maintaining objectivity and holding officials accountable for their actions on the other. However, this conflict does not mean that health officials should avoid interacting with the media for the purposes of providing crucial health information.
Cooper Robbins, Pang, & Leask, 2012	Messages were grouped among the themes: HPV vaccine, vaccine for cervical cancer, cervical cancer vaccine, STD vaccine, STI vaccine, or Gardasil. In addition, each article's title was given a classification of positive, neutral, or negative in relation to its implied message about HPV vaccination.	131 newspaper articles	The top three topics covered were safety and efficacy of vaccine (discussed in 38.9% of articles), concerns with the need to continue Pap screening (19.8%), and the availability and feasibility of HPV vaccination for males (14.5%). Negative titles were more correlated to safety topics.	During the initiation of the national HPV vaccination program, the preoccupations of the media centered on Australian pride in vaccine development;

				details and progress of the National Vaccination Program; the safety of the vaccine; HPV vaccination's future; whether males could and/or should get the vaccine; issues related to sexual activity and the vaccine; and issues about decision making for acceptance of HPV vaccine.
Elbarazi, Raheel, Cummings, & Loney, 2016	The frequency of general information about the HPV vaccine, the types of sources referenced in articles, and headlines and message frames coded using emergent themes.	79 newspaper articles	The messages can be grouped in five main themes: (i) "HPV Screening or Vaccination Programmes in the UAE" (N = 30); (ii) "Cervical Cancer Statistics in the UAE" (N = 22); (iii) "Aetiology of Cervical Cancer and HPVV Efficacy" (N = 12); (iv) "Cultural Sensitivity and Misconceptions Surrounding HPVV in School-Aged Females" (e.g., promoting promiscuity) (N = 8); and (v) "Cost-Effectiveness, Efficacy, and Safety" (N = 7).	Through the analysed messages, UAE media is raising public awareness about cervical cancer and specific governmental health initiatives such as the HPVV program.

Goodyear-Smith, Petousis-Harris, Vanlaar, Turner, & Ram, 2007	Whether the article was "supportive", "neutral" (containing only informative information and did not expressing any stance on immunization), or "opposed" to immunization.	2113 newspaper articles	33% (704) were classified as "supportive", 17% (362) as "opposing", and 51% (1,081) as "neutral". The majority (73%) of anti-immunization media tended to focus on adverse events, tended to be found in letters to the editor, made emotive appeal and cited tragic personal stories, and did not tend to refer to specific vaccines. Proimmunization media tended to be informative rather than opinion based.	Overall positive trend toward reduction in alarmist anti-immunization messages in media. Strategies implemented by the Immunization Advisory Centre to counter misinformation may have contributed to reduction in anti-immunization messages.
Guillaume & Bath, 2008	94 content-based variables and key attributes such as word count and date of publication	227 newspaper articles	The content and format of messages between different information sources varied widely.	Differences in media messages can be attributed to the information source in which they are published, but the variability in the content of these information sources provides a challenge to parents who were shown to be using the mass media as an information source.
Hilton, Hunt, Langan, Bedford,	Key messages around HPV vaccination and tone	344 newspaper articles	The messages were generally positive towards the new HPV vaccination and over the 4 years period the newsworthiness of the HPV vaccination	The positive media coverage surrounding the introduction of the HPV vaccination programme is to be welcomed

& Petticrew, 2010			programme increased. In 2008 two events dominated coverage, firstly, the introduction of the HPV programme in September 2008 and secondly, in August 2008 the diagnosis on camera of cervical cancer given to Jade Goody, a 27 year old mother of two, who gained fame and notoriety in the UK through her participation in several reality television shows.	as it is likely to contribute towards influencing public perceptions about the acceptability and need for HPV vaccination. The focus on prevalence rates of HPV infection among women and on women's sexual behaviours, in relation to HPV vaccination 'encouraging' promiscuity, is an unhelpful aspect of media coverage.
Holton, Weberling, Clarke, & Smith, 2012	Attributions of blame for the controversy and its impacts on vaccination rates; sources that made these attributions; and solutions to address this issue or mobilizing information.	281 newspaper articles	Over the course of the MMR-link controversy, the news media placed an increasing amount of blame on one individual— Wakefield. Sources primarily came from four areas: science/medical, nonprofit, family, and elected officials. News coverage explored causes of this issue without offering solutions, such as where to find more information on a connection from medical and public health sources (e.g., the CDC).	Findings emphasize how news media may attribute blame in health risk communication and how that ascription plays a potentially vital role in shaping public behavior.

Hussain et al., 2011	Information, source affiliations, if data or statistics were presented in the article, and data source(s), whether there was a mention of vaccine safety in the headline, if the article suggested that the number of immunizations is too much for children, and whether information was provided (such as a Web site) as a further resource. Coders also categorized the take-home message from the article as positive, mixed, or negative.	1147 newspaper articles	Six (not mutually exclusive) topics were identified: vaccine-safety concerns (46%); vaccine policy (44%); vaccines are safe (20%); immunizations are required (10%); immunizations are not required (8%); and state/school exemption (8%). Three spikes in the number of newspaper articles about vaccine-safety issues were observed: in 1999 regarding rotavirus vaccine and in 2002 and 2003 regarding smallpox vaccine. Excluding articles that referred to rotavirus and smallpox vaccines, 37% of the articles had a negative take-home message.	Immunization-safety issues have received positive/mixed and negative coverage. In the 10-year period studied, excluding articles regarding smallpox and rotavirus vaccine, 37% of the articles suggested that vaccines are not safe. Ongoing monitoring of news on vaccine safety may help the content and framing of vaccine-safety messages.
Kelly, Leader, Mittermaier, Hornik, & Cappella, 2009	The coding scheme covered primary topics about the vaccine, such as general information about HPV transmission, attention given to key words like "cervical cancer" and "STI," recommendations for cancer screening, and journalistic features. News stories were coded for article source (newspaper or television); location of first mention of HPV, cervical cancer, and STI (headline or body of text); the presence of a description of HPV as a sexually transmitted infection and the presence of discussion	222 newspaper articles, and survey to 4367 individuals	Twenty-three percent of stories did not mention the sexually transmitted nature of the disease and 80% left out information about the need for continued cervical cancer screening after vaccination. Exposure to health-related media content was significantly associated with knowledge about HPV, even controlling for baseline knowledge (OR = 1.62, 95% CI = 1.12– 2.35).	Changes in the volume of coverage over time were associated with knowledge about HPV, but the content analysis reveals that many of the stories were missing important information.

	of the need for continued cervical cancer screening exams after vaccination.			
Krakow & Rogers, 2016	Presence/absence of info about HPV, health outcomes, target populations for the vaccine, common barriers or concerns about HPV vaccination, and inclusion of personal and political stories about the HPV vaccine.	154 newspaper articles	12% of messages provided information related to the transient nature of the disease, 56% noting the sexually transmitted nature of HPV, and 15% of stories describing symptoms associated with HPV. Lack of detailed information connecting HPV directly with men's health. A broader political media context that may, in part, explain how and why important medical information regarding the HPV vaccine was largely displaced from news coverage, despite a major announcement expanding the ACIP's vaccination recommendations.	Public health messages that consider and respond to the information circulating through news media will be well situated to increase vaccination rates for boys and men as a key step toward improving public health.
Martínez-Martínez, Tuells, & Colmenar-Jarillo, 2015	Messages were grouped in the following themes: "bioterrorism", "epidemiological risk", "diplomacy and politics", "pharma industry", "side events", "virus conservation", "science and technology".	416 newspaper articles	Most of the news were published in 2003 (152, 36.5%) The year with more news about smallpox (2003) coincides with the purchase of vaccines in Spain. The type of messages in the news was highly changeable over this six-year period. Those related to "politics and diplomacy",	The alarm raised around the smallpox vaccination was a media phenomenon due to political strategy issues rather than a real public health problem.

			"epidemiological risk", "bioterrorism" and "vaccine" were predominant.	
Meyer et al., 2016	Articles were deductively coded to quantify the risk messages about getting the seasonal flu vaccine presented across the seven newspapers that were analysed.	480 newspaper articles	The most frequent risk messages were inescapable (19.9%), science (13.2%), and death (14.1%). These risk messages relate respectively to the risk that the flu vaccine will not be effective in preventing people from getting the flu, the vaccine being poorly understood by science, and the flu vaccine causing harm (pain, illness, injury or death).	The bulk of risk messages about getting the seasonal flu vaccine related to the potential that the vaccine is not effective, that the vaccine is poorly understood by science, and that the flu vaccine may cause harm.
Olufowote, 2011	Common understandings that appear to undermine the polio vaccination media messages, accepted stories that pose a challenge to the polio immunizations, accepted ideas that generate skepticism toward the polio vaccination campaigns, common values challenge participation in the polio vaccination campaigns.	52 newspaper articles	Three themes emerged as factors contributing to the undermining of the global campaign: Western control and abuse through global organizations, the "philanthropy" of Western nations and global organizations as self-serving and malevolent, and doubts about the vaccine product.	Globalization's tendency toward fragmentation suggests the formation of multiple groups and voices not only within nation-states but also within regions in nation-states.
Pen a & B ban, 2014	Emotional valence of the media material, vaccine label, information about HPV infection, cervical cancer and HPV vaccines and concerns	271 reports: 92 newspap	31.4% of the messages were neutral, 28% were negative or extremely negative, 17% were mixed, while 23.6% were positive towards the vaccine. The most dominant	The results highlight the need for more rigorous standards when communicating about the

		er, 25 magazine , 32 video and 122 website	vaccine-related concerns were side effects and insufficient testing. Elementary information about the vaccine and HPV was constantly left out and sometimes inaccuracies were found. Negatively disposed reports were more likely to contain incorrect data about vaccine efficacy and less likely to provide comprehensive information about the vaccine and HPV-related diseases.	HPV vaccine. It is particularly important to avoid the transmission of inaccurate information, especially given that it is not easy to reject false information [61]. Improving communication between health officials and mass media [83] might represent a useful strategy. In this way, media could be used to equip the public with evidence-based information about the vaccines.
Perez, Fedoruk, Shapiro, & Rosberger , 2016	Article information, epidemiological information, public policy information, article topic; article and title tone, and informant testimony	232 newspap er articles	10% of articles focused on HPV characteristics, and nearly 10% focused on HPV vaccination benefits. Nearly 8% of articles focused on health behaviors; 4.3% on parental attitudes; 3.4% on negative risks; 3% on scientific advances; and 2.6% on moral issues (e.g., abstinence). The majority of articles (85.3%) reported the relation between HPV and cervical cancer. Fewer articles (59.1%) reported the	Our results suggest that the content and tone of articles about HPV and the HPV vaccine have shifted in the 2.5 years following NACI's male recommendation in January 2012. The proportion of articles reporting on male vaccination, programs for males, and HPV-related

			relation between HPV with other (noncervical) HPV-related cancers. Approximately half of the articles (51.7%) reported the relation between HPV and genital warts, Some articles (36.8%) noted HPV's prevalence. Most articles (68.5%) stated that HPV is sexually transmitted. Only 18.1% of articles stated the cost of receiving the HPV vaccine when not covered by public programs. Nearly 70% of the articles (69.8%) had neutral titles with respect to the HPV vaccine, while some (26.7%) were positive in tone, and very few were negative (3.0%) or mixed (0.4%). Many articles were positive in their overall tone (60.3%). Some articles were coded as neutral (22.0%) or mixed (11.2%), while few were negative (6.0%).	cancers in males increased significantly, and the tone toward male vaccination became progressively more positive each year, indicating a positive trend in the media's portrayal of the benefits of male vaccination.
Petousis-Harris, Goodyear-Smith, Kameshwar, &	All articles were assessed for errors of fact – (statements that are false) regarding any comment (whether direct or implied) on vaccine safety, efficacy and/or effectiveness. Acknowledging that it is insufficient to merely classify comments as either	360 newspaper articles	Overall, 21% (n=76) of the articles contained some factually unsubstantiated information about vaccine efficacy or safety. Articles reporting new vaccines were usually accurate. Of 24 articles, only one contained any scientifically incorrect	Most media 'balance' given to immunisation relies on 'he said, she said' arguments using quotes from opposing spokespersons with a failure to verify the scientific validity of

Turner, 2010	substantiated or unsubstantiated, all the articles were reassessed for errors in logic.		information, and there was no unsubstantiated information about the new conjugate Pneumococcal vaccine. On the other hand, 33% of articles about the MMR (measles, mumps and rubella) vaccine contained erroneous information. Many articles contained a number of errors of logic (fallacies) as well as fact. While these errors were predominantly used by those opposed to immunisation, supporters were not exempt from using such strategies. Most of the fallacies occurred in quotes contained within the article rather than as a result of assessment by the reporter.	both the material and the source.
Quintero Johnson, Sionean, & Scott, 2011	Frequency message frames used to describe the HPV vaccine, the extent to which journalists relied on official sources, and the presence of personal examples	547 newspaper articles	Less than half of the articles provided detailed health information. Of the articles that contained a message frame, cancer prevention was most frequently employed. Government/political sources, medical doctors, and the CDC were the most commonly cited sources. Only 16% of all the articles featured personal accounts.	US newspaper coverage lacked detailed information about both HPV and the HPV vaccine in spite of federal approval of the vaccine, legal mandates for the vaccine, and a widespread information campaign.

Rachul, Ries, & Caulfield, 2011	Examine discussion and/or mention of evidence concerning vaccination, risks of the A/H1N1 virus and the vaccine, and tone of messages in regards to the vaccination program in Canada	234 newspaper articles	Message with reasons for getting vaccinated appeared in 71.8% of the articles, whereas only 18.4% provided reasons against getting vaccinated. Discussion of evidence to support claims for or against getting vaccinated appeared in only 27.8% and 6.8% of the articles, respectively. Risks associated with contracting the A/H1N1 virus were discussed in 49.6% of the articles and risks of the A/H1N1 vaccine were discussed in 12.4% of the articles.	Newspaper messages in Canada were largely supportive of the A/H1N1 mass vaccination program. However, serious risks associated with contracting the A/H1N1 virus were also frequently discussed in the print media. The news articles rarely presented direct evidence to support statements that the vaccine was safe, effective and properly tested. Known risks (such as potential allergic reactions and flu-like side effects) of the vaccine were rarely reported.
St John, Pitts, & Tufts, 2010	The messages were themed on facts and data, a reliance on authoritative sources, and a striving for balance	29 newspaper articles	Journalistic framing of the HPV vaccine customarily relied on legislative, medical and health advocacy perspectives. News accounts also emphasized facts about the vaccine, including the target populations, what the vaccine is intended to do, how	Several gaps between news frames and parental discourse regarding the mandatory vaccine. Messages rely on authoritative institutional voices such as physicians,

			the vaccine is administered, and the cost. Messages were based almost entirely on discourse from experts, reflecting almost none of the discussion of parents, whose decisions will ultimately effect statewide adoption of the vaccine. Messages revealed superficial efforts to provide 'two sides'. Although not necessarily reflected in all these accounts, supporters saw the vaccine as a cautious and necessary preventative action; critics countered that the bill was pushed too quickly and that it should not feature a mandatory provision. Very rarely did news accounts offer parental viewpoints within these attempts to balance the news.	legislators and health advocacy organizations. This journalistic focus reveals a significant disconnect from the discourse within families.
Tsuda et al., 2016	Tone of the article as positive, neutral or negative. Authorities and keywords on efficacy and adverse reactions.	1138 newspaper articles	Articles were more likely to include adverse reaction-related and authority-related keywords whereas articles that included efficacy-related keywords decreased significantly. Negative-Negative and Negative-Neutral articles became more frequent.	A sensational case report shaped the tone of negative media coverage as a catalyst, regardless of scientific statements from health authorities.

Ueda, Yokouchi, Onoda, & Ogihara, 2017	Number of articles published per month, the number of characters used per month, and the average character count. Identifying messages with a positive or supportive viewpoint, and with a negative or oppositional viewpoint. Additionally, for each positive and negative article, they counted the numbers of articles that included commentary from experts, which gave an explanation about the cervical cancer vaccine, that included information related to consultation, that included photographs or diagrams, and that dealt with compensation.	219 newspaper articles	Overall, there were 154 (70.3%) positive articles and 51 (23.3%) negative articles toward HPV vaccination. The negative messages commonly cited side effects.	Media messages should report on the cost of not receiving cervical cancer vaccination, global trends concerning cervical cancer vaccination, and statements released by various agencies on the subject.
Wallace & Ache, 2009	Segment length, network, year of broadcast and presentation type. Air dates surrounding the development, efficacy, and controversy regarding HPV vaccination.	27 news broadcasted on TV	18 (66.7%) of the 27 news broadcasts were directly related to 5 seminal events surrounding the development, efficacy, and controversy regarding HPV vaccination. As presented in Table 1, each of the 5 television networks presented HPV-related vaccination information. Just over half of broadcasts contained factual information exclusively. Vaccine manufacturers (85.2%), government agencies (70.4%), and health care professionals (66.7%) were the organizations/persons most frequently	Although most news stories presented information in a factual format (e.g., prevalence of HPV and cervical cancer, efficacy of HPV vaccination) exclusively, the format of 12 broadcasts combined factual and a personal information surrounding HPV and cervical cancer. Thereby, viewers were often provided with a human and/or emotional perspective of HPV and cervical cancer.

			cited as sources of information. broadcasts presented information pertaining to HPV and cervical cancer (HPV causes cervical cancer [96.3%] and provides background statistics on cervical cáncer [59.3%]), information on vaccine labeling (cervical cancer vaccine [96.3%], STD vaccine [74.1%]), impact of the vaccine (general discussion [74.1%] and specific effect on cervical cancer. [88.9%]), and raised issues or concerns about the vaccine (discussed unanswered questions or issues [70.4%] and discussed moral or political concerns [85.2%]). Very few broadcasts mentioned the importance of Pap tests in the prevention of cervical cancer (7.4%) and/or the continued need for Pap tests after receiving the vaccine (7.4%).	

Abreviations: ACIP: Advisory Committee on Immunization Practices (CDC); A/H1N1: subtype of influenza A virus; CDC: Centers for Disease Control and Prevention; HPV: Human Papilloma Virus; HPVV: Human Papilloma Virus Vaccine; MMR: Mumps, Measles, Rubella (vaccine); NACI: National Advisory Committee on Immunization (Canada). STD: Sexually transmitted disorder; STI: Sexually transmitted infection; UAE: United Arab Emirates; UK: United Kingdom; US: United States.

Table 4. Critical appraisal

Authors	Q1*	Q2*	Q3*	Q4*	Q5*	Q6*	Q7*	Q8*	Q9*,**	Q10*
Abdelmutti & Hoffman-Goetz, 2010	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	NA	Yes
Camaño Puig & Martí Jiménez, 2017	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	NA	Yes
Casciotti, Smith, & Klassen, 2014	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NA	Yes
Casciotti, Smith, Andon, et al., 2014	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NA	Yes
Casciotti, Smith, Tsui, & Klassen, 2014	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NA	Yes
Clarke, 2011	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NA	Yes
Cooper Robbins, Pang, & Leask, 2012	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NA	Yes
Elbarazi, Raheel, Cummings, & Loney, 2016	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	NA	Yes
Goodyear-Smith, Petousis-Harris, Vanlaar, Turner, & Ram, 2007	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NA	Yes
Guillaume & Bath, 2008	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	NA	Yes

Hilton, Hunt, Langan, Bedford, & Petticrew, 2010	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NA	Yes
Holton, Weberling, Clarke, & Smith, 2012	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NA	Yes
Hussain et al., 2011	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NA	Yes
Kelly, Leader, Mittermaier, Hornik, & Cappella, 2009	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NA	Yes
Krakow & Rogers, 2016	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NA	Yes
Martínez-Martínez, Tuells, & Colmenar-Jarillo, 2015	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NA	Yes
Meyer et al., 2016	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NA	Yes
Olufowote, 2011	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	NA	Yes
Pen a & B ban, 2014	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NA	Yes
Perez, Fedoruk, Shapiro, & Rosberger, 2016	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NA	Yes
Petousis-Harris, Goodyear-Smith, Kameshwar, & Turner, 2010	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NA	Yes
Quintero Johnson, Sionean, & Scott, 2011	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NA	Yes

Rachul, Ries, & Caulfield, 2011	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NA	Yes
St John, Pitts, & Tufts, 2010	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	NA	Yes
Tsuda et al., 2016	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	NA	Yes
Ueda, Yokouchi, Onoda, & Ogihara, 2017	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	NA	Yes
Wallace & Ache, 2009	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NA	Yes

* The questions can be found in the original reference of the 'JBI Critical Appraisal Checklist for Qualitative Research' [21]. **In those articles following mixed methods including content analysis, surveys or other methods including subjects, the content analysis method and findings were the only material included in our study. NA: Not applicable.

Study 5. The agenda setting in times of anti-vaccine lobbies: A content analysis of national newspaper reporting in Spain.

Abstract

Despite outbreaks of vaccine-preventable diseases have increased, immunization rates are decreasing in Europe. Extant literature has examined the media impact in the response to vaccine campaigns and risk perception. Building from the agenda setting theory, we examine the newspaper reporting in Spain to explore the media portrayal of vaccines and identify potential implications in communication. Results revealed media debates about outbreaks and vaccines supply related crises, and scientific research as the dominant theme. Positive and neutral tone significantly increased during the study period, while negative tone remained unchanged showing a reduction of alarmist articles. Practical and theoretical implications are discussed.

Keywords: Content analysis; media; newspaper; public health; vaccine; agenda setting.

Introduction

Vaccines have been one of the major developments in the history of mankind. During the last century vaccination around the world eliminated most of the diseases that used to cause high mortality rates (Rappuoli, Mandl, Black, & De Gregorio, 2011). The decrease of infectious disease through vaccination is considered to be one of the most important public health interventions, but one that is reliant on a high level of uptake (Dubé et al., 2013). Today, an anti-vaccine lobby thrives in our society. Vaccine adherence is becoming an increasing public health challenge, as recognized by the former World Health Organization's (WHO) Director-General Margaret Chan, who expressed concerns over what she called a "worrisome" public mistrust of vaccines (Margaret Chan, 2011).

Traditionally, public health campaigns have disseminated evidence about vaccine effectiveness and safety, but some parents are not rational consumers of science information as they are emotional beings (Bricker & Justice, 2018). In this regard, the science will be less likely to achieve acceptance, at least by those who are already suspicious of scientific consensus (Coleman, 2018). In Europe, vaccine uptake is decreasing and in some countries the level is close to the minimum required immunization completion rates of 80% – 90%, such as in Italy, France and Portugal (Carrillo-Santisteve & Lopalco, 2012). Now, eleven European countries have mandatory vaccinations and others are considering similar measures (Bozzola et al., 2018). For example, measles is still one of the leading causes of death among young children, even though a safe and cost-effective vaccine is available. According to the WHO (2017), in 2015 there were 134200 measles deaths globally – about 367 deaths every day or 15 deaths every hour. Scientists have argued that declining numbers of vaccinated persons is correlated with the upsurge of a measles cases (Coleman, 2018).

The media have been considered as an important tool for communicating information about vaccines, increasing awareness and motivating the public to make important decisions about their health care (Casciotti, Smith, Tsui, &

Klassen, 2014; Catalan-Matamoros, 2017). In fact, the media are the first source of information about health for wide group in society, and the only contact many have with public health issues, such as vaccination campaigns or other health preventive measures (Vasterman, Yzermans, & Dirkzwager, 2005; Catalan-Matamoros, 2015). With these regards, the traditional media coverage and the rapid growth of the Internet and social media, such as Twitter and Facebook, have made it easier to find and disseminate immunization-related concerns and misperceptions (Kennedy, LaVail, Nowak, Basket, & Landry, 2011).

Research on media coverage of vaccines

The topic of vaccines has attracted extensive media attention in recent years, owing in large part to now-discredited claims about safety. The media are considered an important tool for communicating information and increasing awareness about vaccines. Following this media attention, scholars have investigated the media coverage of vaccines. A recent systematic review shed light about how is communication of vaccines in the traditional media (Catalan-Matamoros & Peñafiel-Saiz, 2018). The authors analysed 24 studies and found that the majority of previous media analyses had been done in newspapers especially from the United States. Moreover, negative messages and inaccurate information was found to be a common pattern in media coverage of vaccines. As it was shown in the systematic review, United Kingdom is the only country where content analyses of media coverage of vaccines had been conducted in Europe. Thus, this review suggested a research agenda in the field asking for more studies in other geographical areas.

The agenda setting

The present study builds from the theory of agenda setting which describes a very powerful influence of the media – the ability to tell us what issues are important. Lippman (1922) first expressed the idea of agenda setting, which was subsequently developed by Lasswell (1948) and Cohen (1963), culminating in a mature agenda-setting theory in the work of McCombs and Shaw (1972). In 1968, McCombs and Shaw assessed the relationship between what voters said were

important issues and the actual content of the media messages used during the campaign (McCombs & Shaw, 1972). They concluded that the media was of significant influence on what voters considered to be the most important issues of the campaign. Thus, the agenda-setting is related to public awareness of, and concerns surrounding salient issues reported by the news media. Two basic assumptions underlie most research on agenda-setting (Afonso JR., Da Rosa, & Paulo Procópio, 2008): (1) the press and the media do not reflect reality, they filter and shape it; (2) media concentration on a few issues and subjects leads the public to perceive those issues as more important than other issues. McCombs and Shaw argued that readers not only learn about a given issue, but are also influenced in terms of how much importance they attach to that issue by the amount of information in a news story and its position (McCombs & Shaw, 1972). The core concept of agenda setting assumes that media stimulates the awareness of people regarding certain issues. Bernard Cohen (Cohen, 1963) stated: "The press may not be successful much of the time in telling people what to think, but it is stunningly successful in telling its readers what to think about". This theory supports the relevance of media information and the importance of analyzing both media content and its characteristics regarding a particular topic.

In the field of public health, the concept of agenda-setting was developed by Kozel et al. (2003). In this regard, health promotion agenda-setting shifts the focus from the traditional health education target of individual risk behavior change to the formulation and adoption of innovative health policies which advocate for the public's health at the population level (Albalawi & Sixsmith, 2015). A study (Pacheco & Boushey, 2014) analyzed public health and agenda-setting in vaccines from the perspective of state attention to vaccines, suggesting that both interest groups and governors can skillfully use the mass media to increase public awareness of particular health issues.

From this perspective, this theory may help us understand how the media shapes the public awareness of vaccines, as well as which are the most important vaccine topics for society to think about. As, nowadays, trust in vaccines is becoming a public health challenge, the analysis of media content about vaccines becomes especially relevant.

Research questions

Therefore, building from the agenda setting theory, we examine the newspaper reporting in Spain to explore the media portrayal of vaccines and identify potential implications in communication. Specifically, we sought to answer the following research questions.

First, a recent systematic review on public communication on vaccines established that there is a need for media content analyses of media coverage about vaccines in other countries besides United States where the majority of previous studies had been conducted (Catalan-Matamoros & Peñafiel-Saiz, 2018). To expand the research to other countries will help to understand the phenomenon in different cultures. It is known that the news embodies and conveys the culture within which it is read and they also constitute a society's culture (Olufowote, 2011). In this way, news can be considered as a repository of culture creating the ideologies of a society (Fürsich, 2002). By analysing the media coverage of vaccines we may understand the society's culture towards vaccination. Therefore, our first research question reads as follows:

> *Q1. What are the main characteristics of media coverage about vaccines in Spain?*

Second, journalists' main professional principles when approaching any 'hard news' story are autonomy and objectivity. Autonomy let journalists keep themselves independent of coercive forces (economic interests, the government, etc.) that could shape the news. Objectivity allows journalists to attempt to build the news story by focusing on facts, turning to expert voices, and balancing sources (St. John, Pitts, & Adams Tufts, 2010). Objectivity includes frames as some cognitive approaches to news selection. News frames are "conceptual tools which media and individuals rely on to convey, interpret and evaluate information" (Neuman, Just, & Crigler, 1992). Scholars consider framing a multifaceted process consisting of (1) inputs constructed by the news media and communication professionals; (2) processes as ways in which frames become

embedded in news stories and in people's minds; and (3) outcomes as audience responses to these frames (Holton, Weberling, Clarke, & Smith, 2012; Scheufele & Tewksbury, 2007).

