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Latin American Anatomists' views on human body dissection and donation

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ABSTRACT

Background: Studies abound regarding the medical students' views on the importance of anatomy and the dissection of human bodies, but little is known about the views of Latin American Anatomists.
Methods: A survey was carried out to test several hypotheses among anatomists of the Americas about how they perceive their professional identity, the use and role of dissection in their undergraduate courses, and the approval degree of bequeathing their body for anatomical teaching/research; another goal was ascertaining to what extent their attitude on these topics depended on gender, length of teaching experience and belief in the afterlife.
Results: One hundred and forty-five anatomists from thirteen Latin American and Caribbean Countries took the survey; 79% stated the main role of an anatomist is teaching; 34% recorded their undergraduate students dissected human cadavers as part of their anatomy lab course—undergraduates dissecting less in the less experienced anatomists' courses ($p = 0.0002$). Most anatomists said dissection was a training tool for undergraduate students, a tool for developing professional skills, and a tool to help control emotions—most experienced anatomists stood out from the rest saying dissection is only to teach anatomy ($p < 0.001$), even if such response was the least valued by them among all replies. Men differed from women in valuing dissection as a tool to help control emotions ($p = 0.006$); less experienced anatomists held the opposite ($p < 0.0001$). Approval of a close doctor-patient relationship diverged, being different between the most and the least experienced anatomists ($p = 0.01$). Anatomists said they would donate only their organs (44%), whole body (9%) and both organs and body (46%). Undecided anatomists about the belief in life after death were the least in favor of donation ($p = 0.05$).

1. Introduction

There is consensus that medical science cannot do without anatomical knowledge (Bergman et al., 2011; Sugand et al., 2010). The teaching of anatomy, in turn, would remain unfinished without dissection. Human cadaveric dissection has been the cornerstone of gross anatomy teaching/learning for centuries, making an integral component of medical education (Elizondo-Omaña et al., 2005). Yet dissection-based teaching alone cannot meet all the needs of a contemporary medical curriculum and needs to be supplemented by newer teaching/learning methods (Ghosh, 2017; Korf et al., 2008). The interdependence of the different teaching/learning methods and techniques in anatomy that forms the crux of the educational model, with human cadaveric dissection at its core, is probably the future of anatomical science education. Human cadaveric dissection is a tool that can stimulate a clear desire to maintain a humanitarian attitude in the practice of medicine (Gustavson, 1988). But undergraduate students in anatomy labs have cognitive-motor reactions to cadavers and death; such reactions are mainly conditioned by the immediacy, novelty and severity of the experience, though they decrease over time in normal personalities (Arráez-Aybar et al., 2007; Biasutto et al., 2019a; Boeckers and Boeckers, 2016; Casado et al., 2012; Greene and Rosen, 2021; Plaisant et al., 2011; Rahman et al., 2016;

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Romo Barrientos et al., 2019; Wong et al., 2021). Still, how much human cadaveric dissection is done in the degree of Medicine today? Is the role attributed to dissection beyond learning about the anatomy of the human body? Can dissection imbue medical undergraduate students with skills and attitudes concerning professionalism? Does the student-cadaver relationship modulate the future doctor-patient relationship? What are the perceptions that anatomists hold about themselves and dissection?

This paper offers the results of a survey on a sample of university anatomists from Latin America and the Caribbean (hereinafter Latin American as a whole) on issues related to (a) anatomists' self-perceived professional role, (b) how many anatomists ask students to do human cadaveric dissection as part of the medical training, (c) benefits of the dissection practice, (d) undergraduate students' emotional response to cadavers in the lab, and (e) anatomists' willingness to donating their own body for anatomical examination. Another goal (f) was to determine the extent to which anatomists' discernments on these issues were dependent on the self-perceived gender, temporal span of their teaching experience, or belief in the afterlife. The results of the present study are aimed as well to complement a previous one carried out on anatomists from 29 Countries, mainly from Europe and Asia (Arráez-Aybar et al., 2014 [to avoid self-quoting, this reference shall be cited as "Global Survey" hereafter]) as well as others on the opinion of physicians and surgeons on akin topics (Arráez-Aybar et al., 2021 [to avoid self-quoting, this reference shall be cited as "Physicians Survey" hereafter]; Arráez-Aybar et al., 2010). Thus, the results of the present study might strongly add to building a global vision of the state of gross anatomy, dissection, and anatomists in the first two decades of the 21st century. The defined objectives and working hypotheses of the study are detailed in the following.

1.1. Objectives and hypothesis

I. Knowing the anatomists' perceptions about their professional identity/ activity. The working HYPOTHESIS here was that Latin American anatomists would perceive themselves as teachers.
II. Investigating to what extent the human cadaveric dissection is currently carried out by undergraduate medical students as part of anatomy courses. HYPOTHESIS: Dissection would be little used by most Latin-American anatomists in their regular undergraduate courses.
III. Expanding knowledge about the professional perception of the usefulness of human cadaveric dissection in the teaching of gross anatomy in medical undergraduate. HYPOTHESIS: Latin American anatomists would think that dissection transmits not only anatomical knowledge, but also other important skills and attitudes in the formation of integral professionals.
IV. Subsidiary to the latter objective, the authors wished to find out the Latin-American anatomists' opinion about whether the experience of dissecting helps to control the students' emotions, and the need to prepare students emotionally before performing their first human cadaveric dissection.
V. Expanding knowledge about the anatomists' perception of possible influences of dissecting human bodies on the future doctor-patient relationship. HYPOTHESIS: Latin American anatomists would consider highly that the attitude of students towards the cadaver during dissection conditions the students' future attitude towards the patient.
VI. Willingness to donate body organs or one's own body. HYPOTHESIS: Latin American anatomists would approve donating their own bodies for anatomical teaching.
VII. Another aim was to determine the extent to which anatomists' attitudes on these issues would be dependent on gender, the temporal span of their teaching experience, and the belief in the afterlife. NO HYPOTHESIS was raised for it.

2. Materials and methods

This study was approved by the Ethical Committee of *"Hospital Clínico San Carlos"* of Madrid, Spain (E-13/262).

