

ORIGINAL ARTICLE

FACTORS THAT INTERFERE IN THE INTERVAL TIME BETWEEN SURGERIES: AN OBSERVATIONAL STUDY

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ABSTRACT

Objective: to investigate the interval time between surgeries and factors that can influence this process. **Method:** a quantitative, observational and cross-sectional study carried out in three surgical centers of a large-sized hospital in southern Brazil. Collection took place in January and February 2020, by observing the interval between script-guided surgeries. Data analysis was performed by means of descriptive statistics, correlation and factor analysis. **Results:** the mean turnover time was 37 minutes. The disassembly ($r=0.540$, $p<0.001$ and $r=0.406$, $p<0.001$), cleaning ($r=0.584$, $p<0.001$) and assembly ($r=0.689$, $p<0.001$) variables were positively and moderately related to turnover. The interval was longer with patients coming from hospitalization units than from outpatient services and, after minor surgeries, the time was shorter than in medium-sized and major surgeries. **Conclusion:** reflections on surgical center processes are provided. They will be useful in planning, implementing and managing this sector.

DESCRIPTORS: Surgical Center Nursing; Surgical Centers; Operating Rooms; Health Management; Service Indicators.

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INTRODUCTION

The Surgical Center (SC) is a set of areas and facilities necessary to perform anesthetic-surgical procedures, as well as post-anesthetic and immediate postoperative recovery⁽¹⁾. Among the various areas of a SC, the Operating Room (OR) stands out, where anesthetic-surgical procedures are performed.

As it is a closed unit, considered critical and full of norms and routines, the SC is one of the most complex and expensive units of the hospital institution, due to technological components, high-cost materials, high number of professionals from different areas and specialties that interact, characterizing their work process as a socio-technical administrative system⁽²⁻³⁾.

Management of the SC must guarantee safe and quality care both to patients and professionals, as well as focus on the sustainability of the sector and, consequently, contribute to institutional sustainability. Good performance of the SC is also related to the quality of its processes and methods of the support services and, for the workflow to be effective, it is necessary to integrate physical facilities, adequate technology and competent and duly trained professionals who work in an integrated manner⁽³⁾.

Quality is intrinsically related to attaining greater benefits and lower risks, involving the dimensions of structure, process and results, defined as a set of attributes that includes professional excellence, efficient use of resources and user satisfaction⁽⁴⁾.

One of the instruments employed to assess quality in the SC is called indicator. Indicators investigate from quality to specific factors: the former assess processes and results, structure and resources; and the latter are responsible for time, surgical fees and care events⁽³⁾.

Turnover is described as the period between the moment when the first patient's bed wheels leave the OR and the minute when the second patient's bed wheels enter the room⁽⁵⁾. As it includes the OR disassembly, cleaning and assembly processes, which are variables stated by a study as parameters that exert an impact on the efficiency of the SC, turnover time is considered one of the aspects that represents the quality level of the unit⁽⁶⁾. The authors also state that, when these processes cease to undergo due monitoring and standardization, the institution's operational and financial integrity ends up harmed.

A strategy that can be used is to establish estimations about the turnover times, considering that different procedures determine different durations. With the allotted time in mind, it becomes the team's duty to record the influencing reasons for the turnover time and, thus, plan performance improvement measures to reduce the OR idle time as much as possible⁽⁷⁾.

Therefore, knowing factors that can interfere with turnover is indispensable, as it helps to monitor indicators that support SC management. Thus, in order to expand knowledge on the topic, this research aimed at investigating the interval time between surgeries and factors that can influence this process.

METHOD

A quantitative, observational and cross-sectional study carried out in three surgical centers of a large-sized philanthropic hospital in southern Brazil; with collection in January and February 2020, by observing the flow between surgeries. The study analyzed the processes referring to release from the OR that occurred in the interval between the

surgeries and the assembly of the OR for the next surgery.

A script developed by the researchers was used to guide the observation and data collection, containing items referring to the interval time; the time used for disassembly and sanitation of the room; the time to assemble the room (equipment and materials) for the next surgery; professionals involved in this process; type of surgery; origin and destination of the patient; and equipment removal time.