Framing becomes relevant in media research since it has effects on the public. A framing effect is "one in which salient attributes of a message (its organization, selection of content, or thematic structure) render particular thoughts applicable, resulting in their activation and use in evaluations" (Price, Tewksbury, & Powers, 1997). In the field of communication research, the concept of framing is linked to agenda setting, as the news media guide public awareness and opinion by emphasizing or focusing on certain issues or issue attributes (Kim, Scheufele, & Shanahan, 2002). It has been studied that agenda setting and framing converge in the ideology individuals convey about subjects, which can affect public response to those issues (Weaver, 2007). In relation to the media coverage of health subjects, researchers have found that journalists treat health stories with a focus on facts and data, authorative sources, and striving for balance (St. John et al., 2010). Previous studies have conducted frame analyses in the media coverage of vaccines (Holton et al., 2012; St. John et al., 2010).

The tone about a certain topic is also an important element that has been studied in previous research. In general, tone can be positive, neutral or negative and influences audience members to think in a certain way about a particular issue (Nijkrake, Gosselt, & Gutteling, 2015). In fact, several studies have found that the tone in media coverage has a significant effect on public opinion (Gunther, 1998; Kim, Carvalho, & Cooksey, 2007) and it shapes the media's agenda (Barnes et al., 2008). In the field of media coverage of vaccines, the tone has been an important variable analysed. For example, two studies analysed the tone of the HPV vaccine in news media (Attipoe-Dorcoo, Singh, & Moodley, 2018; Tsuda et al., 2016) and while Attipoe-Dorcoo et al. found a predominance of the neutral tone, Tsuda et al. found more negative ones. Due to the relevant of framing and tones in the public ideology about a certain issue, our next research questions read as follows:

> Q2. What are the frames that are most present in the media debate about vaccines?

Q3. What is the tone used in media descriptions about vaccines?

Sampling and methodology

In order to answer our research questions, the present study used content analysis as a method of data analysis. Content analysis is a research method that uses a set of categorization procedures to systematically and objectively identify specific characteristics within a text (Meyer et al., 2016). We retrieved national newspaper coverage of vaccines published in Spain from October 1 2012 to October 1 2017. The analysis period began in 2012, coinciding with the publication of the WHO Global Vaccine Action, which was a Plan approved in the 65th World Health Assembly (World Health Organization, 2012), in which, for the first time, it was recognized that: a) some reasons for hesitancy are undoubtedly amenable to improved communication designed to counteract growing anti-vaccination lobby groups and to increase understanding of the value of vaccines or of the danger of diseases, b) governments should engage in dialogue with communities and media and use effective communication techniques to convey messages about vaccines and to address safety concerns, and c) the media should understand the benefits of, and concerns about, immunization in order to accurately report on and effectively promote immunization programs. Moreover, during 2012, Europe experienced significant vaccine preventable diseases outbreaks, such as the measles outbreak in UK, caused by a dip in MMR vaccination rates (Gander, 2017) and the anti-vaccination lobby activities in some European countries during the same year (European Social Policy Network, 2016).

The online database Mynews was used to search the two paid general newspapers with the highest circulation rates according to the General Media Study in Spain (AIMC, 2017). Mynews is a professional media agency that inspects all national daily newspapers and provides copies of all articles. The newspapers *El Pais* and *El Mundo* were selected because both are flagship national newspapers in Spain (*El Pais* with a 1.080 and *El Mundo* with a 0.662 million daily readership rate). Today, both newspapers are generally regarded as

liberal, but in the past *El Pais* was viewed as ideologically left-center and *El Mundo* as right-center. The databases were searched using the following search string in the Spanish language [vacuna* OR inmuniza*] that should be present in the headlines and subheadlines. The article types selected were news articles, features, short articles, opinion articles (including editorials and letters to the editor), interviews, biographies and obituaries. While the word ''article'' is used throughout this study, it should be recognized that this includes the other article types just mentioned. Duplicate articles and those using the term "vaccine" with a metaphoric meaning were excluded.

A trained person conducted the content analysis by using a standardized data-collection instrument to record the type of article (news article, feature, opinion article, etc.), publication date, author, vaccine type, words number and space occupied. Aligned to previous research (Hilton, Hunt, Langan, Bedford, & Petticrew, 2010a), the tone was employed primarily to assess whether, from a public health perspective, vaccine was being supported or advocated. For coding 'tone' we followed a previous study (Tsuda et al., 2016) where positive tone was coded if they focused on benefits, such as disease prevention, neutral if they were not in favour or against vaccination, and negative if they focused on risks, such as adverse events and discouragement of the vaccination. The frames were also coded following a deductive method. The following five news frames that have been identified in previous studies were thus deductively investigated (Semetko & Valkenburg, 2000): conflict, human interest, economic consequences, morality and responsibility. Each article was read and re-read, looking for key words, metaphors, phrases and sentences related to whether vaccination was presented in a positive, neutral or negative perspective, as well as to identify the frames. After the first reading and coding, the next step was to identify the connotative or latent meaning of the text. In addition, the main theme of each news article was coded in order to contextualize the data. This process of coding enabled us to move beyond the surface meaning of the stories to their underlying meaning.

In order to ensure reliability in coding, data was coded first by one author (DCM), followed by a second coder (CSO). After coding was completed, changes were

made to the coding scheme to reflect any disagreements that had been identified and all discrepancies were resolved with the support of a third researcher (CPS) when necessary. Then, articles were imported to QSR NVivo 11 plus and coded using the aforementioned variables. This program allows for the categorization and identification of code frequencies. Then, data was further analyzed using Excel (Microsoft Corporation, Redmond, WA, USA) and SPSS 24th edition (SPSS Institute, Inc., Chicago, IL, USA). These programs were used to conduct the data descriptive analyses and to find *p* values to check for the significance of results when making comparisons.

Results

A total of 159 articles appeared between 2012 and 2017. From those, 28 were not considered because they were duplicates, brief mentions in the list of contents, or because the term vaccine had a metaphoric meaning such as "Brexit, more vaccine and less infection" (*El Pais*, 17.07.2016). Therefore, the final sample included 131 articles. *El Pais* carried 75 articles and *El Mundo* printed 56, with no significant differences among them ($\chi^2 = 2,756$; p = 0.97; df = 1). There was one particularly heavy period of press coverage about vaccines in 2015, during which the selected newspapers printed 52 articles (*El Pais* n = 27, *El Mundo* n = 25). The volume of publications in 2015 was significantly higher compared to the other years of analysis ($\chi^2 = 55,550$; p = < .001; df = 5). During these other years (2012, 2013, 2014, 2016 and 2017) they published a similar number of articles without significant differences ($\chi^2 = 7,646$; p = .105; df = 4). Of the 131 articles, 69% were written by newspaper staff, 6% were written by guest writers (4 of the 7 authors were scientists), 3% were from wire services, 2% were articles from other newspapers and 20% did not identify the author. Three journalists wrote 20% of all the coverage about vaccines: Mr. Emilio de Benito (*El País*, n = 12), Ms. Clara Martín (*El Mundo*, n = 8) and Ms. Elena G. Sevillano (*El País*, n = 6).

We found an average of 377 words and a median of 480 words per article. A substantial proportion of the articles (55%) had ≤500 words. Pair pages included

more articles than odd pages (n = 83 *versus* n = 48). Seventy percent of the articles were printed in the central pages, between pages 20 – 40, with the average being the 25th page and the median the 30th page. 53% of the articles where published in the "Society" section of the newspaper (n = 69). The other sections including articles about vaccines were "Science" (n = 21), "National" (n = 16), "Opinion" (n = 13), "International" (n = 4), "Regional" (n = 3), and "other" (n = 5). 58% of the articles occupied half a page or less. The average size of the articles, including both text and visual elements, was 0,37 (1,00 = full page), and the median was 0,5 or half a page. The most frequent journalistic genre was "news article" (n = 57). Other genres were feature (n = 29), short article (n = 23), opinion article (n = 15), interview (n = 3), biography (n = 2) and obituary (n = 1).

The tone analysis that was also conducted revealed that 44% of articles were positive, 42% were neutral and 14% negative. Therefore, the overall proportion of pro-immunization was significantly higher than that of anti-immunization media in the total sample period. In figure 1 we can find the yearly distribution of articles according to the tone analysis. We found that, in 2012, negative articles (n = 5) were more frequent than either neutral (n = 2) or positive (n = 1) articles, and that the number of negative articles remain similar throughout the study period with no significant differences (χ^2 = 6,00; p = .306; df = 5). However, the number of both positive and neutral articles became significantly increased and were more frequent than negative ones since 2013 (positive articles: χ^2 = 45,241; p = <.001; df = 5; neutral articles: χ^2 = 19,945; p = <.001; df = 5).

Figure 1. Yearly distribution by tone analysis
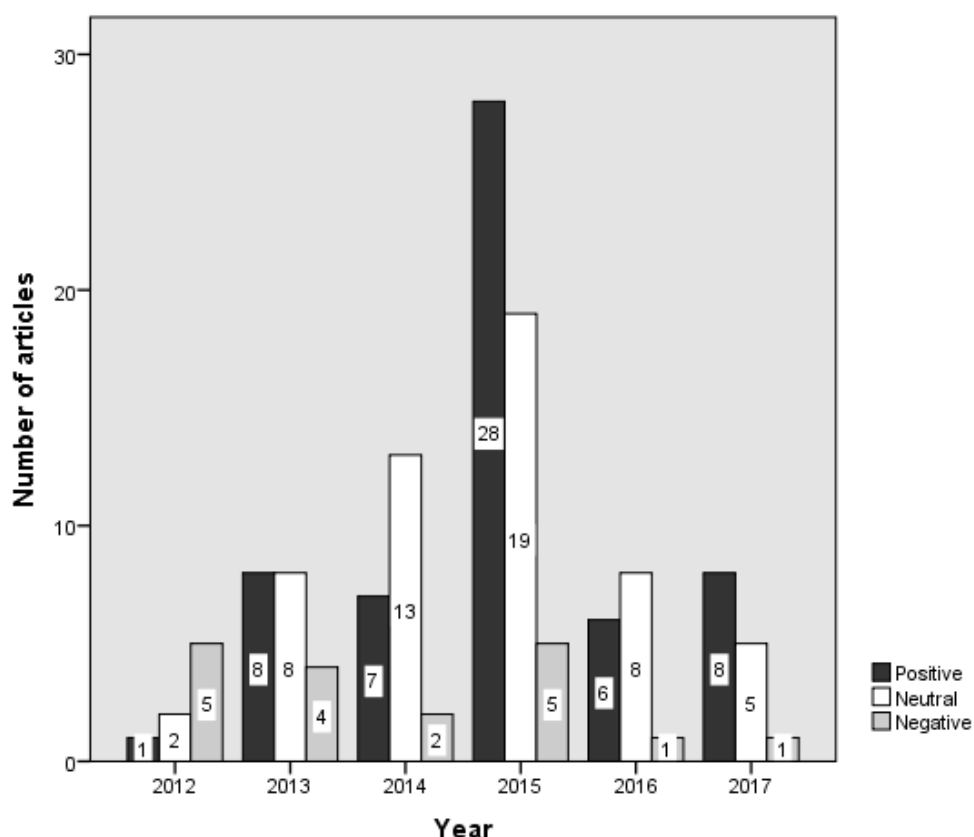
In table 1 we can find the distribution of journalistic genres by article tone, where we can see that negative articles were presented mostly by "news article" (n = 9), "short article" (n = 5) and "feature" (n = 4). In contrast, positive articles were presented throughout all types of journalistic genres, with a higher frequency for "news article" (n = 18), "feature" (n = 13) and "opinion article" (n = 13).

	News	Short	Feature	Obituary	Opinion	Interview	Biography	Total
Positive	18	8	13	1	13	3	2	58
Neutral	30	10	12	0	2	1	0	55
Negative	9	5	4	0	0	0	0	18
	57	23	29	1	15	4	2	131

Table 1. Article types (journalistic genre) by tone

Table 2 includes the frequency of types of vaccines printed in the articles. The vaccines against Ebola (n = 13, 10%), chickenpox (n = 12, 9%), diphtheria (n = 8, 6%) and meningitis (n = 8, 6%) were the most frequently covered by the media sample. In relation to which vaccine types are presented in positive, neutral or negative articles, we found that chickenpox (n = 4) was the most frequent vaccine in the negative category, Ebola (n = 11) in the neutral category and diphtheria (n = 6) and measles (n = 5) in the positive category.

Type of vaccine	n	Percentage
Ebola	13	10%
Chickenpox	12	9%
Diphtheria; Meningitis	8	6%
Influenza; Malaria	7	5%
Cancer; Zika; Measles	6	4.5%
Tuberculosis; HIV	5	4%
Smallpox	4	3%
Hepatitis; Whooping cough; Human Papillomavirus; Polio	3	2%
Pneumococcus	2	1.5%
Alzheimer disease; Autism; Dengue; Yellow fever; Gonorrhea; Mumps	1	18.3%
General / No identified	24	11%

Table 2. Types of vaccines coverage in the articles

The two major frames that were identified among the articles were "human interest" (48%) and "conflict" (34%). The frame "human interest" mostly included how research on vaccines will help individuals and specific groups of population, such as the benefits of the vaccine for skin cancer, or directions of current research in relation to vaccines (i.e. vaccine against HIV) and how society would benefit from them. The frame "conflict" covered scandals or controversy decisions from healthcare administrations on vaccines, mainly regarding vaccines against Ebola and chickenpox. The other frames were also present, but in a clear lower frequency: "responsibility" (9%), "economic" (6%) and "morality" (3%).

Main themes	n	Percentage
Research	43	32,82%
Vaccine hesitancy	20	15,27%
Vaccine availability	11	8,40%
Ebola conflict	11	8,40%
Chickenpox conflict	8	6,11%
Vaccine promotion	8	6,11%
Vaccine schedule	7	5,34%
Vaccine obligation	7	5,34%
Political conflict	4	3,05%
Vaccine costs	4	3,05%
HPV conflict	3	2,29%
Zika conflict	3	2,29%
Autism conflict	2	1,53%

Table 3. Main themes about vaccines

In relation to the themes, as we can see in table 3, "research" was the most common one. Some further information about the themes follows:

Research

In this theme, journalists present the latest research studies and scientific data about vaccines showing original data about effectiveness, epidemiology and safety. The research of the vaccine against malaria was popular due to the studies conducted by Dr. Alonso, a Spanish scientist focusing on malaria and other infectious diseases, who has conducted large projects in African countries. Research about vaccines against cancer was another recurrent theme, especially about skin cancer, for which personalized melanoma vaccines seem to be effective nowadays. Research about HIV vaccine was also frequent, representing an important and historical challenge in vaccine research. Articles about the history of vaccines and scientists' careers in the format of an interview or a biography were also present in this theme as a way to increase the scientific culture in society.

Vaccine hesitancy

This theme is a result of the decrease of vaccine uptake in Europe and some other regions of the world. The vaccines that were mentioned in this respect were those for influenza, measles, diphtheria and whooping cough. Many articles described the alarming decrease of vaccination in the childhood, parents' responsibility and related-deaths. Other articles mentioned tweet messages against vaccines, some by celebrities (i.e. Jim Carrey).

Vaccine availability

11 articles made reference to issues about where vaccines can be acquired, problems with supplies disposals at drugs stores, and unit limitations.

Specific conflicts

A wide number of articles made reference to specific conflicts around vaccines and vaccination. The most common (n = 11) was about the Ebola vaccine, which was linked to the Ebola outbreak in sub-Saharan Africa, 2014. The articles covered the vaccine's development, especially the quick process for this special case. In fact, the most frequently mentioned vaccine in our sample was the one against Ebola. The reason was that, in 2014, a healthcare professional who was part of the team that treated in Madrid the Spanish priests who died of Ebola, was infected with the virus. This case was the first contracted outside Africa and, therefore, it gathered large amount of media attention, both national and international. Another conflict covered by the newspapers focused on the chickenpox vaccine, as it has produced an important media debate between scientists and politicians in relation to its inclusion in the vaccination schedule. Other conflicts, but in a lower frequency, were about the vaccines against human papillomavirus, zika, and the relationship between autism and the MMR vaccine. Finally, political/international conflicts were also present, as for example the deaths of health professionals in Pakistan who were suspected of collaborating with the American Central Intelligence Agency (CIA).

During the analysis period, the newspapers printed significantly more vaccine-related articles in 2015. This is because, compared to other years, there was a large media debate about the vaccines against chickenpox, diphtheria, whooping cough, measles, and meningitis. Concerning chickenpox, the Ministry of Health decided to only provide teenagers that had not passed the disease with the vaccine. The argument, apart from savings in the health budget, was that the disease was mild and easily overcome among children. This originated a large debate in the public health sector, with both supporters and opponents. It was finally revoked in 2016, and the vaccine was again included in childhood immunization schedules. In relation to diphtheria, the last case in Spain was in 1987; however, in 2015, a new case was found in a non-vaccinated child. This event brought a media debate on parents' responsibility regarding the vaccination of their children, as well as supportive articles on vaccination about diphtheria. With regards to the vaccine against whooping cough, the media debate started after a newborn died because the vaccine was not available and the pharma industry subsequently recognized that there were supply problems with this vaccine. Measles was brought to the attention of the Spanish media due to the outbreak in Disneyland, with more than 70 infections. Once again, the media highlighted the importance of vaccination in terms of preventing measles. In relation to the vaccine against meningitis B, it was authorized in 2013 by the European Commission, and, in 2015, the Spanish Ministry of Health recommended that, excluding an outbreak, only population groups at risk should be vaccinated. This decision produced a large debate among pediatricians, as Spain was the country with the fifth highest incidence in Europe according to the European Centre for Disease Prevention and Control (ECDC, 2015). In the many media debates, such as in those pertaining to chickenpox and meningitis, we can see that government decisions are frequently opposed by public health experts, pediatricians, etc. In relation to this, Dr. Ildefonso Hernandez, former general director of Public Health at the Spanish Ministry of Health, argued that "all members of the advisory committee of the Spanish Association of Pediatrics have recognized conflicts of interest with companies producing vaccines" (El Mundo, 2014).

Vaccine promotion, schedule, obligation and costs

Media promotion of immunization contributed to 6,11% (n = 8) of total media for the sample period. Through vaccine promotional contents, the articles focused on vaccine safety and effectiveness in saving lives. Interviews with scientists were also conducted to promote vaccination. Articles supporting vaccination and providing arguments to decrease any doubts against vaccination were also published. Another (mostly informative) important theme was about the vaccination schedule, specifically key dates, changes and the different schedules in the regions of Spain. Other articles focused on the vaccine obligation, especially for children and health professionals. Finally, costs related to the production, delivery and purchase of vaccines were also covered by the articles.

Discussion

This study has examined the newspaper reporting to explore the media portrayal of vaccines and identify potential implications in communication. For this purpose, we have analyzed 131 articles related to vaccines in the largest national newspapers from 2012 to 2017, and have identified the main characteristics including the main themes, frames, most frequent types of vaccines in the media, as well as the tone used in the articles.

The media portrayal of vaccines

From our findings, we can argue that the topic of vaccine is of a certain notoriety in the media, since it is printed most frequently in pair and central pages. As newspapers do not normally print a dedicated health-related section (Martínez Rubio, 2016), the newspaper section 'Society' has been used to include the majority of health-related vaccine articles, as noted in previous research regarding Spanish newspapers (Barcoj-Ramírez, 2016; Serrano Eiroa, Mesas Mesas, & Alegre Arribas, 2017). This is especially relevant to understand the environment around health-related articles, as the section "Society" also includes other topics, such as education, religion and poverty.

In relation to the main characteristics of media coverage about vaccines, we can see that the newspaper *El País* published more vaccines-related contents than *El Mundo*, although the difference was not significant. This finding is aligned with previous research that has also found more health-related articles in this newspaper compared to others in the country (Barcoj-Ramírez, 2016; Martínez Rubio, 2016).

Our study identified that the majority of vaccine related articles were written by journalists. Health officials often view journalists as valuable channels through which to promote the benefits of immunization and communicate risk information (Clarke, 2011). However, some studies have argued that journalists misrepresent the state of scientific evidence and promote a mistrust of immunization (Offit & Coffin, 2003). According to Taylor (2006), journalists and editors want a good story, and often pay little attention to public health. To prevent misinformation which seriously impacts in vaccines uptake, health officials should interact with the media to providing accurate and relevant information about health developments. Indeed, the importance of enhancing collaboration between scientists, clinicians, and journalists has been underscored (Catalan-Matamoros & Peñafiel-Saiz, 2017). Journalists should be considered as an important target group during public health campaigns in order to conduct effective communication strategies.

We found that a high percentage of coverage focused on some crises in relation to the supply of vaccines and the coverage by the national health system. Two specific cases for the vaccines of chickenpox and meningitis took place in 2015. In relation to this, we identified an increasing use of sources from the pharma industry during these crises showing discrepancies about decisions made by the public administration. A number of common PR strategies and tactics employed by pharma companies are opposed to the regulatory bodies (Shir-Raz & Avraham, 2017), and the media debate and conflicts that we find in our analysis might, in part, be a mirror of this situation.

Diphteria, meningitis, influenza and malaria also occupied the top positions among the most cited vaccines. These vaccine-related articles were published

throughout the whole study period. According to the agenda setting theory, readers learn not only about a given issue, but also how much importance to attach to that issue from the amount of information in a news story and its position (McCombs & Shaw, 1972). In telling us what to think about, mass media are perceived to play an influential role in determining priorities related to policies, values, and knowledge on a given topic or issue (Jones, 2017). This may support the argument that these most cited vaccines are the ones to which readers attribute more importance. However, other important vaccines were never mentioned in the study sample, such as those against tetanus and acellular pertussis. A recent study (Kyu et al., 2017) found that tens of thousands of unnecessary deaths from tetanus could be prevented each year by an already available, inexpensive and effective vaccine. The study adds that, in developed countries, deaths continue to occur in unvaccinated individuals. This is an example of how an important vaccine was not mentioned by the media; although, aware due to the decrease in vaccination rates, it is still important to make the public aware of this issue. Once again, the collaboration between public health officials and journalists becomes critical.

With respect to the main themes and frames, we found that 'research' and 'vaccine hesitancy' were the most frequent ones. Vaccine hesitancy refers to either a delay in acceptance or the refusal of vaccines despite the availability of vaccination services. Vaccine hesitancy is complex and context specific, varying across time, place and vaccines (ECDC, 2017). In our study, we can see that vaccine hesitancy is presented as a negative attitude that should be avoided. This term is also related to vaccine safety. Understandably, vaccine safety gets more public attention than vaccination effectiveness, but both independent experts and the WHO have shown that vaccines are far safer than therapeutic medicines (Andre et al., 2008). In relation to the frames, 'human interest' and 'conflict' were the most frequent. The first, described as the "human impact" frame, was also found to be a common frame in the news by previous analyses (Semetko & Valkenburg, 2000). We can see that 'conflict' was also a popular frame and it mainly represented when articles reflected disagreement between parties/individuals/groups. The frame 'responsibility' was not frequent in our data analysis. However, it has been argued that attribution of responsibility is one of

the most important frames for communicating health issues (Hallahan, 1999). Therefore, this may be considered as further area for improvement in the media coverage of vaccines.

Perhaps the most important finding of our study was the significant increase of articles with both a positive and neutral tone during the study period, while those with a negative tone remained similar. Our results suggest that the tone of articles shifted over the 5 years subject to analysis. The proportion of positive and neutral articles increased significantly since 2012. This is indeed a relevant finding, showing how journalists are becoming aware of the importance of writing quality articles without negative messages about vaccination. This finding is in line with previous articles, which also found a majority of positive messages and a positive trend toward the reduction in alarmist anti-immunization articles (Attipoe-Dorcoo et al., 2018; Casciotti, Smith, & Klassen, 2014; Goodyear-Smith, Petousis-Harris, Vanlaar, Turner, & Ram, 2007; Hilton, Hunt, Langan, Bedford, & Petticrew, 2010b; Perez, Fedoruk, Shapiro, & Rosberger, 2016). In contrast, a recent systematic review yielded more articles with a predominance of negative messages about vaccines (Catalan-Matamoros & Peñafiel-Saiz, 2018). Some common, previously noted negative messages about vaccines (Meyer et al., 2016) relay that 'the vaccine is not effective', that 'the vaccine is poorly understood by science', and that 'the flu vaccine may cause harm' due to claims of an association between vaccines and autism, and accusations of "toxins" in vaccines.

Some key implications and further research

In 2012, negative articles toward vaccination were more frequent than either neutral or positive ones. Although this has shifted and, eventually, the amount of negative articles are a minority, we should not rest in calm. The damage of these negative articles can't be solved just by shifting messages. Research has shown how the power of prior beliefs could make modifying false beliefs more difficult (Kuklinski, Quirk, Jerit, Schwieder, & Rich, 2000; Nyhan, 2010). Specifically in the field of vaccines, studies have analysed why it is complicated to reduce or

mitigate false beliefs in relation to vaccine effectiveness and safety (Betsch, Renkewitz, & Haase, 2013; Nyhan & Reifler, 2015). A previous study showed that explicit attempts to correct false beliefs can fail or even backfire, sometimes leading individuals to more strongly endorse the belief (Betsch et al., 2013). One of the reasons could be that ideology can play a role in this sort of motivated processing (Moyer-Gusé, Robinson, & Mcknight, 2018). From a practical standpoint then, changing individual false beliefs may have little substantive impact on behaviour (Moyer-Gusé et al., 2018).

According to Andre et al. (2008), the best way in the long term is to refute wrong allegations at the earliest opportunity by providing scientifically valid data. However, communicating scientific data is not enough. As anti-vaccine lobbies are based on issues related to religion, philosophy, fear and confidence, we agree with Bricker & Justice (2018, p. 14) that a purely rational response to a belief system that values irrationality will not sufficiently address the problem of vaccine skepticism. Pro-immunization articles must be "responsive to the needs and attitudes of [their] audience," accounting for the fact that humans are not always logical, calculating, or rational (George & Selzer, 2007, p. 125). In relation to our findings, even though we found positive articles about vaccinations and that research was a major theme, a broader perspective must be used that recognized the reasons why many parents are still hesitant to vaccinate their children (Bricker & Justice, 2018). Vaccine decision making is a complex construct including factors such as access to healthcare services, risk perceptions concerning the disease or the safety of the vaccine, social models and trust (Arriola et al., 2015; Bish, Yardley, Nicoll, & Michie, 2011; Freimuth, Jamison, An, Hancock, & Quinn, 2017; Quinn et al., 2017).

Another important implication that can be found in our study is that most positive articles described scientific facts and research projects to support vaccines and vaccination. However, Shelby & Ernst (2013, p. 1799) suggested that pro-vaccine articles should not only focus on scientific data but also on story-telling which has been widely used by anti-vaccination activists. Another effective strategy that has been identified (Moyer-Gusé et al., 2018) is the use of humor for reducing resistance to persuasion among individuals who endorse false beliefs regarding

the vaccine safety vaccine. These are just examples showing how further communication strategies not only should focus on providing scientific facts as they should understand the tactics of the anti-vaccination activists that with poorly scientific basis can convince a generation of parents about the vaccine dangers.

Finally, our current research suggests that vaccine related news are currently presented in a positive and neutral manner that covers a wide range of issues with a broad variety of sources, according to the print edition of the two largest national newspapers in Spain. Therefore further research should identify whether anti-vaccine lobbies are more frequent in other media types. In fact, if vaccine trust and vaccination ratios are decreasing, these findings become especially relevant to further public health campaigns considering strategies not only with regard to traditional media, such as newspapers, but also other new media outlets, such as social networks (i.e., YouTube, Facebook, or Twitter). Since 88% of millennials get their news from social media (Gollust, LoRusso, Nagler, & Fowler, 2016), further analysis on this type of media is needed about how contents pertaining to vaccines are issued. This is interesting when seen in the context that the media in part generated much of the mistrust in official information sources about vaccines (Guillaume & Bath, 2008). Nevertheless, we should also recall that many factors contribute to reaching and maintaining high vaccine coverage and, although the media play an important role, public health officials should also consider other relevant factors as well as other communication strategies.

In our study, three potential limitations should be considered when interpreting the results. First, within the present media analysis, we focus on newspapers and therefore do not attempt to completely cover the media landscape. However, these newspapers serve as a proxy indicator for media consumption and impact, thereby providing insight into what could be felt elsewhere (Meyer et al., 2016).

Second, we should be cautious about some of the results included in the study when the N was especially small for example in the tone comparison shown in table 1. Third, our analyses were exclusively limited to national newspapers. It could be possible that many local newspapers have provided frequency and/or

information related to vaccines or vaccination in a different way. Further studies could look at this issue as local media are also important in some communities. In addition, our study suggests further reflections and practical implications. Although we claimed that collaboration between journalists and public health officials is critical, this article does not suggest that journalists should become public health practitioners by persuading readers to get vaccinated. Rather, based on the agenda setting theory, media can serve as a resource through which people become aware of an issue and aware of strategies to address this issue (Clarke, 2011). Finally, previous research on media coverage of vaccines has been largely conducted in the United States, Canada and Australia. As previously stated, recent systematic reviews found this research gap and highlighted the need for more studies in other regions of the world (Catalan-Matamoros & Peñafiel-Saiz, 2017, 2018). Therefore, this study meets current research needs in the field of health communication by exploring vaccine media coverage in a European setting.