2.1. Methodology

An online survey was carried on by means of a questionnaire constructed using Google Forms©. Most of the content of the questionnaire (Survey Questions 4–11, see Supplementary Data) was akin to that of other questionnaire previously validated by peer-reviewed, published studies (Arráez-Aybar et al., 2004 [cited as "Spain Survey" hereafter; see also "Global Survey"). An item was added to the present questionnaire to explore the anatomists' opinion on the own body donation (Survey Question 12). The Survey Questions sought to obtain data on the practice, and consequences, of dissection undertaken by undergraduate students and the opinions of anatomists about themselves, donating their own bodies, and body organs. The respondents' belief in life after death was also pondered. Two different parameters were considered for the analysis of each item: teacher's gender and teacher's teaching seniority. In addition to guaranteeing anonymity and confidentiality, vulnerable groups were not included in the survey and participation was voluntary and consensual.

The Questionnaire was made available to members of the different American national scientific associations of Human Anatomy during the month of October 2020 (Questionnaire can still be seen at: https://docs.google.com/forms/d/e/1FAIpQLSdo9kC9y1ni7AFbs3Y3QvPcZBaukdUpcpm9l0i5ABkINqvQ0w/viewform?vc=0&c=0&w=1&gxids=7628).

2.2. Statistics and data analysis

To provide descriptive statistics for all responses in this study, categorical variables were analyzed using the X^2 Test. When the X^2 Test was not suitable, because the frequency of any of the cells was less than 5, Fisher's Exact Test was employed. In both cases, differences were considered significant when p-values were ≤ 0.05 (95% confidence level). The possible influence of the length of teaching experience on teachers' opinions was analyzed by dividing the survey's respondents into four Teaching-Experience Subgroups (hereafter named TE Subgroups, and numbered TE-1S–TE-4S). TE-1S encompassed anatomists having a maximum of five years teaching experience; TE-2S included anatomists with teaching experience between 6 and 12 years. Teaching experience of anatomists belonging to TE-3S extended between 13 and 20 years. Anatomists within TE-4S had 21 and more years of teaching experience.

Finally, the ordinal nature of the variables for some items (Likert-type Scales) required the use of nonparametric analytical methodologies. Thus, to analyze differences between TE Subgroups the H Test of Kruskal–Wallis was used in the present study. Furthermore, to compare the responses of men and women, the Wilcoxon Rank Sum Test was used here. The latter Test was also employed to correlate the survey respondents' belief in the afterlife and willingness to donate their own bodies/body parts. Some data are described by mean ± standard deviation. The statistical package used was SPSS® v.18.0.

3. Results

A total of 147 anatomists responded the survey, of whom 145 anatomists answered all or almost all questions. Results reported here come from the 145 fully or nearly fully answered questionnaires. The valid response rate was therefore 99%. In the survey respondents were offered the possibility of self-assigning themselves to the masculine ("Man") or feminine ("Woman") gender,

together with the implicit possibility of not choosing either of them, or both. Out of the 145 respondents, 96 (ratio, 66%) identified themselves as being “Man” and 49 (34%) “Woman”. The 145 valid questionnaires came from 13 Countries (Argentina, Brazil, Chile, Colombia, Costa Rica, Cuba, Honduras, Mexico, Nicaragua, Paraguay, St-Kitts-and-Nevis, Uruguay, and Venezuela). Mean age of the 145 respondents was 39.2 ± 14.2 (S.D.) years. Respondents’ mean experience period as a teacher of human anatomy was 14.7 ± 12.3 years (median = 10 years; range = 1– 47 years). The answers of the 145 respondents were distributed by Years-of-Teaching-Experience Subgroups 1–4 (TE Subgroups, see Materials and Methods Section of above). Fifty-one respondents fit in TE-1S (men 49%, women 51%; n = 25 and n = 26, respectively); 27 in TE-2S (men 67%, women 33%; n = 18 and n = 9); 25 in TE-3S (men 84%, women 16%; n = 21 and n = 4); and 42 in TE-4S (men 76%, women 24%; n = 32 and n = 10). The description of results that follows is structured in Subsections that keep on the order of Survey Questions 3–13 (see Supplementary Data).

3.1. Anatomists asking their undergraduate students to dissect human bodies as part of the laboratory activities

Table 1 shows results to the Survey Question 3. Concisely, 49 respondents as a group (ratio, 34% of 145) said their undergraduate students dissected human cadavers in the anatomy course. The Subgroup with the shortest teaching experience (TE-1S) had the lowest percentage for this response, which was statistically significant. There was no statistically significant difference between responses across Gender Subgroups.

3.2. Role attributed to the dissection of the human body in the medical undergraduate

The highest average scores corresponded to responses backing that dissection was “Instrument for professional training” ($\bar{X}$ = 4.5 ± 1.0; Likert-type Scale, where "0" was “total disagreement” and “5” “total agreement”). ”Instrument to develop professional skills” ($\bar{X}$ = 4.2 ± 1.1) and “Source of medical research” ($\bar{X}$ = 4.2 ± 1.2). The next high average score was associated with the response “To help to control emotions in the future doctor” ($\bar{X}$ = 2. 9 ± 1.7). "A tool only useful for teaching/learning Anatomy" obtained low scores in all Subgroups ($\bar{X}$ = 2.1 ± 1.9). Differences between the scores for each of the last two answers ("To help control emotions in the future doctor", on the one hand, and "A tool only useful for teaching/learning Anatomy", on the other) were statistically significant across Subgroups, both TE and Gender. Upper section of Table 2 shows this and other result details to Survey Question 4.

Table 1
Do your medical undergraduate students dissect human cadavers as part of the lab activities? (Survey Question 3).

Years-of-Teaching-Experience Subgroups (N = 145)	**Yes (N = 49; 34%)**
TE-1S (n = 51)	6 (12.2%)*
TE-2S (n = 27)	13 (26.5%)
TE-3S (n = 25)	13 (26.5%)
TE-4S (n = 42)	17 (34.7%)
Gender Subgroups (N = 145)	**Yes (N = 49; 34%)**
Woman (n = 49)	12 (24.5%)
Man (n = 96)	37 (38.5%)

Data are shown, in frequencies and percentages, for two sets of Subgroups. Namely, the Years-of- Teaching-Experience Set contains the TE-1 Subgroup (≤ 5 years of teaching experience, TE-1S), the TE-2 Subgroup (6–12 years of teaching experience, TE-2S), the TE-3 Subgroup (13–20 years of teaching experience, the TE-3S) and the TE-4 Subgroup (> 20 years of teaching experience, TE-4S). The Gender-Subgroups Set consist of the Man Subgroup and the Woman Subgroup.