In the three SCs, minor, medium-sized and major surgeries are performed. SC A has eight ORs, performs a mean of 737 surgeries/month and is geared towards elective surgeries with outpatients; SC B contains four ORs and performs a mean of 241 surgeries/month, mainly in the specialties of digestive tract surgery, general surgery and cardiac surgery; finally, SC C has seven ORs, performs around 512 surgeries/month and is geared towards surgeries for cancer patients.

A pilot test was carried out for three days to verify conformity of the instrument for data collection, with no changes being necessary. The observations of these three days were counted in the study statistics.

The data were collected by the assistant researcher for five days in each SC, in the afternoon period. A single shift was chosen, avoiding possible differences in operation of the unit between shifts. The interval time between surgeries was considered from the moment the recently operated patient left the OR until entry of the next patient. The total time of each interval and the length of each stage of the process were timed, notes were taken, and the instrument was filled in simultaneously with the observation.

The inclusion criteria were defined as all intervals between surgeries that occurred at the time evaluated. The exclusion criteria referred to the process of assembling and disassembling emergency surgeries and idle rooms, that is, those in which, once released, there would be no subsequent surgery, as there was no urgency to clean and assemble the room.

The data obtained were stored and organized in the Excel[®] program. For the quantitative variables, means \pm standard deviation graphs were used, and the qualitative variables were organized into frequency tables for later evaluation. For the inferential statistical analyses, the SigmaStat 3.1[®] program was used. The ANOVA test was applied for the comparison of the three SCs and the three sizes regarding the quantitative variables evaluated, followed by Tukey's post-hoc test when necessary.

In the cases where the variables did not present parametry in the approach through the normality and equality of variance test, the Kruskal-Wallis test was used followed by Dunn's post-hoc test. To compare two samples, the Mann-Whitney test was performed. In order to verify the association between the quantitative variables, Pearson's correlation test was used. Statistically significant differences or associations were considered when $p < 0.05$.

The research was approved by the Research Ethics Committee of the proposing and co-participating institutions under opinions No. 3,797,792 and No. 3,782,552, respectively.

RESULTS

A total of 62 intervals were analyzed, 34 (54.84%) in SC A, 4 (6.45%) in SC B and 24 (38.71%) in SC C. Most of the surgeries were minor procedures, divided into pre-interval (57 [91.93%]) and post-interval (47 [75.80%]) and from different specialties, the most observed being as follows: traumatology, plastic surgery and general surgery; 52 (83.87%) of the pre-interval surgeries were outpatient procedures, in which the patients recovered from the

surgeries in the post-anesthetic recovery room (PARR) and were subsequently discharged from the hospital. It was observed that the professionals involved in release of the room were nursing technicians (circulating nurse and scrub nurse) and the sanitation team.

As for the total interval time between surgeries (turnover), the mean and standard deviation of all observations were 37 ± 26 minutes, a period that involved disassembly, cleaning and assembly of the OR for the next surgery. Disassembly included removal of equipment/materials/medications and of surgical instruments; for the removal of equipment/materials/medications, the mean and standard deviation were 5 ± 9 minutes, and for the removal of surgical instruments, 5 ± 7 minutes; thus, the mean time to disassemble the room was 10 minutes. The room was then cleaned by the sanitation team. The cleaning time had a mean and standard deviation of 6 ± 4 minutes. Once the OR was clean and sanitized, assembly for the next surgical procedure was initiated, with a mean and standard deviation of 20 ± 24 minutes. Table 1 describes the mean disassembly, cleaning and assembly time, stratified by each SC.

Table 1 - Data on the disassembly, cleaning and assembly times for each SC (n=62). Porto Alegre, RS, Brazil, 2020

Surgical Center	Disassembly			Cleaning			Assembly		
	Mean (min)	Standard Deviation (min)	Coefficient of Variation	Mean (min)	Standard Deviation (min)	Coefficient of Variation	Mean (min)	Standard Deviation (min)	Coefficient of Variation
SC A	6	6	1	5	3	0,6	10	14	1,4
SC B	29	40	1,37	12	1	0,083	73	53	0,73
SC C	18	21	1,16	7	3	0,43	25	16	0,64

Source: The authors (2020).

The analysis of variables that could interfere with the interval time is described in Table 2. From Pearson's linear correlation, it is observed that the time variables related to the cleaning, assembly and disassembly processes are positively and moderately related to the interval time, that is, the longer the time of these variables, the longer the interval between the surgeries.

