Solid Organ Donation Process: Correlation between Profile, Learning and Course Indication

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ABSTRACT

Objectives: To understand the profile of professionals trained in the solid organ donation process, to analyze the result of their learning before and after the course, and to correlate the profile and the performance of the professional with the learning and indication of the course. **Methods:** Retrospective, quantitative, analytical-descriptive study with participants of the course Processo de Doação de Órgãos Sólidos para Profissionais de Saúde. Online questionnaires were used on professional profile, performance in the area of organ donation, knowledge assessment, and course indication. The analyses and correlations were verified with the McNemar test, Spearman's rank, and the bisserial point. **Results:** Of the 130 professionals, 62% were nurses, 38% physicians, 35% emergency physicians, 26% intensivists, and 42% had more than 10 years of training. For the profile of work in the area of organ donation, the professionals report having participated in up to five cases in each of the following stages: 44% were involved in the brain death protocol, 56% in the family interview, and 60% in the organ donation process. The class knowledge retention rate was 26.7%, with 29.5% for physicians and 24.8% for nurses. The indication of the course was evaluated following the Net Promoter Score (NPS), being in the promoters zone. The correlation between the groups was positive and statistically significant for those working in the emergency room, with more than 5 years since graduation and with more than five cases reported on the questioned stages of organ donation. No significant correlation was identified between these variables and the indication of the course. **Conclusion:** The course contributed to the learning of professionals with more training time, greater previous experience in the stages of the organ donation process, and working in the emergency sector.

Descriptors: Learning; Knowledge; Behavior; Tissue and Organ Procurement; Patient Care Team.

Processo de Doação de Órgãos Sólidos: Correlação entre Perfil, Aprendizagem e Indicação do Curso

RESUMO

Objetivos: Conhecer o perfil dos profissionais capacitados no processo de doação de órgãos sólidos, analisar o resultado de sua aprendizagem antes e após o curso, e correlacionar perfil e atuação do profissional com sua aprendizagem e indicação do curso. **Métodos:** Estudo retroprospectivo, quantitativo, analítico-descritivo com participantes do curso Processo de Doação de Órgãos Sólidos para Profissionais de Saúde. Utilizaram-se questionários *online* sobre perfil profissional, atuação na área de doação de órgãos, avaliação de conhecimento e indicação do curso. As análises e correlações foram verificadas com os testes de McNemar, postos de Spearman e ponto-bisserial. **Resultados:** Dos 130 profissionais, 62% eram enfermeiros, 38% médicos, 35% emergencistas, 26% intensivistas e 42% tinham mais de 10 anos de formação. Para o perfil de atuação na área de doação de órgãos, os profissionais relataram ter participado em até cinco casos em cada uma das seguintes etapas: 44% no protocolo de morte encefálica, 56% na entrevista familiar e 60% no processo de doação de órgãos. A taxa de retenção de conhecimento da turma foi de 26,7%, sendo a dos médicos 29,5% e a dos enfermeiros 24,8%. A indicação do curso foi avaliada seguindo o indicador Net Promoter Score (NPS), estando na zona de promotores. A correlação entre os grupos foi positiva e estatisticamente significante para os atuantes na emergência, com mais de 5 anos de formação e com mais de cinco casos relatados sobre as etapas questionadas na doação de órgãos. Não foi identificada correlação significativa dessas variáveis sobre a indicação do curso. **Conclusão:** O curso contribuiu para a aprendizagem dos profissionais com maior tempo de formação, maior experiência prévia nas etapas do processo de doação de órgãos e atuantes no setor de emergência.

Descritores: Aprendizagem; Conhecimento; Comportamento; Obtenção de Tecidos e Órgãos; Equipe de Assistência ao Paciente.

INTRODUCTION

In Brazil in 2023, more than 50,000 people were registered on the waiting list for a solid organ[1]. This fact highlights the mismatch between supply (the number of viable organs) and demand (the increasing number of people on the list), resulting in longer waiting times, comorbidities and mortality[2].

The National Transplant System (Sistema Nacional de Transplantes-SNT) is responsible for the regulation and legislation of procuring, donating, and transplanting organs and tissues in the country[3,4]. It seeks to expand training for health professionals to improve and perfect this process through evidence-based practices from excellent hospitals, especially in a scenario in which the knowledge of medical and nursing students about legislation, professional ethics, diagnosis of brain death (BD) and family interview is insufficient[5-9].