* Percentage being significantly different from those of other TE-Subgroups (p = 0.0002).

3.3. On the nature of human cadavers

Table 3 shows results to Survey Question 5. In summary, a cadaver in the dissection lab was "A being that once lived" rather than "An inanimate object" for most respondents. Responses to this question did not result in a statistically significant difference between TE or Gender Subgroups.

3.4. On the need to emotionally prepare students for dissection

In the following are the results to Survey Question 6, which are not shown in any Table. The requirement to emotionally prepare students for dissection was supported by 46.2% of the respondents (n = 67; of whom men were 72% and women 28%), whilst 14.5% of the respondents did not assume the need (n = 21; men 76%, women 24%) and 39.3% were not sure (n = 57; men 56%, women 44%). There was no statistically significant difference between TE or Gender Subgroups.

3.5. Students’ best way to express emotions in the dissection room

Results to Survey Question 7 are not shown in any Table either. To this Question, i.e., “What do you consider to be a student’s most appropriate behavior in the dissection room?”, most respondents responded, “To express their emotions in a controlled manner” (ratio, 73%; n = 106 of whom men were 67% and women 33%). The next preferred answer was “To openly express their emotions” (21.5%; n = 31, men 61%, women 39%). “To not express any emotions” was the least picked response (5.5%; n = 8; men 75%, women 25%). There was no statistically significant difference between TE or Gender Subgroups.

3.6. Student’s attitudes during dissection as a predictor of future attitudes towards patients

The results to Survey Question 8 are not shown in any Table either. The affirmative response to the Question, “Does the student’s attitude facing dissection condition their future attitude towards the patient?” was backed by 38% of respondents (n = 55; of whom men were 64% and women 36%), whilst 21% (n = 31; men 71%, women 29%) said “No” and 41% (n = 59; men 66%, women 34%) said they were not sure. No statistically significant difference between TE or Gender Subgroups was uncovered.

3.7. Appropriate degree of emotional proximity in the doctor-patient relationship

The average score of all responses was 7.1 ± 1.8; Likert-type Scale, where "0" was “total disagreement” and “10” “total agreement”. Table 4 shows results to Survey Question 9 for each of the TE and Gender Subgroups. It is emphasized here that the averaged support for emotional proximity in the doctor-patient relationship was high for the entire survey sample, and that it increased with teaching time so that the subgroups with more years of teaching (i.e., TE-3S and TE-4S) scored above the average. Consequently, a statistically significant difference was found between the mean scores of TE-1S and TE-4S. No statistically significant difference was found between Gender Subgroups.

As a complement to what has been said so far, it was compared the scores of the replies to Survey Question 9 (on the "Adequate degree of emotional proximity in the doctor-patient relationship") with those scores of the answer “To help to control emotions in the future doctor” to Survey Question 4 (“Which is the current role of human cadaver dissection for you?”). No statistically significant correlation resulted from such a comparison. Likewise, the comparison of the scores of the answers to Survey Question 9 (on the

Table 2
Anatomists' opinion on human body dissection, anatomist professional self-perceived role and best use of cadaver donation in the medical undergraduate (Survey Questions 4, 10 and 12).

Survey Question 4: Which is the current role of human cadaver dissection for you?					
	An instrument for professional training	An instrument to develop professional skills	A source of medical research	To help to control emotions in the future doctor	A tool only useful for teaching/ learning Anatomy
By Years-of-Teaching Experience Subgroups (N = 145)					
TE-1S (n = 51)	4.5 ± 1.1	4.1 ± 1.0	4.0 ± 1.2	1.9 ± 1.6^{2S,3S,4S}	1.6 ± 1.7^{4S}
TE-2S (n = 27)	4.3 ± 1.4	4.3 ± 1.3	4.2 ± 1.4	3.0 ± 1.8^{1S}	1.6 ± 1.8^{4S}
TE-3S (n = 25)	4.5 ± 1.0	4.3 ± 1.2	4.5 ± 1.2	3.6 ± 1.5^{1S}	2.2 ± 2.0
TE-4S (n = 42)	4.7 ± 0.6	4.3 ± 0.8	4.4 ± 0.9	3.4 ± 1.2^{1S}	3.0 ± 1.8$^{1S,\ 2S}$
				p < 0.0001	**p = 0.001**
By Gender Subgroups (N = 145)					
Woman (n = 49)	4.4 ± 1.3	4.0 ± 1.3	4.2 ± 1.2	2.3 ± 1.7	1.9 ± 1.9
Man (n = 96)	4.6 ± 0.9	4.3 ± 0.9	4.3 ± 1.2	3.1 ± 1.6	2.2 ± 1.9
				p = 0.006	
Comparison between answers to Survey Questions 4 and 10 (Which is the main role of an anatomist for you?)					
	An instrument for professional training	An instrument to develop professional skills	A source of medical research	To help to control emotions in the future doctor	A tool only useful for teaching/ learning Anatomy
Teaching (n = 114)	4.5 ± 1.0	4.2 ± 1.1	4.2 ± 1.2	2.8 ± 1.6	2.2 ± 1.9
Research (n = 31)	4.5 ± 1.2	4.4 ± 0.9	4.4 ± 1.1	3.3 ± 1.8	1.6 ± 1.9
Comparison between answers to Survey Questions 4 and 12 (For you, body donation is mainly for…?)					
	An instrument for professional training	An instrument to develop professional skills	A source of medical research	To help to control emotions in the future doctor	A tool only useful for teaching/ learning Anatomy
Science (n = 66)	4.5 ± 1.0	4.2 ± 1.1	4.3 ± 112	3.0 ± 1.6	1.9 ± 1.7
Teaching/learning on anatomy (n = 79)	4.6 ± 1.0	4.2 ± 1.1	4.2 ± 1.1	2.8 ± 1.8	2.3 ± 2.0

Table shows data collected from the answers to Survey Questions 4,10 and 12 (top, middle and low parts of the Table, respectively). Data are shown in mean values ± S.D. For Question 4, data are pooled by Years-of-Teaching Experience (TE) and Gender Subgroups. TE Subgroups being TE-1S (≤ 5 years of professional practice), TE-2S (6–12 years of professional practice), TE-3S (13–20 years of professional practice) and TE-4S (> 20 years of professional practice). Data were measured by a Likert-type Scale (with a maximum of "5 points"). Data followed by super-Indexed-Subgroup initials are significantly different (see "p" lettering) from data of the respective Subgroups regarding the answer stated in the column.

