Use of image collections in Forensic Dentistry research: ethical, bioethical and legal aspects

Paulo Henrique Viana Pinto[1], Bruna Saud Borges[2], Ana Luísa Rezende Machado[2], Marco Aurélio Guimarães[3], Ricardo Henrique Alves da Silva[4]

ABSTRACT

Objective: To conduct a quantitative survey of scientific articles that used image collections as source of research in Forensic Dentistry and discuss its use from ethical, bioethical and legal perspectives. **Material and Methods:** A search for scientific articles published and available on Lilacs, PubMed and Scielo databases was carried out from 2015 to 2019 using keywords in Portuguese, English and Spanish. Articles in the area of Forensic Dentistry that used image collections as a source of information were included. Laboratory or clinical, archaeological or anthropological studies, case reports or review articles, prospective studies or that used imaging exams not belonging to collections were excluded. **Results:** 171 scientific articles were included. 22.80% (n = 39) were carried out by authors from Brazilian institutions, and 77.19% (n = 132) mentioned approval by a research ethics committee or corresponding institution with (or without) use of signed Informed Consent Form (ICF). **Conclusion:** Image collections are an important source of information for research in Forensic Dentistry, considering the number of publications during the study period. Most of the articles mentioned ethical approval and respect for participant privacy according to the requirements established for waiver of the ICF.

Keywords: Forensic Dentistry; Bioethics; Research Ethics Committees; Research Ethics; Scientific Publication Ethics.

INTRODUCTION

Forensic Dentistry is the specialty responsible for providing clarifications to the Justice and whose field of action covers demands such as Forensic Dentistry guidance, traumatological exams, expertise in varied domains (civil, criminal, labor or administrative), human identification exams, age estimation, among others[1,2]. The dental expert exam has as main purpose the survey of the largest number of information about the object or situation questioned[3-5], which may require diagnostic imaging exams[5,6].

In this context, imaging exams are an important source of information for post-mortem human identification, and their use makes the process more agile and less costly[7,8]. In addition, radiographic examinations make it possible for dental age estimation methods to be carried out with practicality in social security, adoption or criminal liability areas when the suspect's age is questioned[9-11]. Due to the importance that image examinations hold in the different fields of work of Forensic Dentistry, several studies that used image collections were carried out to test the applicability or even validate methods used internationally in the Brazilian population[12-14]. Image collections have also been used in research to adapt or improve tools related to human identification[15-16], as well as the detection of frauds that can occur in radiographic examinations when these are requested for administrative purposes[17].

For research involving the human being, directly or indirectly, to be carried out in Brazil, it is necessary the approval by the Research Ethics Committee (CEP), which are collegiate bodies whose purpose is to defend the interests of the research subjects and development based on ethical

1 Aluno (Doutorado), Programa de Pós-Graduação, Universidade de São Paulo. Faculdade de Medicina de Ribeirão Preto. Departamento de Patologia e Medicina Legal. Ribeirão Preto (SP), Brasil.
2 Mestre, Programa de Pós-Graduação, Universidade de São Paulo. Faculdade de Medicina de Ribeirão Preto. Departamento de Patologia e Medicina Legal. Ribeirão Preto (SP), Brasil.
3 Professor Associado, Universidade de São Paulo. Faculdade de Medicina de Ribeirão Preto. Departamento de Patologia e Medicina Legal. Ribeirão Preto (SP), Brasil.
4 Professor Associado, Universidade de São Paulo. Faculdade de Odontologia de Ribeirão Preto. Departamento de Estomatologia, Saúde Coletiva e Odontologia Legal. Ribeirão Preto (SP), Brasil.

and bioethical principles[18,19]. Among the bioethical principles, the participant's autonomy concerns the right that is assured for consenting or dissenting about their participation in a certain research[19-21]. Because of this, ethical and legal dilemmas related to the use of secondary data (e.g., medical records and imaging exams) may arise, especially with regard to the need to inform the patient that the information contained in their medical records may be used in scientific research[22]. In this context, while the privacy of patient information is guaranteed by researchers[22], contrary understandings may prevent research from being carried out based on the justification that the act of consenting the patient, at the time of dental care, would not be directed to the performance of specific scientific research. Thus, this article aimed to t a quantitative survey of scientific articles that used image collections as a source of research in Forensic Dentistry as well as to discuss its use under ethical, bioethical and legal perspectives.