For professionals already working, in addition to deficient knowledge, the attitude is impacted by a feeling of unpreparedness and insecurity about the process, whether in the clinical stages of identification and care for maintaining the potential donor, opening or suspending the diagnosis of BD[10-15], or surgical extraction, perfusion, packaging and transport of organs/tissues[2].

To address these weaknesses, the adoption of strategies, such as the creation of protocols based on specific legislation[3,4], use of national and international guidelines and collaborative learning with the Intra-Hospital Organ and Tissue Donation Committee for Transplants (Comissão Intra-Hospitalar de Doação de Órgãos e Tecidos para Transplantes-CIHDOTT), results in more excellent safety and quality of care[14,16,17]. Furthermore, including subjects in the undergraduate curriculum and continuous training on this topic contributes to the student/professional consciously developing the role of multiplier for the population and obtaining qualifications for safe and practical skills in clinical practice.[8,9,13,18].

The organ and tissue donation and transplantation process is complex and based on ethical, moral and legislative criteria. It consists of distinct stages of active search for a possible donor, identification, evaluation and validation of the potential organ donor (POD), diagnosis of BD, hemodynamic maintenance, family interview and logistics of withdrawal, transport and distribution[3,4]. These steps constitute learning objects; when combined with the persona, objectives, methodologies, instructional resources and assessment, they form the pedagogical training plan.

Studies on the impact of training and performance in the health area result in the search for a correlation between the student profile variables and the methodology applied[19-22]. Specifically for the training of professionals in the solid organ donation process, the target audience must be targeted with a profile corresponding to this area's challenges and practices so that its applicability is significant in improving indicators related to donation and transplants[21,22]. Therefore, it is necessary to verify whether there is a correlation between the professional's profile and previous experience in organ donation with their learning and reaction assessment after immersive training on the subject, providing ideas for developing more effective training aimed at the specific needs of these professionals.

The objectives of this study were to understand the profile of professionals trained in the solid organ donation process, analyze their knowledge and reaction and correlate their performance profile in organ donation with their learning and evaluation of opinion after the course.

MATERIALS AND METHODS

This is a retro-prospective, quantitative and analytical-descriptive study approved by the Research Ethics Committee of a philanthropic hospital (CAAE 71710023.9.0000.0071) that correlated the professional profile, performance in the area of organ donation, learning and opinion of students of the Processo de Doação de Órgãos Sólidos para Profissionais de Saúde (Solid Organ Donation Process for Health Professionals) course.

The course offered 16 places made available by the SNT via the Unified Health System (Sistema Único de Saúde) Institutional Development Support Program (Programa de Apoio ao Desenvolvimento Institucional do Sistema Único de Saúde /Proadi-SUS)[23]. This body was responsible for distributing vacancies to all State Transplant Centers (Centrais Estaduais de Transplantes-CETs). The CETs, in turn, nominated the candidates with the premise that they were public servants, doctors and nurses working in the emergency/urgency sectors, intensive care unit or CIHDOTT.

The course format was face-to-face, with a workload of 8 hours. The content taught was based on legislation and resolutions related to the organ donation process[24,25], protocol for the diagnosis of BD, techniques for the hemodynamic maintenance of the potential donor, strategies for validating the potential donor and good practices for family interviews, culminating in the approach to the concepts of process safety and reflections on the family's experience.

The pedagogical plan was based on active teaching methodologies, including flipped classrooms, discussions of clinical cases through questions and answers, an experiential learning cycle focused on professional attitudes towards real cases published in the media, and developing a care plan for potential organ donors. These approaches offered students a variety of methods for achieving learning objectives as described in Bloom's Taxonomy[26].

Four questionnaires were administered during a course[27], created in the online version through the free Google Form™ service, which makes it possible to make questions available via QR code and save the answers in the cloud with access restricted to the leading researcher through the Google Drive™ service.

The first questionnaire explored the professional profile regarding the category, training time and sector of activity; the second examined the profile in the area of organ donation to provide a quantitative view of experiences in the field; the third consisted of knowledge assessment, with pre - and post-test applied at the beginning and immediately at the end of the course, containing ten multiple-choice questions, with questions categorized into three knowledge axes. Questions 1 to 4 addressed aspects related to the diagnosis of BD, 5 to 7 to hemodynamic maintenance and 8 to 10 to communicating bad news and the family member's experience. For the fourth questionnaire, a reaction assessment was applied, with closed questions, following the Net Promoter Score (NPS) method, which sought to evaluate the recommendations of course participants.

