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

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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 2001-2017. 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.

Keywords

Media; medicines; communication; review.

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, 2114). 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 (WHO, 2006).

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.

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 (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.

Under-representation 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 bour 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, Hochman, Bor, and McCormick (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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Figure and table captions

- Figure 1. Prisma flow diagram
- Table 1. Search strategy in PubMed
- Online supplementary table 1. Characteristics of the selected studies
- Online supplementary table 2. Outcomes and conclusions of the selected studies

Figure

Figure 1. Prisma flow diagram

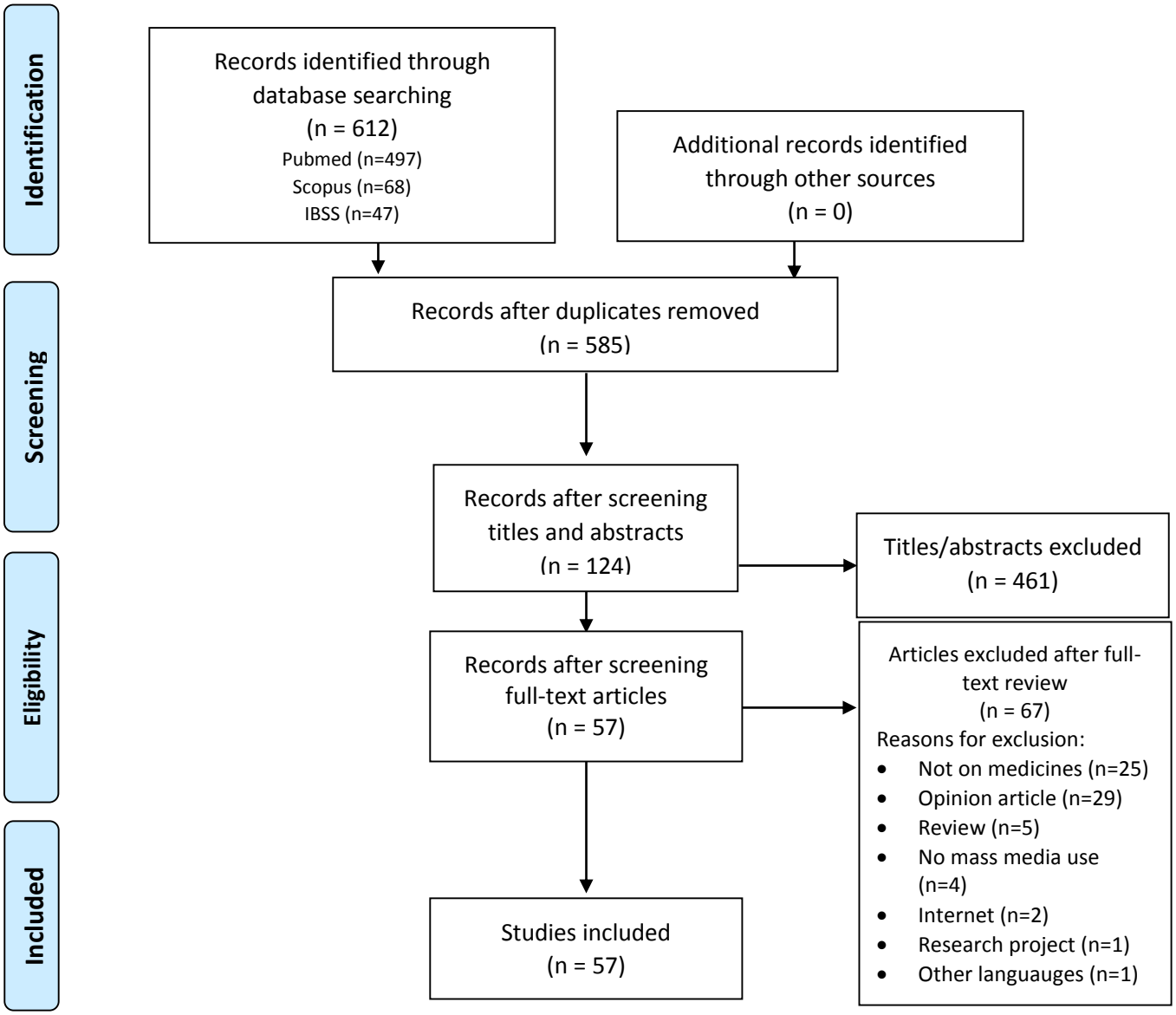

Table 1. Search strategy in PubMed

	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

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 affects future consulting intentions, while maintaining parental satisfaction with care

				infections antibiotics	
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, Hawwa, & McElnay, 2013	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
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	To examine emerging social representations of PEP