MATERIAL AND METHODS

To check the importance of imaging exams as a source of data in scientific research in the area of Forensic Dentistry, scientific articles were searched on Lilacs, PubMed and Scielo databases between 2015 and 2019, using the descriptors "Forensic Dentistry", "Dental Radiography", "Panoramic Radiography", "Magnetic Resonance Imaging", "Ultrasound", "Tomography" and "Diagnostic Imaging" in Portuguese, English and Spanish. "AND" and "OR" relationship operators were duly employed for a wider range of articles.

After initial research, articles were selected based on the established inclusion and exclusion criteria. Articles that formed the sample were selected after reading the title, abstract and methodology in full. All research articles related to the area of Forensic Dentistry using radiographic and image collections of human beings as a source of information were included. Laboratory or clinical, archaeological or anthropological studies, as well as case reports or review articles were excluded from the sample. In addition, prospective studies, as well as research that used imaging exams not belonging to collections, were also excluded. Articles found in two or more databases were counted only once.

The selected articles had their objectives, methodology and results analyzed to check for non-application of the Informed Consent Form (ICF) in research that used image collections as a source of information influenced the approval of the research by ethics committees or corresponding institution. The following information was collected: (I) Country of affiliation of the first author; (II) Origin of the collection; (III) Type of image used; (IV) Age of the participants; (V) Number of exams included; (VI) Source of the collection; (VII) Mention of ethical appraisal and; (VIII) Purpose of the study.

It should be noted, however, that the "origin of the collection" includes information that could include exams from different populations/countries, such as England and Scotland, which were categorized as the United Kingdom. With regard to the "source of the collection", exams from more than one university or university hospitals, for example, were categorized as coming from the university. In addition, regarding the "Age of the participants", age groups delimited by decimal places were categorized in closed intervals, that is, an age range of 6.2 and 24.8 years, for example, was considered to belong to the age group between 6 and 24 years. The data collected were organized in Microsoft Excel® spreadsheets (Microsoft Corp., Redmond, WA, USA) and submitted to descriptive analysis.

RESULTS

One-hundred-seventy-one scientific articles published in national and international journals were selected. Table 1 lists the total number of articles found in Portuguese, English and Spanish and the articles selected after applying the inclusion and exclusion criteria.

When classified per year of publication, the use of image collections in scientific research was present in a considerable number, in addition to the increase in the use of image collections in the evaluated period, as illustrated in Figure 1.

Table 1
Number of articles found and selected

Database	Language	Articles found	Selected articles
	Portuguese	297	14
Lilacs	English	239	1
	Spanish	199	0
	Portuguese	0	0
PubMed	English	329	148
	Spanish	0	0
	Portuguese	44	1
Scielo	English	64	3
	Spanish	43	4
TOTAL		**1,215**	**171**

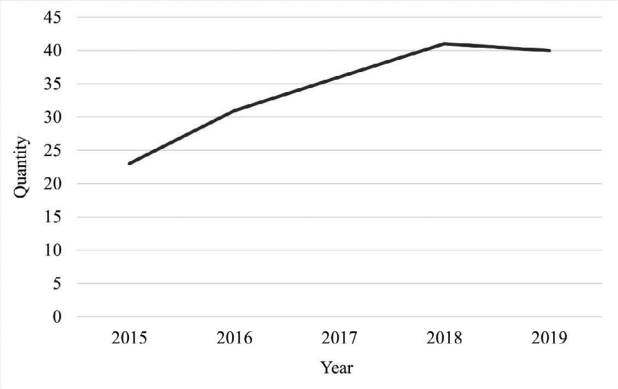
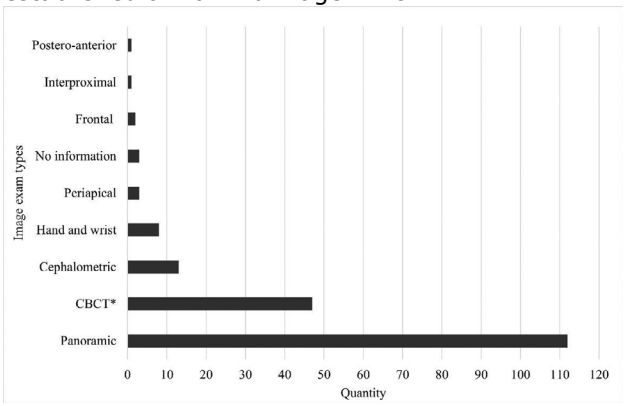