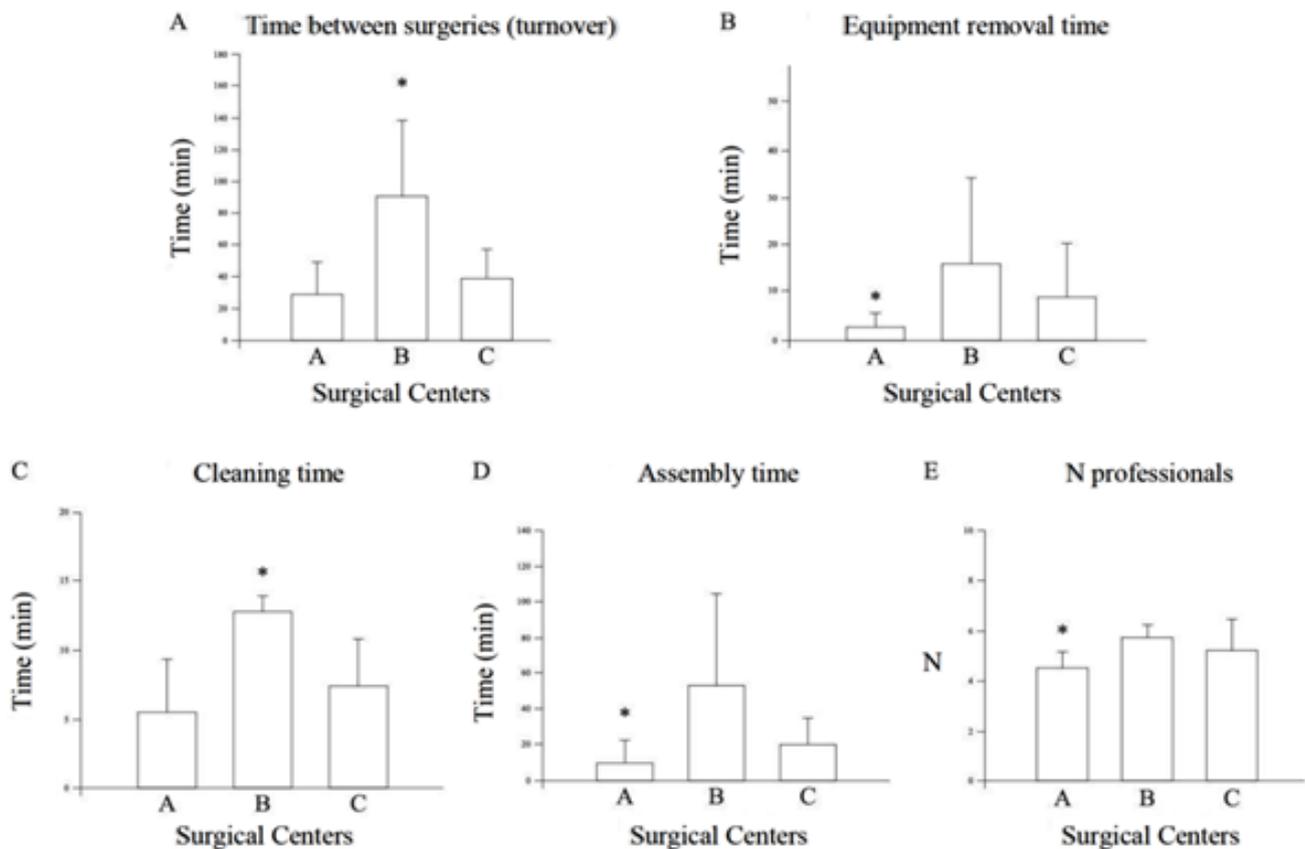
Table 2 - Association between the variables studied and the interval time between the surgeries (n=62). Porto Alegre, RS, Brazil, 2020

	Time to remove equipment/materials/medications	Time to remove instruments	Cleaning time	Assembly time	Number of professionals in the surgery
Time between surgeries	r=0,540 P<0,001	r=0,406 P<0,001	r=0,584 P<0,001	r=0,689 P<0,001	r=0,171 P=0,184

All times were recorded in minutes. Values in bold mean that a direct linear correlation was found.