Categorical variables were described using absolute frequencies and percentages, and numerical variables were described using means and standard deviations (SD). Grades were calculated by the total number of correct questions and weighted by the number of valid questions answered using the formula (number of correct questions) * 10/number of valid questions.

The answers were correlated with each other, the association of knowledge was verified by the McNemar test and the correlation between professional profile, performance in the area of organ donation, learning and opinion using the point-biserial for a dichotomous variable (category), and Spearman ranks for an ordinal variable (training time), with a significant result of $p < 0.05$.

RESULTS

The study was conducted with nine classes of the Solid Organ Donation Process for Healthcare Professionals course, held between August and November 2023, with the participation of 130 respondents.

Table 1 shows that 62% (81) were nurses and 38% (49) were doctors. Most of these professionals 38% (49) belonged to the Northeast Region, followed by the North Region, with 31% (40).

Table 1. Sociodemographic profile and professional category.

Sociodemographic profile	Nurse n (%)	Physician n (%)	Total n (%)
Total	81 (62)	49 (38)	130 (100)
Region			
North	19 (48)	21 (53)	40 (31)
Northeast	33 (67)	16 (33)	49 (38)
Midwest	9 (69)	4 (31)	13 (10)
Southeast	20 (71)	8 (29)	28 (22)
South	0 (0)	0 (0)	0 (0)
Professional sector			
Emergency	24 (53)	21 (47)	45 (35)
CTI	15 (44)	19 (56)	34 (26)
Other sectors	26(81)	6 (19)	32 (25)
CIHDOTT	16 (84)	3 (16)	19 (15)
Training time (years)			
1 to 4	4 (16)	21 (84)	25 (19)
5 to 10	39 (76)	12 (24)	51 (39)
Over 10	39 (71)	16 (29)	55 (42)
Have you already participated/performed the BD protocol			
Yes	50 (58)	36 (42)	86 (66)
No	31 (70)	13 (30)	44 (34)
If yes, the number of BD protocols			
1 to 5	25 (66)	13 (34)	38 (44)
6 to 10	7 (41)	10 (59)	17 (20)
11 to 20	5 (36)	9 (64)	14 (16)
Over 21	13 (76)	4 (24)	17 (20)
Total			

Table 1. Continuation...

Sociodemographic profile	Nurse n (%)	Physician n (%)	Total n (%)
Have you participated in/carried out a family interview?			
Yes	45 (64)	25 (36)	70 (54)
No	49 (82)	11 (18)	60 (46)
If yes, the family interview number			
1 to 5	23 (61)	15 (39)	38 (56)
6 to 10	6 (55)	5 (45)	11 (16)
11 to 20	3 (50)	3 (50)	6 (9)
Over 21	9 (81)	2 (18)	11 (16)
Total			
Have already participated/carried out the effective donation process			
Yes	47 (69)	21 (31)	68 (52)
No	35 (56)	27 (44)	62 (48)
If yes, the number of effective donation processes			
1 to 5	27 (66)	14 (34)	41 (60)
6 to10	7 (64)	4 (36)	11 (16)
11 to 20	4 (80)	1 (20)	5 (7)
Over 20	8 (73)	3 (27)	11 (16)

Source: Elaborated by the authors

Regarding the sectors of activity, 35% (45) worked in the emergency sector, 26% (34) in the intensive care unit (ICU), 25% (32) in other sectors (surgical center, medical clinic) and 15% (19) at CIHDOTT. It is essential to highlight that most nurses (84%) worked at CIHDOTT, while 56% of doctors were intensive care physicians.

Regarding training time, 19% had 1 to 4 years of experience, 84% were doctors, 39% had 5 to 10 years, 42% had more than 10 years of training, and 71% were nurses.

Concerning work in the area of organ donation, 66% (86) have already worked on the BD protocol, 54% (70) participated in family interviews, and 52% (68) were involved in the actual process of organ donation. Of these, the majority report participating in up to five cases in each stage: 44% in the BD protocol, 56% in the family interview and 60% in the organ donation process. However, in all cases, nursing has direct or indirect participation in more than 20 cases.

Knowledge assessment was done through a pre-test, with a mean of 7.3 and SD of 1.8, and a post-test, with a mean of 9.2 and SD of 1.0. Regarding knowledge retention, the class achieved a rate of 26.7%.

