

## Adherence to hand hygiene technique: an observational study

Adesão à técnica de higiene das mãos: estudo observacional  
Adhesión a la técnica de higiene de manos: estudio observacionalMarília Duarte Valim<sup>1</sup>  <https://orcid.org/0000-0002-2746-1865>Gabriel Ferreira Reis<sup>1</sup>  <https://orcid.org/0000-0002-1752-6389>Bruno da Silva Santos<sup>1</sup>  <https://orcid.org/0000-0002-3677-6287>Layala de Souza Goulart<sup>1</sup>  <https://orcid.org/0000-0001-6575-1831>Juliano Bortolini<sup>1</sup>  <https://orcid.org/0000-0003-0126-3040>Joana Darc Chaves Cardoso<sup>1</sup>  <https://orcid.org/0000-0003-1989-4043>

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## Abstract

**Objective:** To verify adherence and quality of hand hygiene techniques performed by health professionals at recommended times and identify impacting factors.**Methods:** This is an observational study, with 41 professionals from the Adult Intensive Care Unit of a Brazilian teaching hospital. Data collection took place from September to December 2021, using a sociodemographic questionnaire and observation form from the World Health Organization. Statistical tests of binomial analysis and mixed-effects logistic regression model were applied, and a significance level of 0.05 was adopted.**Results:** A total of 1,055 hand hygiene opportunities were observed; the adherence rate was 23.98%; and it can be seen that professionals did not perform the recommended technique. The binomial test verified greater adherence to moments "after" when compared to moments "before" ( $p < 0.001$ ) and a negative impact of using gloves was found ( $p < 0.001$ ). The logistical model reinforced greater adherence in moments "after". Even though adherence is low among all professional categories, the logistical model demonstrated more chances of hand hygiene by nurses.**Conclusion:** Adherence to hand hygiene was considerably low, especially considering the appropriate technique. A negative impact of using gloves on hand hygiene adherence was verified. Professionals demonstrated greater chances of adhering to hand hygiene in the moments "after" when compared to moments "before".

## Resumo

**Objetivo:** Verificar a adesão e a qualidade da técnica de higiene das mãos realizada por profissionais de saúde nos momentos preconizados e identificar os fatores impactantes.**Métodos:** Estudo observacional, com 41 profissionais de Unidade de Terapia Intensiva Adulto de um hospital de ensino brasileiro. A coleta de dados foi de setembro a dezembro de 2021, utilizando questionário sociodemográfico e formulário de observação da Organização Mundial da Saúde. Foram aplicados testes estatísticos de análise binomial e modelo de regressão logística de efeitos mistos e adotou-se nível de significância de 0,05.**Resultados:** Um total de 1.055 oportunidades de Higiene das Mãos foram observadas, a taxa de adesão foi de 23,98% e pode-se verificar que os profissionais não executaram a técnica preconizada. O teste binomial verificou maior adesão aos momentos "após" quando comparados aos momentos "antes" ( $p < 0,001$ ) e foi constatado impacto negativo do uso de luvas ( $p < 0,001$ ). O modelo logístico reforçou a maior adesão nos momentos "após". Ainda que a adesão esteja baixa entre todas as categorias profissionais, o modelo logístico demonstrou mais chances de higiene das mãos pelos enfermeiros.<sup>1</sup>Universidade Federal de Mato Grosso, Cuiabá, MT, Brazil.

Conflict of interest: nothing to declare.

**Conclusão:** A adesão à higiene das mãos foi consideravelmente baixa principalmente considerando a técnica adequada. Foi verificado impacto negativo do uso de luvas na adesão higiene das mãos. Os profissionais demonstraram maiores chances de aderirem a higiene das mãos nos momentos “após” quando comparados aos momentos “antes”.

## Resumen

**Objetivo:** Verificar la adhesión y la calidad de la técnica de higiene de manos realizada por profesionales de la salud en los momentos recomendados e identificar los factores impactantes.