Source: The authors (2020).

The variables related to the interval, disassembly, cleaning and assembly times, and the number of professionals present in the surgeries were analyzed and compared between the SCs. The results are described in Figure 1.

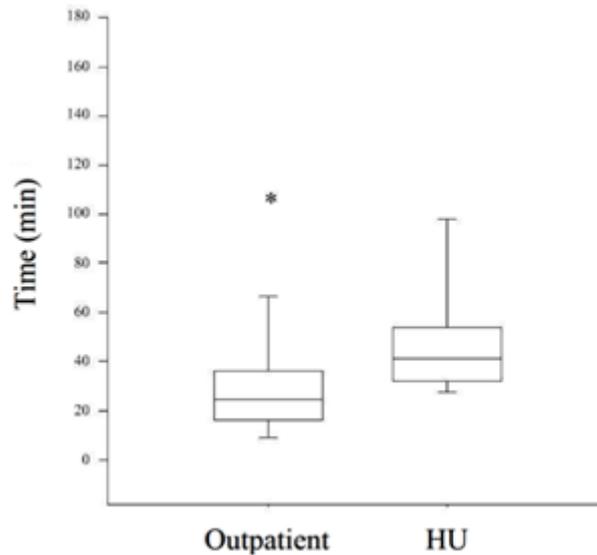


In the graph,* means the occurrence of a statistically significant difference in the ANOVA test (respectively: $p < 0.001$; $p = 0.002$; $p = 0.001$; $p < 0.001$; $p = 0.004$) and that, in Tukey's test, the time or number of the respective SC was different from the other two SCs ($p < 0.05$).

Figure 1 - Comparison between the SCs in terms of time (min) or number (N) for the main variables studied: (A) time between surgeries; (B) equipment removal time; (C) cleaning time; (D) assembly time; (E) number of professionals ($n = 62$). Porto Alegre, RS, Brazil, 2020.

Source: The authors (2020).

It was observed that the interval between surgeries was longer when the patients came from hospitalization units when compared to outpatient surgeries, as seen in Figure 2.

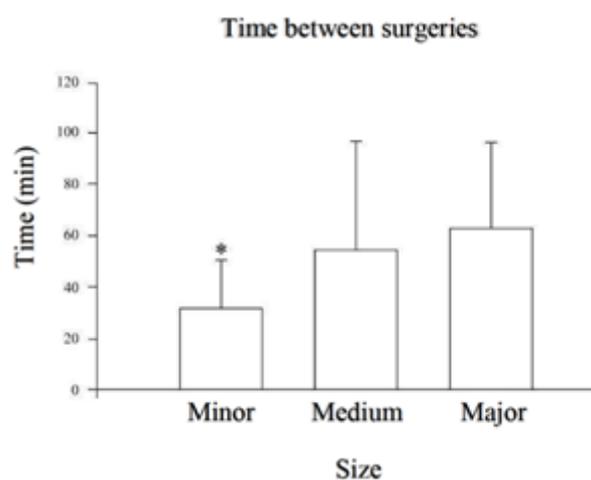


In the graph, * means that the locus promoted a statistically significant difference between the medians ($p < 0.001$).

Figure 2 - Comparison between outpatients and patients coming from hospitalization units regarding the interval time between the surgeries (n=62). Porto Alegre, RS, Brazil, 2020.

Source: The authors (2020).

As shown in Figure 3, the interval time after minor surgeries was shorter than after medium-sized and major surgeries.



In the graph, * means the occurrence of a statistically significant difference in the ANOVA ($p = 0.006$) and Tukey tests: minor surgeries had shorter interval times than the other two categories ($p < 0.05$).

Figure 3 - Comparison between the sizes of the surgeries in terms of time (min) (n=62). Porto Alegre, RS, Brazil, 2020

Source: The authors (2020).

It is noteworthy that, in the three SCs analyzed, there were two nursing technicians per room, one being a scrub nurse and the other circulating in the room, with the exception of one room in SC C, where there was only the circulating nurse, with the scrub person

being a professional from the medical team. The sectors also had an assistant nurse and a lead nurse in each SC. As for the sanitation team, these professionals were responsible for cleaning the SC and its respective rooms. In SC A, availability of employees varied from one to three, in the same way as in SC C; however, at SC B, there was only one employee available, and he also served other areas of the hospital in addition to the SC.