Table 3
What is the cadaver for you? (Survey Question 5).

TE Subgroups (N = 145)	TE-1S (n = 51)	TE-2S (n = 27)	TE-3S (n = 25)	TE-4S (n = 42)	M (n = 96) — W (n = 49)
An inanimate object (n = 23)	11 (21.6%)	5 (18.5%)	2 (8.0%)	5 (11.9%)	16 (16.7%) — 7 (14.3%)
A being that once lived (n = 122)	40 (78.4%)	22 (81.5%)	23 (92.0%)	37 (88.1%)	80 (83.3) — 42 (85.7%)

Data (frequencies and percentages) are presented by Years-Of-Teaching-Experience Subgroups (TE-1S, ≤ 5 years; TE-2S, 6–12 years; TE-3S, 13–20 years; TE-4S, > 20 years) and Gender Subgroups (M and W: Man and Woman, respectively).

"Adequate degree of emotional proximity in the doctor-patient relationship") with those of the answers to Survey Question 5 ("What is the cadaver for you?") resulted in no statistically significant correlation. (Not shown in any Table.).

3.8. Which is the main role of an anatomist for you?

Anatomists were asked "Which is the main role of an anatomist for you?" (Survey Question 10) and most respondents answered "Teaching" (n = 114; ratio, 79% out of 145; men, 65% out of 114; women, 35%). High ratio of adherents averaged by TE Subgroups resulted for TE-1S and TE-4S (ratios, 36% and 32% for 41 and 36 adherent responses out of the respective Subgroup members). Only 31 respondents (ratio, 21% out of 145; men 71% out of 31, women 29%) answered "Research". By TE Subgroups, the highest averaged ratio of adherents to the latter response was that of TE-1S (ratio, 32%, n = 10). It was seen a steady decrease as the years of teaching experience increased (TE-2S, 26%; TE-3S, 23%; TE-4S, 19%). However, no statistically significant difference was found between TE or Gender Subgroups. (Not shown in any Table.).

In addition, the numbers of respondents adhering to the "Teaching" or "Research" responses were checked against the numbers of respondents adhering to the responses to the Survey Question 4, that is, "Which is the current role of human cadaver dissection for you?". The middle part of Table 2 shows the results of such a comparison, expressed by means of a Likert-type Scale where "0" was "total disagreement" and "5" "total agreement". After comparison, there was no difference between the scores of the answers saying "Teaching" or "Research". It emerged, in addition, a common display of acceptance of the answers on the usefulness of dissection

Table 4
Appropriate degree of emotional proximity in the doctor-patient relationship (Survey Question 9).

TE Subgroups (N = 145)	TE-1S (n = 51)	TE-2S (n = 27)	TE-3S (n = 25)	TE-4S (n = 42)	M (n = 96) — W (n = 49)
Degree of emotional proximity	6.5 ± 1.9 *	6.7 ± 1.7	7.5 ± 1.6	7.7 ± 1.6*	7.2 ± 1.8 — 6.8 ± 1.7)

Data were measured by a Likert-type Scale with a maximum of "10 points". Data (mean values ± standard deviation) are shown by Years-Of-Teaching-Experience Subgroups (TE Subgroups: TE-1S, ≤5 years of teaching experience; TE-2S, 6–12 years of teaching experience; TE-3S, 13–20 years of teaching experience; TE-4S, > 20 years of teaching experience), and Gender (M = Man; W = Woman). The average score of all 145 responses was 7.1 ± 1.8.

* A statistically significant difference was found between the mean values of TE-1S and TE-4S (p = 0.01).

Table 5
Willingness for bequest of the own body and belief int the afterlife.

Survey Question 11: Would you donate your body? (N = 145)				
TE Subgroups (N = 145)	Only the organs (n = 60; 41,4%)	Only the whole body (n = 13; 9%)	The organs and the whole body (n = 63; 43,4%)	NO donation (n = 9; 6,2%)
TE-1S (n = 51)	28 (54.9%)	2 (3.9%)	19 (37.2%)	2 (3.9%)
TE-2S (n = 27)	9 (33.3%)	4 (14.8%)	12 (44.4%)	2 (7.4%)
TE-3S (n = 25)	7 (28.0%)	3 (12.0%)	13 (52.0%)	2 (8.0%)
TE-4S (n = 42)	16 (38.1%)	4 (9.5%)	19 (45.2%)	3 (7.1%)
Gender Subgroups (N = 145)	Only the organs (n = 60; 41,4%)	Only the whole body (n = 13; 9%)	The organs and the whole body (n = 63; 43,4%)	NO donation (n = 9; 6,2%)
Woman (n = 49)	22 (44.9%)	4 (8.2%)	20 (40.8%)	3 (6.1%)
Man (n = 96)	38 (39.6%)	9 (9.4%)	43 (44.8%)	6 (6.2%)
Survey Question 13: Belief-In-The-Life-After-Death and willingness for bequest of the own body (N = 145)				
Comparison of answers to Survey Questions 13 (below) and 11 (on the right)	Only the organs (n = 60; 41,4%)	Only the whole body (n = 13; 9%)	The organs and the whole body (n = 63; 43,4%)	NO donation (n = 9; 6,2%)
No (n = 43)	18 (41.9%)	6 (13.9%)	19 (44.2%)	0 (0.0%)
Yes (n = 57)	27 (47.4%)	4 (7.0%)	23 (40.3%)	3 (5.3%)
Not sure (n = 45)	15 (33.3%)	3 (6.7%)	21 (46.7%)	6 (13.3%)

Data (frequencies and percentages) are presented by Gender and Years-Of-Teaching-Experience Subgroups (TE Subgroups: TE-1S, ≤ 5 years of teaching experience; TE-2S, 6–12 years of teaching experience; TE-3S, 13–20 years of teaching experience; TE-4S, > 20 years of teaching experience), No statistically significant difference was found across Subgroups. There was a statistically significant difference when comparing responses to Survey Question 13 with those to Survey Question 11 in favour of body donation (including the three response modes, i.e., organs only, whole body only, and body and organs separately). Here, all unbelievers and 95% of believers said they were willing to donate compared to 87% of "doubters" (p = 0.05).

like that shown for Survey Question 4 (see middle and upper parts of Table 2). There was no statistical significance resulting from this comparison.