The combination of our results emphasizes the need for journalists to address the following issues when writing articles about vaccine or vaccination: (1) avoid negative messages about the safety of vaccines, (2) provide messages about the effectiveness of vaccines by not only scientific facts or research studies, but other communication strategies such as story-telling or humor, (3) keep in mind that media are an important source of information for parents and the public in general. Our study has also shown that journalists might have been persuaded to write more pro-vaccination articles. Further studies should analyse whether the public health community is doing more outreach to journalists or whether they were better educated than their predecessors. By interviewing journalists, we could may shed light on these issues. Further research could also focus on the effects that different communication strategies have on the culture or on public understanding of vaccines. Nevertheless, we believe that the present study will not only contribute and inform in further vaccination campaigns aiming to shape public awareness, but also in advancing understanding of the media portrayal of vaccines and its relation with the broader field of communication.

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Study 6. Media and mistrust of vaccines: a content analysis of press headlines

Reference: Catalán-Matamoros, D., & Peñafiel-Saiz. C. Media and mistrust of vaccines: a content analysis of press headlines. *Revista Latina de Comunicación Social. Under review*

Abstract

Introduction: Mistrust of vaccines is a serious health challenge. The media can encourage use of effective healthcare services. Objective: Examine media coverage of vaccines and identify key features, frames and the tone towards vaccines. Methodology: A content analysis of 131 headlines and lead paragraphs about vaccines was conducted in the Spanish print media from 2012 to 2017. Results: Headlines were succinct, mean of 8.5 words (range: 1-19, SD: ± 3.5). Positive headlines were more frequent than neutral and negative ones, and while negative headlines remained unchanged (p = .163), positive and neutral ones increased significantly (p < .001, p = .037 respectively). The most frequent words related to a) actors involved in vaccination; b) specific vaccines; c) actions related to vaccination; and d) research. Conclusions: Positive and neutral headlines towards vaccination have increased. Findings may contribute to the broader task of improving media practices in times of anti-vaccine lobbies.

Keywords

Vaccines; media; public health; newspaper; mistrust; headline.

Introduction

The use of vaccines in healthcare services are considered one of the major scientific developments in the history of human being. The societal and economic impact of vaccine preventable diseases are well reported (Goodyear-Smith, Petousis-Harris, Vanlaar, Turner, & Ram, 2007). Vaccination uptake has greatly reduced mortality especially during the last century when vaccination around the world eliminated most of the diseases that used to cause high mortality rates (Rappuoli, Mandl, Black, & De Gregorio, 2011). However, mistrust in vaccines is today a serious public health challenge as recognized by the former World Health Organization's (WHO) Director-General Margaret Chan, who expressed concerns over what she called a "worrisome" public mistrust of vaccines (Margaret Chan, 2011). In Europe, vaccine uptake is decreasing and in some countries the level is close to the minimum required immunization completion rates of 80% – 90%, such as in Italy, France and Portugal (Carrillo-Santisteve & Lopalco, 2012). Now, France and Italy have established obligatory vaccination in childhood and other European countries are considering similar measures to increase vaccine coverage.

A recent study has asked for additional measures in Europe to improve vaccine coverage in all age groups (Sheikh *et al.*, 2018). Success in vaccine uptake requires multifaceted approaches. Many aspects are crucial to reach and maintain high vaccine coverage where different actors play an important role: parents, caregivers and clinicians. These are influenced by certain environmental elements such as policy and legislation, education, socioeconomic conditions, and by mass communication (Abdelmutti & Hoffman-Goetz, 2010; Casciotti, Smith, Andon, et al., 2014; Goodyear-Smith et al., 2007). The media have been considered as an important tool for communicating information about vaccines, increasing awareness and motivating the public to make important decisions about their health care (Casciotti, Smith, Tsui, & Klassen, 2014; Catalán-Matamoros, 2017). Indeed, it has been revealed that after people complete their school education, the mass media become the most important source of

information and, for many people, the only source when it comes to science, scientific processes and scientific findings (Riobó, 2016). A previous Cochrane review revealed that the media should be considered in the field of vaccines as it can encourage use of effective healthcare services and discourage those of unproven effectiveness (Grilli, Ramsay, & Minozzi, 2002).

Some now-discredited claims about vaccine safety have attracted extensive media attention in the last decade, and previous studies have investigated the media coverage of vaccines. A recent systematic review analysed communication of vaccines in the traditional media (Catalan-Matamoros & Peñafiel-Saiz, 2018). The authors examined 24 studies and found that the majority of media analyses had been done in newspapers especially from the United States. Moreover, negative messages and inaccurate information was found to be a common pattern in media coverage of vaccines. This review suggested a research agenda in the field asking for more studies in other geographical areas. As it was shown in the systematic review, United Kingdom is the only European country where more content analyses of media coverage about vaccines had been conducted. Three articles have been conducted in Spain analysing media communication, one was focused on media contents about smallpox (Martínez-Martínez, Tuells, & Colmenar-Jarillo, 2015) and two were focused on the human papillomavirus vaccine (Camaño Puig & Martí Jiménez, 2017; Tuells *et al.*, 2013). Our study meets some research gaps in the field of public communication of vaccines by deepening our understanding of media coverage from a general perspective including all types of vaccines in Spain, the fifth largest country in the European Union by population.

The reach of the print media in Spain is wide, covering most homes in all regions at least once per week (including free newspapers). In our study we analysed the vaccine related coverage of two national newspapers *El País* and *El Mundo* which are the two paid general newspapers with the highest circulation rates, *El País* with a 1.080 and *El Mundo* with a 0.662 million daily readership rate (AIMC - Asociación para la investigación de medios de comunicación, 2017). Today, both newspapers are generally regarded as liberal, but in the past *El País* was viewed as ideologically left-center and *El Mundo* as right-center. We selected

newspapers because despite competition from online and social media, traditional media remains a popular and widely trusted source of information (Catalan-Matamoros & Peñafiel-Saiz, 2017). In addition, online sources include information about science from credible or non-credible sources. However, when seeking credible, evidence-based and independent sources, laypersons still turn and trust to established traditional media (Guenther, Bischoff, Löwe, Marzinkowski, & Voigt, 2017).

1.2. Research questions

The above literature review demonstrates that little research has focused on the media contents of vaccines. Hence, the aim of the study is to examine the media coverage of vaccines and identify key features, frames and the tone towards vaccines or vaccination. Therefore, in order to gain a more complete understanding of the media coverage of vaccines, we conducted content analysis to answer the following research questions.

First, considering than far more media consumers read headlines only than full-text articles (Dor, 2003), in our study we have analysed headlines and lead paragraphs of vaccine-related articles. These specific contents are the most visible ones especially in the Internet era when headlines are tweeted and shared by millions of people daily. In newspapers, the relevance of headlines is magnified by the fact that they are composed by editors rather than by reporters seeking to attract readers while still appointing into their prior beliefs and expectations. Headlines are thus shaped by non-specialist editors with non-specialist readers in mind and are consequently more likely to reflect prevailing societal beliefs (Bleich, Stonebraker, Nisar, & Abdelhamid, 2015). Therefore, headlines differ in significant ways from the full text of the article and have an independent impact on readers' perceptions of events (Ifantidou, 2009). We believe that the analysis of wording used in headlines may be pertinent as it could shed light on key perspectives that are used by journalists. Finally, although there are some few brief analyses of headlines about vaccines-related coverage (Hilton, Hunt, Langan, Bedford, & Petticrew, 2010; Hussain *et al.,* 2011; Kelly, Leader, Mittermaier, Hornik, & Cappella, 2009; Quintero Johnson, Sionean, &

Scott, 2011; Quintero Johnson *et al.,* 2011; St. John, Pitts, & Adams Tufts, 2010), we have only found two studies analysing media headlines about vaccines as the central research question, one focusing on the meningococcal B vaccine (Turner, York, & Petousis-Harris, 2009), and the other one on the human papillomavirus vaccine (Camaño Puig & Martí Jiménez, 2017). As it has been previously argued (Larson, Cooper, Eskola, Katz, & Ratzan, 2011), there is need to conduct research in other international settings, as vaccine safety issues can make headlines worldwide with potentially negative consequences on vaccine uptake. Based on the aforementioned assumptions, and due to the paucity of research on headlines about vaccines (Turner *et al.,* 2009), it is our effort to address an important theoretical gap in the current research by answering the following research questions in the Spanish print media:

> *Q1. What are the key features of headlines and lead paragraphs in media coverage about vaccines?*

Second, in relation to the tone of the article, previous research has revealed that the headline and lead paragraph are central areas that act to anchor the most newsworthy aspect of the story, its main trajectory and encapsulate what the journalist might consider most important (Champion & Chapman, 2005). The tone has been used to determine, from a public health perspective, whether vaccine was being supported or advocated (Tsuda *et al.,* 2016). For example, headlines with a negative tone towards vaccination questioning vaccine safety may significantly increase parental concern and vaccine hesitancy. And third, frame analysis is relevant since they have the potential to shape public health by influencing the information environment in which vaccines are understood, accepted, adopted, and eventually routinized (Quintero Johnson *et al.,* 2011). The frames that journalists construct when delivering news information about vaccines have the capacity to influence the public's knowledge and behaviors about vaccination. In relation to our study, research often emphasizes that the most obvious or dominant frames are typically determined by the headline and lead paragraph (Weaver, Lively, & Bimber, 2009). Due to the relevant of framing and tones in the public ideology about a certain issue, our next research questions read as follows:

Q2. What is the tone of headlines and lead paragraphs in print media toward vaccines or vaccination?

Q3. What are the frames that are most common among headlines and lead paragraphs in the print media coverage about vaccines and vaccination?

Methods

Methodological strategies

This study draws on a content analysis of the media coverage about vaccines or vaccination in the Spanish print media. Traditionally, content analysis has been used as a descriptive tool to identify characteristics of messages (Iyengar & Simon, 2000).

Sample selection

In our study we analysed any vaccine-related article that has been published by two major national newspapers in Spain: *El País* and *El Mundo*. From each of these articles we used *MyNews* to extract all headlines and lead paragraphs from from October 1 2012 to October 1 2017. By 'lead paragraph' we also include the term 'sub-title'. The online database *Mynews* is a professional media agency that inspects all national daily newspapers and provides copies of all articles. The database were searched using the following search string in the Spanish language [vacuna* OR inmuniza*] that should be present in the headlines and subheadlines or lead paragraphs. Nowadays far more media consumers read headlines than full-text articles, therefore by analysing headlines instead of full articles, we are able to efficiently tap into a data-set that both reflects and influences common perceptions about the vaccines coverage (Bleich *et al.,* 2015). The article types selected were news articles, features, short articles, opinion articles (including editorials and letters to the editor), interviews, biographies and obituaries. Duplicate articles and those using the term "vaccine" with a metaphoric meaning were excluded.

Analysed variables

The content analysis was conducted using QSR NVivo (v. 11 plus). We draw on a coding system to identify word frequencies that are considered as flashpoints in vaccine-related discourses. Our content analysis determines the frequency of these keywords as well as the association with other topics, since the same message could make reference to more than one topic. A trained person conducted the content analysis by using a standardized data-collection instrument to record the type of article (news article, feature, opinion article, etc.), publication date, author, vaccine type, words number and space occupied. Aligned to previous research (Hilton *et al.,* 2010), the tone was employed primarily to assess whether, from a public health perspective, vaccine was being supported or advocated. For coding 'tone' we followed a previous study (Tsuda *et al.*, 2016) where positive tone was coded if they focused on benefits, such as disease prevention, neutral if they were not in favour or against vaccination, and negative if they focused on risks, such as adverse events and discouragement of the vaccination. The frames were also coded following a deductive method. The following five news frames that have been identified in previous studies were thus deductively investigated (Semetko & Valkenburg, 2000): conflict, human interest, economic consequences, morality and responsibility.

Procedure

In each of the identified articles, each headline and lead paragraph, when available, was read and re-read, looking for key words related to whether vaccination was presented in a positive, neutral or negative perspective, as well as to identify the frames. After the first reading and coding, the next step was to identify the connotative or latent meaning. This process of coding enabled us to move beyond the surface meaning of the stories to their underlying meaning.

In order to ensure reliability in coding, data was coded first by one author (DCM), followed by a second coder (CSO), who randomly reviewed 15% of the articles to determine intercoder reliability. The average simple agreement for all variables included in the study was found to be 82.02% (range: 71% - 100%). The formula

outlined by Miles and Huberman (1994) is reliability = number of agreements (same coding)/total codes (agreements + disagreements). The average kappa score was 0.75. After intercoder reliability testing was completed, changes were made to the coding scheme to reflect any disagreements that had been identified and all discrepancies were resolved with the support of a third researcher when necessary.

Finally, data was further analyzed using Excel (Microsoft Corporation, Redmond, WA, USA) and SPSS 24th edition (SPSS Institute, Inc., Chicago, IL, USA). These programs were used to conduct the data descriptive analyses and to find *p* values to check for the significance of results when making comparisons.

Results

A total of 159 articles appeared between 2012 and 2017. From those, 28 were not considered because they were duplicates, brief mentions in the list of contents, or because the term vaccine had a metaphoric meaning such as "Brexit, more vaccine and less infection" (*El Pais*, 17.07.2016). Therefore, the final sample included 131 articles. *El Pais* carried 75 articles and *El Mundo* printed 56, with no significant differences among them (χ^2 = 2,756; p = 0.97; df = 1). There was one particularly heavy period of press coverage about vaccines in 2015, during which the selected newspapers printed 52 articles (*El Pais* n = 27, *El Mundo* n = 25). The volume of publications in 2015 was significantly higher compared to the other years of analysis (χ^2 = 55,550; p = < 0.001; df = 5). During these other years (2012, 2013, 2014, 2016 and 2017) they published a similar number of articles without significant differences among them (χ^2 = 7,646; p = .105; df = 4).

Of the headlines and lead paragraphs that were included in the study, 2402 words were analysed, 1040 words were headlines. 1193 words were published by El Mundo from which 446 words were used in headlines. 1209 words were published by El País from which 594 words were in headlines. Headlines had a mean number of 8.5 words (range: 1-19, SD: ± 3.5). Lead paragraphs had a mean

number of 11.0 words (range: 0-75, SD: ± 12.0). El País and El Mundo were not different in relation to the length of the headlines with a mean number of words 8.0 versus 9.1 respectively (t = -1.71; p = 0.090; df = 129). However both newspapers showed significant differences in relation to the length of the lead paragraph (t = -2.89; p = 0.005; df = 129) as El País had a mean of 8.4 words *versus* 14.4 words by El Mundo.

The tone analysis for headlines and lead paragraphs that was also conducted revealed that 45% (n = 59) of articles were positive, 36% (n = 47) were neutral and 19% (n = 25) negative. Therefore, the overall proportion of pro-immunization was significantly higher than that of anti-immunization media in the total sample period. In Figure 1 we can find the yearly distribution of articles according to the tone analysis. We found that, during the period of 2012 that was included in our analysis, the negative tone (n = 3) was most frequent than the positive tone (n = 1), and that the number of headlines or lead paragraphs with negative tone remained similar throughout the study period with no significant differences (χ^2 = 7.89; p = .163; df = 5). However, the number of both positive and neutral tones significantly changed during the study period, especially in years 2013, 2014 and 2015 (positive articles: χ^2 = 47.07; p = <.001; df = 5; neutral articles: χ^2 = 11.85; p = .037; df = 5).
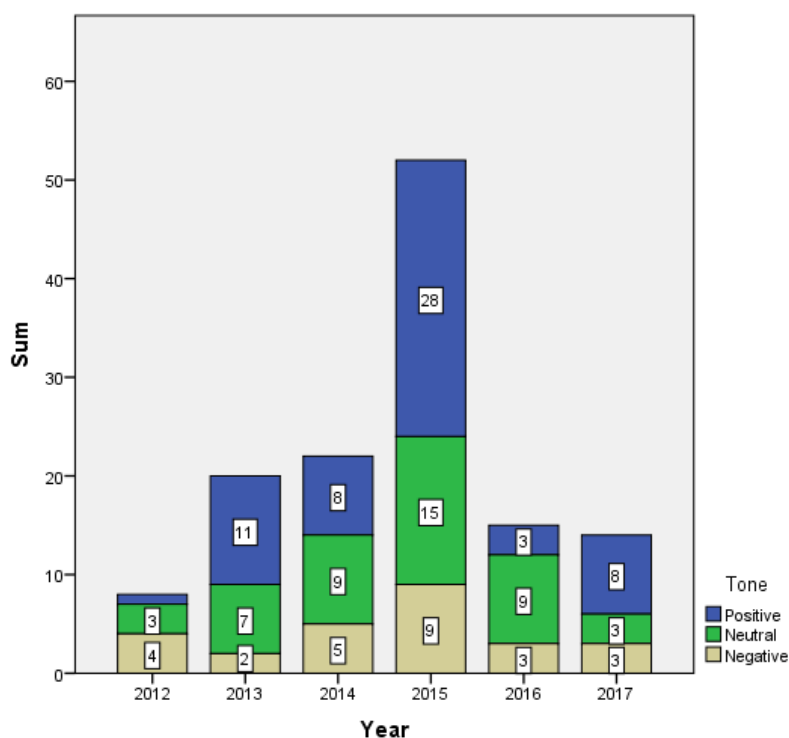
Figure 1. Yearly distribution by headline/lead paragraph tone (p = < 0.001).

Table 1 shows the terms that were used in the study sample. We can identify four specific group of terms in relation to a) actors involved in vaccination: health system, Spain, pharmacies, parents, director, experts and medical doctors; b) specific vaccines: *chicken pox, influenza, meningitis, cancer, Ebola, zika, malaria* and *polio*; c) actions related to vaccination: *against, schedule, cases, dose, sell, protect, campaign, letters, medicine, infection, obligatory, protection* and *rates*; and d) research: *effective, trial, study, success* and *group*. In addition, a special analysis has been conducted to determine term differences according to the tones. Interestingly, in negative tones we found the term *paediatrics* instead of *children* which was most frequently used among positive and neutral tones. Other terms included in negative tone headlines or lead paragraphs not being present among neutral and negative tone ones were *campaigns, elderly, error, experts, group, little, pregnant women, rate* and *sell.* Among neutral tone headlines these were the most representative terms: *director, medicine, now, number* and *trials.* And the terms used only among the positive tone ones were: *parents, virus, schedule, effective, infection, obligatory, first, protection, approve, dose, study, success, pregnant women, youth, million* and *live.*

	Most frequent words* in the full reviewed sample	Most frequent words* in the positive tone sample	Most frequent words* in the negative tone sample	Most frequent words* in the neutral tone sample
Words	Vaccine, against, children, health system, chicken pox, influenza, meningitis, years, cancer, Spain, pharmacies, parents, virus, schedule, cases, Ebola, effective, trial, health, zika, director, dose, study, experts, millions, first, sell, malaria, polio, protect, campaign, letters, success, medicine, group, infection, medical doctors, obligatory, protection, public, rates.	Vaccine, against, children, meningitis, parents, virus, cases, health system, schedule, effective, pharmacies, infection, obligatory, first, protection, influenza, approve, dose, Spain, study, success, pregnant women, youth, millions, lives.	Vaccine, against, influenza, years, Spain, rate, health system, chicken pox, error, elderly, campaigns, experts, group, paediatrics, little, sell.	Vaccine, against, chicken pox, cáncer, Ebola, zika, director, Yeats, United States, trials, pharmacies, medicine, children, number, health, health system, Brazil, influenza, Liberia, tuberculosis, tumor, now.

Table 1. The most frequent words in the analysed headlines and lead paragraphs.

In table 2 we can find the distribution of frames by the tone in the headlines and lead paragraphs, where we can see that negative articles were presented mostly under the conflict frame (n = 19). In contrast, positive articles were presented throughout all types of frames, with a higher frequency for "human interest" (n = 34), similarly to neutral tone articles.

		Frames					Total
		Human interest	Responsibility	Conflict	Morality	Economic	
T o n e	Positive	34	5	14	4	2	59
	Neutral	25	6	8	1	6	46
	Negative	6	0	20	0	0	26
	Total	65	11	42	5	8	131

Table 2. Frames by tone in relation to headlines and lead paragraphs

To provide a sense of each of the coding categories of the three tones and the five frames, Table 3 includes examples of headlines coded each category:

Tone	Headline
Positive	"A safe vaccine for hepatitis C" (El Mundo, 6 November 2014, p.37)
	"A new vaccine: even more effective" (El Mundo, 13 April 2015, p.52)
	"Discarded any relationship between vaccines and autism" (El País, 22 April 2015, p. 35)
	"Life with HIV, better thanks to a vaccine" (El Mundo, 17 February 2016, p. 31)
Neutral	"Spain will have a common schedule with eight vaccines" (El País, 20 March 2013, p. 36 & 37)

	"The vaccine against meningitis B arrives in pharmacies in October" (El País, 23 November 2015, p. 22)
	"When the vaccine arrives in a drone" (El Mundo, 7 November 2016, p. 38)
	"This is how the cancer vaccine is being created" (El País, 24 March 2017, p. 28)
Negative	"Withdrawals Novartis flu vaccines" (El País, 26 October 2012, p. 40)
	"Hard vaccine" (El País, 6 January 2013, p. 28)
	"Health Ministry and paediatricians don't agree on the limits of the chicken pox vaccine" (El Mundo, 19 April 2014, p. 14)
	"Experts disagree about the chicken pox vaccine" (El País, 23 July 2015, p. 21)
Frames	
Human interest	"Hilary Koprowski, author of the first vaccine against Polio" (El País, 24 April 2013, p. 52).
	"Meningitis vaccine, already in pharmacies" (El Mundo, 24 March 2017, p. 30)
Responsibility	"The girl deceased by meningitis, without being vaccinated" (El Mundo, 5 April 2017, p. 39).
	"Vaccination is to protect" (El País, 8 June 2015, p. 10)
Conflict	"Spain has two million expired pox vaccines" (El País, 21 June 2016, p. 34)
	"Public health practitioners, against the chicken pox infant vaccine" (El Mundo, 21 July 2015, p. 30)
Morality	"Vaccination of children cannot be an arbitrary decision of their parents" (El Mundo, 5 June 2015, p. 3)

	"Let's give away vaccines" (El País, 24 February 2013, p. 36)
Economic	"Vaccinating males against papilloma is profitable" (El Mundo, 13 April 2015, p. 52)
	"300 million for a vaccine" (El País, 6 August 2015, p. 9)

Table 3. Examples of headlines by tone and frame

Discussion and conclusions

This paper explored the media coverage of vaccines through a sample of national print media by means of content analysis. The aim of the study was to examine the media coverage of vaccines and identify key features, frames and the tone towards vaccines or vaccination. Taken together, our findings show key patterns in the coverage of vaccines and identify significant features. More specifically, our content analysis has analysed headlines and lead paragraphs of 131 articles related to vaccines in the largest general paid newspapers from 2012 to 2017. This study demonstrates that the overall proportion of headlines with a positive or pro-immunization tone was significantly higher than that of negative or anti-immunization tone in the total sample. However, when looking at the yearly distribution, the negative tone was the most frequent in 2012, but in the coming years, we identified a significant increase of both positive and neutral tone in headlines and lead paragraphs, while messages with negative tone remained without significant differences in the study period. In addition, we found four categories of most common words used in the sample: a) actors involved in vaccination, b) specific vaccines, c) actions related to vaccination, and d) research. The study also revealed that the most common frames were human interest and conflict, and that negative tone articles were mostly presented under the conflict frame.

In relation to the first research question, our study shed light on key patterns of the media coverage of vaccines in relation to the headlines and lead paragraphs. Primarily, we explored quantitative characteristics. We found that the headlines

included a mean number of 8.5 words, without significant differences between both newspapers. With these regards, it has been suggested that a headline should not be longer than 10 words to ensure clarity and a higher impact in readers (Gómez Mompart, 1982). Our study is aligned with this suggested length in the headlines of both newspapers. Additionally it is worthy to mention that the lead paragraph or subtitle were significantly different between both newspapers, being longer in *El Mundo*, showing how this newspaper provided more descriptions in this highlighted text. However, *El País* published more vaccines-related articles, 75 *versus* 56, although this difference was not significant. This finding confirms previous research that has also found more health-related articles in *El País* when it was compared to other newspapers in Spain (Barcoj-Ramírez, 2016; Martínez Rubio, 2016).

During the analysis period, we significantly identified more vaccine-related headlines in 2015, when it was compared to the other years of the study period (2012-2017). In fact, during this year there was a wide number of public health events and media debates about vaccines. The most frequent types of vaccines that were highlighted during 2015 were for diphtheria, chickenpox, whooping cough, meningitis B and measles. With regards diphtheria, the alarm was developed after a new case in a non-vaccinated child was found in Spain after 28 years. As a result, the media focused on parents' responsibility in the vaccination of their children. In relation to the chickenpox, the Ministry of Health decided to only provide teenagers that had not passed the disease with the vaccine. That the disease was mild and easily overcome among children was the primarily argument, in addition of costs reduction. Both supporters and opponents led to a large debate in the public health sector, and the Ministry decision was finally revoked in 2016, so the vaccine was again included in standard immunization programs. With regards to whooping cough, a newborn died because the vaccine was not available and the pharma company confirmed supply problems with this vaccine. In relation to meningitis B, the vaccine was authorized in 2013 by the European Commission, and, in 2015, the Spanish authorities recommended that, excluding an outbreak, only population groups at risk should be vaccinated. This decision produced a large debate among pediatricians, as Spain was the country

with the fifth highest incidence in Europe according to the European Centre for Disease Prevention and Control (ECDC, 2015). Measles was brought to the attention of the Spanish media due to the outbreak in Disneyland, with more than 70 infections. Once again, the media highlighted the importance of vaccination in terms of preventing measles. In some of the aforementioned media debates, we observed that headlines and lead paragraphs largely focused on opposed government decisions by public health experts, pediatricians, etc. In relation to this, Dr. Ildefonso Hernandez, former general director of Public Health at the Spanish Ministry of Health, argued that "all members of the advisory committee of the Spanish Association of Pediatrics have recognized conflicts of interest with companies producing vaccines" (El Mundo, 2014). As it was not the aim of our study, we suggest that further research should explore these tensions between regulatory bodies and the industry.

With respect to the analysis of the use of words, it revealed four categories. The first one represents the actors that may play a role in vaccination by using words such as *experts* and *parents*. The second category showed specific vaccines names such as *chicken pox, influenza and meningitis*. The third category showed actions related to vaccination where the used of words such as *against*, *schedule*, *cases*, *dose*, or *protect* were frequent. The last category addressed terms related to research such as *effective*, *trial* and *study*. With regards to the first category, the use of the term *experts*, science journalists often quote different experts in a variety of ways, but they consider scientists to be particularly credible and more reliable than other types of sources (McIntosh White, 2006). In relation to *parents*, as they are the key actors in childhood vaccination, we believe that including this group of population in the headlines might be an effective strategy to attract their attention. In this regard, previous authors (St. John *et al*., 2010) stated that science journalists tend to prioritise information from institutional sources within the government and business spheres, and that citizens are paid little attention in news construction. Guidelines for public/civic journalism (Haas, 2007) suggest the use of additional views beyond scientific experts to aid in improving issues of civic participation. Recognising other players can mark the entrance of new topics and views, thus by the headlines that we have analysed, we can anticipate that

views from experts and parents might be present. With regards to research in the field of public communication of vaccines, it has largely studied the media communication of the human papillomavirus vaccine (Catalan-Matamoros & Peñafiel-Saiz, 2018). Interestingly, it is in contrast with our findings as this vaccine was not mentioned more frequently than others such as the ones for the chicken pox, influenza and meningitis. Therefore further research should also focus on other types of vaccines that have been poorly investigated such as the vaccines for Ebola, zika and malaria. Another analysis was conducted by grouping the most frequent words according to tone of the headline or lead paragraph. Interestingly, in negative messages we found that the word *paediatrics* was used instead of *children* that was most frequently used in positive or neutral messages. This shows how the health system perspective is the most frequent focus in negative messages instead of vaccine users.