There was an increase above the class average (29.5%) for medical professionals, with grades ranging from 7.3 to 9.5. For nurses, the percentage was slightly below the general average (24.8%), with grades ranging from 7.2 to 9.0.

Tables 2 and 3 show the topics covered in the assessments and the analysis of correct and incorrect answers before and immediately after the course.

Table 2. Assessment of nurses' knowledge and its variation in successes and errors by content (n = 81).

Theme of the questions	Pre-test n (%)		Post-test n (%)		*p*-value
	Right	Error	Right	Error	
Question 1: definition of brain death	78 (96.3)	3 (3.7)	79 (98.0)	2 (2.0)	1.000
Question 2: prerequisites for opening the BD protocol	67 (83.0)	14 (17.0)	76 (94.0)	5 (6.0)	**0.039**
Question 3: procedures that make up the BD protocol	60 (74.1)	21 (25.9)	76 (94.0)	5 (6.0)	**< 0.001**
Question 4: correct time of patient death	52 (64.2)	29 (35.8)	69 (85.2)	12 (14.8)	**< 0.001**
Question 5: rewarming measures for hypothermia	49 (60.5)	32 (39.5)	74 (91.4)	7 (8.6)	**< 0.001**
Question 6: infection control for the potential donor	60 (74.1)	21 (25.9)	74 (91.4)	7 (8.6)	**0.004**
Question 7: parameters for potential kidney donor	56 (69.2)	25 (30.8)	77 (95.1)	4 (4.9)	**< 0.001**
Question 8: communication about the opening of the BD protocol	66 (81.5)	15 (18.5)	68 (84.0)	13 (16.0)	0.814
Question 9: consent to organ donation	30 (37.5)	51 (62.5)	67 (83.0)	14 (17.0)	**< 0.001**
Question 10: family conflicts and donation authorization	68 (84.0)	13 (16.0)	73 (90.0)	8 (10.0)	0.267

Source: Elaborated by the authors
Values of *p* < 0.05 are statistically significant.

Table 3. Assessment of doctors' knowledge and its variation in successes and errors by content before and after (n = 49).

Theme of the questions	Pre-test n (%)		Post-test n (%)		*p*-value
	Right	Error	Right	Error	
Question 1: definition of B D	48 (98.0)	1 (2.0)	49 (100.0)	0 (0.0)	-
Question 2: prerequisites for opening the BD protocol	42 (86.0)	7 (14.0)	48 (98.0)	1 (2.0)	**0.041**
Question 3: procedures that make up the BD protocol	44 (90.0)	5 (10.0)	49 (100.0)	0 (0.0)	-
Question 4: correct time of patient death	35 (71.0)	14 (28.5)	47 (96.0)	2 (4.0)	**0.003**
Question 5: rewarming measures for hypothermia	33 (67.0)	16 (32.6)	45 (92.0)	4 (8.1)	**0.010**
Question 6: infection control for the potential donor	40 (82.0)	9 (18.0)	47 (96.0)	2 (4.0)	0.070
Question 7: parameters for potential kidney donor	34 (69.0)	15 (30.6)	47 (96.0)	2 (4.0)	**< 0.001**
Question 8: communication about the opening of the BD protocol	42 (86.0)	7 (14.2)	45 (92.0)	4 (8.0)	0.450
Question 9: consent to organ donation	10 (20.0)	39 (79.5)	44 (90.0)	5 (10.0)	**< 0.001**
Question 10: family conflicts and donation authorization	33 (67.0)	16 (32.6)	48 (98.0)	1 (2.0)	**< 0.001**

Source: Elaborated by the authors
Values of $p < 0.05$ are statistically significant.

Specifically for questions Q2 (prerequisites for opening a BD protocol), Q4 (correct time of death), Q5 (rewarming measures for hypothermia), Q7 (clinical parameters for the care of the potential kidney donor) and Q9 (consent to organ donation), a statistically significant difference ($p < 0.05$) was obtained between the responses in the pre-and post-test for both categories.

Question Q9 stands out due to the significant reduction in the number of students who made mistakes in the pre-test and who continued to make mistakes in the post-test, with 31% of doctors and 72% of nurses. Among doctors, 100% were emergency physicians, and 87% were intensivists, while in nursing, 62% were emergency physicians, and 90% were intensivists.