DISCUSSION

The results of this study indicate that turnover time presented a mean of 37 minutes, in line with a study carried out in the inland of São Paulo with a mean of 35.6 minutes between surgeries⁽⁶⁾, while another study obtained a mean turnover time of 119.8 minutes.⁽⁸⁾ Turnover time can be pointed out as a relevant component of OR efficiency⁽⁹⁾, and may also be used as an indicator, a tool that contributes to promoting institutional changes and as basis for interventions⁽¹⁰⁾. The results show the importance of measuring it to guide decision-making and unit management processes.

Cooperation between the different teams (nursing, sanitation and physicians) is necessary in managing turnover time; it is necessary to establish objectives and analyze the results, making it possible to identify opportunities for improvement involving the teams that work in the SC⁽⁷⁾.

A measure described in the literature⁽¹¹⁾ called "room rotation" is highly effective in reducing the interval times between surgeries. This measure consists of a trained team supported by a manual and protocols, which, at the end of a procedure, is responsible for disassembling, concurrent cleaning and leaving the OR ready for assembly⁽¹¹⁾. A study shows that, before implementing this measure, the interval between surgeries was 50 minutes, with a 36% improvement in this value after performing room rotation. In addition to resulting in a reduction in the interval times, the method also contributed benefits to productivity and performance of the SC⁽¹¹⁾.

According to Table 1, there was a similarity between the data from SC A and SC C, considering that the number of observations in both of them was close. On the other hand, the number of observations in SC B was considerably lower, due to the low flow of surgeries during the collection period. Sampling may have influenced the results of the comparisons. The variation in the data can also be related to issues such as delays of team members or even to the need to relocate some professionals to other sectors, increasing turnover time. However, the analysis of this difference in results between the SCs must also consider that the OR is a complex environment, with several social interactions between teams, patients and scenarios provided by the different types of procedures⁽¹²⁾.

Analyzing the other variables involved in the interval time, it was observed that the mean cleaning time was six minutes, in line with a study⁽⁶⁾ that describes a mean cleaning time of seven minutes. One of the strategies cited in the literature that can help to reduce turnover time is to invest in improving communication between the different professionals who work in this process, such as investing in automated communication, which consists, among other measures, in employing integrated systems with the use of digital boards or tablets, speeding up communication, especially with the sanitation team, as these professionals work in several areas of the SC, not necessarily only in the OR^(9,13).

Although the current study has not analyzed staff sizing, the literature indicates that adequate human resources provide a reduction in the room cleaning and preparation times⁽¹⁴⁾, while their inadequacy is related to suspension of surgical procedures⁽¹⁵⁻¹⁶⁾ and to an increase in turnover time⁽¹⁷⁾.

Therefore, adequate staffing is fundamental for the proper functioning of the SC, considering technological advances and the increasing complexity of surgical interventions,

evidencing the need for constant updating and training for greater efficiency and efficacy in the care provided⁽¹⁸⁾. Sizing must be suitable for all professional categories, according to the needs of each service. It is noteworthy that the analysis of the sanitation team sizing should be included, taking into account the dynamics of the operating room, the type of procedures performed and the number of surgeries. Currently, there is no specific legislation that guides the sizing of the sanitation team in surgical centers. Analysis of the need should be done collectively, involving management of both the accommodation and sanitation service and of the surgical center.

The trans- and intraoperative periods must be planned and executed focusing on care quality and the on safety of patients and professionals alike. Therefore, disassembly, sanitation and preparation of the OR for the following procedure must be carried out carefully, according to the institution's recommendations. Adequate preparation of the OR is essential for safe and quality care⁽¹⁹⁾. In this sense, providing all the materials and equipment necessary for each surgical procedure is an important factor, which implies not only safe surgical care but also the time spent in the OR. Management of material resources in the SC is an essential and challenging activity for nurses⁽²⁰⁾.

Another relevant factor found in this study was the origin of the patient: procedures in hospitalized patients had a longer turnover time than in outpatients (coming from their homes). This result is attributed to the fact that outpatients were instructed by the medical team to arrive at the hospital at least one hour before the time of the surgery so that they could be admitted to the SC without delays, while the hospitalized patients were called to the SC as soon as the OR was free; depending on the team of the unit where the patient was, transfer to the SC did not always occur quickly, given the activities of that unit.