The second research question asked about the tone of headlines and lead paragraphs toward vaccine or vaccination. In answer to this research question, our analysis indicated that the readers were provided mostly with positive and neutral messages towards vaccination. Our results are in contrast with other studies that found more negative messages towards vaccination (Goodyear-Smith et al., 2007; Hussain et al., 2011; Penta & Baban, 2014). Negatively disposed messages might in itself be more powerful in the media than the positive ones, consistent with the well-known research that claims that 'bad is stronger than good' (Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001). On the other hand, in headlines with positive tone, a previous study that analysed the tone of media coverage of the human papillomavirus vaccine found that articles reporting positive messages were more likely to include important detailed information than articles with neutral or negative tones (Perez, Fedoruk, Shapiro, & Rosberger, 2016). The same study also found that neutral headlines were more descriptive, rather than evoking strong positive or negative associations with the vaccine. Another study found significant correlations showing that articles with a negative headline were significantly more likely to mention safety as an issue and to have a lower number of correct facts presented, which should be read as less in-depth

factual information being contained in the article (Cooper Robbins, Pang, & Leask, 2012).

A notable aspect in our study is that negative headlines were more frequent than positive and neutral ones in 2012. During this year, headlines focused on important vaccine issues: the problems of the Novartis flu vaccines, the WHO stop of the anti-polio campaign in Pakistan due to Taliban attacks, and problems on the research of the Malaria vaccine. However, after 2012, the positive and neutral tone significantly increased whereas the negative tone remained the same during the whole study period. This could be a sign of how journalists have become more aware about vaccines as an important public health challenge. In fact, this could be an achievement of public health strategies towards journalists as it has been previously suggested the need for an effective collaboration of researchers, health care providers, and policymakers with journalists to disseminate complete and accurate vaccine information (Perez *et al.*, 2016; Catalan-Matamoros, 2015).

In relation to the third research question, we found a majority of 'human interest' and 'conflict' frames. The first, the most frequent among all the analyses, is further described as the human impact frame (Semetko & Valkenburg, 2000). For example, those headlines employing personalization of an event, applications of new research studies on vaccines, or others showing a clear impact on human beings, they were framed as 'human interest'. The frame 'conflict' was the second most popular frame and, among our analyses, it mainly represented when headlines or lead paragraphs showed discrepancy between parties/individuals/groups. Our findings are aligned with previous authors who confirmed that 'human interest' and 'conflict' are one of the most commonly utilized frames (Wendorf Muhamad & Yang, 2017). Other frames were not frequent in our sample such as 'responsibility' and 'morality'. However, it has been argued that attribution of responsibility is one of the most important frames for communicating health issues (Hallahan, 1999). Taking this outcome into account and since frames are important as they have the ability to bring the

reader's attention to specific features, further research on frames in the field of vaccines is needed.

Despite these interesting findings, some potential limitations of the study should be considered when interpreting the results. First, although the analysis of headlines offers important data, we do not believe that focusing on headlines alone is sufficient for understanding the entirely media landscape of vaccines. As it has been earlier suggested, while headlines help structure readers' interpretation of the subsequent text, they do not determine it (Bleich *et al.*, 2015). Moreover, some studies have found that headlines are frequently incomplete or ambiguous summaries of the article that follows, and that readers often bring their own ad hoc interpretive schemas to bear when interpreting them (Ifantidou, 2009). In addition headlines are frequently developed by subeditors independently of the journalists who write the articles, and hence there can be quite a difference in intent between the headline and the article (Turner *et al.,* 2009). However, we believe that headlines are still an important content in news articles and as it was previously mentioned, most media consumers read headlines only instead of full-text articles (Dor, 2003). Another important aspect is that we should recognise that we focus on newspapers and therefore we do not attempt to completely cover the media landscape including radio, television, internet, etc. Still, newspapers can be a rather good indicator, thereby providing insight into what could be felt elsewhere (Meyer *et al.,* 2016). Another significant limitation is that this work does not attempt to assess the effect of the sources included in these articles on readership. In reference to this, research is limited when it comes to determining whether exposure to headlines influences actual viewpoints, attitudes or behaviours. Therefore, we would recommend that future research analyse the impact of sources on opinions. Another point is that we only analysed coverage in national newspapers, and significant differences between national and local/regional coverage have been previously found (Boumans, Vliegenthart, & Boomgaarden, 2016) therefore further research should focus on these other media types and formats. Nevertheless, we believe that the present study provides a solid starting point for understanding journalistic practices in

relation to media communication of vaccines and vaccination, an increasing public health challenge in our current society.

In conclusion, our results add new knowledge to the limited understanding of media communication of vaccines in countries with little previous research in the field, and especially deepening on headlines where international research has not been deeply developed yet. It is hoped that this comparative research can contribute to the broader task of improving news media practices within and across national media systems for the benefit of their citizenries in times of anti-vaccine lobby. Finally, it would be immature to recommend that journalists should only report differently on vaccines and in doing so promote the social acceptance of vaccination. A number of factors conspire to make it very difficult to achieve this goal. However, we believe that by advancing understanding of the headlines patterns about vaccines, our study can contribute to current public health challenges by building powerful headlines who can add value in shaping public awareness during further vaccination campaigns.

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Study 7. Sourcing in specialised journalism. A content analysis of print media in times of anti-vaccine lobby

Abstract

The relationship between journalists and their sources is important because it concerns the role of journalism in democratic maintenance. This article examines sourcing patterns in specialised journalism using the case of vaccines as a backdrop. Articles were retrieved from national newspapers in Spain from 2012 to 2017. Content analysis was undertaken for 131 articles to examine the sources and other variables such as tone, frames, journalistic genre and length of the article. The key findings of this study indicate that sources related to the government, professional associations and scientific companies are the most frequently used, confirming the central role of government institutions as sources in specialised journalism. These were followed by university scientists, scientific journals and clinicians. On the other hand, NGOs and patients groups were included only in less than 5% of the articles. Another key finding was that more than 30% of the articles included none or just one single source expressing unbalanced perspectives, and this applied mostly to the opinion articles. Significant differences and correlations were identified among the study variables. The over-representation of certain source types, especially governmental, may illuminate state structures of power.

Keywords: content analysis; media; newspaper; public health; sources; vaccine.

Introduction

A well-functioning society is dependent upon having a well-informed population. After people complete their school education, the mass media become the most important source of information and, for many people, the only source when it comes to science, scientific processes and scientific findings (Riobó, 2016). As most people do not have any direct contact with science or scientists (Priest, 2013), the media are crucial in keeping the public informed about scientific issues. The information they receive from the media can potentially shape the public's perception of issues and events, their opinions, attitudes or even behaviours (Cacciatore et al., 2012).

In our expanding media universe, with increasing coverage of health and science issues (Boyce, 2006), sourcing is considered an important task in journalism practice and is a key component in story construction which provides journalists with story content and context (Schneider, 2012). Journalists have the power to select their sources and are often challenged to find interesting and trustworthy voices beyond their networks and socio-cultural environments. The notions of accuracy and impartiality are enshrined in any type of journalism, and identifying credible sources to help tell a story and source verification become vital (Lewis & Cushion, 2017).

Studies of journalism and news production have shown that in the relationship between sources and journalists, sources increasingly lead the dance (Boumans, Vliegenthart, & Boomgaarden, 2016). In journalism research, the study of news sources is inextricably linked to questions of agenda-setting (*what*) and framing (*how*) (Stroobant, De Dobbelaer, and Raeymaeckers 2018, p.1). Thus, the study of source structures, relationships and activities remains central to understanding news content (Tiffen et al., 2014). Although journalism is a source-driven practice, the amount of research on sourcing is relatively limited (van der Meer, Verhoeven, Beentjes, & Vliegenthart, 2017), especially regarding specialised journalism. Previous research of this kind has been undertaken on sources and news within particular countries or world regions, especially in the United States

(Tiffen et al., 2014). Therefore, it is necessary to analyse the differential roles of the media in informing the citizenry in different parts of the world, culture and political systems.

To broaden understanding, and since the research literature still lacks knowledge on important questions of how science journalists deal with scientific issues, this study explores the journalists' work in their relations with sources on specialised topics. Using the case of vaccines as a backdrop, and by conducting content analysis of print media, this research aims to analyse the sourcing patterns. In this study we want to identify the particular use of sources which may play a role in shaping the public's understanding of vaccines; indeed, these actors may represent a public health perspective but have not been so obviously defined in previous research. By setting up quantitative content analysis that incorporates print national media in Spain, we try to shed light on how science-related stories are sourced. As content analysis is an established tool to measure the characteristics of sourcing (Gupta & Sinha, 2010), the analysis will, firstly, explore which sources are commonly used in the coverage of vaccines and, secondly, discover the different characteristics of sourcing.

Literature review

The journalistic sources

Some types of journalists, such as sports journalists or war correspondents, can bring to the public first-person information regarding what it is happening. Other journalists have to cover events that take place outside of their immediate experience and must obtain the necessary information from sources. The use of sources and quotations enables journalists to call on others' voices to frame stories in particular ways (Schneider, 2012). Some relevant functions of journalistic sources have been identified (Dimitrova & Strömbäck, 2012; Reich, 2009): (1) offering a way to verify the news account; (2) adding credibility to the news story; (3) reducing uncertainty under deadline pressure; (4) providing diverse viewpoints; and (5) protecting against accusations of bias.

In daily journalistic work, sources are a key element and an indispensable part of the news production process. There may be considerable source dependency during the news discovery phase, although this may be less prominent in the later phases of news gathering and news writing (Maat & de Jong, 2013). Previous research has analysed sources in specific settings (van der Meer et al., 2017) and in specific cases or topics (Boumans et al., 2016; Di Salvo & Negro, 2016; Schneider, 2012). These analyses of sources provide valuable insights into the performance of the news media (Boumans et al., 2016).

Source pluralism is influenced by multiple factors at the level of the news issue and can thus vary among different situations (van der Meer et al., 2017). A broad analysis of sourcing patterns is thus crucial to understand how news coverage is constructed and to confirm whether the public can make informed decisions using the media. Source selection criteria depend on specific determinants (van der Meer et al., 2017). The first determinant is the journalists' own judgment of key source qualities, which includes the level of knowledge about the source and its credibility. Second is the sources' communicative activities, such as, for example, whether they take journalistic practices into account by being easy to reach and willing to comment. Third, the source selection criteria also depend on the nature of the exchange relationships that exist between the source and the journalist; for example, journalists rely more frequently on contacts and sources that they have built up over time. However, before journalists select their sources, stories are shaped by their own ideas or by editorial direction. In this regard, the following quote (Schneider 2012, 9) represents how journalists may use interviews to fill slots in items:

> As someone who has on occasion been interviewed for news reports, I have been frustrated by journalists' attempts to get me to provide a particular answer for an item they already have in mind, rather than being willing to hear my thoughts about what the story is or could be.

Source selection is also driven by the valued journalistic principle of balance (Elías, 2008). Many issues are embraced by the principle of impartiality, and it has been argued that the best place to begin a source analysis is to explore the extent to which news coverage is broadly balanced on the overall spectrum of different views or perspectives. Moreover, another factor that may influence source selection is expressed by agenda-setting theorists who maintain that journalists choose their sources based on the agenda which their media organisation wishes to develop (McIntosh White, 2006).

Sources in science journalism

Journalists who are specialised in science, known as science journalists, see themselves as agents of mediation of information to the public from scientists and experts (McIntosh White, 2006). The emergence of science journalism is underlined by the steady number of scientific articles published via all types of media, but also by the increasing public debate on scientific issues, such as the global spread of infections and global warming (Summ & Volpers, 2016). However, there are some obstacles which science journalists face, such as: deadline pressures, finding reliable sources, increased commercialisation, and budget and staff cuts (Amend & Secko, 2012).

As is acknowledged, the press environment is where scientists meet the public (Calsamiglia & Ferrero, 2003) and journalists report, but do not make, the news. News must be supported by scientific knowledge such as data, facts and experts. Science journalists often quote different experts in a variety of ways, but they consider scientists to be particularly credible and more reliable than other types of sources (McIntosh White, 2006). Journalists invite scientists as sources to clarify, shape, and illustrate their stories, as well as to lend credibility to their work (Amend & Secko, 2012). This is the reason why expertise is sought after and seen as a main element when covering specialised issues. Indeed, one of the main job components of science journalists is finding appropriate sources. Although science journalists aim to develop a "symbiotic relationship" with scientists (Hansen 1994, 112), this relationship is not easy, since science and

journalism follow different objectives and decide on different criteria. For example, the concept of "publication timing" is very different between journalists and scientists. While journalists need to prepare publications in days or sometimes in hours, the publication process of scientists lasts much longer (several months or even years). These differences have raised some discrepancies in this relationship. Some scientists have reported positive experiences when working with journalists, although others, and especially those fearful of being misquoted, have reported that journalism is not transparent enough, often inaccurate, and does not adequately identify scientific evidence (Guenther, Bischoff, Löwe, Marzinkowski, & Voigt, 2017; Sperbeck, 1997).

Science journalists do not just inform people about the most recent developments in science and the newest scientific findings, but are also watchdogs who report critically on scientific topics (Guenther et al., 2017). Journalists do not report for scientists, but for the public. Therefore, in addition to the use of scientists as sources, it is acknowledged that multiple other sources (e.g. politicians, companies, patients) can also play a crucial role in the coverage of a scientific issue. As such, through our paper we try to explore and describe this phenomenon and provide an important starting point in understanding general sources patterns in specialised journalism.

The case of vaccines and the media

Vaccines constitute one of the greatest advances in history. During the last century, vaccination around the world has eliminated most of the diseases that used to cause high mortality rates (Rappuoli, Mandl, Black, & De Gregorio, 2011). The decrease of infectious disease through vaccination is considered to be one of the most important public health interventions, but one that is reliant on a high level of uptake (Dubé et al., 2013). Today, an anti-vaccine lobby thrives in our society. Vaccine adherence is becoming an increasing public health challenge, as recognised by the former World Health Organization's (WHO) Director-General Margaret Chan, who expressed concerns over what she called a "worrisome" public mistrust of vaccines (Chan, 2011). A clear example can be

found in the case of measles, which is one of the leading causes of death among young children, even though a safe and cost-effective vaccine is available. According to the WHO (2017), in 2015 there were 134,200 measles deaths globally – approximately 367 deaths every day or 15 deaths every hour. In Europe, vaccine uptake is decreasing, and in some countries the level is close to the minimum required immunisation completion rate of 80% – 90%, such as in Italy, France and Portugal (Carrillo-Santisteve & Lopalco, 2012).

The topic of vaccines has attracted extensive media attention in recent years, owing in large part to now-discredited claims about safety. The media have been considered an important tool for communicating information about vaccines, increasing awareness and motivating the public to make important decisions about their health care (Casciotti, Smith, Tsui, & Klassen, 2014; Catalan-Matamoros, 2017). Following this media attention, scholars have investigated media coverage of vaccines. A recent systematic review shed light on the nature of communication about vaccines in the traditional media (Catalan-Matamoros & Peñafiel-Saiz, 2019). The authors analysed 24 studies and found that the majority of previous media analyses had focused on newspapers, and especially those from the United States. Moreover, negative messages and inaccurate information were found to be a common pattern in media coverage of vaccines. The above-mentioned review suggested a research agenda in the field asking for more studies in other geographical areas. As was shown in the systematic review, the United Kingdom is the only European country where content analyses of media coverage of vaccines have been conducted. Our paper will help to advance this research field by analysing media coverage of vaccines in the national media of Spain – the fifth largest in the European Union by population.

Research questions

The above literature review demonstrates that little research focuses on sourcing practices in specialised journalism. Hence, the aim of the current study is to obtain a more nuanced understanding of the sourcing patterns in specialised

journalism using the case of vaccines as a backdrop. Specifically, we seek to answer the following research questions.

First, despite the amount of attention paid to the matter of source choice and its implications for and reification of prominent communication theories, an exhaustive search of the relevant literature concerning sourcing in news articles on vaccines yielded no studies which were directly relevant to the current research. Thus, the issue of whether there is a diversity of sources when covering the specialised topic of vaccines in the news is a very pertinent research question. The relationship between journalists and their sources is generally important because it is a relationship that concerns the role of journalism in democratic maintenance (Splendore, 2017). Sources can be identified and grouped in different ways according to the literature review, i.e. political and non-political sources (Dimitrova & Strömbäck, 2012). The second question is a variant of the first, and tries to identify whether there is a balance among the variety of sources, i.e. scientists, politicians, patients, scientific journals, etc. This will help the understanding of general sources patterns in specialised journalism

> *RQ1. Which sources are used in Spanish dailies about vaccines or vaccination?*
>
> *RQ2. Is there a balance of sources in the news, or do some source types dominate?*

A third research question will focus on the simplest, but a nonetheless revealing measure of sources in the news, which is the number of sources cited in a news story. The aim is to identify key patterns related to the number of sources that are used by journalists. This analysis has become even more pertinent as news corporations are ever more profit conscious, meaning that the pressure to increase journalistic productivity has substantially intensified (Davis, 2002; Tiffen et al., 2014). Thus, time for the production of a news article is more limited and there is the potential risk of less rigorous verification and cross-checking.

Tiffen et al. (2014, 5) stated that a story based on a single source allows that source's view of events to be carried unchallenged, and reflects a passive

orientation. On the other hand, using multiple sources indicates an active news media orientation, providing checks on what is said and bringing more variety and balance to the views presented (Guenther et al., 2017; Holtzman et al., 2005). While the number of sources is the starting point for analysing balanced views in the news, the next step is examining the relation of sources with other characteristics, such as the tone of the article, frame, type of vaccine and length of the article. Based on the above, we have established that the use of none or one single source in a news article is considered an inappropriate journalistic practice, while the use of two or more sources could be a positive practice, as previously suggested by Schneider (2012). Therefore, a special emphasis on the empirical part of the current paper will test this assumption. Consequently, in the current study, the following important research question arises:

RQ3: How many sources do journalists use when covering vaccine-related topics and what is the number of sources related to the tone, journalistic genre, frame and length of the article?

Sampling and methodology

To answer the study's research questions about source use in media coverage of immunisation, we conducted content analysis of stories in selected major national newspapers in Spain. Content analysis is a research method that uses a set of categorisation procedures to systematically and objectively identify specific characteristics within a text (Meyer et al., 2016). We examined source choices for stories published during a 5-year period, from 2012 to 2017, seeking to identify the source use patterns in the media coverage of topics about immunisation.

The online database Mynews was used to search the two paid general newspapers with the highest circulation rates in Spain according to the General Media Study (AIMC - Asociación para la investigación de medios de comunicación, 2017). Mynews is a professional media agency that inspects all national daily newspapers and provides copies of all articles. The newspapers *El*

Pais and *El Mundo* were selected because both are flagship national newspapers in Spain (*El Pais* with a 1.080 and *El Mundo* with a 0.662 million daily readership rate). Today, both newspapers are generally regarded as liberal, although in the past *El Pais* was viewed as ideologically left-centre, and *El Mundo* as right-centre. The databases were searched using a specific search string in the Spanish language [vacuna* OR inmuniza*], which should be present in the headlines and subheadlines in order to obtain relevant articles about vaccines or vaccination. The article types selected were news articles, features, short articles, opinion articles (including editorials and letters to the editor), interviews, biographies and obituaries. While the word 'article' is used throughout this study, it should be recognised that this includes the other article types just mentioned. Duplicate articles and those using the term "vaccine" with a metaphoric meaning were excluded. We selected newspapers because despite competition from online and social media, traditional media remains a popular and widely trusted source of information (Catalan-Matamoros & Peñafiel-Saiz, 2017). Online sources include information about science from credible or non-credible sources. However, when seeking credible, evidence-based and independent sources, laypersons still turn to established traditional media (Guenther et al., 2017).

Articles were imported to QSR NVivo 11 plus. This program allows for the categorisation and identification of code frequencies. A trained person conducted the content analysis by using a standardised data-collection instrument to record the journalistic genre (news article, feature, opinion article, etc.), vaccine type, number of words, tone and frames. In alignment with previous research (Hilton, Hunt, Langan, Bedford, & Petticrew, 2010), the tone was employed primarily to assess whether, from a public health perspective, vaccine was being supported or advocated. When coding 'tone', we followed the approach adopted in a previous study (Tsuda et al., 2016), where positive tone was coded if the articles focused on benefits, such as disease prevention, neutral if they were not in favour of or were against vaccination, and negative if they focused on risks, such as adverse events and discouragement of the vaccination. The frames were also coded by adhering to a deductive method. The following five news frames, which have been identified in previous studies, were thus deductively investigated

(Semetko & Valkenburg, 2000): conflict, human interest, economic consequences, morality and responsibility. Each article was read and re-read, and the focus was on looking for keywords, metaphors, phrases and sentences related to whether vaccination was presented in a positive, neutral or negative way, as well as identifying the frames. After the first reading and coding, the next step was to identify the connotative or latent meaning of the text. In addition, the main theme of each news article was coded in order to contextualise the data. This process of coding enabled us to move beyond the surface meaning of the stories to their underlying meaning.

A source was identified as a person or institution from which reporters derived story information. The sources were classified, according to the affiliation of the individual, in the following categories: "government scientific organisations", such as the National Regulatory Medicines Agency and the National Health Institute Carlos III; "government organisations", such as the Ministry of Health (minister, state health secretary, etc.), the health regional administrations, and international organisations; "scientific companies", including the pharmaceutical and health technology sectors; "university scientists", including researchers affiliated with any university or research centre; "clinicians", including any health professional working at any healthcare centre; "scientific journals", including any scientific peer-reviewed publication; "media", such as a press agency or a media channel; professional associations, including any organisations composed of health professionals as members, such as the Spanish Association of Pediatrics (AEP, for its Spanish acronym), and the Spanish Society of Public Health and Health Administration (SESPAS, for its Spanish acronym); "consumer groups", including representatives from patients or users' associations; "NGOs", including any non-governmental organisation used as a source. The category "other" was used when a source was not able to be included in any of these categories. In addition, the sources have been grouped into two large categories in the present study: scientific and non-scientific sources. Within each category, we have identified a number of sub-categories. Under scientific sources we have the following sources: "government scientific organisations", "professional organisations", "scientific companies", "university scientists", "clinicians" and "scientific journals".

Moreover, under the non-scientific sources there are: "media", "government organisations", "NGOs", "consumer group representatives" and "others".

In order to ensure reliability in coding, data was coded first by one author (DCM), followed by a second coder (CSO). After coding was completed, changes were made to the coding scheme to reflect any disagreements that had been identified and all discrepancies were resolved with the support of a third researcher (CPS) when necessary. Finally, data were further analysed using Excel (Microsoft Corporation, Redmond, WA, USA) and SPSS 24th edition (SPSS Institute, Inc., Chicago, IL, USA). These programs were used to conduct the data descriptive analyses and to find p values so as to check the significance of results. Next, we followed the methodology conducted in a previous similar study (McIntosh White, 2006) as follows: a) chi-square and Goodness of Fit analyses were employed to determine whether the category distribution significantly differed from an expected even distribution; b) t-test analyses were conducted when possible. C) bivariate correlation and the Spearman rho test of statistical significance were also performed, as the data under analysis were nonparametric.

Results

The search yielded 159 articles. Of these, 28 were not included because they were duplicates, mentioned in the list of contents, or because the term vaccine had a metaphoric meaning such as "Brexit, more vaccine and less infection" (*El Pais*, 17.07.2016). Therefore, the final sample included 131 articles. *El Pais* carried 75 articles and *El Mundo* printed 56, with no significant differences among them ($\chi^2 = 2.756$; p = 0.97; df = 1). Table 1 shows the characteristics of the study sample in terms of journalistic genre, tone of the article, type of vaccine, frames and length of the article.

Table 1. Characteristics of the study sample

Journalistic genres	N	%
News	57	43.5
Feature	29	22.1
Short news	23	17.6
Opinion	15	11.5
Interview	4	3.1
Obituary	1	0.8
Biography	2	1.5
Total	131	100.0
Tone of the article		
Positive	58	44.3
Neutral	55	42.0
Negative	18	13.7
Total	131	100.0
Type of vaccine		
Ebola	13	9.9
Chickenpox	12	9.2
Diphtheria; Meningitis	8	6.1
Influenza; Malaria	7	5.3
Cancer; Zika; Measles	6	4.6
Tuberculosis; HIV	5	3.8
Smallpox	4	3.1
Hepatitis; Whooping cough; Human Papillomavirus; Polio	3	2.3
Pneumococcus	2	1.5
Alzheimer disease; Autism; Dengue; Yellow fever; Gonorrhea; Mumps	1	0.8

General / No identified	24	18.3
Total	131	100
Frames		
Human interest	69	52.7
Conflict	43	32.8
Responsibility	9	6.9
Economic	6	4.6
Morality	4	3.1
Total	131	100.0
Length (number of words)		
1-100	15	11.4
101-200	10	0.8
201-300	12	9.2
301-400	19	15.5
401-500	17	13.0
501-600	12	9.2
601-700	12	9.2
701-800	13	9.9
801-900	11	8.4
901	10	0.8
Min	32	
Max	2158	
Mean	377.7	
Median	480	
Standard deviation	332.0	

With regard to the analysis of sources, Table 2 displays descriptive statistics for the variety of sources. In total, 374 sources were found among the 131 articles, with a mean of 2.8 sources per article. Government scientific organisations were the most frequent type of source (25,4%, n = 95), followed by professional associations (16,5%, n = 62), political leaders representing government organisations (15,2%, n = 57), and "scientific companies" (10.4%, n = 39). The other types of sources, although with a lower frequency, were "university scientists", "scientific journals", "clinicians", "NGOs", "media" and "consumer groups". Results from a Chi-Square analysis revealed that the distribution of sources was not significantly different, χ^2 (df = 8) = 1.27, p = .996.

In addition, Table 2 shows the number of sources used in each of the articles (i.e. 1 source, 2 sources, etc.). 12 articles (9.2%) did not reference any source, and 30 articles (22.9%) referenced only 1 source, this being the most commonly-used pattern in the study sample. Indeed, results from a Chi-Square analysis showed that the distribution of number of sources in the articles was significantly different, χ^2 (df = 9) = 66.18, p < .001. Therefore, we have explored the differences in tone, type of vaccine, journalistic genre, frames and length of the article in relation to the sources count, either of 0–1 sources or ≥2 sources per article. In relation to the tone and types of vaccines, there were no significant differences between both sourcing patterns (tone: χ^2 = 2.18; df = 2; p = .337; type of vaccine: χ^2 = 21.28; df = 23; p = .564). However, in relation to the journalistic genre, we did find significant differences (χ^2 = 38.78; df = 6; p < .001). Specifically, the genres "news" and "features" showed a higher frequency of articles with ≥2 sources (48 vs 9, and 24 vs 5 respectively), but for "short news" and "opinion articles" we found the opposite, specifically a dominance of articles with 0–1 sources (10 vs 13, and 2 vs 13 respectively). In relation to the frames, we also found significant differences (χ^2 = 17.90; df = 4; p < .05). This was particularly so in the frames "responsibility" and "morality", which showed higher frequency of articles with 0–1 sources (2 vs 7, and 0 vs 4 respectively). In relation to the length of the article, we also found significant differences between the two types of journalistic practice (t = -4.03; gl = 129; p < .001); the articles including ≥2 sources had a mean of 581 words, while those including 0–1 sources had a mean of 346 words.

Table 2. Frequency counts for sources

Types of sources	N	%
Government scientific organizations	95	25,4
Professional associations	62	16,5
Government organizations	57	15,2
Scientific companies	39	10,4
University scientists	39	10,4
Scientific journals	30	8,0
Clinicians	25	6,6
NGOs	15	4,0
Media	6	1,6
Consumer groups	3	0,8
Others	3	0,8
Total	374	100
$X^2 (df = 8) = 1.27, p = .996$		
Category of sources	N	%
Scientific sources	290	77,5
Non-scientific sources	84	22,5
$X^2 (df = 1) = 0.05 \ p = .830$		
Number of sources per article	N	%

0	12	9,2
1	30	22,9
2	25	19,1
3	22	16,8
4	15	11,5
5	10	7,6
6	9	6,9
7	4	3,1
8	2	1,5
10	2	1,5
Total	131	100,0
X^2 *(df = 9) = 66.18, p < .001*		

In order to obtain a broader perspective on the use of scientific sources versus non-scientific sources, we grouped them into two categories. The first was the category "scientific sources", which included: "government scientific organisations", "professional associations", "scientific companies", "university scientists", "scientific journal" and "clinicians". On the other hand, the following sources were grouped under "non-scientific sources": "government organisations", "NGOs", "media", "consumers group representatives" and "others". The results showed that the distribution of sources between the two groups was not significantly different (χ^2 = 0.05; df = 1; p = .830). Interestingly, in a cross table, we can compare the use of scientific sources *vs* non-scientific sources in each of the 131 articles included in the sample. We can see that 12 (9.2%) articles did not use any source and that 11 (8.4%) articles only used non-scientific sources, meaning that the use of scientific sources was avoided in at least 23 articles (17.6%). In contrast, 49 (37.4%) articles used both types of sources (scientific and non-scientific ones), while 59 (45.0%) articles used scientific sources only, meaning that non-scientific sources were avoided in 108 articles (82.4%). These findings revealed that when journalists wrote articles

without using any scientific source, all of them (100%, 23/23) included only 0–1 sources. However, when journalists used scientific sources only, 56% of the articles (40 out of 71) cited ≥2 sources. Indeed, we found significant differences between the number of sources included in the article and scientific sources (x^2 = 101.38; df = 8; p < .001), as well as a high direct association (C = .661; p < .001). On the other hand, we found neither significant differences (x^2 = 9.89; df = 5; p = .078) nor a significant association (C = .265; p = .078) between the number of sources and non-scientific sources. Therefore, we may state that the use of scientific sources is directly associated with the number of sources. In other words, the more sources are consulted by the journalist, the more scientific sources are used.