For questions Q1, about the definition of BD, and Q8, about communication regarding the opening of the BD protocol between medical professionals and nurses, no significant improvement was observed.

Emphatically, Q1 stands out for being the only question in which 100% of students, both doctors (emergency and intensivists) and emergency nurses, answered correctly in both the pre-test and post-test.

Question Q6, about infection control in potential donors and significant retention of learning, was identified only for doctors. Question Q10, which addressed family conflicts and authorization for organ donation, was only important for nurses.

In the reaction assessment, 35% (46) did not undertake any training on this topic, and of those who did, 96% rated it as significantly better. The NPS instrument was used, which consists of a rating question from 0 to 10 about the probability of recommending the course. All respondents were classified as promoters, resulting in an NPS of 100, indicating that the course is in the "enchantment" zone, with a rating of 10 given by 100% of doctors and 97% of nurses.

Statistical studies of comparative correlation between groups were conducted to investigate whether the student's profile influences their knowledge retention and post-course opinion assessment. Those with five or more years of training, with more than five indicators being considered experienced, were participants in the protocol/interview/organ donation process and working in a reference sector (CIHDOTT).

Regarding learning, the results of the analysis, described in Table 4, demonstrate that individuals with more than five years of training, working in sectors such as emergency and with participation in more than five cases of BD protocol, family interview and donation process of effective organs showed less variation in scores between the pre- and post-test, indicating a more consistent learning gain in this group. For the correlation of the reaction evaluation, especially regarding the course indication, no apparent relationship was identified between the category variables, training time, work in emergency sectors, ICU, CIHDOTT, and participation in the stages of the organ donation process. These factors may not directly influence the overall perception of the course or participants' willingness to recommend it. Other aspects that should be addressed in the research may be more strongly associated with assessing participants' reactions.

Table 4. Analysis of the professional profile with learning retention and opinion satisfaction (n = 130).

Variables	Learning		Reaction Assessment		Correlation type
	Correlation	*p*-value	Correlation	*p*-value	
Category (medicine x nursing)	0.102	0.249	-0.097	0.271	Point-biserial correlation
Training time (less x more than 5 years)	**0.268**	**0.002**	0.146	0.098	Spearman's rank correlation
Work sector (emergency x other sectors)	**0.191**	**0.030**	0.040	0.648	Point-biserial correlation
Work sector (emergency x CIHDOTT)	**0.317**	**0.011**	0.082	0.520	Point-biserial correlation
Work sector (ICU x CIHDOTT)	0.155	0.269	0.104	0.460	Point-biserial correlation
Work sector (others x CIHDOTT)	0.230	0.105	-	-	Point-biserial correlation
Work sector (emergency x ICU)	0.207	0.067	-0.023	0.843	Point-biserial correlation
Organ donation process (less x more than 5 cases)	**0.361**	**0.000**	-0.090	0.308	Point-biserial correlation
BD protocol (less x more than 5 cases)	**0.423**	**0.000**	-0.032	0.720	Point-biserial correlation
Family interview (less x more than 5 cases)	**0.336**	**0.000**	0.068	0.439	Point-biserial correlation

Source: Elaborated by the authors
Values of *p* < 0.05 are statistically significant.

DISCUSSION

Due to the potential organ donor's multiple physiological changes, intensive management of this patient becomes a challenge for the health teams in critical patient units (emergency and ICU) to which the role of care is transferred. However, these teams are not directly involved in conducting any stage of the donation process. Therefore, training these professionals is a crucial strategic measure to ensure the use of viable and quality organs for recipients awaiting transplantation[28,29].

In this study, the majority of the people with training were nurses. Research shows that nurses are the most significant number of professionals in the donation and transplant system[14], acting wholly in all stages of the process, including assertive communication and empathetic listening to family members, essential actions for humanization and constructing a relationship of trust. This care was highlighted in 80% of the articles analyzed in an integrative review on the importance and role of nursing in organ donation[30].

Learning was similar when comparing the categories of doctors and nurses. However, a relationship was observed with training time, in which professionals with greater professional maturity showed more significant learning gains, which is corroborated by studies in which 44% of nurses with more than eight years of training reported that more experience in the process of death and dying results in changes in behavior concerning organ donation[14]. Furthermore, 38 intensive care physicians with more than five years of experience had a higher success rate in their assessments[13], and 518 medical students gradually increased their knowledge on this topic as they approached the end of the course[10].

