


Assessment of physicians' knowledge about brain death and organ donation and associated factors

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Abstract

Precocity and assertiveness when diagnosing brain death are essential for identifying potential donors. To assess the knowledge of physicians about brain death and organ donation, cross-sectional web-based survey was carried out with physicians from different specialties. The knowledge about brain death and organ donation was assessed by a questionnaire with 12 multiple-choice or multiple-answer questions (possible range from 0 to 12). The nonparametric Mann–Whitney and Kruskal–Wallis tests were performed to verify the association between the physicians' knowledge and others variables. The project was approved by the Research Ethics Committee of the Hospital das Clínicas, Faculty of Medicine of Ribeirão Preto, University of São Paulo, under number 4.022.657, and all patients agreed to participate and provided free prior-informed consent. Three hundred sixty physicians were included in this study, most of them have postgraduate (55%) and 59.2% were intensive care physicians. The median of responses was 5 (obtained range from 0 to 10). The participants were classified in 2 groups: with satisfactory knowledge (scores above 5) or without satisfactory knowledge (scores equal/below 5). There was better performance among participants who: completed graduation between 6 and 10 years ($P < .012$); were intensive care physicians ($P < .002$); had participated in training courses ($P < .001$); and those who had worked in intensive care unit (ICU) from 6 to 10 years ($P < .023$); had performed over 10 brain death protocols ($P < .001$), and felt safe to talk to family members about brain death ($P < .001$). The results showed that the participants had low knowledge about diagnosis of brain death and organ donation protocols despite the majority working in ICUs. Be an intensive care physician, had large time experience in ICU, and had performed brain death protocols were associated with unsatisfactory knowledge concerning the subject.

Abbreviations: BD = brain death, FCM = Federal Medicine Council, ICU = intensive care unit.

Keywords: brain death, doctors, knowledge, organ and tissue donation

1. Introduction

The concept of death has been discussed and changed over time, not being recognized as death only when the individual progresses to cardiac arrest, but also when there is loss of activity in the cerebral trunk and cortex, for a known and irreversible cause, capable of causing the clinical picture in the patient, characterized as brain death (BD).^[1,2]

In Brazil, in 2019, 11,400 potential organ and tissue donors were notified, and of these, only 3211 had their organs transplanted, with the non-confirmation of brain death as one of the factors for the non-accomplishment of transplants.^[3] In 2020, the Coronavirus Disease 2019 pandemic resulted in a

significant drop in the number of effective donors, from 18.1 per million population per year (pmp/year) to 15.8.^[4] For the BD confirmation process to be established, the patient must be under intensive care, assisted by competent and trained medical professionals, since the late recognition of this process can lead to hemodynamic instability, use of unnecessary interventions, increased suffering family, and a high rate of refusals for organ donation, thus hindering the implementation of transplants.^[1,5-7]

Although the concept of BD is well defined through well-founded national and international guidelines, there may still be doubts among medical professionals about making the diagnosis of BD and maintaining the potential donor.^[7-9]

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The authors have no conflicts of interest to disclose.

The datasets generated and analyzed during the current study are available from the corresponding author on reasonable request.

Supplemental Digital Content is available for this article.

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Considering the above and given the perception of the existence of weaknesses of medical professionals in performing the diagnosis of BD, there was an interest in better investigating the actual knowledge of these professionals and the factors that are involved in this context. Therefore, the aim of this study was to assess the knowledge of physicians working in different regions of Brazil with experience in the intensive care unit (ICU) on the diagnosis of brain death and organ donation, using an instrument developed by the authors and validated in face and content by a committee of experts based on literature review and Resolution 2173/2017 of the Federal Council of Medicine. Therefore, the question we intend to answer is: Is the knowledge of medical professionals about the protocol of brain death and organ donation satisfactory?

2. Methods

This is a cross-sectional web-based survey carried out with physicians from different specialties, with experience in the ICU, working in different regions of Brazil. They answered the survey between August 2020 and June 2021. All participants agreed to participate in the study and provided free prior-informed consent. The project was approved by the Research Ethics Committee of the Hospital das Clínicas, Faculty of Medicine of Ribeirão Preto, University of São Paulo, under number 4.022.657.

2.1. Study population

The population of interest to the study consisted of physicians who had been working for at least 1 year in hospital services, located in the 5 regions of Brazil. Participants who did not complete the questionnaire were excluded.