While content analyses in media coverage are predominantly descriptive (Guenther et al., 2017), in order to go beyond discerning descriptive differences regarding news media sources, we also attempted to establish whether there were consistent relationships between sources and types of vaccines, tone, frames or length of the article. For this purpose, we created a bivariate correlation; the Spearman rho test of statistical significance was used because the data under analysis were nonparametric, as was the case with most of the variables of interest in our study, according to the Kolmogorov Smirnov test (Field, 2009). As shown in Table 3, the tone was only significantly correlated with professional association sources (p < .05). Descriptive analysis showed that these sources were used more frequently for positive (n = 14) and neutral (n = 10) articles than for negative ones (n = 6). In relation to the journalistic genre, it was found to correlate with scientific journal sources (p < .05), as the majority of the use of journal citations was implemented in news (n = 17) and features (n = 8). In contrast, journals were rarely used in short news (n = 2) and opinion articles (n = 1), and never in other genres such as interviews or biographies. The vaccine type was correlated with professional associations sources (p < .05), which were largely used in articles about chickenpox (n = 10). In relation to the frames, these correlated to scientific companies (p < .001) and scientific journals (p < .01) sources. We found a higher frequency of "scientific company" and "scientific journal" sources in articles with a human interest frame (n = 18, n = 22

respectively). The length of the article, as measured in absolute number of words per article, was not correlated with any of the dependent variables. Finally, when we grouped the sources into either scientific or non-scientific categories, more significant correlations were found. Here the journalistic genre was strongly correlated with both scientific sources ($p < .001$) and non-scientific sources ($p < .05$). Both the types of vaccines and the frame of the article were significantly correlated ($p < .05$) with scientific sources. The length of the article was significantly correlated with both scientific ($p < .001$) and non-scientific sources ($p < .01$).

Table 3. Correlations among source types and the article characteristics (tone, journalistic genre, vaccine type and frame).

Articles characteristics	Government Scientific Agencies[1]	Government organizations[2]	Scientific companies[1]	University scientists[1]	Clinicians[1]	Scientific journal[1]	Media[2]	Professional associations[1]	NGO's[2]	Scientific sources	Non-scientific sources
Tone	.49	-.17	.08	-.16	-.10	-.31	-.61	.36*	.05	.17	-.07
Journalistic genre	.04	-.24	-.14	.00	-.20	.40*	--	-.23	-.07	-.37***	-.20*
Vaccine type	-.09	-.01	.27	-.07	-.13	.03	.00	-.45*	-.11	-.18*	-.15
Frame	-.16	.09	.70***	.18	-.05	.58**	-.56	-.19	-.42	-.21*	.16
Length of article	.23	-.13	.02	.26	.00	.17	-.71	.17	.37	.52***	.28**

Notes: Table shows Spearman rho correlations (two-tailed). ***, **, and * indicate statistically significant at .001, .01 and .05 levels.

The sources "patients' associations" and "others" where not included in the above analysis due to its low frequency (n = 3 each).

[1]Scientific sources category. [2]Non-scientific sources category.

Discussion

This study has analysed 131 articles related to vaccines in the largest general paid newspapers from 2012 to 2017. The data in this article highlight the use of sources by journalists when covering the specialised topic of vaccines or vaccination. We have identified the main characteristics of sources and their relation with the frames, types of vaccines, the tone and the length of articles. This study demonstrates that sources related to the government, professional associations and scientific companies are the most cited in news articles about vaccines, while it also confirms the central role of government institutions sources in specialised journalism.

The data analysed for this study illustrate that the type of sources whose voices are heard are related to "government scientific organisations" such as the National Public Health Institute (Instituto de Salud Carlos III), to "professional associations" such as the Spanish Association of Pediatrics, to "government organisations" where politicians voices are included, to "scientific companies" representing the industry, and to "university scientists". These findings are supported by Schudson (1996; 2012), who stated that news is generally dominated by institutional and political sources. This could be so because business and institutional sources tend to be attractive for journalists, as they are easily accessible, well-resourced and provide a regular supply of information (Cottle, 2003). Previous authors (St. John, Pitts, & Adams Tufts, 2010) stated that science journalists tend to prioritise information from institutional sources within the government and business spheres, and that citizens are paid little attention in news construction. This is also aligned with our findings, as sources related to civil society, "NGOs" and "consumer groups" represented less than 5% of the total number of sources. It has also been stated that the media in a democracy should give voice to social constituencies and currents of opinion (Tiffen et al., 2014). In addition, science is limited and uncertain, meaning that it requires other types of sources to examine issues such as the civil society (Secko, Amend, & Friday, 2013). In this regard, some basic guidelines lean towards using scientific

sources, although other guidelines for public/civic journalism (Haas, 2007) suggest the use of additional sources beyond scientific experts to aid in improving issues of civic participation. Recognising other players as news sources can mark the entrance of new topics and views.

Our findings indicate that "government scientific organisations" and "government organisations" represent the majority of the types of sources employed, with more than 40% use in total. However, other more politically-independent sources, such as "scientific journals" and "university scientists", are less frequent. In science issues, the power of politics tends to matter more than the quality of evidence-based and peer-reviewed academic research (Lewis & Cushion, 2017). These findings should be put into context. In Spain, the sources located within a power structure, namely political sources, play a central role in the journalistic culture, while science news focuses closely on the government side, providing a central role to politicians (Barrera Páez, 2016). In our paper, we do not intend to support any specific sourcing practice model in science journalism, but to present our results and compare them with previous research. In this sense, Secko et al. (2013) identified four models of how science journalism can be produced: science literacy, contextual, lay-expertise and public participation. Our findings show nuances of the four models, although the most dominant one is the public participation model, which addresses politics and policy issues over public understanding of science. On the other hand, the science literacy model, which values expert scientific sources above others, is less frequent in our study.

Another point that should be taken into account is the number of sources used in the articles. The use of multiple sources has been supported by different authors as a way of bringing more balance to, and better checks on, the views presented (Guenther et al., 2017; Holtzman et al., 2005). In contrast, the use of none or only one source has been critiqued (Tiffen et al., 2014), as the view of the story could be unchallenged and unbalanced. In our study, we found that each article included almost three sources on average; this figure is higher than that yielded by a recent study which found two sources on average, but in the coverage of Belgian health news in general (Stroobant et al., 2018). However, more than 30%

of articles included none or just one single source. The danger of this generation of stories is that the news media may act simply as passive conveyors of dominant sources' views. This line of criticism has been previously cited under the concept of "churnalism" (Johnston & Forde, 2017), where pressure on journalists to speed up and escalate their production of news leads to less balancing and verifying of different views. In relation to the use of a low number of sources, we found significant differences in opinion articles in comparison to the other journalistic genres. This could be due to that there is a quite number of articles smaller than 100 words, and under the journalistic genre of opinion. In fact, 87% of opinion articles included none or just one single source. This is known as the interpretive style of writing, where journalists use strategic frames to express their opinion, explain why something happened, or speculate about the future without referring to verifiable facts. Our study shows how these opinion articles express only one viewpoint and thus are "unbalanced" in terms of sourcing. Although systematic research on this phenomenon is lacking (Salgado & Strömbäck, 2012) to discern whether it is most appropriate including more sources to ensure the principle of balance, media have been accused of giving equal balance or weight to unfounded claims about the MMR vaccine (Lewis & Speers, 2003). Therefore, it is not suggested that the principle of balance be applied between sources with a high degree of scientific consensus and others failing to reflect any scientific evidence (Lewis & Cushion, 2017).

Despite these interesting findings, some potential limitations of the study should be considered when interpreting the results. First, some media researchers recognise that construction of news is embedded in the 'social and cultural relations that develop between journalists and their sources' (Ericson, Baranek, & Chan, 1989). As the study sample is based in Spain, the results might not be applicable to other nations. Another significant limitation is that this work does not attempt to assess the effect of the sources included in these articles on readership. In reference to this, research is limited when it comes to determining whether exposure to sources influences actual viewpoints. Therefore, we would recommend that future research analyse the impact of sources on opinions. In this respect, we focus on newspapers and therefore we do not attempt to

completely cover the media landscape including radio, television, internet, etc. However, newspapers can be a rather good indicator, thereby providing insight into what could be felt elsewhere (Meyer et al., 2016). Another point is that we only analysed coverage in national newspapers, and significant differences between national and local/regional coverage have been previously found (Boumans et al., 2016) therefore further research should focus on this other media types and formats. Finally, the hypothesis is tested in a very specific context – vaccines. Empirical research on media-source dynamics in different contexts is urgently needed. While vaccination is an important public health issue as such, and we have no specific reasons to expect patterns for other issues to be very different, there remains an empirical question: will we find the same similarity patterns for other cases? Nevertheless, further research on the relation between sources and journalists remains of vital importance (Boumans et al., 2016). The approach presented in the current article can aid in this crucial task. In fact, the present study provides a solid starting point for understanding sources practices in specialised journalism.

In conclusion, our findings contribute to the theoretical and practical development of journalism. Our analysis adds new knowledge to the limited understanding of the news media in their national settings, and shed light on the selection of sources. The over-representation of certain source types, especially governmental, may illuminate state structures of power. It is hoped that this comparative research can contribute to the broader task of improving news media practices within and across national media systems for the benefit of their citizenries. Finally, it would be naïve to suggest that journalists could simply report differently on vaccines and in doing so promote the social acceptance of vaccination. A number of factors conspire to make it very difficult to achieve this goal. An important practical measure to improve source use in coverage of vaccines could be to train and inform journalists on the variety of sources they could use, alongside the provision of some advice. This kind of training might be important, because some researchers have suggested that journalists could also seek out sources who are most like themselves, and avoid quoting those sources who disagree with their own ideas (Donsbach, 2004). Therefore, we believe that

by advancing understanding of the sourcing patterns about vaccines, our study can contribute to current public health challenges in times of anti-vaccine lobbies.

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Study 8. Specialty matters. Analysis of health journalists' coverage about vaccines

Abstract

This study examines specific professional patterns among health journalists, and assesses whether these differ from those among generalists in the case of vaccines. 131 articles were analysed from national newspapers in Spain, of which 52% (n=68) were written by specialised health journalists. Content analysis was undertaken to examine the differences in terms of journalistic genre, frames, tone, sources and length of the article. Results revealed key journalistic patterns and confirmed that health journalists perform significantly differently than other authors in terms of journalistic genre, tone, sources and length of the article. Health journalists wrote more features and less opinion articles, from a more neutral perspective, using a wider number of scientific sources, especially those from professional associations and scientific journals. These findings provide insights into the process of health journalism, and identify potential aspects to further develop the profession for the broad dissemination of health news to the public.

Keywords: content analysis; media; newspaper; sources; public health; specialty; vaccine; science.

Introduction

The mass media are today the most important source of information and are the only source about health and science for many people (Riobó, 2016; Yanovitzky & Blitz, 2000). The media are crucial in keeping the public informed about scientific issues as well as framing and heightening the salience of health-related issues (Viswanath et al., 2008). In addition, the media allow citizens to stay informed so that they can participate in the public debate regarding health issues, and even manage their own health; this is due to the fact that the media can potentially shape beliefs, attitudes, and even behaviours (Cacciatore et al., 2012; Hinnant, Len-Ríos, & Oh, 2012). In this regard, journalists have a great responsibility in the scientific field, because through their routine coverage of scientific studies, news media are a key intermediary in translating research for the public, patients, policymakers and clinicians (Viswanath et al., 2008).

Despite their importance in the dissemination of health and scientific information, only few studies have explored the professional practices of health and science journalists (Viswanath et al., 2008; Deprez & Van Leuven, 2018). Many studies have conducted media content analyses of health topics but without examining the specific routine of health specialised journalists in comparison with generalists (i.e. Casciotti *et al.*, 2014; Clarke, 2008; Meyer *et al.*, 2016). This is in great contrast with other specialties, such as political journalism, where many research studies have been carried out over the last decades. The present article is an attempt to fill this gap by analysing the work conducted by health journalists from a comparative perspective to understand the added value of the specialisation in health journalism. Using the case of vaccines as a backdrop, and by setting up content analysis of print media in Spain, this research attempts to shed light on the nature of health journalists' coverage and explore the differences between said coverage and the coverage of other journalists and authors who also cover health issues in the media. The findings here provide insights into the key advantages of health journalists and lead to discussion surrounding the tension between different ideologies and practices in the structure of professional journalism.

The specialty of health journalism

Science journalism is considered a minor specialty within the profession (Fedler, Counts, Carey, & Santana, 1998) when compared to others such as history, law, international, economics and politics. The development of science journalism mirrors the growth of the scientific research enterprise and the need to inform the public of important scientific developments, such as the discovery of antibiotic "wonder drugs" that could tackle highly deadly illnesses. While science journalism is a broad specialty including topics such as environment, technology, space, etc., the most dominant specialty is health (D. Kennedy, Overholser, & American Academy of Arts and Sciences, 2010).

It is an interesting time to study health journalism nowadays, since it has experienced important changes in the last decade. Health journalism has fallen victim to the overall problems facing journalism, which have been exacerbated by the global economic downturn in 2008 (Bristol & Donnelly, 2011). There is less space and time to tell a story in traditional media outlets; news media are shorthanded, while science sections have seen significantly cut back in number and scope throughout North America and Europe, and the number of health journalists holding full-time jobs is decreasing (Brumfiel, 2009; A. Kennedy, LaVail, Nowak, Basket, & Landry, 2011). In Spain, the amount of specialised health journalists is decreasing (Cebrián, 2016), however after the economic crisis new health-related media and contents are being published (Barrera Páez, 2016). In fact, health topics are not being reduced in the media, as public interest in health news is higher than ever (Molyneux; Holton, 2015). Therefore, there is an increasing international tendency for health journalists to be replaced with generalists to cover health issues (Len-Ríos et al., 2009) and those who write about a broad range of topics, from full-time health/science journalists to general-assignment journalists.

Health news articles have been questioned by public health officers for incorrect, misleading, careless or unfair coverage (Amend & Secko, 2012). Studies have

revealed that some of this distortion is attributable to ignorance or an inability to interpret and convey the nuanced results of clinical studies (Dentzer, 2009). In fact, many journalists consider themselves poorly trained when it comes to understanding clinical studies and statistics; indeed, this is considered a public health threat, as such reporting can lead people to make misguided choices that may put their health at risk (Voss, 2002). Therefore, the need for better training seems clear. In this regard, journalism specialties offer professionals a combination of academic training and practical experience. Health journalists are well equipped staff who can cover not only routine health topics but also unpredictable events, and particularly threats, such as the Ebola outbreak, or a bioterrorism incident, when the need arises (A. Kennedy et al., 2011). Little research has been conducted to gauge the added value of health journalists compared to generalists. A previous study surveyed health journalists in order to characterise individual practices which lead to the development of health news (Viswanath et al., 2008). Results describe the participants' education profile and reveal that the newsworthiness criteria were mostly based on "potential for public impact" and "new information or development". Another study combined in-depth interviews and a content analysis of Twitter to explore how health journalists monitor and use sources (Deprez & Van Leuven, 2018). They revealed that Twitter is used in a basic fashion for news sourcing, mainly to stay updated and get new story ideas. They also found that top-down actors are overrepresented in the health journalists' sourcing practices, followed by health experts. Despite a large literature review conducted, we did not found studies comparing the coverage from health journalists with that of other generalists. We agree with Amend and Secko (2012), who argued that each journalist has his/her own "way of doing things", with trusted scientific sources, methods of collecting information, preferred formats and topics, and distinguishing styles. Still, we believe that there are some common professional patterns among those who are specialised in health topics in comparison who those who are not. Our paper will address this in order to shed light on the added value, if any, of the specialty health journalism.

The vaccines in the media

During the last century, vaccination around the world has eliminated most of the diseases that used to cause high mortality rates (Rappuoli, Mandl, Black, & De Gregorio, 2011). The decrease of infectious disease through vaccination is considered one of the most important public health interventions, but one that is reliant on a high level of uptake (Dubé et al., 2013). Today, an anti-vaccine lobby thrives in our society. Vaccine adherence is becoming an increasing public health challenge, as recognised by the former World Health Organization's (WHO) Director-General Margaret Chan, who expressed concerns over what she called a "worrisome" public mistrust of vaccines (Margaret Chan, 2011). A clear example can be found in the case of measles, which is one of the leading causes of death among young children, even though a safe and cost-effective vaccine is available. According to the WHO (2017), in 2015 there were 134,200 measles deaths globally – approximately 367 deaths every day or 15 deaths every hour. In Europe, vaccine uptake is decreasing, and in some countries the level is close to the minimum required immunisation completion rate of 80% – 90%, such as in Italy, France and Portugal (Carrillo-Santisteve & Lopalco, 2012).

The topic of vaccines has attracted extensive media attention in recent years, owing in large part to now-discredited claims about safety. The media have been considered an important tool for communicating information about vaccines, increasing awareness, and motivating the public to make important decisions about their healthcare (Casciotti, Smith, Tsui, & Klassen, 2014; Catalan-Matamoros, 2017). Following this media attention, scholars have investigated the media coverage of vaccines. A recent systematic review on media communication of vaccines (Catalan-Matamoros & Peñafiel-Saiz, 2018) analysed 24 studies and found that the majority of media analyses had focused on newspapers, and especially those from the United States. Moreover, negative messages and inaccurate information was found to be a common pattern in media coverage of vaccines. This review suggested a research agenda in the field, asking for in-depth analyses and studies focused on other geographical areas. As was shown in the systematic review, the United Kingdom is the only European country where content analyses of media coverage of vaccines have

been conducted. In this case, the coverage of the MMR (measles, mumps and rubella) vaccine and the media role of HPV (Human Papilloma Virus) vaccine were analysed. Results revealed that information about MMR vaccine varied widely based on the media source and how news media attributed blame in health risk communication. In relation to HPV, there was a positive media coverage surrounding the introduction of the HPV vaccination programme. Our paper will help to advance this research field by analysing the coverage of vaccines in the national media of Spain – the fifth largest in the European Union by population.

Research questions

The above literature review demonstrates that little research has focused on the specialty of health journalism and the differences between this type of coverage and the coverage of generalists. Hence, the aim of the study is twofold: (1) to examine the professional patterns among health journalists and (2) to compare the extents to which these patterns differ with those among generalists. Therefore, in order to gain a more complete understanding of the specialised journalists' practices, we conducted content analysis to answer the following research questions.

First, despite the amount of attention given to the matter of health in the mass media and its implications for public health, an exhaustive search of the relevant literature in specialised journalistic practices yielded very few studies directly relevant to the present research; most of said studies involved surveys or interviews with health journalists. Thus, whether there is a difference in journalistic performance between health-specialists and generalists is a very pertinent research question, especially nowadays, when media organisations are replacing specialists with generalists. As research around this current professional issue is lacking, the present study will attempt to answer the following research questions:

> *RQ1: What are the characteristics of the media coverage of vaccines in terms of journalistic genres, tone, frames, and length of the article?*

RQ2: Are there any differences between health specialised journalists and generalists in the coverage of news articles about vaccines?

The third research question will focus on the use of journalistic sources in the news. This analysis has become even more pertinent, as news corporations are ever-more profit conscious, meaning that the pressure to increase journalistic productivity has substantially intensified (Davis, 2002; Tiffen et al., 2014). In light of this, time for the production of a news article is more limited, and there may be a risk of less rigorous verification and cross-checking. In this regard, Tiffen *et al.* (2014, 5) stated that a story based on a single source allows that source's view of events to remain unchallenged, and reflects an uncritical orientation. On the other hand, using multiple sources indicates an active news media orientation, providing checks on what is said and bringing more variety and balance to the views presented (Guenther, Bischoff, Löwe, Marzinkowski, & Voigt, 2017; Holtzman et al., 2005). Thus, we have made the assumption that the use of none or one single source in a news article is considered an inappropriate journalistic practice, while the use of two or more sources could be a positive practice, as previously suggested by Schneider (2012). Therefore, a special emphasis on the empirical part of the current paper will test this assumption. Consequently, the following research question arises:

RQ3: What are the source patterns in terms of types and number of sources used by health journalists in comparison with generalists?

Methodology

To answer the study's research questions regarding the differences between health-specialised journalists and general journalists, we conducted a descriptive cross-sectional study based on a mixed quantitative and qualitative content analysis of stories about immunisation in selected major national newspapers in Spain. Content analysis is a research method that uses a set of categorisation procedures to systematically and objectively identify specific characteristics within a text (Meyer et al., 2016). We examined specific patterns or variables for articles published over a 5-year period, from 2012 to 2017.

The online database *Mynews* was used to search the two paid general newspapers with the highest circulation rates in Spain according to the General Media Study (AIMC - Asociación para la investigación de medios de comunicación, 2017). *Mynews* is a professional media agency that inspects all national daily newspapers and provides copies of all articles. The newspapers *El Pais* and *El Mundo* were selected because both are flagship national newspapers in Spain (*El Pais* with a 1.080 and *El Mundo* with a 0.662 million daily readership rate). The databases were searched using the following search string in the Spanish language: [vacuna* OR inmuniza*]; this string had to be present in the headlines and subheadlines in order to obtain relevant articles about vaccines or vaccination. The article types selected were news articles, features, short articles, opinion articles (including editorials and letters to the editor), interviews, biographies and obituaries. While the word 'article' is used throughout this paper, it should be recognised that this includes the other article types just mentioned. Duplicate articles and those using the term 'vaccine' with a metaphoric meaning were excluded. We selected the print versions of the newspapers because, despite competition from online and social media, traditional media remains a popular and widely-trusted source of information (Catalan-Matamoros & Peñafiel-Saiz, 2017).

Articles were imported to *QSR NVivo 11 plus*. This program allows for the categorisation and identification of code frequencies. A trained person conducted the content analysis by using a standardised data-collection instrument to record the author, journalistic genre (news article, feature, opinion article, etc.), vaccine type, number of words, tone and frames. Following previous research (Hilton, Hunt, Langan, Bedford, & Petticrew, 2010), the tone was employed primarily to assess whether, from a public health perspective, vaccine was being supported or advocated. For coding 'tone' we followed a previous study (Tsuda et al., 2016), where positive tone was coded if the articles focused on benefits (such as disease prevention), neutral if they were not in favour of or were against vaccination, and negative if they focused on risks (such as adverse events and discouragement of the vaccination). The frames were also coded following a deductive method. The

following five news frames, which have been used in previous studies, were thus deductively investigated (Semetko & Valkenburg, 2000): conflict, human interest, economic consequences, morality and responsibility. Moreover, a source was identified as a person or institution from whom or which reporters derived story information. The sources were classified according to the affiliation of the individual in the following categories: "government scientific organisations" such as the National Regulatory Medicines Agency and the National Health Institute Carlos III; "government organisations", such as the Ministry of Health (Minister, State Health Secretary, etc.) and the health regional administrations and international organisations; "scientific companies", including industrial companies such as those from the pharmaceutical and health technology sectors; "university scientists", including researchers affiliated with any university or research centre; "clinicians", including any health professional working at any healthcare centre; "scientific journals", including any scientific peer-reviewed publication; "media", such as press agencies and media channels; professional associations, including any organisations composed of health professionals as members, such as the Spanish Association of Pediatrics (AEP, for its Spanish acronym), and the Spanish Society of Public Health and Health Administration (SESPAS, for its Spanish acronym); "consumer groups", including representatives from patients or users' associations; "NGOs", including any non-governmental organisation used as a source. The category "other" was used when a source was not able to be included in any of these categories.

Each article was read and re-read, all the while looking for keywords, metaphors, phrases and sentences related to the above study variables. After the first reading and coding, the next step was to identify the connotative or latent meaning of the text. This process of coding enabled us to move beyond the surface meaning of the stories to their underlying meaning.

In order to ensure reliability in coding, data was coded by one author (DCM), and a second coder (CSO) randomly reviewed 15% of the articles to determine intercoder reliability. The average simple agreement for all variables included in the study was found to be 82% (range: 71% – 100%). The formula outlined by

Miles and Huberman (1994) is reliability = number of agreements (same coding)/total codes (agreements + disagreements). The average kappa score was 0.75. After intercoder reliability testing was completed, changes were made to the coding scheme to reflect any disagreements that had been identified. All discrepancies were resolved with the support of a third researcher (CPS) when necessary.

Finally, data was further analysed using *Excel* (Microsoft Corporation, Redmond, WA, USA) and *SPSS 24th edition* (SPSS Institute, Inc., Chicago, IL, USA). Excel was used to conduct the data descriptive analyses while SPSS was used to find *p* values to check the significance of results. When possible, chi-square goodness of fit and t-test analyses were performed to determine whether the category distribution significantly differed from the expected even distribution, and to compare the dependent variables between the two groups: specialised versus general journalists. To create these two groups, we reviewed all articles authors in order to recognise their specialisation either in health or science journalism. We judged whether an author was a specialised journalist according to these two indicators: 1) the journalist has written a large number of health- or science-related articles over the last years, 2) the journalist has clearly expressed a specialisation in science or health journalism in his/her curriculum vitae or on his/her social network profiles (i.e. Twitter). Therefore, the group "specialised journalists" included those journalists who met the previous criteria, while the group "other authors" included those journalists who did not meet the previous criteria. In addition, articles from press agencies that did not include the name of the journalist, and from guest authors such as scientists, politicians, managers, etc. were also considered as "other authors".

Results

The search yielded 159 articles. Of these, 28 were not included because they were duplicates, were mentioned in the list of contents, or because the term "vaccine" had a metaphoric meaning, such as "Brexit, more vaccine and less infection" (*El Pais*, 17.07.2016). Therefore, the final sample included 131 articles.

El Pais printed 75 articles and *El Mundo* 56, with no significant differences among them (χ^2 = 2.756; p = .97; df = 1). Table 1 shows the characteristics of the study sample in terms of journalistic genre, tone of the article, type of vaccine, frames and length of the article. According to the authors, 68 articles were written by health/science specialised journalists and 63 were written by other authors. In total, we identified 14 specialised journalists, the most frequent being Mr. Emilio de Benito (n = 12, *El País*), Ms. Clara Marín (n = 8, *El Mundo*) and Ms. Elena G. Sevillano (n = 6, *El País*).

In relation to the journalistic genre, comparisons between both groups revealed significant differences (*p*<.01). The greatest differences were found in features, which were used more by specialised journalists (21 *vs* 8), while opinion articles were mostly written by other authors (8 *vs* 1). According to the tone of the article, significant differences (*p*<.01) indicated that specialised journalists wrote neutral articles more frequently (37 *vs* 18) while other authors wrote more positive articles (36 *vs* 22). In relation to the type of vaccine, differences were also found (*p*<.05). The greatest differences were shown in the vaccines for "chickenpox" and "cancer", which were more frequently covered by specialised journalists, while the vaccine for "diphtheria" was more covered by other authors. No significant differences were found in relation to the frames, where we can see that "human interest" and "conflict" were the most frequent frames in both groups. Regarding the length of the article, significant differences (*p*<.05) between both groups were also found, revealing that specialised journalists wrote longer articles on average: 564 *vs* 435 words per article.