3.9. Anatomists' opinions concerning donation of their own bodies, or body organs, or both

Results to Survey Question 11 are shown at the top of Table 5 and briefly commented in the following. One hundred and thirty-six out of the 145 respondents approved the donation and use of their own remains for research, teaching/learning, or transplantation. Of the 136 (93,8%) respondents who expressed approval, 9% would only donate the whole body, 41.4% would only donate organs, and 43.4 would donate both, organs and body. Donating "Only the whole body" always scored a low ratio across Subgroups, the lowest score being that of TE-1S. The options, "Donate only my organs" and "Organs and the whole body" seized more support, which varied to a point across Subgroups. Only 6.2% of the respondents chose the "No, I would never donate" option. Such a choice scored a very low supporting ratio in TE-1S among TE Subgroups and resulted in a 1:1 distribution by Gender Subgroups. For all these issues, there was no statistically significant difference across Subgroups, either TE or Gender.

3.10. Anatomists' opinion concerning if body donation is mainly for science or for teaching/learning of human anatomy

Anatomists were asked if for them the body donation is primarily for science or for teaching (Survey Question 12). Some of the results are offered in the following. Out of the 145 respondents, a majority (n = 79; ratio, 54.5%; of whom 67% were men and 34% women) stated that the body bequest was "For teaching/learning of anatomy". The statement "For science" was chosen by the remaining 45.5% of the respondents (n = 66; of whom 67% were men and 33% women). There was no significant difference across Subgroups. (Not shown in any Table.).

Then, the numbers of respondents adhering to the "Science" or " Teaching/learning anatomy" replies were checked against the numbers of respondents adhering to the responses to the Survey Question 4, that is, "Which is the current role of human cadaver dissection for you?". The bottom part of Table 2 shows the results of such a comparison, expressed by means of a Likert-type Scale where "0" was "total disagreement" and "5" "total agreement". After comparison, there was no difference between the scores of the answers saying "Science" or " Teaching/learning anatomy". It emerged, in addition, a common display of acceptance of the answers on the usefulness of dissection like that shown for Survey Question 4 (see bottom and upper parts of Table 2). There was no statistical significance resulting from this comparison.

3.11. Body bequest and faith in the afterlife

The transcendental/spiritual conviction of the respondents was explored succinctly to find if there was a correlation between it and the willingness to donate the whole body or parts of it. Thus, it was asked, "Do you believe in life after death?" (Survey Question 13), but without further inquiring about specific religion or spiritual beliefs (Bottom part of Table 5). Fifty-seven (ratio, 39%) of the respondents declared they believed in the afterlife, 43 (ratio, 30%) said they did not, and 45 (ratio, 31%) said they had doubts about it. By Gender (not shown in any Table), 43% of the women (21 out of 49) declared they believed in the afterlife, 29% (n = 14) that they did not and 29% (n = 14) that they were doubtful. Regarding men, 37.5% (36 out of 96) stated that they believed in the afterlife, 30.2% (n = 29) that they did not and 32.3% (n = 31) that they were doubtful. By TE Subgroups (not shown in any Table), the highest percentage of unbelievers in the afterlife was found in TE-4S (36%). There was an increase in the number of believers in relation to the decrease in years of teaching (33% of respondents in TE-1S declared believing in life after death vs. 25% in TE-4S). None of the differences mentioned in the previous paragraph was statistically significant. Neither was there when comparing the answers to Survey Question 13 ("Do you believe in life after death?") with those to Survey Question 12 ("For you, body donation is mainly for Science or for teaching-learning of Anatomy"?).

In contrast, there was statistical significance when comparing responses to Survey Question 13 ("Do you believe in life after death?") with those to Survey Question 11 in favor of body donation (three response modes are included here, i.e., organs only, whole body only, and body and organs separately). Here, all unbelievers and 95% of believers said they were willing to donate compared to 87% of "doubters" (p = 0.05).

4. Discussion

The present study surveyed opinions of university anatomists from the Americas about the profession of anatomist, dissection in the medical undergraduate carried out by regular students, and donation of the anatomists' own body. Opinions about dissection in medical school by regular students included anatomists' views about the collateral consequences the experience might have for students. The study was aimed as well to determine whether the span of the teaching experience, self-perceived gender, and belief in the afterlife were influential in shaping the opinions of the respondents.

One hundred and forty-five valid questionnaires were collected, each with 13 questions answered completely or almost completely. Responses came from anatomists teaching in 13 Latin American universities, from Mexico, Cuba and St-Kitts-and-Nevis all the way to Argentina and Chile. The survey complemented previous research on the views of university anatomists of Spain ("Spain Survey") and 29 Countries most of them of Asia and Europe ("Global Survey"). Added with physicians' opinion on similar issues ("Physicians Survey"), it should contribute to shaping a trustworthy perception on gross anatomy, dissection, and anatomists in the first two decades of the XXI century. Results of the present survey shall be discussed henceforth in a logic sequence that departs from the order of the Survey Questions in the questionnaire. In the latter, the questions were arranged randomly so as not to guide the answers.

4.1. What is the main role of an anatomist?

A major objective of the present study was to know the anatomists' perception on what their professional main activity is. This perception has been little explored, just as the perceptions that physicians and undergraduate medical students may have on the matter have also been little studied. The hypothesis was that Latin American anatomists would perceive themselves as teachers.

The results confirmed the hypothesis: most respondents stated the main role of an anatomist is "Teaching" (see Table 2 here). This opinion was not surveyed neither in the "Spain Survey" nor in the "Global Survey". In "Physicians Survey", the statement saying that the anatomist is a "Teacher" was supported by 50.4% of the overall respondents, obtaining ratios of 58% and 46% of affirmative responses between surgeons and physicians, respectively. Nevertheless, the other answer offered in "Physicians Survey" was not "Research" but "Physician", "Biologist" or "Scientist". More data are needed to objectify assumptions of the self-perceived role of anatomists, or the role that other professionals and society perceive of them. The result of such an analysis may be decisive to enhance the vocational choice to become anatomists (Wilson et al., 2020).