2.2. Data collection

First at all, we developed the instrument named Knowledge Assessment Questionnaire on Brain Death and Organ Donation (Supplemental Digital Content (Appendix, <http://links.lww.com/MD/H401>). The instrument face validity was carried out by 5 health professionals who were specialists in ICU field. The agreement between these raters was 100%, as recommended in the literature.^[10,11]

The instrument comprised 2 parts. The first one has socio-demographic (gender), medical training (experience with the subject during the undergraduate course; time since medical graduation, level of postgraduate education, medical specialty), and professional information (Brazilian region in which they work, training in ME, length of experience in the ICU, opening the BD protocol, security when explaining to the family about the BD diagnosis). The second part has 12 questions referring to knowledge about the protocol of brain death and organ donation, divided into multiple-choice questions (2,3,4,6,9,10,12) and multiple answer questions (1, 5,7,8, and 11). The answers were correct according to the current literature on the subject (Resolution 2173 of 2017 of the Federal Council of Medicine). The answers correct received the value 1 (1 point) and the incorrect received the value 0. The possible range was 0 to 12.

For this study, because of the conditions and risks in which all were found, resulting from the pandemic caused by the new coronavirus (Coronavirus Disease 2019), it was applied the instrument through the search manager application, known as Google Forms, and to access to the participants, the questionnaire link was disseminated through chains of references, a technique known as snowballing.^[12,13] The means of dissemination were Whatsapp, medical groups on telegram and Facebook, e-mail, newspapers, and associations (Brazilian Association of Intensive Medicine and Brazilian Association of Organ Transplantation).

3. Statistical analysis

Data were tabulated in an Excel spreadsheet and analyzed using the IBM *Statistical Package for Social Science* software, version 23.0 for Windows. Descriptive analysis was performed to characterize the participants. Measures of central tendency and variability were also calculated as median (maximal and minimum), as well as the frequency of the number of correct answers. In this study, responses were evaluated and scored (1) for right and (0) for wrong. To assess the factors associated with expert knowledge, we considered expert knowledge when the participant had a hit above the average, which for this study was 5. Shapiro–Wilk (normality test) assessed data distribution. Considering that the distribution of all variables was non-parametric, the Mann–Whitney test was applied where the variable had only 2 categories and the Kruskal–Wallis test in cases where the variable had over 2 categories. These tests were used to assess statistical significance between the medians in relation to the categories of the variables of interest. It was considered that there was a statistical difference between the variables (time since graduation, medical specialty, length of experience in the ICU, training and opening of BD protocol, safety when talking

Table 1
Sociodemographic and professional characteristics of the 360 study participants.

Variable	Frequency	(%)
Sex		
Feminine	171	47.5
Masculine	189	52.5
Training time		
1–5 years	56	15.6
6–10 years	76	21.1
11–20 years	132	36.7
21 years or more	96	26.7
Level of training		
Graduation	28	7.8
Residence	134	37.2
Postgraduation	198	55.0
Specialty		
Intensive care	213	59.2
No intensive care	147	40.8
Region		
Southeast	169	46.9
South	82	22.8
North East	46	12.8
Midwest	50	13.9
North	13	3.6
Training BD		
Yes	248	68.9
No	112	31.1
Time of experience in the ICU		
Less than 1 year	72	20.0
1–5 years	81	22.5
6–10 years	68	18.9
11–20 years	93	25.8
21 years or more	46	12.8
Opening of BD protocol		
Less than 5 protocols	109	30.3
Between 5 and 10 protocols	53	14.7
More than 10 protocols	198	55.0
Safety when explaining to the family about BD		
Yes	324	90.0
No	36	10.0
Approach to BD during the graduation course		
Yes	40	11.1
No	320	88.9
Total	360	100.0

BD = brain death, ICU = intensive care unit.

to the family, approach to the topic during the undergraduate course). The significance level was 0.05.

4. Results

The sample comprised 360 physicians (171 women and 189 men), with different specialties, and working in all regions of the country (Table 1). As for the socio-demographic characteristics of the 360 participants, 132 (36.7%) completed graduation between 11 and 20 years old and 198 (55%) completed postgraduate studies. In addition, 213 (59.2%) were of the intensive care, 93 (25.8%) had between 11 to 20 years of experience in the ICU, 248 (68.9%) received training in BD, 320 (88.9%) consider that there was not enough approach about BD during the undergraduate medical course, 198 (55%) opened over 10 BD protocols, and 324 (90%) felt safe when explaining about BD to the patient's family.