Table 1. Journalistic genre, tone, vaccine, frame and length comparisons between specialized journalists *versus* other authors (N = 131)

Journalistic genres	N	%	Specialised	Other
News	57	43.5	34	23
Feature	29	22.1	21	8[†]
Short news	23	17.6	8	15
Opinion	15	11.5	1	14[†]
Interview	4	3.1	2	2
Obituary	1	0.8	1	0

Biography	2	1.5	1	1
Total	131	100.0	68	63

χ^2 (df = 6) = 22.19, p <.01

Tone of the article	N	%	Specialised	Other
Positive	58	44.3	22	36[†]
Neutral	55	42.0	37	18[†]
Negative	18	13.7	9	9
Total	131	100.0	68	63

χ^2 (df = 2) = 9.76, p <.01

Type of vaccine	N	%	Specialised	Other
Ebola	13	9.9	7	6
Chickenpox	12	9.2	11	1[†]
Diphtheria	8	6.1	1	7[†]
Meningitis	8	6.1	5	3
Influenza	7	5.3	2	5
Malaria	7	5.3	6	1
Cancer	6	4.6	6	0[†]
Zika	6	4.6	3	3
Measles	6	4.6	2	4
Tuberculosis	5	3.8	4	1
HIV	5	3.8	1	4
Smallpox	4	3.1	2	2
Hepatitis	3	2.3	2	1
Whooping cough	3	2.3	1	2
Human Papillomavirus	3	2.3	0	3
Polio	3	2.3	1	2
Pneumococcus	2	1.5	1	1
Alzheimer disease	1	0.8	1	0
Autism	1	0.8	1	0
Dengue	1	0.8	1	0
Yellow fever	1	0.8	1	0
Gonorrhea	1	0.8	1	0
Mumps	1	0.8	0	1
General/No identified	24	18.3	8	16[†]
Total	131	100	68	63

χ^2 (df = 23) = 41.07, p <.05

Frames	N	%	Specialised	Other
Human interest	69	52.7	41	28
Conflict	43	32.8	20	23
Responsibility	9	6.9	3	6
Economic	6	4.6	3	3
Morality	4	3.1	1	3
Total	131	100.0	68	63

Length (number of words)	N		Specialised	Other
χ² (df = 4) = 4.47, p = .34				
Min	32		32	32
Max	2158		2158	1224
Mean	502.1		564	435*
Median	480		514	383
Standard deviation	332.0		335.0	293.0
t (df = 129) = 2.26, p < .05				

Significant differences between specialised and general journalists *p <.05 **p <.01 ***p <.001

[†]Residual values <-1.96 or >1.96 showing a greater discrepancy (MacDonald & Gardner, 2000)

Table 2 shows the source patterns exhibited in both groups of authors. In general, significant differences between both groups were found in the selection of sources (*p*<.01). Specifically, we found that specialised journalists used more sources (234 *vs* 140, *p*<.001). By analysing each of the source categories, we found that sources related to professional associations and scientific journals (*p*<.001 and *p*<.01 respectively) were more used by specialised journalists. By grouping the sources into either "scientific sources" or "other sources" we found that scientific sources were more used by specialised journalists (*p*<.001). Finally, in relation to the sources count in each article for either "0-1 sources" or "≥2 sources", we also found significant differences (*p*<.01), thus indicating that specialised journalists more frequently used ≥2 sources per article (54 *vs* 33), while other authors used none or only one source more frequently (30 *vs* 14).

Table 2. Frequency counts for sources and comparisons between specialised journalists *versus* other authors

Sources	N	%	Specialised	Other
Government scientific organizations[ss]	95	25,4	59	36
	62	16,5	54	8***
Professional associations[ss]	57	15,2	32	25
Government organizationsg[os]	39	10,4	21	18
Scientific companies[ss]	39	10,4	24	15
University scientists[ss]	30	8,0	19	11**

	N	%	Specialised	Other
Scientific journals[ss]	25	6,6	14	11
Clinicians[ss]	15	4,0	8	7
NGOs[os]	6	1,6	1	5
Media[os]	3	0,8	2	1
Consumer groups[os]	3	0,8	0	3
Others[os]	374	100	234	140***
Total				
$t\ (df = 10) = 3.92,\ p < .01$				
Category of sources	N	%	Specialised	Other
Scientific sources	290	77,5	191	99***
Other sources	84	22,5	43	41
Total	374	100	234	140***
$t\ (df = 130) = 9.76,\ p < .001$				
Sources number in each article	N	%	Specialised	Other
0-1	44	33,6	14	30[†]
≥2	87	66,4	54	33[†]
Total	131	100	68	63
$\chi^2\ (df = 1) = 10.71,\ p < .01$				

Significant differences between specialised and general journalists *p <.05 **p <.01 ***p <.001

[†] Residual values <-1.96 or >1.96 showing a greater discrepancy (MacDonald & Gardner, 2000)

[ss] Scientific source, [os] Other source

Discussion

This paper set out to explore the practices of journalists when covering health topics, with special attention paid to the health specialised journalists by means of content analysis. The aim of the study was to examine specific professional patterns among health journalists, and compare the extents to which these patterns differed from those among generalists. Taken together, our findings show key journalistic patterns in the coverage of vaccines and confirm that health journalists perform differently in terms of journalistic genre, tone of the article, sources and length of the article. More specifically, our content analysis shows that health journalists, in comparison with other authors, write more features and less opinion articles, from a more neutral perspective, using a wider number of

sources from the scientific field, especially from professional associations and scientific journals.

In relation to the first and second research questions, our study sheds light on the characteristics of the media coverage of vaccines as well as interesting differences between health journalists and generalists. First, we found that "news" was the most common journalistic genre or style in our study sample in both groups of authors. However, the groups differed significantly in "feature stories" – a style which is more used by health journalists, and "opinion articles", which are more used by other authors. "Feature stories" are more elaborated narrative stories relying upon objectivity and subjectivity to make an emotional connection with the readers; they are, however, truthful and based upon facts and expert sources (Garrison, 2010). In contrast, opinion articles mainly reflect the author's opinion and thus objectivity and expert sources are not mandatory. Our group, "other authors", not only included general journalists but also others such as scientists and policymakers, who were invited to write an article for the newspaper; indeed, this could be the reason why said journalistic style is significantly higher in this group when compared with health journalists.

Our findings confirm that health journalists tend to write in a more neutral tone, while other authors write in a more positive tone towards vaccines or vaccination. Writing health articles in a positive tone has received criticism (Amend & Secko, 2012) as it is a tendency that can mislead messages about research findings. It is also relevant to point out that the negative tone was less frequent in both groups. This finding is in contrast with a recent systematic review which found a majority of studies with a dominance of media articles which contained negative messages about vaccines or vaccination (Catalan-Matamoros & Peñafiel-Saiz, 2018).

Another point that should be taken into account is the length of the article, as our findings indicate that health journalists write longer articles. This is relevant because nowadays there is less space to tell a story in traditional media outlets (A. Kennedy et al., 2011) and thus the number of words may be limited because

of external factors. However, we could also reflect that this imbalance in article length may indicate inequivalent amounts of elaboration across conditions in terms of offering deeper analyses of health issues, such as providing facts, context, bias and mobilising messages for the public. Our study found, on average, 502 words per article in total, with 564 words for those written by health journalists and 435 for those written by other authors. Previous content analyses of print news about vaccines have found slightly larger average counts per article: 485, 725 and 765 words (Krakow & Rogers, 2016; Perez, Fedoruk, Shapiro, & Rosberger, 2016; Quintero Johnson, Sionean, & Scott, 2011). In order to identify any difference in the elaboration of contents, we would suggest further careful qualitative content analyses to clarify the reasons for these length differences within both groups of authors, as well as among countries, as has just been shown in relation to other studies.

Regarding the third research question, it is interesting to confirm different sourcing patterns between both groups of authors. First we found that professional associations and scientific journals were used most commonly by health journalists. This is not surprising, as both types of sources may require a thoughtful knowledge of scientific literature and databases. For example, searching, reading and understanding scientific papers is not an easy task for journalists; this is a specific subject for the training of health journalists. Our findings are aligned with previous research which pointed out that health journalists working in national media organisations have a great reliance on scientific journals and use them frequently, especially to find their initial idea (Viswanath et al., 2008). It is also important to highlight that our study revealed that health journalists use more scientific sources in general. This finding may show that other journalists or authors could have an alternative focus in the health topic, such as legal aspects, political issues or economics. However, previous studies have pointed out that scientific sources are preferred for reasons of contextualisation and interpretation of technical and compound health information (Len-Ríos et al., 2009). Another important fact is related to the number of sources used in each article, since health journalists included, in general, two or more sources in their articles. The use of multiple sources has been supported by

different authors as a way of bringing about more balance and better checks on the views presented (Guenther et al., 2017; Holtzman et al., 2005). In our study, the other authors differed from this; indeed, the findings showed that approximately 50% of articles used none or only one source. Not presenting a range of expert opinions has been criticised (Holtzman et al., 2005), as the danger of this generation of stories is that the news media may act simply as passive conveyors of dominant sources' views. This line of criticism has been previously cited under the concept of "churnalism" (Johnston & Forde, 2017), where pressure on journalists to speed up and escalate their production of news leads to les balancing and verifying of different views.

Despite these interesting findings, some potential limitations of the study should be taken into account. First, the findings of our study cannot be generalised to the broader population of health journalists due to the limited scope of our sample (vaccine media coverage by 14 journalists specialised in health in Spain). Research including more journalists in different health areas and in different countries is necessary. Another limitation is that our study only analysed media coverage in newspapers. Thus, future studies may focus on health journalists working in other media formats, such as radio or television, and particularly those with a different journalistic practice. However, newspapers can be a rather good indicator, thereby providing insight into what could be felt elsewhere (Meyer et al., 2016). Nevertheless, the findings in this study are a starting point for developing a more comprehensive portrait of the work of journalists engaged in health. In attempting to create a profile of health journalists, we learned that they are similar to generalists in several ways, although there are some key differences that could represent the added value of the health journalism specialty. We may well encourage further research to test the hypothesis that journalists with knowledge of how best to communicate about health are better equipped to tell the story than general-assignment reporters with no health-writing experience. Indeed, we have tried to paint a more complete picture of the nature of the work of health journalists; this is a different view from the common sense assumption that journalists aim to "sell news" or to "sensationalise" to increase audience numbers. Moreover, findings from this study have important

public health implications given the critical role of news media as gatekeepers between researchers and the public.

With this study, we contributed to the theoretical and practical development of journalism studies. This systematic analysis of health journalists, one of the first of its kind, characterises how those with a health journalism specialty perform differently from those without such a specialty. Collectively, these findings provide insights into the process of health journalism, and identify potential aspects to further develop the profession for the broad dissemination of health news to the public.

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Study 9. A visual content analysis of vaccine coverage in the print media

Abstract

Visual imagery is essential in the media and is broadly recognised to increase attention, recall information, improve comprehension and even change adherence to clinical guidelines. Despite the social debate about vaccination, the study of vaccine media images has received little attention. Therefore, this study aims to analyse the visual content of newspaper coverage of vaccines and to identify some key patterns that might be more likely to influence audience understanding. Coverage from 2012 to 2017 about vaccines was retrieved from the flagship Spanish newspapers *El Pais* and *El Mundo*. An imagery content analysis was undertaken for 131 articles. Results reveal that images are commonly used in the print media, appearing in 56% (n=74) of articles about vaccines. Images were mostly located in the top area of the page ($p<.001$), and each image occupied about 28% of the total surface in the page. Each article included 1 image on average, and 76% (n=64) of visual resources were photography and the frames 'human interest' and 'conflict' were the most frequent ones. The themes of the images focused most commonly on the action of vaccination, vaccines as such, the biological aspects of the vaccine and research. The study provides descriptive knowledge related to the use of visual contents coverage about vaccines in the print media. We suggest further research on the influence of visual contents in the context of vaccines as well as a collaboration between public health experts and designers to create effective visual contents and messages.

Keywords: vaccine; media; newspaper; imagery; photography.

Introduction

The general public is highly interested in health news, and the media are often used as the first source of information (Molyneux & Holton, 2015; Riobó, 2016), thus playing a crucial role in health education and significantly influencing health behaviours (Odone, Tramutola, Morgado, & Signorelli, 2018). The visual imagery is an essential element in the media and its importance is broadly recognised in the field of health communication (Chang, 2013; López-Villafranca, 2016). It has been recognised that publishing photographs next to text can markedly increase attention, recall of health information, improve comprehension and can even change adherence to health instructions (Houts, Doak, Doak, & Loscalzo, 2006). A clear example is found in the pictorial warnings on cigarette packages, which are considered to be a central element for encouraging smokers to attend health education programs and abandon smoking, and maintaining the effects longer than text-only warnings (Fong, Hammond, & Hitchman, 2009).

Today, an anti-vaccine lobby thrives in our society and vaccine uptake is considered a public health challenge (Carrillo-Santisteve & Lopalco, 2012), and vaccine scepticism is on the rise in Europe (Larson, 2018a, 2018b). A recent national survey in Spain showed that citizens are not well informed about health related issues (Catalán-Matamoros, 2018). This is especially relevant because information and opinions from both vaccines' supporters and opponents is frequently found in the media. In fact, the traditional media coverage and the rapid growth of the Internet and social media have made it easier to find and disseminate immunization-related concerns and misperceptions (Kennedy, Lavail, Nowak, Basket, & Landry, 2011).

Although the topic of vaccines has been largely studied within the field of media communication of medicines (Catalan-Matamoros & Peñafiel-Saiz, 2017), the analysis of vaccine-related images has received little attention. Nyhan et al. (Nyhan, Reifler, Richey, & Freed, 2014) conducted a web-based survey that revealed the image of a sick child had the opposite effect, as it increased parents' beliefs in serious vaccine side effects. Other previous studies have analysed the

imagery of vaccines in the social media sites of *Facebook* (Broniatowski, Hilyard, & Dredze, 2016), *Pinterest* (Elena Milani, 2015; Guidry, Carlyle, Messner, & Jin, 2015) and *Twitter* (Chen & Dredze, 2018). Studies conducted on the traditional media (newspapers, radio or television) have not been found. A recent systematic review of studies analysing the media coverage of vaccines (Catalan-Matamoros & Peñafiel-Saiz, 2019) suggested that further research should also focus on the analysis of visual materials especially because it is the newspaper readership that mostly consume headlines and images. Our work aims to fill these research gaps in the field of media coverage of vaccines in the print press.

In this context, and building on previous research, the aim of the current study is to quantitatively and qualitative analyse the visual content during a 5-year period of newspaper coverage of vaccines and vaccination as well as to identify some key patterns that might be more likely to influence audience understanding, perception and, ultimately, behaviours towards vaccines. We retrospectively monitored the use of images in the reporting of vaccines and vaccination, on all published issues of the most read general and paid newspapers in Spain: *El Pais* and *El Mundo*.

Methodology

The present study used quantitative and qualitative content analysis as a method of data analysis. We retrieved national newspaper coverage of vaccines published in Spain from October 1, 2012 to October 1, 2017. The analysis period in 2012, coincided with the publication of the WHO Global Vaccine Action, which was a Plan approved in the 65th World Health Assembly (World Health Organization, 2012), in which, for the first time, it was recognised that the media should understand the benefits of, and concerns about immunization in order to accurately report on and effectively promote immunization programmes. Moreover, during 2012, Europe experienced significant vaccine preventable diseases outbreaks, such as the measles outbreak in UK, caused by a dip in MMR vaccination rates (Gander, 2017) and the anti-vaccination lobby activities

in some European countries during the same year (European Social Policy Network, 2016).

The online database Mynews was used to search the two paid general newspapers with the highest circulation rates according to the General Media Study in Spain (AIMC - Asociación para la investigación de medios de comunicación, 2017). Mynews is a professional media agency that inspects all national daily newspapers and provides copies of all articles. The newspapers *El Pais* and *El Mundo* were selected because both are flagship national newspapers in Spain (*El Pais* with 1.080 and *El Mundo* with 0.662 million daily readership rates). The databases were searched using the following search string in the Spanish language [vacuna* OR inmuniza*] that should be present in the headlines or sub-headlines. The article types selected were news articles, features, short articles, opinion articles (including editorials and letters to the editor), interviews, biographies and obituaries. Duplicate articles and those using the term "vaccine" with a metaphoric meaning were excluded.

A content analysis, using a standardized data-collection instrument was followed and it included the following variables: publication date, vaccine type, captions, type of image (photography, infographics, table, drawing, map or graphic), location that the image occupied in the page (top, central or bottom), and total occupancy percentage of the visual content for each article in relation the page. Aligned to previous research (Hilton, Hunt, Langan, Bedford, & Petticrew, 2010), the tone analysis was employed primarily to assess whether, from a public health perspective, vaccine was being supported or advocated. For coding 'tone' we followed a previous study (Tsuda et al., 2016) where the positive tone focused on benefits, such as disease prevention, the neutral one if they were not in favour or against vaccination, and negative if they focused on risks, such as adverse events and discouragement of the vaccination.

In addition, the frames were analysed which represent conceptual tools which media and individuals rely on to convey, interpret and evaluate information" (Neuman, Just, & Crigler, 1992). The following five news frames that have been

identified in previous studies were deductively investigated (Semetko & Valkenburg, 2000): conflict, human interest, economic consequences, morality and responsibility. 'Conflict frame' emphasizes conflicts between individuals, groups or institutions as means of capturing audience interest. 'Human interest frame' shows the human impact to the presentation of an event, issue, or problem. 'Economic frame' reports an event in terms of the consequences it will have economically. 'Morality frame' puts the event, problem or issue in the context of religious tenets or moral prescriptions. 'Responsibility frame' presents an issue or problem in such a way as to attribute responsibility or its cause or solution to either an individual or group. Finally, the main visual theme for each article was coded in order to contextualise the data. In the cases where there was more than one image, we prioritized the theme of the larger image.

In order to ensure reliability in coding, data was coded first by one author (DCM), followed by a second coder (CSO). After coding was completed, changes were made to the coding scheme to reflect any disagreements that had been identified and all discrepancies were resolved with the support of a third researcher (CPS) when necessary. Then, the text from captions that accompanied the images were imported to QSR NVivo 11 plus and word frequency analysis was conducted. Data from the coding was further analysed using Excel (Microsoft Corporation, Redmond, WA, USA) and SPSS 24th edition (SPSS Institute, Inc., Chicago, IL, USA). These programmes were used to conduct the data descriptive analyses and to find *p* values to check for the significance of results when making comparisons.

Results

A total of 159 articles were published between 2012 and 2017. From those, 28 were not considered because they were duplicates, brief mentions in the list of contents, or because the term vaccine had a metaphoric meaning such as "Brexit, more vaccine and less infection" (*El Pais*, 17.07.2016). Therefore, the final sample included 131 articles. *El Pais* carried 75 articles and *El Mundo* printed 56, with no significant differences among them (χ^2 = 2,756; *p* = 0.97; df = 1). There

was one particularly heavy period of press coverage about vaccines in 2015 (χ^2 = 55,550; p = < 0.001; df = 5) during which the selected newspapers printed 52 articles (*El Pais* n = 27, *El Mundo* n = 25). Of the 131 articles that covered vaccine-related issues during the period of analysis, we found visual contents in 56% (n = 74). From these, 84 visual units were identified and thus these were further analysed. Figure 1 shows the flow diagram and the variables that were analysed in each step.

Figure 1. Flow diagram

```
        ┌─────────────────────────────┐
        │ Articles identified through  │
        │      database searching      │
        │         (n = 159)            │
        └─────────────────────────────┘
                     │
                     ▼
        ┌─────────────────────────────┐
        │   Articles after screening   │
        │         (n = 131)            │
        │ El País (n = 75) El Mundo (n = 56) │
        └─────────────────────────────┘
                     │
                     ▼
  ┌──────────────────────────┐      ┌─────────────────────────┐
  │ Articles including visual │─────▶│ Analysis of framing, size │
  │        contents           │      │     theme and tone        │
  │        (n = 74)           │      └─────────────────────────┘
  └──────────────────────────┘
                     │
                     ▼
  ┌──────────────────────────┐      ┌─────────────────────────┐
  │      Visual units         │─────▶│ Analysis of type of image │
  │        (n =84)            │      └─────────────────────────┘
  └──────────────────────────┘
```
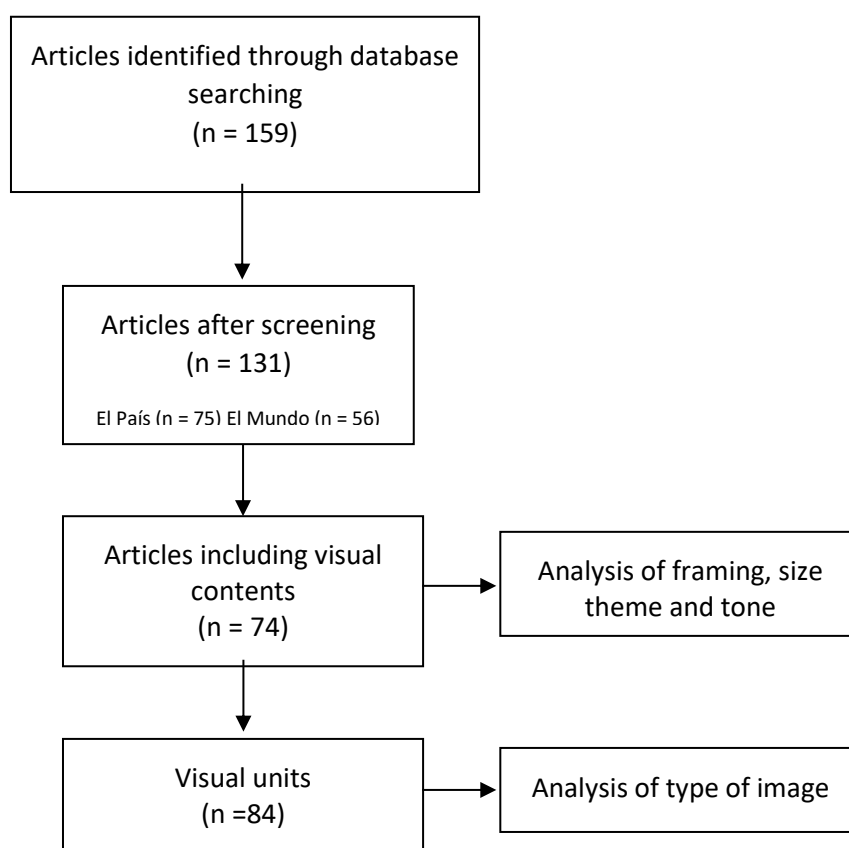
On average, there were 1.14 (SD = ±0.382, range 1-3) images in each article that included any visual content. In table 1, the type of image, framing, location, size and themes are shown. In relation to the type of image and the total amount of visual units (N = 84), photography was clearly the most used one with 76% (n = 64). Infographics are the next format but with a much lower frequency of 16% (n = 14). The other types of image were poorly used (table, drawing and map). In relation to the framing and the total amount of articles including visual units (N = 74), human interest (66%, n = 49) and conflict (24%, n = 18) were the most

frequent ones used. The frames morality, responsibility and economic were rarely used. The majority of images were located in the top area of the page (73%, n = 54), followed by the central location (23%, n = 17) and just a few were located in the bottom area (4%, n = 3). Moreover, the average size of the total visual surface in each article covered 28% of the page (range: 10 - 100%, SD: ±0.18). This does not mean that the 72% remaining surface is filled with verbal messages as it also includes white space and other design elements that occupy space. In relation to the tone of the article towards vaccines or vaccination, in the total sample of articles including visual units (N = 74) we found that 13% (n = 10) of the articles had a negative tone, 42% (n = 31) of the articles had a neutral tone and 45% (n = 33) of the articles had a positive tone.

Table 1: Type of image, framing, location, size and themes of the study sample

Type of image	N	%
Photography	64	76.1
Infographics	14	16.7
Table	4	4.8
Drawing	1	1.2
Map	1	1.2
Graphic	0	0
Total	84	100.0
t (gl = 5) = 1.4, p =.229		
Framing		
Human interest	49	66.2
Conflict	18	24.4
Morality	3	4.0
Responsibility	3	4.0
Economic	1	1.4
Total	74	100.0
χ² (gl = 4) = 111.4, p <.001		
Location		
Top	54	73.0
Central	17	23.0
Bottom	3	4.0
Total	74	100.0
χ² (gl = 2) = 59.3, p <.001		
Size (100 = 1 full page)		
10	9	12.2
20	35	47.3

30	14	19.0
40	8	10.8
50	4	5.4
60	0	0
70	1	1.3
80	0	0
90	0	0
100	3	4.0
Total	74	100.0

$t\ (gl = 73) = 13.0,\ p < .001$

Themes

Vaccination	19	25.7
Vaccine	10	13.5
Biological aspects	8	10.8
Research	8	10.8
Logistics	7	9.5
Patient	5	6.8
Epidemiological data	4	5.4
Conflict	2	2.7
Others	11	14.9
Total	74	100.0

Table 2 shows the amount of images and average per article and type of vaccine. The most frequent vaccines were Ebola (10%, n = 13), chickenpox (9%, n = 12), diphtheria (6%, n = 8) and meningitis (6%, n = 8). However, the types of vaccines including more average of images were the ones for malaria and cancer. The words frequency analysis of the captions that accompanied the images revealed that the ten most common words were: vaccine, health, source, vaccination, campaign, children, virus, dose, national, and system.

Table 2. Amount of images and average per article and type of vaccine (the most frequent vaccines only)

Type of vaccine	n	Percentage	Number of images	Average
Ebola	13	10%	10	0.79
Chickenpox	12	9%	10	0.83
Diphtheria	8	6%	3	0.37
Meningitis	8	6%	3	0.37
Influenza	7	5%	4	0.57
Malaria	7	5%	7	1.00
Cancer	6	4.5%	6	1.00
Zika	6	4.5%	3	0.50
Measles	6	4.5%	4	0.66

Finally, in relation to the overall theme of the entire visual content in each article (N = 74), the analysis revealed that 25% (n = 19) were about the action of vaccination showing a vaccine being injected mostly in a baby. Around 13% (n = 10) of images were about vaccines, as such showing the package or the dose of vaccine. Next we found images related to the biological aspects related to the vaccine (n = 8, 10%) such as the gonorrhea bacterium, the tuberculosis bacillus, or a HIV cell infecting a lymphocyte. Another theme was research (n = 8, 10%) that showed scientists and laboratories. The theme logistics showed images about the infant vaccination schedule and about the delivery of vaccines to stores. The following theme represented the vaccine targets, patients (n = 5; 7%), where the majority 80% (n = 4) were represented by photographs of babies and children. The next theme was epidemiological data (n = 4; 5%) showing tables and infographics about the prevalence of vaccine preventable diseases. Two images (3%) showed specific conflicts related to vaccines such as the Ebola vaccine. Below there are some pictures about the abovementioned themes:

Image 1. Theme Vaccination. *El Pais*, 20 March 2013, *p.* 36

Image 2. Theme Vaccine. *El Mundo*, 10 August 2016, *p.* 18

Image 3. Theme Biological aspects. *El Mundo*, 3 April 2015, *p.* 34
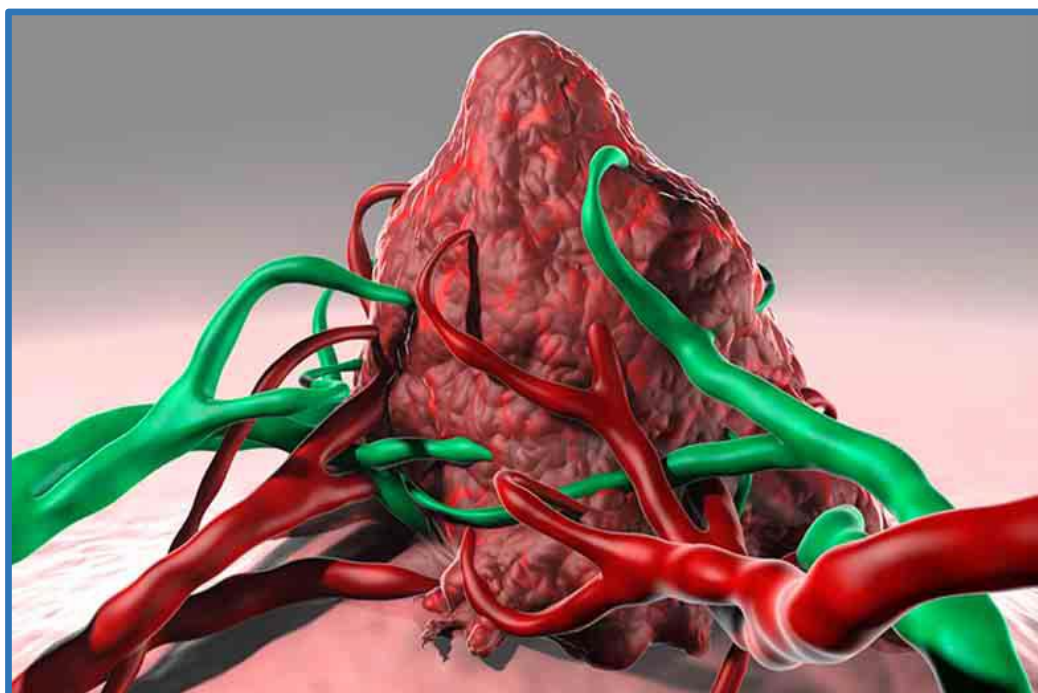
Image 4. Theme research. *El Pais*, 24 March 2017, *p.* 28
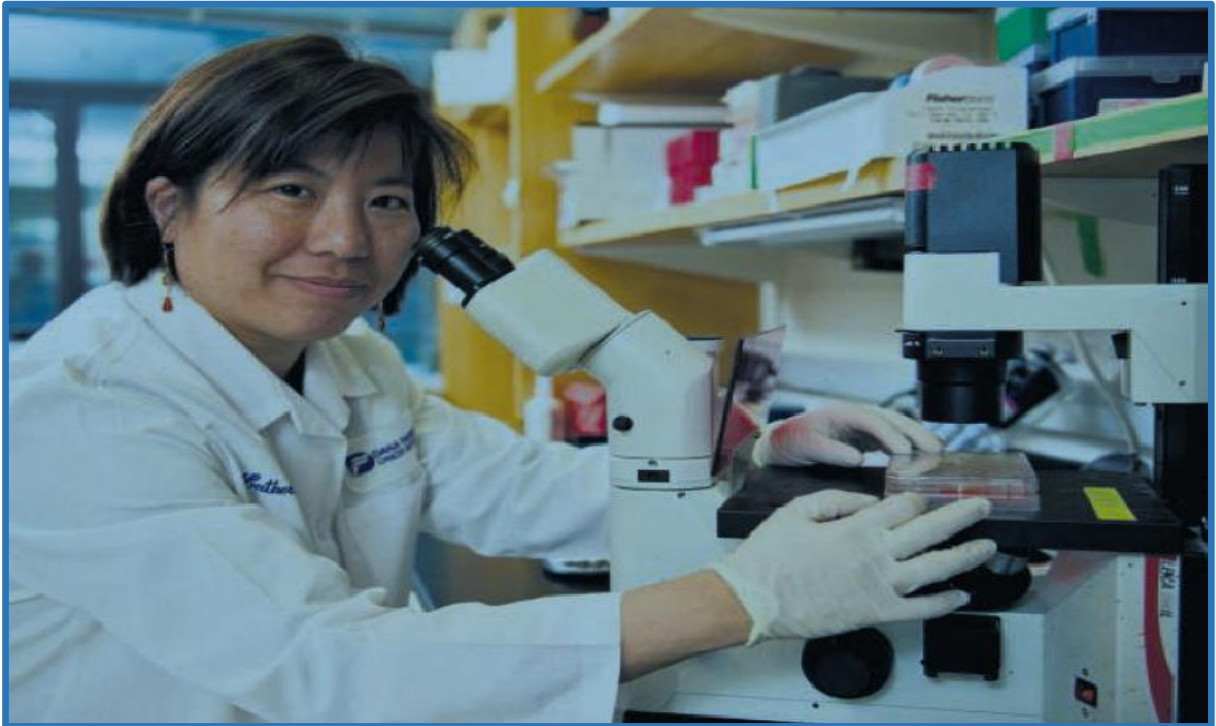
Image 5. Theme logistics. *El Pais*, 4 September 2013, *p.* 34

Calendario de vacunas infantiles para 2014

	Meses						Años								
	0	2	4	6	12	15	18	3	4	6	10	11	12	13	14	15
Poliomelitis		■	■	■			■									
Difteria-Tétanos-Tosferina		■	■	■			■			■					a	
Haemophilus influenziae b		■	■	■			■									
Sarampión-Rubeóla-Parotiditis					■			■	■							
Hepatitis B (b)	■	■			■											
Meningitis meningocócica C		■			■								■			
Varicela													■			
Virus del papiloma humano															■	

a. Sólo difteria y tétanos.   **b.** En niños de madres portadoras la pauta es de 0, 1 y 6 meses.