Figure 1: Number of articles selected per year of publication

With regard to the first author's affiliation country, of the total of 171 selected articles, 22.80% (n = 39) articles were produced by authors linked to Brazilian institutions. Regarding the origin of the collections, the same number was obtained, and one of the surveys used collections from two countries. Not necessarily, the studies that were conducted in Brazil, had a Brazilian sample. There was a case in which the research was carried out in Brazil and the collection was from Portugal and in another, from the Netherlands. The rest were distributed in several different countries, as listed in Tables 2 to 4 of the supplementary material.

Another information of great relevance is in relation to the variability of the types of dental image used in the research, as illustrated in Figure 2. In this aspect, it is important to highlight that 14 articles used two types of image in the study, one article used three types of image and another, four types. Therefore, once the same study has used different types of images, the number of exams shown in Figure 2 exceeds the number of articles analyzed.

Another factor explored was the age of the participants. From 171 articles, the lowest age found was three years and the highest was from a study that mentioned that the age would go up to 100 years. However, numerous studies have not established a maximum age limit.



* Cone-Beam Computed Tomography.

Figure 2: Distribution of dental image types among the selected articles

When analyzing the number of exams used in each study, it is observed that the minimum number of the sample used was 10 exams and the maximum, 43,467 exams. The ages and sample numbers of all studies are listed in Tables 2 to 4 of the supplementary material.

Regarding the analysis performed on each article, separately, it was possible to observe that 77.19% (n = 132) selected articles mentioned approval by a research ethics committee or corresponding institution. In addition, 119 articles obtained the samples at universities, 22 at radiological clinics outside universities, 18 at clinics outside universities (not being detailed if they were radiological clinics), 11 at hospitals with no university bond and nine did not mention the source of the collection. It is important to note that eight studies obtained the samples in two different databases and because of this, the amount of information related to the source of the collection (n = 179) presents a greater quantity in relation to the number of articles analyzed (n = 171).

The published articles were mostly distributed in the themes presented in Figure 3. Further, other articles evaluated Forensic Facial Approximation (n = 9); Ancestry (n = 2); Audit (n = 1); Anatomy applied to Forensic Dentistry (n = 1) and Sexual Dimorphism (n = 1). Together, all themes were evaluated 177 times out of 171 articles analyzed, since there were articles that evaluated more than one theme. Thus, four articles evaluated sex estimation and age estimation; one article assessed sex and ancestry estimates, and one article assessed sexual dimorphism and ancestry.

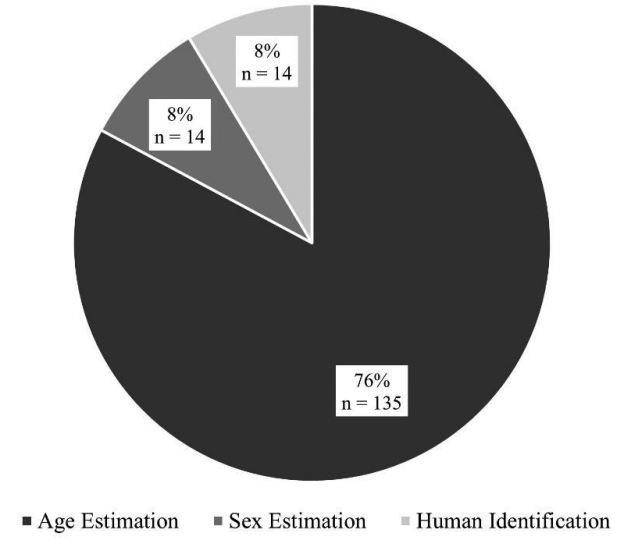


Figure 3: Purpose of the studies that were most cited in the surveys

DISCUSSION

The protection and promotion of human rights, as well as the individual's autonomy as a patient or participant in scientific research, emerged in post-World War II with the publication of the Nüremberg Code (1947) and the Universal Declaration of Human Rights (1948)[21]. In health services and scientific research, the bioethical principle of autonomy and the right to self-determination of the human person translates into a free choice based on the ability that individuals have to receive, understand and consent to certain information[19,21].