**Métodos:** Estudio observacional con 41 profesionales de una unidad de cuidados intensivos adulta de un hospital universitario brasileño. La recopilación de datos se realizó de septiembre a diciembre de 2021, mediante un cuestionario sociodemográfico y un formulario de observación de la Organización Mundial de la Salud. Se aplicaron pruebas estadísticas de análisis binominal y el modelo de regresión logística de efectos mixtos, y se adoptó un nivel de significación de 0,05.

**Resultados:** Se observó un total de 1.055 oportunidades de higiene de manos. El índice de adhesión fue del 23,98 % y se pudo verificar que los profesionales no ejecutan la técnica recomendada. La prueba binominal verificó una mayor adhesión en los momentos “después” comparado con los momentos “antes” ( $p < 0,001$ ) y se constató un impacto negativo del uso de guantes ( $p < 0,001$ ). El modelo logístico reforzó la mayor adhesión en los momentos “después”. Aunque la adhesión sea baja en todas las categorías profesionales, el modelo logístico demostró mayor probabilidad de higiene de manos por parte de los enfermeros.

**Conclusión:** La adhesión a la higiene de manos fue considerablemente baja, sobre todo si se considera la técnica adecuada. Se verificó un impacto negativo del uso de guantes en la adhesión a la higiene de manos. Los profesionales demostraron mayores probabilidades de adhesión a la higiene de manos en los momentos “después” comparado con los momentos “antes”.

## Introduction

Healthcare-associated infections (HAIs) are adverse events present in health services that affect millions of people around the world, presenting themselves as a global challenge for patient safety.<sup>(1,2)</sup> Every day around the world, more than 1.4 million people are affected by preventable HAIs. In Brazil, around 3 to 15% of people admitted to hospital develop some type of HAI, which can complicate the patient's health situation, expose them to contamination, require longer hospital admission, increase costs with medications and tests and cause death. Furthermore, HAIs are related to the emergence of multidrug-resistant microorganisms.<sup>(3)</sup>

Evidence shows that low adherence to hand hygiene (HH) is one of the main factors for the increase in HAIs, increasing costs related to patient care.<sup>(4,5)</sup> Faced with this worrying scenario, the World Health Organization (WHO), which was included in the World Alliance for Patient Safety, adopted HH as the first challenge to promote patient safety since 2004.<sup>(3)</sup>

HH is a simple, low-cost measure with proven effectiveness in preventing HAIs, as it reduces the microbial load present on the hands and prevents the spread of pathogenic agents.<sup>(6,7)</sup> However, even with scientific evidence that proves its effectiveness, low adherence to HH practice is still a problem faced worldwide, which challenges professionals and managers of health institutions.<sup>(2,8,9)</sup>

In this regard, infection control programs need to monitor not only adherence rates based on opportunities, but also the HH technique quality, which consists of following the steps and time recommended for the appropriate action of the antiseptic.<sup>(10)</sup> Recent studies propose that the rationalized 3-step technique is as effective as the 6-step technique recommended by the WHO,<sup>(11,12)</sup> whose rationalization of steps follows: 1- covering all surfaces of the hands; (2) rotational rubbing of the fingertips in the palm of the alternate hand; and (3) rotational rubbing of both thumbs. Regarding time, recent studies have shown that reducing the time from 30 to 15 seconds with alcoholic preparations was effective in reducing bacterial counts on hands.<sup>(13,14)</sup>

However, another problem found worldwide is the poor quality in the HH technique execution, with low levels of friction on the tips of fingers and thumbs as well as reduced time for the antiseptic to act.<sup>(15,16)</sup>

Considering the above, this study aimed to verify the adherence and quality of the HH technique performed by health professionals at recommended times and identify the impacting factors.

## Methods

This is an observational, analytical study. Data collection was carried out in the Intensive Care Unit

(ICU) of the *Hospital Universitário Júlio Muller* (HUJM), municipality of Cuiabá, Mato Grosso, Brazil, from September to December 2021, in the morning, afternoon and night shifts, during all days of the week. The hospital is considered medium-sized and offers tertiary care to the state's population. The study population was made up of professionals who had been carrying out care activities in the adult ICU for at least three months. At the time, there were 93 health professionals, distributed between morning, afternoon and night shifts. Of these, 48 were excluded due to termination of their employment contract or were reassigned to another sector and four because they were on sick leave or on vacation, which totaled a final sample of 41 health professionals. In order to minimize the Hawthorne effect, health professionals received the study information and signed the Informed Consent Form (ICF) at least one month before the beginning of observations.