Fuente: Consejo Interterritorial del Sistema Nacional de Salud (Ministerio de Sanidad).   EL PAÍS

Image 6. Theme patients. *El Pais*, 24 April 2015, *p.* 39

Image 7. Theme epidemiological data. *El Mundo*, 5 August 2017, *p.* 23
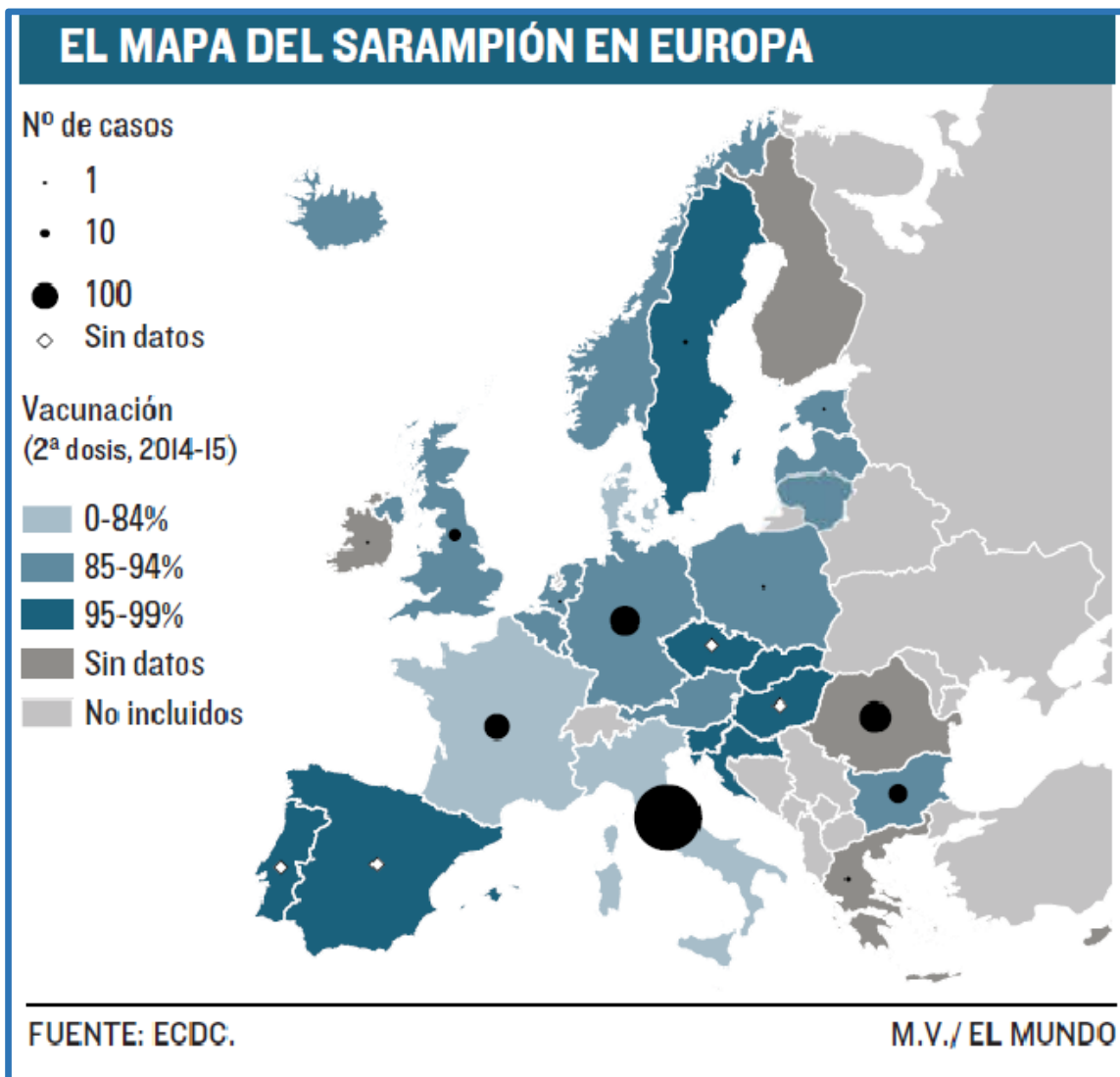
Image 8. Theme other. *El Mundo*, 17 March 2016, *p.* 27

Discussion

This study is among the first to analyse the imagery of vaccines in the print media. The aim of the study was to analyse the visual content of 131 newspaper articles about vaccines or vaccination and identify some key patterns and themes. Taken together, our study shows that images are commonly used in the print media appearing in 56% of articles about vaccines. More specifically, we found that images were mostly located in the top area of the page and occupied about 28% of the total surface. Each article including images used just 1.14 on average, 76% of them were 'photography', and the frames 'human interest' and 'conflict' were the most frequent ones. The themes of the images focused most commonly on the action of vaccination, vaccines as such, the biological aspects of the vaccine and research.

We found a clear dominance of the photography in articles about vaccines, which shows how this visual resource is still very much used in the print press regardless of the rapid development of the digital technology. Our findings confirm a previous study (Arriaga Silva, 2017) that revealed that photography is still the most common visual element in the print press. It was surprising to find a low usage of infographics and tables with data. The use of these graphical resources for data displays has been recommended (Lipkus, 2007), however it seems to have been ignored in our sample of print coverage about vaccines.

In relation to the type of vaccine and the average of images in each article, images were mostly used among articles related to malaria, cancer, chickenpox and Ebola. Although the reasoning for this was not further studied, one explanation could be that journalists desired to increase understanding and attention of the message relevance, or increase reader interest in the message as it has been stated in earlier research reviews (Houts et al., 2006). Moreover, the amount of images and the percentage of occupied surface in articles about vaccines was higher than in a previous study analysing images in health promotion materials about cancer (King, 2015). These outcomes may suggest there could be more opportunities in articles about vaccines to analyse the intentional educational, informative and persuasive role of images.

Our analysis showed that the majority of articles had either a positive or a neutral tone towards vaccine. However, Guidry et al. (Guidry et al., 2015) analysed images about vaccine publications in Pinterest and found a majority of posts with negative and neutral tone. Although this study varies in its methodology, and thus cannot be directly compared with our study, this might indicate that public voicing of anti-vaccination sentiment is larger in the digital social media than in traditional media. A reasonable explanation could be that newspapers are written mainly by journalists who are trained to keep the principle of accuracy. Taking into account that a previous review (Catalan-Matamoros & Peñafiel-Saiz, 2019) found that the traditional media published

more articles with negative tone toward vaccines in earlier years than our study period, we could think that journalists have been now persuaded to write more pro-vaccination articles. Further studies should analyse whether the public health community is doing more outreach to journalists or whether they were better educated than were their predecessors.

Finally, The theme analysis revealed that images showing health professionals vaccinating babies were more frequent. This finding is aligned to a previous study (Chen & Dredze, 2018) that found that the images in Twitter about vaccines were about the injection and babies. This is not surprising as the most representative and effective use of vaccines is found in childhood, and these images may also suggest audience segmentation. In this regard, demonstrating actions or behaviours could likely model certain behaviours based on the social cognitive theory (Matusitz & Breen, 2011) which helps us understand the psychosocial mechanisms of how symbolic communication influences human thought and actions. Further, it might be relevant to analyse the influence of various visual designs on attitudes and behaviours towards vaccines.

There are certain limitations in our study that should be discussed. The samples used dealt with only one health issue, vaccine or immunization, and these were obtained through two specific newspapers in Spain. Although these newspapers are ranked first in readership by the Spanish population and Spain is one of the most populated countries in Europe, our findings may only show some trends in aspects related to the design of visual messages. They cannot be transferred to symbolise a consent on the characteristics and use of images in newspapers and generalised in all health issues and geographical settings. Another limitation is that our study only analysed media coverage in newspapers. Thus, future studies may focus on visual contents in other media formats, i.e. television. However, we agree with Meyer et al. (Meyer et al., 2016) that newspapers can be a rather good indicator, thereby providing insight into what could be felt elsewhere. Nevertheless, the findings in this study are a starting point for developing a more comprehensive portrait of the visual contents used in the media coverage of health issues.

In conclusion, our study provides descriptive knowledge related to the use of visual contents in the print media coverage about vaccines. Our data shows what type of imagery people will encounter when they seek or find vaccine information in newspapers. As the media provide us with useful data on how the topic is perceived by the general population, this data can inform future planning, implementation and evaluation of effective health promotion campaigns. The potential effect of these images was guided by visual communication and visual messaging theories. We suggest the need for further experimental research on the influence of the use of visual contents and message presentation strategies in the health communication context of vaccines. We agree with King (King, 2015), in that researchers should collaborate with professional artists and designers who may be able to create a more effective visual content as well as identify design or content characteristics that accurately add to important paradigms like attractiveness or cultural appropriateness. Further research and collaboration will advance the

role of visual messages aimed at persuading or informing about vaccines. We strongly recommend health authorities to consider the potential of evidence-based media content analyses of vaccines in disease prevention and health promotion campaigns.

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Study 10. Exploring the relationship between newspaper coverage of vaccines and childhood immunization rates in Spain

Abstract

Background: Despite the effectiveness of vaccines being well established and recognized by the research community, eleven European countries have adopted mandatory immunization programs. Lack of information and fake news are considered the main reasons for low vaccine uptake. The media are a powerful tool for spreading vaccine-related information. Despite the social debate around vaccination, the study of media effects on vaccine uptake has received little attention in Europe. Objective: To explore the association of childhood immunization rates in Spain with vaccine-related coverage in print media. Methods: A quantitative and qualitative content analysis of newspaper coverage of vaccines was conducted by using descriptive statistics and correlation analysis. The study variables were: national childhood vaccination rates, article publication dates, and tone and main theme of the articles. We conducted a correlation analysis to assess the association between media coverage and childhood vaccine uptake. Results: While vaccine coverage with positive and neutral tones significantly increased during the study period ($p < .001$), the number of articles with a negative tone remained unchanged ($p = .306$). There was a significant and inverse correlation between negative newspaper coverage and childhood vaccine uptake with a lag of one year from the media exposure ($r = -.771$, $p < .05$). During 2016 and 2017, although the media reporting declined, immunization rates kept increasing. The most frequent theme was about the development of the Ebola vaccine (10%, $n = 13$). The chickenpox and meningitis vaccine crises were other frequent themes. Conclusions: Our findings expand the understanding of media influence on vaccination and suggest that the media need to be considered as an important player during vaccination campaigns. The study points to the important educational role of the media in public health.

Keywords: mass media; newspapers; content analysis; correlation.

Introduction

Although the effectiveness of vaccines is well established and recognized by the research community, there remain some issues regarding vaccine confidence and trust among the population (Jamison, Quinn, & Freimuth, 2019; Martínez-Martínez & Cuesta Cambra, 2018; Siu, 2018), as well as low vaccination rates for some vaccine types and geographical regions (Broniatowski, Hilyard, & Dredze, 2016). Factors that may influence vaccination rates include: access to healthcare services, risk perceptions concerning the disease or the safety of the vaccine, social models, and trust (Arriola et al., 2015; Bish, Yardley, Nicoll, & Michie, 2011; Freimuth, Jamison, An, Hancock, & Quinn, 2017; Quinn et al., 2017). These factors are influenced by a few high profile anti-vaccination campaigns which have had a harmful effect, to the extent that vaccine uptake is considered a public health challenge (Carrillo-Santisteve & Lopalco, 2012) and that eleven European countries now have mandatory vaccinations for at least one of the following: diphtheria, tetanus, pertussis, hepatitis B, poliovirus, haemophilus influenzae type b, measles, mumps, rubella, and varicella (Bozzola et al., 2018).

Lack of information and fake news are actually recognized as being among the main reasons contributing to low immunization coverage (Bozzola et al., 2018). A recent national survey in Spain showed that citizens are not well informed about health-related issues (Catalán-Matamoros, 2018). The general public is highly interested in health news and the media are often used as the first source of information (Molyneux & Holton, 2015; Riobó, 2016). In this regard, the media are considered to be a powerful tool for spreading information and increasing awareness about vaccines and opinions from both vaccine supporters and opponents. In fact, the traditional media coverage and the rapid growth of the Internet and social media have made it easier to find and disseminate immunization-related concerns and misperceptions (Kennedy, Lavail, Nowak, Basket, & Landry, 2011).

The topic of vaccines has attracted extensive media attention in recent years, owing in large part to now-discredited claims about safety. Scholars have studied how the topic of vaccines has been covered by the media. A recent systematic review (Catalan-Matamoros & Peñafiel-Saiz, 2018) found that negative messages and inaccurate information were found to be a common pattern in media coverage of vaccines. The majority of previous media analyses about vaccines were carried out in newspapers, especially in the United States; another study (Odone et al., 2015) showed a lack of this research field in other geographical areas. The review also suggested the need to further analyse media effects on vaccine uptake because previous studies have mainly examined the focus of media coverage or its influence on perceptions of risk (Meyer et al., 2016). In relation to this, vaccine uptake has been reported to vary by media coverage (Ahmed, Quinn, Hancock, Freimuth, & Jamison, 2018; Meyer et al., 2016; Sagy, Novack, Gdalevich, & Greenberg, 2018; Smith, Ellenberg, Bell, & Rubin, 2008) and by the use of mass media (Jung, Lin, & Viswanath, 2015; Sohn, Lin, & Jung, 2018; Tran et al., 2018). To our knowledge, only one study (Suppli et al., 2018) has been made on the association between media coverage use and immunization rates in Europe, which only focused on the HPV vaccine uptake and related media coverage in Denmark. In this context, there is a research need to further investigate the association between vaccine rates and media coverage for other types of vaccines and other geographical regions, especially in Europe where evidence is still limited. Therefore, building on previous research, the aim of the current study is to explore the association of childhood immunization rates in Spain and vaccine-related coverage in the print media.

Material and methods

The present study used quantitative and qualitative content analysis of print media coverage of vaccines published in Spain. We followed a similar research method of a previous study (Meyer et al., 2016). A content analysis, using a standardized data-collection instrument, was used and included the following variables: national vaccination rates, publication date, tone of the article, and main theme. For coding 'tone', we followed a previous paper (Tsuda et al., 2016)

where the positive tone focused on vaccine benefits, such as disease prevention; the neutral tone referred to if they were not in favour or against vaccination; and a negative tone implied they focused on risks, such as adverse events and discouragement of the vaccination. We also conducted an inductive thematic analysis to contextualize the data. Finally, we performed an analysis of correlation between vaccine articles and vaccine rates in Spain.

The newspapers *El Pais* and *El Mundo* were selected because both are flagship national newspapers in Spain (*El Pais* has a daily readership of 1.08 million readers and *El Mundo* has 0.662 million daily readers). The online database MyNews was used to search the articles by using the following search string in the Spanish language [vacuna* OR inmuniza*]; these were present in the headlines or sub-headlines from October 1, 2012, to October 1, 2017. The article types selected were news articles, features, short articles, opinion articles (including editorials and letters to the editor), interviews, biographies, and obituaries. Duplicate articles and those using the term 'vaccine' with a metaphoric meaning were excluded. The immunization rates were compiled from the vaccination health information system of the Spanish Ministry of Health (Ministerio de Sanidad, 2017). Vaccination rates for each year from 2012 to 2017 show the average rates of the following vaccines: first dose of Poliomyelitis, DTaP (diphtheria, tetanus and pertussis), Hib (haemophilus influenza type B), Hepatitis B, MMR (measles, mumps and rubella), and all doses of HPV (human papilloma virus).

In order to ensure reliability in coding, data was coded first by one author (DCM), followed by a second coder (CSO). After coding was completed, changes were made to the coding scheme to reflect any disagreements that had been identified and all discrepancies, when necessary, were resolved with the support of a third researcher (CPS). With the aim of reflecting the impact that vaccine articles had on vaccination rates in Spain, a weighting factor was created based on the daily readership of the selected newspapers. In this regard, *El Pais* had the highest weight of 0.62 (i.e., 62% of the total circulation of the two newspapers included in the analysis). The newspaper *El Mundo* was given the remaining weight of 0.38.

The weight was applied to the number of articles about vaccines by year in each newspaper to create a weighted index of the potential impact of the vaccine articles among the selected newspaper articles. The analysis of correlation between vaccination rates and the vaccine articles in the media was calculated using a one-year time lag in recognition of the delayed impact that media reporting might have had on people's behaviours towards vaccination (Meyer et al., 2016). Since immunization rates were only published until 2017 at the time of data analysis, immunization rates for 2018 were estimated considering the immunization rates from 2012 to 2017 (see Table 1). Therefore, for the analysis of correlation, the estimated immunization rate was 94.9 for the year 2018. For data analysis we used Excel (Microsoft Corporation, Redmond, WA, USA) and SPSS, 24th edition (SPSS Institute, Inc., Chicago, IL, USA). These programs were used to conduct the data descriptive analyses and to find p values to check for the significance of results.

Results

Overall, the initial search in MyNews yielded 159 articles. Of these, 28 were not considered because they did not meet the inclusion criteria. Therefore, the final sample included 131 articles. *El Pais* carried 75 articles and *El Mundo* carried 56, with no significant differences among them (x^2 = 2,756; p = 0.97; df = 1). Table 1 shows the distribution by year of immunization rates in Spain, the number of articles about vaccines in the selected newspapers, and the tone, including the weight factor based on circulation rates. In relation to the immunization rate, although there was a slight decrease in 2013, a yearly continuous increase can be found since 2014. Regarding the articles, there was one particularly significant heavy period of press coverage about vaccines in 2015 (x^2 = 55,550; p < 0.001; df = 5) during which time the selected newspapers printed 52 articles (*El Pais* n = 27, *El Mundo* n = 25). The tone analysis revealed that 44% (n = 58) of articles were positive, 42% (n = 55) were neutral, and 14% (n = 18) negative. Therefore, the overall proportion of pro-immunization articles was significantly higher than that of anti-immunization in the total sample period. However, we found that, in 2012, negative articles (n = 5) were more frequent than either neutral (n = 2) or

positive (n = 1) articles, and that the number of negative articles remained similar throughout the study period with no significant differences (χ^2 = 6,00; p = .306; df = 5). In contrast, the number of both positive and neutral articles became significantly more frequent than negative ones since 2013 (positive articles: χ^2 = 45,241; p <.001; df = 5; neutral articles: χ^2 = 19,945; p <.001; df = 5).

Table 1. Immunization rate, number of articles, and risk messages for Spain (2012–2017)

	Immunization rate[a] Spain (%)	Articles[b]	Positive tone articles (weight)[c]	Neutral tone articles (weight)[c]	Negative tone articles (weight)[c]
2012	92.1	8	1 (0.62)	2 (1.24)	5 (2.62)
2013	92.0	20	8 (4.72)	8 (4.24)	4 (2.24)
2014	92.5	22	7 (3.62)	13 (7.10)	2 (1.24)
2015	93.6	52	28 (14.00)	19 (9.86)	5 (2.38)
2016	93.9	15	6 (3.24)	8 (3.76)	1 (0.38)
2017	94.4	14	8 (3.52)	5 (2.38)	1 (0.62)
Total	93.1	131	58 (29.72)	55 (28.58)	18 (9.48)

Notes: [a]From statistics of the Ministry of Health, Spain. Data shows average immunization rates for: first dose of Poliomyelitis, DTaP (diphtheria, tetanus and pertussis), Hib (haemophilus influenza type B), Hepatitis B, MMR (measles, mumps and rubella), and all doses of HPV (human papilloma virus). [b]Total number of articles reporting on vaccines from two major newspapers in Spain. [c]Total number of articles by tone and a weight factor representing an index of the potential impact of articles based on circulation rates of newspapers.

The findings of the inductive thematic analysis are described in Table 2. We can see that the most frequent theme was about the development of the Ebola vaccine (10%, n = 13). The crises of the chickenpox and meningitis vaccines were

also extensively covered by the selected newspapers. Other trending themes were articles about the decrease of vaccination in European countries and the obligatoriness of vaccination. The other frequent themes focused on the vaccine supply, and some specific vaccines and outbreaks related to influenza, malaria, cancer, diphtheria, whooping cough, and Zika (see Table 2 for further information).

Table 2. Most frequently trending themes in newspaper articles included in the analysis

Coverage dates (dd/mm/yy/)	Trending themes	Theme description	Frequency of articles, n (%) N = 131
03/08/2014 – 18/12/2015	Development of the Ebola vaccine	Coverage about the development of the Ebola vaccine, which was intensified after the first case of Ebola infection outside Africa which took place in Madrid, in October 2014	13 (10%)
04/09/2013 – 09/03/2016	Chickenpox vaccine crisis	The Ministry of Health limited chickenpox vaccine storage in pharmacies due to overuse. After pressure from the pharma industry and some professional associations, the Ministry decided to unblock this vaccine.	12 (9%)
10/05/2014 – 05/04/2017	Meningitis vaccine crisis	Firstly, in 2014 and 2015, the coverage focused on the Ministry decision to not dispatch the meningitis vaccine to pharmacies. After some paediatric associations criticized this decision, the Ministry decided to allow the delivery of this vaccine. Secondly, in 2017, the coverage focused on a lack of provision of this vaccine in Spain and the death of some children who had not been vaccinated.	8 (6%)

03/06/2015 – 5/08/2017	Decrease of vaccination	This coverage focused on the alarming decrease of vaccination in some European countries. Articles recalled the positive aspects of vaccination, especially in childhood.	8 (6%)
24/04/2015 – 21/05/2017	Obligatoriness of vaccination	Due to the decrease in vaccination rates and laws in other countries (Italy, France) about making vaccination obligatory, the Spanish media covered these news items and included some opinion articles about the obligation to vaccinate.	7 (5%)
26/12/2012 – 26/08/2015	Influenza vaccine	In 2012, a stock of influenza vaccines had to be taken out of market due to unexpected side effects. In 2014, coverage focused on the low uptake of the influenza vaccine in Spain. In 2015, the media covered a research project to find a universal influenza vaccine.	7 (5%)
10/11/2012 – 24/10/2015	Development of the malaria vaccine	The research into a vaccine against malaria was popular in Spain due to studies conducted by Dr. Alonso, a Spanish scientist who has conducted large projects in African countries about Malaria.	7 (5%)
15/02/2013 – 06/07/2017	Development of cancer vaccines	Media attention was given to research developments towards different research projects about new vaccines for different types of cancer.	6 (4%)
24/02/2013 – 24/02/2017	Vaccine supply	In this theme, articles about vaccine supply issues were included, such as the new vaccination schedule for children and delivery issues in low-income countries.	6 (4%)
06/06/2015 – 30/06/2015	Diphtheria vaccine outbreak	The death of an unvaccinated child due to diphtheria brought media coverage of	6 (4%)

28/10/2015 – 24/11/2015	Whooping cough outbreak	Media attention was given to a child infected with whooping cough because there was no supply of the vaccine in pharmacies and the child's mother could not get the vaccine. It was the first case since 1987 in Spain.	6 (4%)
04/02/2016 – 14/07/2017	Zika alarm	The Zika alarm, especially in South American countries, was reported by the media in relation to the development of a vaccine.	6 (4%)

Using the data from Table 1, the immunization rates in Spain were mapped against the number of articles about vaccines or vaccination (see Figure 1). Data suggests that vaccination rates increased since 2014. From 2013–2015, there was a rapid increase of the total number of articles. During 2016 and 2017, although the media reporting declined, immunization rates kept increasing. Figure 2 shows the relation between immunization rates and the articles according to the tone towards vaccination. We can see that articles with negative tone were more frequent in 2012, and that the vaccination rates decreased the year after, in 2013. Since 2013, articles with positive and neutral tones increased and were more frequent than negative ones. Since 2014, vaccination rates consistently increased. In the analysis of correlation, we found a significant and inverse correlation, revealing that vaccination rates were correlated to reporting of negative articles towards vaccination (r = -.771, p < .05), suggesting that the decrease of negative tone articles might have a positive effect on the immunization rates in the following year. We did not find significant correlations between vaccination rates and positive or neutral articles.