				(PEP) after HIV risk	
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, Choi, & Lee, 2007	US	Magazines	Advertising	Prescription drugs	Identify and quantify the race, gender, and age of all models featured in four magazine genres' DTCA
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 pain, heart	Examine the effect of adding placebo rates and framing to DTCA

				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 assessment
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, 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.	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 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 ($p<0.05$)	These results extend previous research to a new health condition and hold implications for regulatory policy.	1++
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, & Dahm, 2010	CA	Type of advertisement, claims of effectiveness, references of research studies, inducements, and use of tables, figures, and pictures	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 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.	DTCA of prescription drugs for urological conditions are found in select journals and focus on few highly prevalent conditions. None of 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.	2+
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	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+

				ratio 0.34; 0.20 to 0.57). Satisfaction, reassurance, and parental 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 comments and 51 individuals 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 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.	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+
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	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 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	2+

		to adherence and the main source of adherence information. Aarticle slant.		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.	knowledge regarding the importance of medication adherence; this potential is not being realised at present.	
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 satisfaction with antihyperglycemic medication information.	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 with medication information and diabetes distress achieved in the iDecide group at three months translate into better longer-term diabetes outcomes.	1+
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 newspaper editors who indicate that their articles	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 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%-	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+

		report pharmaceutical company f unding; the editors who indicate that their articles refer to medications by generic names; and the newspapers with policies about these issues.		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 emphasis of those messages in a press statement.	2+
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 “improved availability or no shortage”	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 referred to the shortage of medicines, 97 (26%) reported no shortage or alleviating of concerns.	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 alleviation of the shortages of medicines. The analysis provides evidence of negative effects of the sanctions on access to medicines in Iran.	2+
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, Choi, & Lee, 2007	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. 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.	Implications for targeted use of magazine genres as a means of providing health information to specific populations are discussed.	2+
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	Observational	Rate of weekly cervical screening tests	3 media campaigns analysed	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+

Niederdeppe et al., 2013	Survey	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'Donoghue et al., 2016	Focus groups and survey	Perceived efficacy likelihood, perceived efficacy magnitude, perceived risk likelihood, perceived risk magnitude, perceived clarity and trust in information	38 in focus groups, and 1629 survey	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 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.	There are gaps in general knowledge about both FDA procedures generally and composite scores specifically.	2++
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 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.	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+
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	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	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	2+

		content, which included whether the news article provided reasons for and/or against getting the vaccine, The theme of the article was coded as descriptive, supporting the vaccine, questioning the vaccine, or presenting both sides.		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.	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.	
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 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.	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+
Schnellinger et al., 2010	RCT	Proper antibiotic use survey to three groups: control, pamphlet and video.	84 participants	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, & Andrews, 2013	Survey	What flu clinic media sources were visualized and if they encouraged them to obtain vaccination.	721 students	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 source of information visualized had a moderate to strong influence over their decision to get vaccinated.	Various communication channels should be utilized to increase influenza vaccination rate on a university campus. Use of mass media to influence college students to perceive, retain, and act on the message of obtaining the influenza vaccine did produce a noteworthy outcome.	2+
Singh et al., 2016	CA	How many articles included the term “evolve” and analyzed how	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	This study highlights the globally low usage of the word “evolve” in the popular press. Authors suggest this low usage	2+

		this varied with newspaper, country, and time		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.	may affect public understanding and acceptance of evolutionary concepts.	
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 by 12% ($p<0.001$). The increase was largest among the Cantonese-speaking seniors (27%), followed by the Mandarin (8%) and Italian seniors (4%, $p<0.001$).	The radio campaign was effective in increasing awareness and knowledge of QUM among seniors. However, the effectiveness of the campaign varied between language groups.	2+

Turner, Boudewyns, 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	Survey	Ability to recall and recognize information from the drug ads	180 participants	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 scientific articles	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 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.	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 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.	2+