4.2. Do your students dissect human cadavers?

Other main objective of the present study was to discern the extent the human cadaveric dissection is currently carried out by regular undergraduate medical students as part of the anatomy courses. Numerous Latin American authors point out that at the foundation of the teaching of human anatomy should be the dissection of the human body (as an example, (Collipal Larre and Silva Mella, 2011)). The hypothesis was that dissection would be a teaching activity little used by most anatomists in their courses.

The hypothesis was confirmed. Dissection of human bodies was a component of the anatomy courses of one third of the Latin American respondents. In comparison, more dissection is performed in medical undergraduate courses in Spain and the 29 Countries of Asia and Europe previously surveyed (respective ratios, 87% and 55%; see "Spain Survey" and "Global Survey").

4.3. What is the current role of human cadaveric dissection for you?

Other major objective of the present survey was to expand knowledge about the perception of usefulness of human cadaveric dissection in the teaching of gross anatomy in Latin American medical undergraduate (Biasutto et al., 2014, Biasutto et al., 2018a; Biasutto et al., 2018b; Biasutto et al., 2019a; Biasutto et al., 2019b; Biasutto et al., 2019c; Biasutto et al., 2021; Gatica-Araneda and Alfaro-Toloza, 2014). The hypothesis was that Latin American anatomists would regard the role of human cadaveric dissection in medical training similarly to their fellows around the world (see "Spain Survey, "Global Survey", "Physicians Survey"), i.e., they would deem that dissection transmits not only anatomical knowledge, but also other important skills and attitudes in the formation of integral professionals.

The results confirmed the hypothesis in all its terms. As in the other surveyed Countries, dissection resulted most valued here as "Instrument for professional training", "Instrument to develop professional skills" and "Source of medical research". The reply "Only to teach anatomy" was the least valued by far. The second least valued answer was "Dissection helps to control emotions in the future doctor".

4.4. The experience of dissecting and its influence on the future doctor-patient relationship

If proper dissection is done during undergraduate years with the addition of honoring those who voluntarily donate their bodies to science, dissection could establish attitudes toward life and death (Brenner and Pais, 2014; Flack and Nicholson, 2018; Moxham et al., 2019; Riederer and Bueno-López, 2014; Wu et al., 2021) and therefore the future doctor-patient relationship could be anticipated (Arráez-Aybar et al., 2014, 2008; Charlton et al., 1994; Goss et al., 2019; Gustavson, 1988). Dissection of human bodies could stimulate also a clear desire to provide a caring attitude in the practice of medicine (Gustavson, 1988) if teaching anatomists fostered, reinforced, and guided respectful and compassionate attitudes in undergraduate students from the start of the courses (Goss et al., 2019; Karunakaran et al., 2017; Ong et al., 2020; Pabst et al., 2017; Shiozawa et al., 2016; Sándor et al., 2015). Expanding knowledge about the anatomists' perception of possible influences of dissection of human bodies on the future doctor-patient relationship was other objective of the present survey. Bearing in mind the results of the previous study on the opinion of anatomists around the world (see "Global Survey"), the hypothesis was that Latin American anatomists would sustain that the attitude of students towards the cadaver during dissection conditions the students' future attitude towards the patient.

The results did not confirm the hypothesis. Only 38% of the Latin American anatomists surveyed indicated that students' attitudes to dissection conditions future attitudes and behaviors towards patients. Such a percentage was lower than those 79% (Bourguet et al., 1997) and 63% ("Global Survey") of previous studies on anatomists. It is particularly important to bring up here that the averaged opinion of physicians surveyed on the same topic was even lower (29%; see "Physicians Survey"). Thus, the results found in the present study ratified the trend seen previously, i.e., that anatomists think more favorably than physicians about the influence of dissection on shaping of the doctor-patient relationship. It was so even if Latin American anatomists were closer to the physicians' opinions than to those of their anatomy colleagues around the Globe.

4.5. The experience of dissecting and the support of a high degree of affective proximity considered adequate in the doctor-patient relationship

No hypothesis was explicitly anticipated for Survey Question 9. The opinions of anatomists and physicians known so far differ. In the present survey, Latin American anatomists' approval of affective closeness in the doctor-patient relationship averaged a score of 7.1 ± 1.8, which is very close to the 6.9 ± 1.7 and 7.2 ± 1.9 reported previously for Spanish anatomists and physicians ("Spain Survey" and "Physicians Survey"). Anatomists around the world consider appropriate a greater detachment (5.8 ± 2.3) in such a relationship (see "Global Survey"). (All three scores measured by means of Likert-type Scales where "0" was "total disagreement" and "10″ "total agreement".).

On the other hand, in the present survey no correlation was found between the approval of both, the affective closeness in the doctor-patient relationship and the statement that dissection is useful "To help control emotions in the future doctor" (Survey Questions 9 and 4). This was consistent with that reported on anatomists in "Global Survey" but diverged from the statistically significant correlation found in other studies ("Spain Survey" and "Physicians Survey").

4.6. The experience of dissection and consideration of the nature of the cadaver

No hypothesis was enunciated for the outcome of Survey Question 5 of the present study. Results unveiled that 84% of the Latin American respondents thought that bodies in the dissection room were "A being that once lived" rather than "An inanimate object". Such a perception ratio of the cadaver under dissection as "a being that once lived" was higher than that 66% registered from Colombian university students ((Jagua Gualdrón and Urrego Mendoza, 2011)Jagua Gualdrón and Urrego Mendoza, 2011) and coincided with the opinion ratio of Spanish anatomists, physicians and anatomists from 29 Countries (97%, 84.5% and 84%, respectively; see "Spain Survey", "Physicians Survey" and "Global Survey"). This suggests that the nature of the cadaver is perceived differently by medicine students and professionals. All these findings would jointly support the need to integrate in the teaching of professionalism in gross anatomy courses the balance between professional concern and detachment (Goss et al., 2019).

4.7. The experience of dissecting and the necessity to prepare students emotionally before carrying out dissection

No hypothesis was anticipated for the outcome of Survey Question 6. Compared to the 85% found previously in "Global Survey", only 46% of Latin American anatomists surveyed here believed that it should be necessary to prepare undergraduate students for emotional and psychological reactions before dissection. Undergraduate students in anatomy labs have cognitive-motor reactions to bodies and death. Such reactions would be mainly conditioned by the immediacy, novelty and severity of the experience, but they should decrease over time in normal personalities (Arráez-Aybar et al., 2007; Casado et al., 2005). More quantitative and qualitative research should be needed now to assess these important questions that can currently only be hinted at. Effective preparatory programs for mental preparation and knowing what to expect in medical training and practicing medicine seem essential before entering the dissection room for the first time (Cahill and Ettarh, 2009; Casado et al., 2012; Riederer, 2016).