Figure 1. Immunization rate in Spain by number of articles in the two selected newspapers (2012 – 2017)
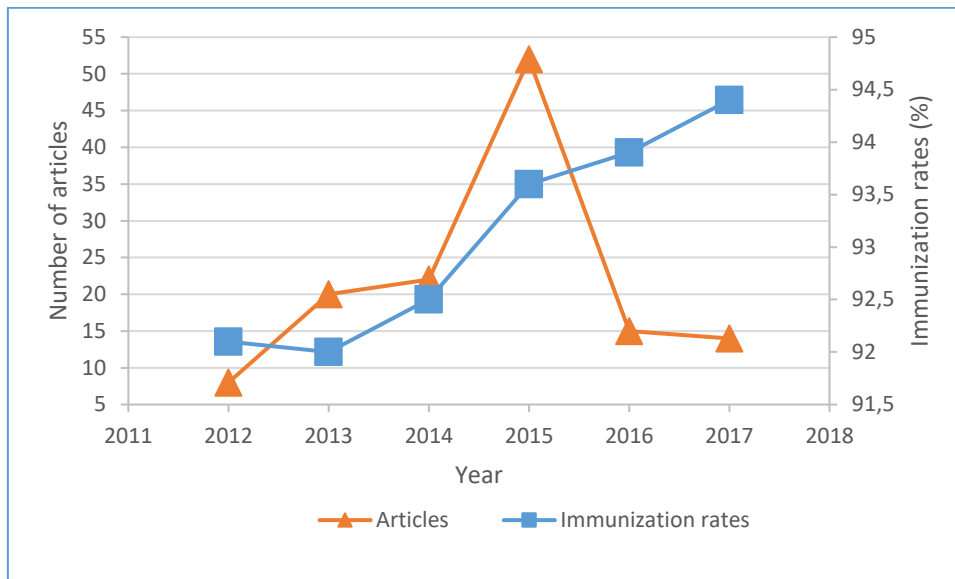
Note: Adapted from Meyer et al. (2016)

Figure 2. Immunization rate by tone of articles weighted by circulation (2012 – 2017)
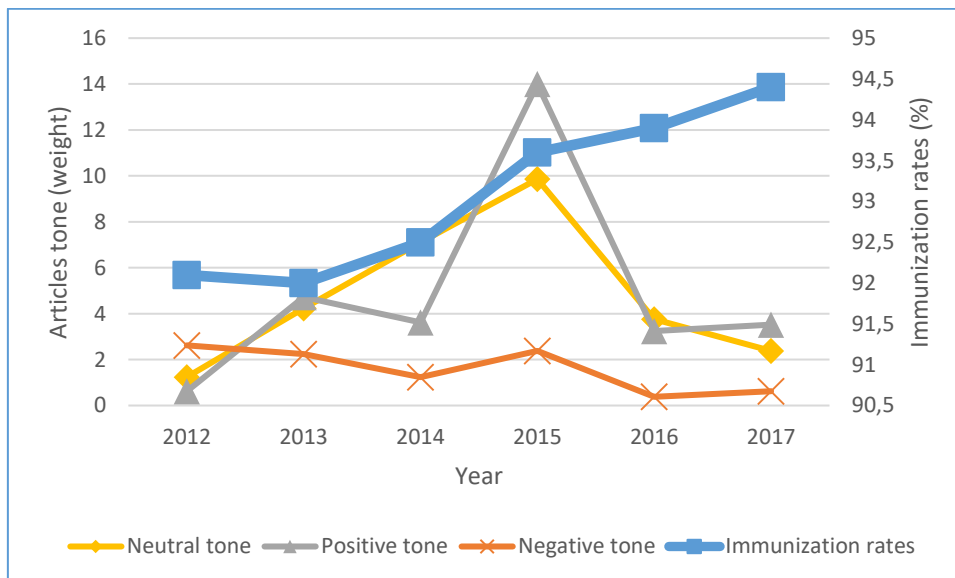
Note: Adapted from Meyer et al. (2016)

Discussion

The findings of this study reveal key facts about news articles' tone patterns towards vaccination, the most trending themes about vaccines, and the association between vaccine media coverage and the uptake of childhood vaccines in Spain. The key results that are relevant to our study's aim are as follows: a) the proportion of positive and neutral articles increased significantly since 2012; b) the tone of the majority of articles shifted from negative in 2012, to positive and neutral during the following years; c) the most commonly identified themes included the development of the Ebola vaccine, the crises of the chickenpox and meningitis vaccines, as well as the topic of the decrease of vaccine uptake in Europe; d) a significant and inverse correlation was found between the reduction of articles with negative tone and vaccination rates; and, finally, e) despite the volume of vaccine articles decreasing after 2015, vaccination rates increased. The spike in media reporting in 2015 may be explained by the diphtheria and whooping cough outbreaks, the crises of the chickenpox and meningitis vaccines, and the development of the Ebola vaccine that was very often commented on by the media because, in 2014, the first Ebola infection case outside Africa happened in Madrid.

Our study confirms other previous analyses, which also found a majority of positive messages towards vaccination (Attipoe-Dorcoo, Singh, & Moodley, 2018; Casciotti, Smith, & Klassen, 2014; Goodyear-Smith, Petousis-Harris, Vanlaar, Turner, & Ram, 2007; Hilton, Hunt, Langan, Bedford, & Petticrew, 2010; Perez, Fedoruk, Shapiro, & Rosberger, 2016). However, recent systematic reviews revealed that there is a majority of negative articles in the traditional media (Catalan-Matamoros & Peñafiel-Saiz, 2017, 2018). The reason for this might be that the analyses included in the reviews were conducted in earlier years than the years chosen for our study. In this regard, our data shows how journalists might have been persuaded to write more pro-vaccination articles. Further studies should analyse whether the public health community is carrying out more outreach to journalists or whether they were simply better educated than their predecessors.

Perhaps the most important finding of our study is that we found significant associations between media coverage and childhood vaccine uptake, as shown in recent studies (Sagy et al., 2018; Meyer et al., 2016). The bulk of articles with a negative tone about vaccination had a significant and inverse correlation with vaccination rates. A previous study that analysed the relation between the seasonal flu vaccine and vaccination rates in Canada (Meyer et al., 2016) found that any media publication about vaccines, regardless of content, influences an increase in vaccine uptake. Our study adds, for the first time, that the tone of the article might influence people's behaviour towards vaccines. Nevertheless, we would need a larger prospective study to specifically investigate this correlation to determine a more robust conclusion. In this regard, this preliminary data suggests the need for further research projects to reach a better understanding of the relationship between the characteristics of the work of journalists and vaccination rates.

Another important finding in our study is that, since 2015, reporting declined although vaccination rates kept increasing. Meyer et al. (Meyer et al., 2016) found that seasonal flu vaccine reporting influences an increase in flu vaccine uptake; a decrease of this reporting might lead to vaccination decline. Our contrary findings might be due to three possible facts: 1) negative tone articles were less frequent than positive and neutral articles towards vaccination; 2) since 2015, the media frequently reported on the positive effects of vaccination and on new laws about obligatory vaccinations in some neighbouring countries (i.e., Italy and France); and 3) in 2015, there were diphtheria and whooping cough outbreaks in Spain, and it has been demonstrated that media exposure may influence public behaviour specifically during infectious diseases outbreaks (Sagy et al., 2018).

We should acknowledge important limitations related to our study. The main limitation of our study is that, due to the ecological nature of study, we could not obtain a reason for vaccine uptake. We did not consider other additional factors and media formats that may influence vaccination. In the last decade, there has been an important shift from print to digital news, and social media are crucial for

spreading information and misinformation about vaccines. In this regard, prior research has focused on how vaccines were represented in social media (Blankenship, 2018; Faasse, Chatman, & Martin, 2016; Guidry, Carlyle, Messner, & Jin, 2015) and how misinformation is spread (Bessi et al., 2015; Del Vicario et al., 2016; Larson, Wilson, Hanley, Parys, & Paterson, 2014). Consequently, additional research is required to analyse these new digital formats and their relationship with vaccination uptake. Another limitation is that we did not conduct a readability analysis of the newspaper articles, so we cannot ensure how accessible and understandable the press reporting was for readers. Finally, we must acknowledge that our study analysed just two national newspapers in Spain during five years of coverage; therefore, our findings cannot be generalized. Nonetheless, it was not our intention to review all media in this study. Rather, we aimed to follow this novel method to analyse the association between vaccine media coverage and childhood immunization rates. Despite these limitations, we believe that our results may show the relevance of mass media in promoting childhood vaccine uptake in Spain, as well as suggesting further research which could elucidate causal relationships among the study variables.

Conclusions

This study stresses the added-value of analysing the media effects on vaccination and suggests that during vaccination campaigns the media need to be considered as an important player. Nowadays, eleven European governments have enforced mandatory vaccination programmes and others are considering adopting similar strategies. In this regard, our study shows that media monitoring by public health departments could be also included as an effective tool in future vaccination programmes, as previously suggested by Suppli et al. (2018). For this, collaboration between public health officials and media staff is important in order to develop accurate and effective information in the media about immunization. We believe that the present study expands the current understanding of media influence on vaccination and it can contribute to and inform further vaccination campaigns by pointing to the important educational role of the media in public health.

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Discussion and conclusions

Discussion

This dissertation presents theoretical and empirical research that contributes to a better understanding in the field of health communication about how we can improve public communication of medicines, and vaccines specifically. Building a basis for a health communication which can have a significant positive impact on health-related attitudes, beliefs and behaviours in relation to vaccines requires efforts especially from both the public health departments and the media. Moreover, the findings contribute to the theoretical and practical development of health journalism and communication as a profession.

These results add new knowledge to the limited understanding of media communication of vaccines in countries with little previous research in the field. It is hoped that this comparative research can contribute to the broader task of improving news media practices within and across national media systems for the benefit of their citizenries in times of anti-vaccine lobby. By using qualitative and quantitative methods from the field of media research to gain insights into the mechanism of how communication is a key player in public health, important implications for future research and practice are suggested. In fact, this dissertation provides a useful basis and will be of interest to those in the health field and the media, as well as researchers and policy makers who are trying to communicate their message about vaccines to the public. It would be immature to recommend that journalists should only report differently on vaccines and in doing so promote the social acceptance of vaccination. A number of factors conspire to make it very difficult to achieve this goal. However, I believe that by advancing understanding of the headlines patterns about vaccines, this dissertation can contribute to current public health challenges by powerful media articles which can add value in shaping public awareness. Thus, in this final chapter, I will briefly summarize what has been learned from the 10 studies composing this PhD thesis.

a. The media serve as a key resource in public health

In the literature and systematic review (studies 1-4), there is an understanding of the media as key players in the field of public health, especially in health campaigns, disease prevention and health promotion activities, as well as in health attitudes, beliefs and behaviour change. Health information is a relevant topic that brings the audience's attention, being more and more demanded by the society. The media are becoming among the first information sources for health questions, even on top of health professionals, giving the media a predominant role in public health. In this regard, a common perspective about the role of media in public health (Clarke, 2011; Meyer et al., 2016) was found that it is not suggested that journalists should become public health practitioners tasked with persuading people to be vaccinated. Rather, media can serve as a resource through which people become aware of an issue, aware of strategies to address this issue, and potentially motivated to take action depending on pre-existing attitudes and predispositions.

b. The media are shifting toward neutral and positive tone toward vaccines

Perhaps one of the most important findings in this dissertation was the significant increase of articles with both a positive and neutral tone during the study period, while those with a negative tone remained similar and low. This is indeed a relevant finding, showing how journalists are becoming aware of the importance of writing quality articles without negative messages about vaccination. This finding is in line with previous articles, which also found a majority of positive messages and a positive trend toward the reduction in alarmist anti-immunization articles (Attipoe-Dorcoo, Singh, & Moodley, 2018; Casciotti, Smith, & Klassen, 2014; Goodyear-Smith, Petousis-Harris, Vanlaar, Turner, & Ram, 2007; Hilton, Hunt, Langan, Bedford, & Petticrew, 2010; Perez, Fedoruk, Shapiro, & Rosberger, 2016). In contrast, the systematic reviews conducted in the studies 3 and 4 in this dissertation yielded more articles with a predominance of negative messages about vaccines. In this regard, it is important to note that some

common and previously noted negative messages about vaccines (Meyer et al., 2016) relay that 'the vaccine is not effective', that 'the vaccine is poorly understood by science', and that 'the vaccine may cause harm' due to claims of an association between vaccines and autism, and accusations of "toxins" in vaccines.

In this dissertation, the empirical studies revealed that in 2012, negative tone articles were more frequent than either neutral or positive ones. Although this has shifted and, eventually, the amount of negative articles are a minority, we should not rest in calm. The damage of these previous negative articles can't be solved just by shifting messages. Research has shown how the power of prior beliefs could make modifying false beliefs more difficult (Kuklinski, Quirk, Jerit, Schwieder, & Rich, 2000; Nyhan, 2010). Specifically in the field of vaccines, studies have analysed why it is complicated to reduce or mitigate false beliefs in relation to vaccine effectiveness and safety (Betsch, Renkewitz, & Haase, 2013; Nyhan & Reifler, 2015). A previous study showed that explicit attempts to correct false beliefs can fail or even backfire, sometimes leading individuals to more strongly endorse the belief (Betsch et al., 2013).

c. Including scientific data supporting vaccination is not enough

According to Andre et al. (2008), the best way to combat anti-vaccine messages about vaccines in the long term is to refute wrong allegations at the earliest opportunity by providing scientifically valid data. However, communicating scientific data is not enough. As anti-vaccine lobby is based on issues related to religion, philosophy, fear and confidence, we agree with Bricker & Justice (2018, p. 14) that a purely rational response to a belief system that values irrationality will not sufficiently address the problem of vaccine skepticism. In fact, in the empirical studies of this dissertation, most positive articles described scientific facts and research projects to support vaccines and vaccination. However, Shelby & Ernst (2013, p. 1799) suggested that pro-vaccine articles should not only focus on scientific data but also on story-telling which has been widely used by anti-vaccination activists. Another effective strategy that has been identified

(Moyer-Gusé, Robinson, & Mcknight, 2018) is the use of humor for reducing resistance to persuasion among individuals who endorse false beliefs regarding the vaccine safety vaccine. These are just examples showing how further communication strategies not only should focus on providing scientific facts as they should understand the tactics of the anti-vaccination activists that with poorly scientific basis can convince a generation of parents about the vaccine dangers. Pro-immunization articles must be "responsive to the needs and attitudes of [their] audience," accounting for the fact that humans are not always logical, calculating, or rational (George & Selzer, 2007, p. 125). In this regard, we should note that vaccine decision making is a complex construct including factors such as access to healthcare services, risk perceptions concerning the disease or the safety of the vaccine, social models and trust (Arriola et al., 2015; Bish, Yardley, Nicoll, & Michie, 2011; Freimuth, Jamison, An, Hancock, & Quinn, 2017; Quinn et al., 2017).

d. Headlines and lead paragraphs should be carefully elaborated

As it is well known, headlines and lead paragraphs are powerful elements in any media article, and frequently, they are the only text that it is read by the public. In the study 6, it was found that the headlines that were analysed about vaccines included a mean number of 8.5 words. As it has been suggested that a headline should not be longer than 10 words to ensure clarity and a higher impact in readers (Gómez Mompart, 1982), we can determine that the length was appropriate. Moreover, the use of the term *experts* in headlines was frequent. Science journalists often quote different experts in a variety of ways, but they consider scientists to be particularly credible and more reliable than other types of sources (McIntosh White, 2006). In relation to the term *parents*, that was the second most frequent one, as they represent the key actors in childhood vaccination, we believe that including this group of population in the headlines might be an effective strategy to attract their attention. In this regard, previous authors (St. John, Pitts, & Adams Tufts, 2010) stated that science journalists tend to prioritise information from institutional sources within the government and business spheres, and that citizens are paid little attention in news construction.

Guidelines for public/civic journalism (Haas, 2007) suggest the use of additional views beyond scientific experts to aid in improving issues of civic participation. Recognising other players can mark the entrance of new topics and views, which might be supported by the findings in study 6 as experts and parents have been found among the most cited terms in headlines and lead paragraphs.

e. Use a variety of sources

The study 7 shed light on the selection of sources. These findings contribute to the theoretical and practical development of journalism. The data analysed for this study illustrate that the type of sources whose voices are heard are related to "government scientific organisations" such as the National Public Health Institute (Instituto de Salud Carlos III), to "professional associations" such as the Spanish Association of Pediatrics, to "government organisations" where politicians voices are included, to "scientific companies" representing the industry, and to "university scientists". These findings are supported by Schudson (1996; 2012), who stated that news is generally dominated by institutional and political sources. This could be so because business and institutional sources tend to be attractive for journalists, as they are easily accessible, well-resourced and provide a regular supply of information (Cottle, 2003). The over-representation of certain source types, especially governmental, may illuminate state structures of power. Previous authors (St. John et al., 2010) stated that science journalists tend to prioritise information from institutional sources within the government and business spheres, and that citizens are paid little attention in news construction. This is also aligned with our findings, as sources related to civil society, "NGOs" and "consumer groups" represented less than 5% of the total number of sources.

An important practical measure to improve sources use in coverage of vaccines could be to train and inform journalists on the variety of sources they could use, alongside the provision of some advice. This kind of training might be important, because some researchers have suggested that journalists could also seek out sources who are most like themselves, and avoid quoting those sources who

disagree with their own ideas (Donsbach, 2004). Therefore, we believe that by advancing understanding of the sourcing patterns about vaccines, our study can contribute to current public health challenges in times of anti-vaccine lobby.

Another point that should be taken into account is the number of sources used in the articles. The use of multiple sources has been supported by different authors as a way of bringing more balance to, and better checks on, the views presented (Guenther, Bischoff, Löwe, Marzinkowski, & Voigt, 2017; Holtzman et al., 2005). In contrast, the use of none or only one source has been critiqued (Tiffen et al., 2014), as the view of the story could be unchallenged and unbalanced. In the present study, we found that each article included almost three sources on average; this figure is higher than that yielded by a recent study which found two sources on average, but in the coverage of Belgian health news in general (Stroobant, De Dobbelaer, & Raeymaeckers, 2018). However, more than 30% of articles included none or just one single source. The danger of this generation of stories is that the news media may act simply as passive conveyors of dominant sources' views. Although systematic research on this phenomenon is lacking (Salgado & Strömbäck, 2012) to discern whether it is most appropriate including more sources to ensure the principle of balance, media have been accused of giving equal balance or weight to unfounded claims about the MMR vaccine (Lewis & Speers, 2003). Therefore, it is not suggested that the principle of balance be applied between sources with a high degree of scientific consensus and others failing to reflect any scientific evidence (Elías, 2015).

f.   Promote the health specialty in journalism and communication

The present dissertation may contribute to the theoretical and practical development of journalism studies. This systematic analysis of health-specialised journalists that was done in study 8, one of the first of its kind, characterises how those with a health journalism specialty perform differently from those without such a specialty. These findings show key journalistic patterns in the coverage of vaccines and confirm that health journalists perform differently in terms of journalistic genre, tone of the article, sources and length of the article. More

specifically, the content analysis shows that health journalists, in comparison with other authors, write more features and less opinion articles, from a more neutral perspective, using a wider number of sources from the scientific field, especially from professional associations and scientific journals.

Health-specialised journalists significantly wrote more "feature stories" – a style which is more used by health journalists, and "opinion articles", which are more used by other authors. "Feature stories" are more elaborated narrative stories relying upon objectivity and subjectivity to make an emotional connection with the readers; they are, however, truthful and based upon facts and expert sources (Garrison, 2010). In contrast, opinion articles mainly reflect the author's opinion and thus objectivity and expert sources are not mandatory. Moreover, findings confirm that health journalists tend to write in a more neutral tone, while other authors write in a more positive tone towards vaccines or vaccination. Writing health articles in a positive tone has received criticism (Amend & Secko, 2012) as it is a tendency that can mislead messages about research findings. It is also relevant to point out that the negative tone was less frequent in both groups.

Another point that should be taken into account is the length of the article, as our findings indicate that health journalists write longer articles. This is relevant because nowadays there is less space to tell a story in traditional media outlets (Kennedy, LaVail, Nowak, Basket, & Landry, 2011) and thus the number of words may be limited because of external factors. However, we could also reflect that this imbalance in article length may indicate inequivalent amounts of elaboration across conditions in terms of offering deeper analyses of health issues, such as providing facts, context, bias and mobilising messages for the public. Moreover, it is interesting to confirm different sourcing patterns between both groups of authors. First we found that professional associations and scientific journals were used most commonly by health journalists. This is not surprising, as both types of sources may require a thoughtful knowledge of scientific literature and databases. For example, searching, reading and understanding scientific papers is not an easy task for journalists; this is a specific subject for the training of health journalists. These findings are aligned with previous research which pointed out

that health journalists working in national media organisations have a great reliance on scientific journals and use them frequently, especially to find their initial idea (Viswanath et al., 2008). Another important fact is related to the number of sources used in each article, since health journalists included, in general, two or more sources in their articles. The use of multiple sources has been supported by different authors as a way of bringing about more balance and better checks on the views presented (Guenther et al., 2017; Holtzman et al., 2005). In our study, the other authors differed from this; indeed, the findings showed that approximately 50% of articles used none or only one source. Not presenting a range of expert opinions has been criticised (Holtzman et al., 2005), as the danger of this generation of stories is that the news media may act simply as passive conveyors of dominant sources' views. This line of criticism has been previously cited under the concept of "churnalism" (Johnston & Forde, 2017), where pressure on journalists to speed up and escalate their production of news leads to les balancing and verifying of different views. Collectively, these findings provide insights into the process of health journalism, and identify potential aspects to further develop the profession for the broad dissemination of health news to the public.

g. Use a variety of visual resources

Data from the study 9 shows what type of imagery people will encounter when they seek or find vaccine information in newspapers. We found a clear dominance of the photography in articles about vaccines, which shows how this visual resource is still very much used in the print press regardless of the rapid development of the digital technology. Our findings confirm a previous study (Arriaga Silva, 2017) that revealed that photography is still the most common visual element in the print press. It was surprising to find a low usage of infographics and tables with data. The use of these graphical resources for data displays has been recommended (Lipkus, 2007), however it seems to have been ignored in our sample of print coverage about vaccines.

The theme analysis revealed that images showing health professionals vaccinating babies were more frequent. This finding is aligned to a previous study(Chen & Dredze, 2018) that found that the images in Twitter about vaccines were about the injection and babies. This is not surprising as the most representative and effective use of vaccines is found in childhood, and these images may also suggest audience segmentation. In this regard, demonstrating actions or behaviours could likely model certain behaviours based on the social cognitive theory (Matusitz & Breen, 2011) which helps us understand the psychosocial mechanisms of how symbolic communication influences human thought and actions. As the potential effect of images is well known, these findings may provide us with useful data on how the topic is perceived by the general population, and can inform future planning, implementation and evaluation of effective health promotion campaigns.

h. Media coverage of vaccines may influence vaccine uptake

This dissertation stresses the added-value of analysing the media effects on vaccination and suggests that, during immunization campaigns, the media should be considered as an important player. In the study 10, significant association between media coverage and childhood vaccine uptake was found, as earlier shown in recent studies (Sagy, Novack, Gdalevich, & Greenberg, 2018; Meyer et al., 2016). The bulk of articles with a negative tone about vaccination had a significant and inverse correlation with vaccination rates, indicating that less amount of negative messages about vaccine is associate to more vaccine uptake. A previous study that analysed the relation between the seasonal flu vaccine and vaccination rates in Canada (Meyer et al., 2016) found that any media publication about vaccines, regardless of content, influences an increase in vaccine uptake. Our study adds, for the first time, that the tone of the article might influence people's behaviour towards vaccines. Nevertheless, we would need a larger prospective study to specifically investigate this correlation to determine a more robust conclusion. In this regard, the analysis shows that media monitoring by public health departments could be also included as an effective tool in future vaccination programmes, as previously suggested by Suppli et al. (2018).

i. Collaboration between health professionals with journalists and media experts

To prevent misinformation which seriously impacts in vaccine uptake, public health officials implementing vaccination programs should develop a close collaboration with journalists and the media to providing accurate and relevant information. Journalists should be considered as an important target group during public health campaigns in order to conduct effective communication strategies. In addition, collaboration with professional artists and designers is also relevant who may be able to create a more effective visual content as well as identify design or content characteristics that accurately add to important paradigms like attractiveness or cultural appropriateness (King, 2015). Our analysis shows that, after 2012, the positive and neutral tone significantly increased whereas the negative tone remained the same during the whole study period. This could be a sign of how journalists have become more aware about vaccines as an important public health challenge. In fact, this could be an achievement of public health strategies towards journalists as it has been previously suggested the need for an effective collaboration of researchers, health care providers, and policymakers with journalists to disseminate complete and accurate vaccine information (Perez et al., 2016).

Limitations

Despite these interesting findings, some potential limitations of the study should be taken into account. The most important limitation is that the analyses was conducted on print media, newspapers, and consequently additional research is required to analyse other new digital media formats. Although the growth of online media, traditional media are not dead and still play an important role in the communication landscape (Belch & Belch, 2014). In fact, traditional media have been in existence for long and are still a main medium of communication in many regions of the World. For example, in India traditional media yet occupy an important role in the delivery of messages to a large number of people

(Mathiyazhagan, Kaur, Ravindhar, & Devrani, 2015). Furthermore, we agree with Meyer et al. (2016) that newspapers can be a rather good indicator, thereby providing insight into what could be felt elsewhere.

Another aspect is that we must acknowledge that our study analysed two national newspapers in Spain during five years of coverage. Therefore, our findings cannot be fully generalized in the entirely media landscape. Nonetheless, it was not our intention to review all media in this study. Rather, we aimed to provide new knowledge and a solid starting point that may contribute to future research in the field.

In relation to the studies 2, 3 and 4, undertaking systematic reviews implies significant limitations according to the search strategy followed, such as what search terms and databases have been selected. Although we tried to use large databases and include as many search terms as possible, we should acknowledge that these systematic reviews might not cover all scientific literature. In addition, the systematic reviews did not include studies analysing online social networks (i.e., YouTube, Facebook, or Twitter). In spite of this limitation, to our knowledge, these are the largest systematic reviews to date analyzing the use of media for public communication about medicines and vaccines.

In the empirical studies, the search in the national newspapers in Spain was only for the keywords to be in the headline or subheadline, and so we would have missed some articles. However, even if this were the case, the rates of missed coverage would be very low, and the fundamental conclusions remain. Another limitation is that, within the statistical analysis, we should be cautious about some of the results included in the study when the N was especially small for example in the tone comparison.

Further research

There are plenty of future research thinking resulted from this Doctoral Thesis. A fascinating research project would be to conduct the content analyses on other

types of media such as in television and radio, as well as in Internet and social networks (i.e. Twitter, Facebook and Instagram). In this way we could get a broader perspective of the media coverage of vaccines that could help to determine where the anti-vaccine lobby is more active. Indeed, our current research suggests that vaccine related news are currently presented in a positive and neutral manner that covers a wide range of issues with a broad variety of sources, according to the print edition of the two largest national newspapers in Spain. Therefore further research should identify whether the anti-vaccine lobby is more frequent in other media types. In fact, if vaccine trust and vaccination ratios are decreasing, these findings become especially relevant to further public health campaigns considering strategies not only with regard to traditional media, such as newspapers, but also other new media outlets, such as social networks. In this regard, 88% of millennials get their news from social media (Gollust, LoRusso, Nagler, & Fowler, 2016), and in the last decade, there has been an important shift from print to digital news. In this regard, additional research is required to analyse these new digital formats and their relationship with vaccination uptake.

This dissertation has shown that journalists might have been persuaded to write more pro-vaccination articles. Thus, further studies could analyze whether the public health community is doing more outreach to journalists or whether they were better educated than their predecessors. By interviewing journalists, we could may shed light on these issues. Further research could also focus on the effects that different communication strategies have on the culture or on public understanding of vaccines.

Another research field for further research would be to explore other geographical areas especially in non-English speaking countries and low-income countries. The systematic reviews conducted in the studies 2, 3 and 4 showed that there is an increasing need for analyses of public communication of medicines in low-income countries because laws regarding public communication on medicines (i.e. advertising) are rarely implemented in these countries due to lack of commitment and resources on the part of the law enforcement departments

(Byarugaba, 2004). In fact, according to our systematic review, the characteristics and outcomes of public communication of medicines in low-income countries is currently unknown.

A suggestion for further research could be the need for further experimental research on the influence of the use of visual contents (i.e. various visual designs) and message presentation strategies in the health communication context of vaccines. This research could illuminate what communication strategies could be more effective for influencing attitudes, beliefs and behaviour change.

Conclusions

In this concluding chapter, the most relevant contributions of this Doctoral Thesis are summarized giving new insights into the fields of public health and the media.

1. The media serve as a key resource in public health and should be considered as key players in any public health campaign.

2. More research on public communication of medicines and vaccines is needed in other media formats beyond newspapers, such as in television and radio.

3. Media coverage of medicines and vaccines in low-income countries is almost unknown from the research perspective.

4. The tone of the articles published in the media is shifting toward positive and neutral ones toward vaccination, whereas negative ones remain low.

5. Publishing scientific data supporting vaccines is not enough, other communication strategies such as story-telling and humour should be used.

6. The specialty of health journalism allows journalists reporting quality vaccine-related articles in terms of sourcing, genre, tone of the article and depth.

7. Institutional, political and business sources are frequently used in the media coverage of vaccines which may illuminate state structures of power.

8. Photography is the most common visual resource used in the media coverage of vaccines. In contrast, infographics and tables with data are rarely used.

9. The media coverage of vaccines and the tone of articles toward vaccination may influence vaccine uptake.

10. Finally, public health officials implementing vaccination programs should develop a close collaboration with journalists and the media to providing accurate and relevant information.

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Appendix

All stories used in sample

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