The median of correct answers was 5 (Q1 = 4.0 and Q3 = 6.0), with a minimum value of 1 and a maximum of 10 (Table 2). Regarding the participants' knowledge about the BD protocol and organ donation, there was a greater performance among those who had graduated from 6 to 10 years

($P < .012$). Intensive care physicians also had better knowledge than non-intensive physicians ($P < .002$) and those who participated in BD training also performed better than those who did not participate ($P < .001$). Still, it was evidenced that those who had 6 to 10 years of experience in the ICU had a higher number of correct answers ($P < .023$), and those who had over 10 openings of BD protocols too ($P < .001$). In addition, those who felt secure when talking to their family about BD also performed better than those who did not feel secure ($P < .001$).

Although most participants did not receive a sufficient approach to the subject during their undergraduate course, we did not identify a statistical difference ($P < 0,690$) between expert knowledge and the fact of having had it or not. Of the 360 participants, 216 (60.0%) were below the average of correct answers, which showed knowledge below expectations (Fig. 1).

The behavior of the variables that showed statistical significance in the number's distribution of correct answers conditioned with the variables time since graduation, specialty, BD training, length of experience in the ICU, opening of the BD protocol, and safety when talking to the patient's family about the BD are represented in Figure 2.

Table 2

Descriptive statistics for the distribution of the number of correct answers according to the study variables.

Variable	(Q1)	Media	(Q3)	Min	Max	P value
Sex						
Feminine	4.0	5.0	6.0	1.0	10.0	.512*
Masculine	4.0	5.0	6.0	1.0	10.0	
Training time						
1–5 years	3.0	4.0	6.0	1.0	9.0	
6–10 years	4.0	5.0	7.0	2.0	10.0	<.012**
11–20 years	4.0	5.0	6.0	1.0	10.0	
21 years or more	3.0	5.0	6.0	1.0	9.0	
Level of training						
Graduation	3.0	4.0	6.0	2.0	9.0	.218**
Residence	4.0	5.0	6.0	1.0	10.0	
Postgraduation	4.0	5.0	6.0	1.0	10.0	
Specialty						
Intensive care	4.0	5.0	6.0	1.0	10.0	<.002*
No intensive care	3.0	5.0	6.0	1.0	10.0	
Region						
Southeast	3.0	5.0	6.0	1.0	10.0	
South	4.0	5.0	6.0	1.0	10.0	0.102**
North East	4.0	5.0	6.0	1.0	9.0	
Midwest	4.0	4.5	6.0	1.0	8.0	
North	2.0	4.0	6.0	2.0	8.0	
Training BD						
Yes	4.0	5.0	6.0	1.0	10.0	<.001*
No	3.0	4.0	6.0	1.0	10.0	
Time of experience in the ICU						
Less than 1 year	3.0	4.0	6.0	1.0	9.0	
1–5 years	4.0	5.0	7.0	2.0	10.0	<.023**
6–10 years	4.0	6.0	7.0	1.0	9.0	
11–20 years	4.0	5.0	6.0	1.0	10.0	
21 years or more	3.0	5.0	6.0	1.0	9.0	
Opening of BD protocol						
Less than 5 protocols	3.0	4.0	5.0	1.0	9.0	
Between 5 and 10 protocols	4.0	5.0	6.0	3.0	9.0	<.001**
More than 10 protocols	4.0	5.5	7.0	1.0	10.0	
Safety when explaining to the family about BD						
Yes	4.0	5.0	6.0	1.0	10.0	<.001*
No	2.0	4.0	5.0	1.0	9.0	
Approach to BD during the graduation course						
Yes	3.0	5.0	6.0	1.0	10.0	.690*
No	4.0	5.0	6.0	1.0	10.0	
Hits	4.0	5.0	6.0	1.0	10.0	-

BD = brain death, ICU = intensive care unit, Max = maximum, Min = minimum, Q1 = percentile 25, Q3 = percentile 75.

*The Mann–Whitney test was used for 2 categories.