The guarantee of protection of the rights of research participants consists of the fundamental purpose for which the research ethics committees were created, and their ethical appraisals evaluate the merit of conducting scientific research through analysis of factors such as the balance between risks and benefits present in a survey[19]. Although there is no regulation that specifically deals with the use of image exams as a source of information in scientific research, there must be additional care on the part of the researchers regarding the privacy of the information that at that moment fits as research participants[22,23].

By analyzing the articles surveyed herein, it can be seen that the majority of research (77.19%) that used image collections as a source of information showed concern about the ethical approval of the studies. On the other hand, it is noteworthy that 22.81% did not mention appraisal by ethics committees or a corresponding institution does not imply that they have not been reviewed and approved by ethics councils or committees, or that researchers have not carried out the studies in accordance with ethical and bioethical principles.

Although the present survey considered national and international publications, 22.80% used Brazilian image collections. In this regard, CNS/MS Resolution 466/12[18], which regulates the conduct of research involving humans in Brazil, is generic in terms of the participant's confidentiality and privacy, including the use of the patient's medical record as a source of information in scientific research[22]. Despite this, the importance of using image collections in Forensic Dentistry becomes evident, since a considerable and growing number of studies published in this area can be found during the evaluated period (Figure 1).

As for the scenario of scientific publications that used image collections in their analysis, panoramic radiographs were the most used type of image (Figure 2), with universities being the main place of origin of the collections (119/171 articles). In general, most studies focused on age estimation (Figure 3). Considering the affiliation of the main author, 22.80% of the published articles had their affiliation reported to Brazilian institutions.

With the reading of the methodology of the articles included in this study, it is also possible to observe a consensus of the authors

with regard to the concern for the privacy of the information, since the secrecy before the identity of the participants was ensured by collecting only information of interest to research such as sex, age or ethnicity[24,25], which is appropriate[22].

The articles analyzed repeatedly stated that the participants were not exposed to any type of radiation, and that all exams were used for the primary diagnostic or therapeutic purpose[16]. In addition, some articles mentioned that patients or their guardians consented to the possibility that such exams could be used for research or educational purposes[25,26].

In this context of consent, the need to inform patients and potential research participants about the possible use of the information in medical records in scientific research (called secondary use) stands out, giving rise to their refusal through a self-exclusion clause[22]. Although the Dental Code of Ethics[27] does not specifically deal with the secondary use of the medical record, the referred rule addresses aspects related to scientific research and publication, and the Medical Code of Ethics[28] allows the use of medical records in scientific research as long as approved by CEP or the National Research Ethics Committee (CONEP)[22].

Therefore, with regard to the attribution of research ethics committees for such approval, it is not for the CEP/CONEP System to legislate on the access and use of the medical record, but rather to determine compliance with the secrecy and confidentiality of the information[23,29]. However, the denial of research proposals involving analysis of medical records or image collections has already occurred, and as a justification for the fact that the image exams belong to the patient and that they would not have authorization from the participant for this use for scientific purposes.

Regarding this dilemma, Albuquerque (2019) explains that the rule for the secondary use of medical records is to access authorized documentation through the patient's consent. Nevertheless, when it is impossible to obtain consent, the anonymity of the information must be performed, which can be done through digital resources that remove the identification of the exams and preserve the patient's identity and privacy[22]. Thus, research using image collections is likely to be carried out in an ethical and legal manner without the need to use an ICF.

This occurs in the usual way when it comes to collections of images in the medical field (e.g. X-rays, computed tomography, magnetic resonance and even histopathology images), both in hospitals and clinics. Hospital institutions, especially in universities, have a very large collection of old exams, requested for diagnostic purposes and not for research, which is routinely used for this purpose, since locating patients to sign the informed consent form would make it impossible to carry out much of the research proposals. Changes in addresses, forms of contact and even deaths justify the waiver of requesting the consent form for imaging exams, just if the exams are unidentified. The possibility that someone will be recognized through a medical image exam is considered very low or virtually null and unless it can cause damage to the person's image and honor (highly specific situations that will only exceptionally be questioned) only then will the ICF signature be expected. Medical professionals in medical imaging sciences and even hospital CEPs are unfamiliar with the situation of requiring ICF for research involving, for example, panoramic radiographs in Dentistry.

And in this theme, it is important to emphasize that, in specific cases of Forensic Dentistry, human identification methods are often based on image exams, and the use of such banks, preserving the anonymity of the subjects and with a unique and exclusive focus on methodologies that can be applied with greater security and validity are extremely important. And, it is not always possible to affirm that university environments will have sufficient collections for scientific criteria, as well as there is no way to affirm that, just because it is a collection of a university environment, it implies a consent process properly performed with respect to the secondary use.