4.8. What is the body donation for?

Question 12 of the present study was not in the questionnaires of previous studies by the same authors here on similar topics. No initial hypothesis was formulated for the outcome of the query. Results indicated that Latin American anatomists considered that the donation of the body is for "Teaching/learning anatomy" rather than for "Science". Such appreciation did not differ with statistical significance after comparison with the opinion that the same Latin American anatomists had about the usefulness of dissection for students ("What is for you the current role of dissection of human cadavers?"), or the self-perception of the role of the anatomist also asked in this study (Survey Questions 4 and 10, respectively; Table 2). No other studies have been found that have addressed similarly such comparisons.

4.9. Willingness to donate body organs or one's own body

The hypothesis to Survey Question 11 was that Latin American anatomists would approve donating their own bodies for anatomical teaching. The hypothesis was confirmed. Fifty-two percent of the respondents said that they would donate "Only the whole body" or "The organs and the whole body" (see Table 5). The sum of these percentages was higher than that found in the "Global Survey" (34%), In Nigeria (24%) (Anyanwu and Obikili, 2012) or in The Netherlands (26%) (Bolt et al., 2012) but lower than the 75% observed in Mexico (Quiroga-Garza et al., 2017). The approval ratio of "Only the whole body" donation found in the present survey (9.5%) was very close to the 9% revealed in "Global Survey". In both surveys, anatomists with less teaching experience and presumably younger were the least supportive of body donation while they were the most supportive of donating "Only the organs" (Table 5).

Anatomists belong to an educational establishment that is supposed to be beyond cultural stigmas and fear of donation. Anatomical professionals know better than anyone the importance of donated bodies to anatomical science and medical education. Although anatomists can encourage the general population to donate bodies, anatomists' willingness to donate their bodies is less discussed in the literature (Akanaku et al., 2019; Anyanwu and Obikili, 2012; Bolt et al., 2012; Cornwall et al., 2012; "Global Survey"; Ozor et al., 2020; Pandey et al., 2020; Quiroga-Garza et al., 2017; Riederer, 2016; Sehirli et al., 2004; "Spain Survey"). There are differences among various studies as to whether the performance or even the sight of dissections changes the perception of the donation of one's own body or not (Anyanwu et al., 2014; Bahşi et al., 2021; Larner et al., 2015; Mwachaka et al., 2016). Some study has pointed out that factors specific to the profession and the influence of social relationships are the two main explanations for the unwillingness of anatomical professionals to donate their bodies (Bolt et al., 2012). Having been published that handling the cadaver in the dissection room was the main barrier in the bequeathing unwillingness in the case of medical students and physicians (Saha et al., 2015).

4.10. Donation and belief in life after death (Combined analysis for Questions 11 and 13 of the Questionnaire)

The bequest of one's body for medical purposes is an act that may incorporate financial considerations, pragmatic decisions, humanistic/ethical values without spiritual transcendence, spiritual beliefs, religious beliefs or a combination of all of it. Donors of their own bodies would have strong motivations for their decision, most of which would stem from a desire for their death to be meaningful and useful to others (Bolt et al., 2010). Many people explicitly or implicitly would accept a transcendental belief in the face of one's own death. Understanding all these sentiments might contribute to

the implementation of body legacy programs. It has been reported that spiritual and religious beliefs would be one of the reasons against bequeathing one's own body (Alashek et al., 2009; Bolt et al., 2010; Boulware et al., 2004; Bresnahan et al., 2007; Holman, 2012; Rokade and Gaikawad, 2012), and that most people who register as donors would have no religious affiliation (Bajor et al., 2015; Cornwall et al., 2012). Although spirituality and religion share common roots, they would be interrelated but not be the same. A spiritual belief may or may not be religious, but religious people are spiritual (Bajor et al., 2015). Doctrinally, only Confucianism and some animist religions (Anyanwu and Obikili, 2012; Lewis and Pickering, 2003) would not accept the donation of the body. The other religions would leave the decision to donate the body to the person (Gillman, 1999; Shrestha et al., 2021; Subasinghe and Jones, 2015).

The influence of transcendental beliefs would be much lower for anatomy teachers than for the general population (4.3%) (Bolt et al., 2012; Sehirli et al., 2004). It has been reported that the reduction of the influence of religion on body donation by anatomists would be more consistent with the training and education received (Anyanwu and Obikili, 2012; Larner et al., 2015). The little influence that religion and spirituality have on the will to donate the body among anatomists and health professionals could be attributed to the well-known scientific secularism.

No hypothesis was made for the outcome of the question posed above. In the present study it was investigated whether the respondents believed in life after death but not about their religious faith, if any. The distribution of responses was around one third per option given at Survey Question 13, which is, “Do you believe in life after death?” Results coincide with the results about the same belief (39%) acquired in “Global Survey”. It is interesting to highlight that the Latin American anatomists that were undecided about the belief in life after death were the least in favor of donation (Table 5). In the present study, the number of unbelievers was higher in the subgroup with longer teaching experience (TE-4S). This is like that found in "Global Survey", but without the statistical significance with respect to the other ET groups revealed by "Global Survey".

4.11. The influence of teaching seniority

Here it was hypothesized that teaching seniority would influence the opinions of Latin American anatomists on the issues surveyed. The hypothesis was confirmed, not in all its terms but, not the least, in some critical ones. Namely, dissection was significantly performed less in the anatomy courses taught by Latin American anatomists with briefer teaching experience (see TE-1S in Table 1), who would have graduated presumably more recently. This outcome was in general agreement with those of surveys on anatomists (“Global Survey”) and physicians (“Physician Survey”), and endorse the general decline perceived by others in the use of dissection as an anatomy teaching tool in the medical degree (McBride and Drake, 2018; Noël et al., 2022; Singh et al., 2015). Besides, Latin American anatomists with more teaching experience (TE-4S) and presumably older were significantly more supportive than most of the remaining TE Subgroups for the response that the current role of human cadaveric dissection is "A tool only useful for teaching/ learning Anatomy " (Table 2); this outcome is like that one revealed in "Physician Survey" but not in "Global Survey". Furthermore, there was also a statistically significant difference for the lesser support found for the statement "To help to control emotions in the future doctor" between TE-4S and the remaining TE Subgroups of the present study (Table 2); this was not found in "Global Survey". Moreover, the approval of a close doctor-patient relationship increased with teaching time until reaching a statistically significant difference between the TE Subgroups with less and more teaching experience (Table 4); this difference is not in the "Global Survey" either. Finally, no statistically significant difference was found in the present study for the desire to donate the body among the Latin American anatomists with dissimilar time experience, although in other parts of the world this desire increases significantly as such experience increases ("Global Survey").