**The Kruskal–Wallis test was used for more than 2 categories.

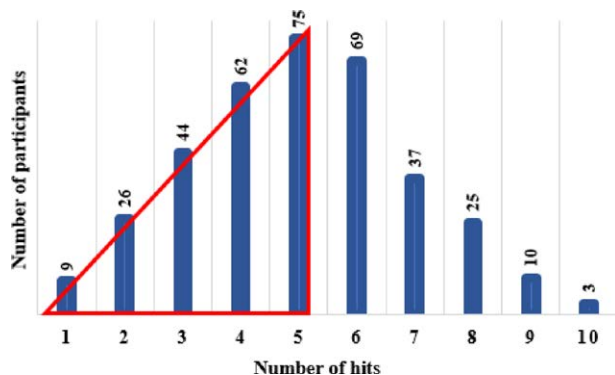


Figure 1. Distribution of the number of correct answers by number of participants. Highlighted, 216 participants performed below expectations.

5. Discussion

This study aimed to evaluate the knowledge of intensive care and non-intensive doctors working in different regions of Brazil. Our results showed a mean of correct answers equal to 5, which showed that physicians did not have good knowledge about the diagnosis of BD and organ donation in the studied sample. These findings corroborate other studies that evaluated the knowledge of 5th and 6th year medical students and physicians with experience in comatose patients, noting that they had little knowledge about the protocol and the application of the BD criteria.^[7,8,14]

In the present study, those who had graduated from 6 to 10 years (22%) performed better than the others, which corroborated the results of another study carried out with intensive care physicians, in a state hospital, in Rio de Janeiro, showing a result similar to ours.^[15] Those participants who had 6 to 10 years of experience in the ICU (58%) also had a better rate of correct answers. This finding becomes worrying and needs

further investigation, since the ICU is the place that has the largest number of patients in BD, thus requiring that all medical professionals are able to work in this sector,^[15] regardless of specialization.

Intensive care physicians performed better than physicians from other specialties ($P < .005$). In a study carried out with medical students, intensive care physicians and other specialties, knowledge about BD was evaluated, and it was noted that intensive care physicians had better results,^[16] corroborating the present study. We assume that the justification for this statistically difference is because intensive care physicians have more experience and more frequent care for critically ill patients, and because they frequently participate in training and continuing education courses for the management of patients in BD than others.

According to the criteria defined in the new Federal Medicine Council (FCM) resolution, resolution 2173 of 2017, physicians trained to diagnose BD must have experience in caring for patients in coma and have followed or performed at least 10 BD determinations, besides participating of training courses for this purpose.^[2] However, this study showed that most physicians participated in training on BD (68.9%) and performed over 10 protocol openings (55%), achieving better results than the others. These findings validate the criteria defined by the FCM and reinforce the importance of conducting training courses for the qualification of medical professionals in this area.

When asked about the security they had when talking to the family about BD, the majority (90%) responded positively, performing better than the others, which corroborated the results of another study, carried out in Teresina, with physicians working in the ICU, and 84.4% considered themselves to have the highest levels of safety when asked about the safety they attributed to themselves when explaining BD to the patients’ relatives.^[17] This encouraging result can generate a significant increase in the family’s acceptance for organ donation, consecutively resulting in the realization of transplants.