Thus, although the importance of consent is recognized, specifically with regard to collections, the ICF cannot be seen as the only instrument that determines the ethical nature of research to the detriment of its methodology[19,29], and the

non-use of ICF, even due to the infeasibility of its application, does not justify the non-acceptance by the ethics committees or corresponding institution, since it is not up to the CEP/CONEP System to impose restrictions on research proposals when there are methods that justify the waiver of the informed consent[18].

Because of this, different from what one might think, CEPs are assigned the function of evaluating research protocols based on principles such as impersonality and rationality in order to avoid redundancies and slowness in the analyses[18]:

> VIII.1 – to evaluate research protocols involving human beings, with priority on topics of public relevance and strategic interest in the SUS priority agenda, based on epidemiological indicators, issuing an opinion, duly justified, always guided, among others, by the principles of impersonality, transparency, rationality, proportionality and efficiency, within the deadlines set in the operational standard, avoiding redundancies that result in slowness in the analysis. (Brasil, 2020c, p.8)[18]

Thus, legal consequences may arise when damage to the research or damage to the researcher(s) in its most varied aspects (material and moral, for example) occurs, if proven to be due to the delay or unjustified non-acceptance of the research proposals. Therefore, even if it presents risks, research that uses medical records or image collections as a source of information is likely to be carried out, as long as the researchers and the professional responsible for keeping the documents ensure the confidentiality of the information[22].

CONCLUSION

Image collections are an important source of information for research in Forensic Dentistry and most of the articles analyzed mentioned ethical approval, as well as respect for the privacy of information related to the identification of research participants in accordance with the requirements inherent to studies that propose waiver of the ICF, which demonstrated the researchers' prudence regarding ethical, bioethical and legal premises that guide scientific research with human beings.

REFERENCES

1. Brasil. Lei 5.081, de 24 de agosto de 1966. Regula o exercício da Odontologia. Disponível em: http://www.planalto.gov.br/ccivil_03/leis/L5081.htm. Acesso em: 12 de maio de 2020a.
2. Brasil. Conselho Federal de Odontologia. Consolidação das normas para procedimentos nos conselhos de odontologia. Resolução nº 63, de 8 de abril de 2005. Disponível em: http://transparencia.cfo.org.br/wp-content/uploads/2018/03/consolidacao.pdf. Acesso em: 12 de maio de 2020b.
3. Silva RHA. Orientação profissional para o cirurgião-dentista: ética e legislação. São Paulo: Santos; 2010.
4. Gonçalves RA, Soriani NC, Silva RHA. Descrição de protocolo fotográfico para utilização na rotina pericial odontológica em âmbito civil. Rev Bras Odontol Leg RBOL. 2018;5(2):49–58.
5. Lima KF, Figueiredo BMJ, Guimarães MA, et al. Registro de informações odontológicas pós morte com fins de identificação humana: descrição do protocolo utilizado no LAF-CEMEL. Rev Bras Odontol Leg RBOL. 2018;5(1):48–60.
6. Carvalho SPM, Silva RHA, Lopes-Júnior C, et al. A utilização de imagens na identificação humana em odontologia legal. Radiol Bras. 2009;42(2):125–30.
7. Hinchliffe J. Forensic odontology, part 2. Major disasters. Br Dent J. 2011; 210(6): 269–74.
8. Borowska-Solonynko A, Dąbkowska A, Moskała A, et al. Radiological examination of mass disaster victims – position statement of the Forensic Imaging Examinations Commission at the Polish Society of Forensic Medicine and Criminology. Arch Med Sadowej Kryminol. 2018;68(3):201–7.
9. Willems G, Van Olmen A, Spiessens B, et al. Dental age estimation in Belgian children: Demirjian's technique revisited. J Forensic Sci. 2001;46(4):893-895.
10. Cameriere R, Ferrante L. Canine pulp ratios in estimating pensionable age in subjects with questionable documents of identification. Forensic Sci Int. 2011;206(1-3):132–5.
11. Silva RF, Mendes SDSC, Rosário Júnior AF, et al. Evidência documental x evidência biológica para estimativa da idade–relato de caso pericial. Rev Odontol Bras Central. 2013;21(60):6-10.