Regarding the place of work, emergency professionals showed significant knowledge (*p* = 0.011) compared to experts on the CIHDOTT topic. Still, there was no difference compared to intensivists, which differs from a survey of 100 professionals, in which the intensivists demonstrated more excellent knowledge compared to emergency physicians[31] and with 90 nurses; the knowledge score was directly correlated to their experience working in the ICU[32].

The professionals in this research with a more significant number of direct or indirect participation in stages of the organ donation process showed more excellent learning retention when compared to those who had less exposure to this practice. However, there is no consensus among studies regarding this correlation. For example, a survey showed that 50% of intensive care physicians who participated in more than 10 BD protocols did not have higher success rates[13]. In contrast, 58% of nurses who worked in CIHDOTT for up to 2 years showed higher knowledge scores associated with safer attitude and practice[6].

From this perspective, the content evaluated concerning the concept of BD showed that 98% of nurses got it right in the post-test, with a higher rate found in studies that resulted in 50%[6]. The question of the time of death was statistically significant, with 96% of doctors getting the question right, higher than in the study that had 86% as a result[13]. This fact reinforces that these two issues are fundamental for correctly identifying the potential donor and his death declaration in ethical and legal principles.

Among the questions about potential donor maintenance guidelines, the rewarming measure for hypothermia had a high error rate in the pre-test for nurses (39.5%) and doctors (32.6%). However, it was lower than the number presented in the study with 27 CIHDOTT nurses, 94.1%[6], and 68.9% of emergency and ICU nurses[33].

Hypothermia is one of the leading causes of potential donor loss, according to research. There were 321 deaths, 27% of which were BD; temperatures below 35.5 °C resulted in the loss of 17% of cases[16]. It is worth highlighting that this factor can be improved through protocolized actions and training directed to the needs of the local team to stabilize the patient's hemodynamics[16].

For the behavioral items referring to communicating bad news and the family member's experience, consent to organ donation was the item with the most significant deficit in prior knowledge: 62.5% of nurses and 79.5% of doctors. The study also observed this knowledge gap with 123 CIHDOTT professionals considered a reference in this assistance: 88.2% got this concept wrong[6].

Another area for improvement was the number of professionals who reported needing to complete training on the topic (35%). Despite being a lower rate than that found in the literature, greater than 75%[28,30], studies suggest that educational initiatives can positively influence the attitude and knowledge of professionals from different positions and health students in the organ donation process[10,12,14,16,28]. However, these surveys focus on the level of knowledge and applicability, not addressing the level of reaction, that is, the opinion or recommendation using the NPS, making it impossible to make comparisons with the finding of 100% of promoters of the applicability of this study.

Other limitations include the need for assessment of the applicability of this learning after the course, which prevents capturing the sustainability of results in the medium and long term due to the research focusing on the individual (subjective) rather than the relational dimension of the work environment. Furthermore, the competencies regarding the skills and attitudes of professionals and their opinions about encouraging organ donation or considering themselves as donors were separate from the subject of research.

CONCLUSION

Considering the insufficiency of training in solid organ donation for undergraduates and health professionals, the results of this study highlight essential aspects of the importance of training as a means of reducing the loss of potential donors, thus increasing the supply of organs for the growing demand from patients waiting for a transplant.

Therefore, professionals with more extended training and previous experience in the stages of the organ donation process and working in the emergency sector retained more knowledge. However, the caveats mentioned are essential, as there are insufficient studies on the topic, and existing models vary in how they evaluate and correlate the profile, knowledge, skills and attitudes of nurses and doctors in critical patient sectors.

Institutions that seek to apply training in this area need to consider the student's profile and the creation of a pedagogical plan that provides behavioral change, aiming at the professional's decision-making in applying post-course knowledge in the face of difficulties encountered in solid organ donation.

CONFLICT OF INTEREST

Nothing to declare.

AUTHOR'S CONTRIBUTION

Conceptualization: Morgado SR, Afonso Junior JE; **Metodology:** Santos JG, Calado DAMC, Nascimento Neto J;. **Investigation:** Santos JG e Paglione HB; **Data curation:** Santos JG, Calado DAMC, Nascimento Neto JM; **Supervision:** Morgado SR, Afonso Junior JE, Silva WP; **Article writing:** Santos JG, Silva WP; **Critical revision:** Paglione HB; Silva WP; **Final approval:** Santos JG.

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