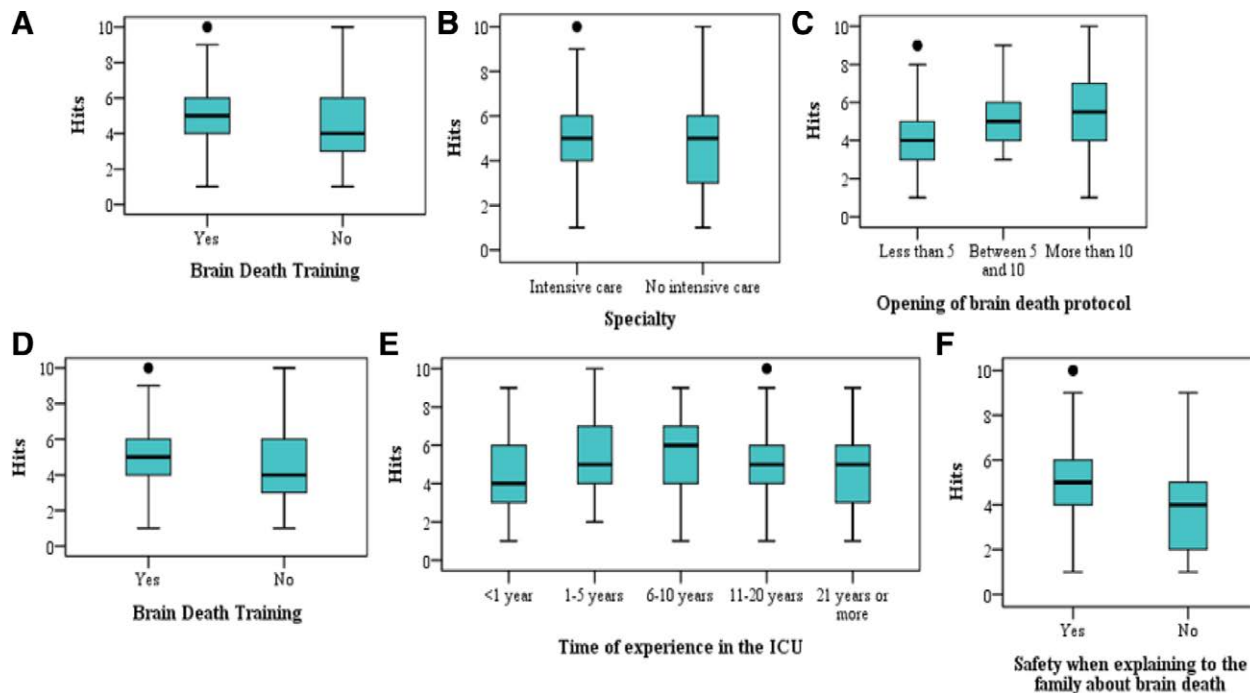


Figure 2. Boxplots of the distribution of the number of correct answers conditioned to the variables that showed statistical difference. In (A) those who participated in the brain death (BD) training performed better than those who did not ($P < .001$), (B) intensive care physicians had better knowledge than no intensive care physicians ($P < .002$), (C) those who performed more than 10 openings of BD protocols also ($P < .001$), (D) those who participated in the BD training had a better performance than those who did not participate ($P < .001$), (E) those with training between 6 and 10 years old also performed better ($P < .012$), and (F) those who felt safe talking to their family about BD also performed better than those who did not feel safe ($P < .001$).

Another interesting finding in this study was related to the approach to BD during the undergraduate course, where most participants (88.9%) considered it insufficient. In a study carried out in Minas Gerais, it was found that 90% of the participants considered the approach to the subject during medical graduation to be insufficient,^[7] affirming our finding and highlighting the need to include the theme in the curriculum of courses in the medical field.

It is also noteworthy that through this investigation it was possible to identify, through the low percentage of correct answers in the questions, the lack of existing knowledge among medical professionals about the resolution 2173 of 2017 established by the FCM. The basic aim of this resolution was to define parameters to standardize the definition of BD determination, legally, bringing relevant information about the method used to perform the diagnosis and thus standardize them,^[18] promoting patient safety, and strengthening the importance of the role of all physicians in preserving life through organ donation.

The limitations presented in this study were, a priori, related to the sample size, considered small from the perspective of the Brazilian medical population. Also, because of the scarcity of studies in the literature after updating the diagnosis of BD, the discussion of our results became limited. We consider it important that our results can be validated in future studies so that we can actually contribute to the improvement of physicians' knowledge about BD.

The present research gives medical science an originality, as it shows, through current scientific evidence, the knowledge of medical professionals about brain death and organ donation based on an instrument validated in face and content, developed specifically for this study. Still to highlight the strengths and weaknesses existing in this context.

Based on the results of the present study, the need for medical professionals to participate in training and continuing education courses about BD is clear, as they are fundamental strategies to fill existing knowledge gaps. It is also advisable to prepare new studies that can verify their knowledge before and after participation in training courses.

6. Conclusion

The results showed that the participants had low knowledge about diagnosis of brain death and organ donation protocols despite the majority working in ICUs. Be an intensive care physician, had large time experience in ICU, and had performed brain death protocols were associated with unsatisfactory knowledge concerning the subject.

Author contributions

Conceptualization: Mayra Gonçalves Meneguetti, Anibal Basile-Filho, Rosana Aparecida Spadoti Dantas, Maria Auxiliadora-Martins.

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