12. Lavez GP, Terada ASSD, Dezem TU, et al. Age estimation using Olze's method in an adult Brazilian population. J Forensic Leg Med. 2017;52:241–244.

13. Luz LCP, Anzulović D, Benedicto EN, et al. Accuracy of four dental age estimation methodologies in Brazilian and Croatian children. Sci Justice. 2019;59(4):442–7.

14. Sousa AMS, Jacometti V, AlQahtani S, Silva RHA. Age estimation of Brazilian individuals using the London Atlas. Arch Oral Biol. 2020;113:104705.

15. Beaini TL, Duailibi-Neto EF, Chilvarquer I, et al. Human identification through frontal sinus 3D superimposition: Pilot study with Cone Beam Computer Tomography. J Forensic Leg Med. 2015;36:63–9.

16. Franco A, Orestes SGF, Coimbra EF, et al. Comparing dental identifier charting in cone beam computed tomography scans and panoramic radiographs using INTERPOL coding for human identification. Forensic Sci Int. 2019;302:109860.

17. Díaz-Flores-García V, Labajo-González E, Santiago-Sáez A, et al. Detecting the manipulation of digital clinical records in dental practice. Radiography. 2017;23(4):e103–e107.

18. Brasil. Ministério da Saúde. Conselho Nacional de Saúde. Resolução nº 466, de 12 de dezembro de 2012. Diretrizes e normas regulamentadoras de pesquisas envolvendo seres humanos. Disponível em: http://conselho.saude.gov.br/resolucoes/2012/Reso466.pdf. Acesso em: 12 de maio de 2020c.

19. Cosac DCS. Autonomia, consentimento e vulnerabilidade do participante de pesquisa clínica. Rev Bioét. 2017;25(1):19–29.

20. Barboza, HH. Princípios da bioética e do biodireito. Rev Bioét. 2000;8(2):209-216

21. Wanssa, MCD. Autonomia versus beneficência. Rev Bioét. 2011;19(1):105-117.

22. Albuquerque, AO. Pesquisa com prontuário: análise ético-jurídica à luz dos Direitos Humanos dos Pacientes. Cadernos de Ética em Pesquisa. 2019;1(1):41-52.

23. Brasil. Conselho Nacional de Saúde. Comissão Nacional de Ética em Pesquisa. Carta Circular nº. 039/2011/CONEP/CNS/GB/MS. Uso de dados de prontuários para fins de Pesquisa. Brasília, 30 de setembro de 2011. Disponível em: https://www.puc-campinas.edu.br/wp-content/uploads/2019/05/Carta-Circular-CONEP-n.-039.11-30-09-2011-Uso-Prontuarios.pdf. Acesso em: 13 de maio de 2020d.

24. Arge S, Boldsen JL, Wenzel A, et al. Third molar development in a contemporary Danish 13–25 year old population. Forensic Sci Int. 2018;289:12–7.

25. Hegde S, Patodia A, Dixit U. The applicability of the original and revised Demirjian standards to age estimations of 5-15 year old Indian children. J Forensic Odontostomatol. 2018;36(1):1-13.

26. Balla SB, Lingam S, Kotra A, et al. New regression models for dental age estimation in children using third molar maturity index: A preliminary analysis testing its usefulness as reliable age marker. Leg Med. 2019;39:35–40.

27. Brasil. Conselho Federal de Odontologia. Código de Ética Odontológica. Aprovado pela Resolução CFO-118/2012. Disponível em: http://website.cfo.org.br/wp-content/uploads/2018/03/codigo_etica.pdf. Acesso em: 13 de maio de 2020e.

28. Brasil. Conselho Federal de Medicina. Código de Ética Médica. Resolução CFM nº 2217 de 27/09/2018. Disponível em: https://portal.cfm.org.br/images/PDF/cem2019.pdf. Acesso em: 13 de maio de 2020f.

29. Macedo, JL. Quando a Ética se Torna Moral: considerações sobre o sistema CEP no Brasil. Revista Mundaú. 2017;1(2):54-66.

Conflito de interesses

Não houve conflito de interesse.

Corresponding Author
Prof. Dr. Ricardo Henrique Alves da Silva.
ricardohenrique@usp.br

Editor:
Prof. Dr Felipe Villela Gomes

Received in: July 28, 2020
Approved in: Oct 29, 2020