The results of the current study corroborate the findings of a survey⁽²¹⁾ that observed the delay of patients coming from the wards as one of the factors that increase turnover time, confirming a study⁽²²⁾ that presents similar results and highlights the distance between the SC and the hospitalization units as a factor that contributes to the delay of the surgical procedures. In view of this, a measure that the institution can promote is sharing information, in this case, between the SC and the hospitalization units, as the result of the study shows the dynamics between the sectors and the impact that their relationship can generate on the indicators, with sharing being able to assist in the implementation of measures to improve routines.

When analyzing the association between surgical size and turnover time (Figure 3), it became clear that the greater the size of the surgeries, the longer the interval times. This result is attributed to the fact that, in general, the larger the size of the surgeries, the more equipment and materials are needed for the procedure, demanding more time for room preparation and disassembly, a result that is in line with a study⁽¹⁴⁾ which highlights that the room cleaning and preparation times increase proportionally to the size of the surgery.

Given the above, inadequate sizing, both of the Nursing team (circulating and instrumentation) and of the sanitation team, can exert a direct impact on this relationship. In addition to that, a study carried out in a university hospital from France⁽²³⁾ that compared elective lower limb and trauma surgeries obtained a lower turnover time in elective surgeries when compared to trauma. Another study⁽²⁴⁾ corroborates that the type of surgery is important, as procedures that require special materials present longer turnover times due to preparation.

In this study, it is noted that the room assembly stage was the one that required the most time, with the OR preparation processes (turnover time components) being fundamental for the quality and safety of intraoperative care and good progress of the surgery. Therefore, investments in continuing and permanent education are necessary to train professionals to carry out each activity. Establishing institutional protocols or Standard Operating Procedures (SOPs), as well as training the team for their proper follow-up, can contribute to creating a quality standard^(3,25). In this context, the importance of the nurse as a team leader and responsible for the SC is highlighted, accompanying preparation of the

ORs to monitor interferences in the safety of patients or professionals and encourage time optimization in a safe way⁽²⁶⁾.

As the Nursing service involves managing people, it is important to appreciate the collaborations brought about by the professionals, seeking more practical and innovative solutions to everyday problems⁽²⁷⁾, reinforcing the importance of the engagement of the team, SC managers and the institution for the excellence practice.

The relevance of this study is highlighted, as it analyzed the dynamics of the assembly and disassembly of ORs in three surgical centers, obtaining unique and fundamental results for the elaboration of strategies to improve care quality and patient safety in the intraoperative period, in addition to improvements in the turnover time indicator.

A limitation can be the non-inclusion of surgeries performed in the morning and evening shifts, as well as the lack of analysis of procedures performed during the weekends. It would be opportune for future research studies to continue addressing the influence and/or relationship of the patients' origin and size of the surgeries with turnover time.

CONCLUSION

The study made it possible to investigate turnover time and factors that can influence this process. It showed that the time spent in the disassembly, cleaning and assembly processes of the OR have a positive relationship with the increase in the interval time. Origin of the preoperative patients and size of the surgeries also showed to influence turnover time. Such results can contribute to evidence-based practice in Nursing, allowing for less operating room idleness, reducing surgery delays and, consequently, contributing to safe and good quality patient care in the perioperative period.

A number of factors and actions that may contribute to optimizing the time between surgeries and better functioning of the SC stand out, such as team training, adequate sizing of professionals (both the Nursing team and the surgical center sanitation team), development and implementation of protocols, effective communication and collaboration between the teams, strategies that favor performance of the sector, and quality and safety of the processes and the assistance provided.

The results of this study are important because they provide opportunities and support reflections on care and administrative processes related to work in the surgical center, particularly the sizing of human resources. The findings may be useful for Nursing professionals and managers in the planning, implementation and management of the surgical center.

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Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work - Peralta T, Bourscheit F, Patricia Treviso P; Drafting the work or revising it critically for important intellectual content - Peralta T, Santos AA dos, Bourscheit F, Oliveira Junior NJ de, Somensi EM, Patricia Treviso P. All authors approved the final version of the text.

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