4.12. The influence of gender

In the present study, hypothesis was raised that gender of the anatomists would influence their opinions on the issues surveyed. This hypothesis was not fully satisfied. A statistically significant difference regarding the respondent gender was disclosed here only for the statement “Dissection is a tool to help control emotions in a future doctor”, being the averaged ratio of affirmative replies higher in men than women. This outcome parallel that seen in “Global Survey”. Nonetheless, "Global Survey" further revealed that the requirement to dissect human cadavers in undergraduate courses is significantly higher in courses taught by men, what did not turn out like that in the present survey. In turn, that the anatomist is “A scientist” is more significantly supported by men in the "Physicians Survey" but it was not so in the present study.

4.13. Differences between Latin American anatomists’ opinions and opinions of anatomists and physicians of other parts of the Globe

For everything said so far, Latin American anatomists' opinions on most of the issues surveyed in the present study would parallel those expressed by anatomists and physicians from other regions of the world. Differences were discovered with opinions of physicians and anatomists for the influence of dissecting has on the future doctor-patient relationship (See Subsection 4.4); with opinions of physicians and Spain anatomists for the correlation between the approval of affective closeness in the doctor-patient relationship and dissection usefulness "To help control emotions in the future doctor" (See Subsection 4.5); with Colombia students for the consideration of the nature of the cadaver (See Subsection 4.6); with opinions of anatomists of 29 Countries for the necessity to prepare students emotionally before carrying out dissection (See Subsections 4.7); and finally with opinions of anatomists of Mexico, Nigeria, The Netherlands and 29 Countries for the desire to donate the own bodies for anatomical teaching (See Subsection 4.9).

5. Limitations of the study

This research is not without limitations. Here are some that might be of importance. Firstly, the choice of Survey Questions was based on previous research and therefore concepts particular to the world region explored now might have been omitted or involuntarily emphasized. Secondly, respondents were only given a choice between "Man" or "Woman" as *gender* options; still, there was also the choice of leaving the question unanswered or answer both options simultaneously. This was as done in previous surveys in other parts of the world. Thirdly, the study focused on the opinion of the respondents about the role of dissection and anatomists in medical training only. Fourthly, it would certainly have been interesting to ask the respondents about the grade that qualified them to be university anatomists, anatomical training and staff category. None of this was asked as not to add more complexity to the survey. Fifthly, many Latin American anatomists, in addition to belonging to their national anatomical association or society, were members of those of other Countries and, in some cases, of several. This has prevented the authors establishing the percentage of participation response by Countries. Sixthly, efforts were made to get anatomists working in Canada and the U.S.A. to participate in the survey, but to no avail. Seventhly, while some Latin American and Caribbean Countries were well represented in the survey responses, the representation of other Countries seemed limited or even non-

existent. Therefore, the data and conclusions presented here cannot be generalized for all Latin America and the Caribbean Countries. Finally, the scarcity of more national and international studies in Latin America with questions like the ones posed here limited the discussion of the results.

However, the authors have considered that the results presented were significant despite the limitations mentioned. The extent of the sample and the importance of the region explored have been deemed by the authors to be of value to the scientific literature on anatomy and medicine. The results of the present study were sufficient to be weighed against those of studies on anatomists in Asia and Europe. This has pushed to publicize the study without waiting for the increase in the number of respondents or the geographical region explored.

6. Conclusions

Several conclusions might be drawn from the results of the present study on Latin American anatomists' discernments about the profession, dissection and body donation; the authors have prioritized the following ones.

I. The dissection of human cadavers should serve not only as a way of learning anatomy, but also as a method that helps develop technical, professional, emotional and scientific attitudes in medicine students.
II. Although human cadaveric dissection is considered useful for so many reasons, it seems to not be widely used today in the medical degree.
III. The backing of the emotional aspects linked to the practice of human cadaveric dissection would be greater among most experienced anatomists, together with the approval of a close doctor-patient relationship. It remains to be explored whether it was due to the greater temporal extension of their teaching experience or to the training and early experiences they underwent being presumably older than their other surveyed colleagues.
IV. Anatomists should consider the characteristics and contradictions found between the opinions of anatomists and physicians for the implementation of teaching strategies and the application and improvement of body legacy programs.

As well, it seems appropriate to state four suggestions as the last conclusion of the present study. Firstly, medicine students might need to be prepared for their first experience dissecting human cadavers. Secondly, it would be highly desirable for anatomists to include in their courses an informed approach that highlights the benefits of human cadaveric dissection to improve health education. Thirdly, it would also be helpful to have as many ways as possible to publicly honor donors in a way that body-bequest earns the public esteem. Finally, it would also be highly desirable to conduct periodic opinion surveys on anatomy and anatomists (preferably with international agreement on methodology and use of questionnaires) to obtain an extensive body of comparable data on questions such as those in the present survey. This would increase knowledge on anatomical profession.

Ethical statement

This study was approved by the Ethical Committee of "Hospital Clínico San Carlos" of Madrid, Spain (E-13/262).

CRediT authorship contribution statement

Luis-A. Arráez-Aybar: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Sofware, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. **Susana Biasutto:** Investigation, Methodology, Data curation, Resources, Sofware, Supervision, Visualization, Writing – review & editing. **Mariano A.R. Amer:** Data curation, Investigation, Resources, Visualization, Writing – review & editing. **Ricardo García-Mata:** Formal analysis, Methodology, Sofware, Visualization, Writing – review & editing. **José L. Bueno-López:** Conceptualization, Project administration, Validation, Visualization, Writing – original draft, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.aanat.2022.152037.

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