The dependent variable was adherence to HH based on the moments recommended by the WHO.<sup>(3,17)</sup> Independent variables were professional category, sex, observation period, moments recommended for HH,<sup>(3,17)</sup> HH technique quality (steps performed and time spent), glove use and unit infrastructure. Sociodemographic and work variables were collected using a self-administered questionnaire, containing closed-ended and multiple-choice questions about age, sex, education level and professional category. Adherence to HH was collected by direct observation using the observation form validated by the WHO.<sup>(17,18)</sup>

The observation form recommended by the WHO makes it possible to calculate the adherence rate to HH by health professionals based on the actions carried out in relation to the total number of opportunities verified.<sup>(17,18)</sup> It is a checklist containing initial identification of observer, date, start and end time of observations, period of observation, professional category, opportunities and recommendations for HH in accordance with the five moments recommended by the WHO:<sup>(17)</sup> 1- before touching a patient, 2- before clean/aseptic procedures, 3- after body fluid exposure/risk, 4- after touching a patient, 5- after contact with patient

surroundings. Two moments for HH were added, following the WHO recommendation during the COVID-19 pandemic: 6- before putting PPE and 7- after removing PPE.<sup>(3)</sup>

This form allows observers to quantify the total number of HH opportunities, the number of times professionals performed the HH technique and, when performed, whether it was performed with alcohol-based products or soap and water. To meet the study objectives, a question was added to the form about glove use by professionals when the opportunity for HH was verified and, once HH was performed, a question was added with the aim of assessing the technique quality, recording the time of the steps performed:<sup>(11,12)</sup> 1- covering all surfaces of the hands; 2- rotational rubbing of the fingertips in the palm of the alternate hand; and 3- rotational rubbing of both thumbs. The recommended time of 15 seconds for HH with alcoholic preparations and 40 to 60 seconds for HH with soap and water was considered correct. A digital chronometer tested and approved by the Brazilian Institute of Metrology, Quality and Technology (INMETRO - *Instituto Brasileiro de Metrologia, Qualidade e Tecnologia*) was used.

Data were collected by two trained observers. In order to verify whether the two observers were satisfactorily trained to observe the moments recommended for HH and assess the level of agreement between them, a total of 42 HH opportunities were observed and the Kappa coefficient was calculated. Observations were carried out in a ward belonging to the medical clinic of the aforementioned hospital with seven health professionals during their work activities, in three 20-minute sessions and were not part of the study. The researcher in charge acted as the gold standard (judge). The Kappa coefficient found was 0.84, therefore classified as almost perfect agreement.<sup>(19)</sup>

To verify the study's infrastructure for HH, a questionnaire validated by the WHO was used.<sup>(18)</sup> The instrument was filled out by observers. It is a checklist containing 27 items referring to the physical resources for HH existing in the units, such as availability of water, existence of alcoholic preparation within reach in perfect working order

and/or refilled, types of dispensers, availability and stock of procedure gloves, number of beds, number of sinks stocked with water, soap and paper towels available, presence/location of illustrative posters about HH, number of health professionals in the sector, participation in training on HH and presence of audit on adherence to HH in the institution.<sup>(18)</sup>

The HH adherence rate was determined by the total number of HH opportunities in which professionals performed HH divided by the total number of opportunities. The rate of adherence to HH with correct technique was calculated by the number of HH opportunities in which professionals performed HH with appropriate technique divided by the total number of HH opportunities performed. The number of times health professionals were wearing gloves during unexecuted HH opportunities was also calculated by the total number of unexecuted HH opportunities in order to estimate the percentage of unexecuted opportunities that could be associated with glove use.

In descriptive data analysis, frequency distributions, medians, means, standard deviation, minimum and maximum were estimated for the numerical variables. Confidence intervals for proportions, bivariate analysis for calculating differences between two proportions and mixed-effects logistic regression were calculated to verify the association between the adherence rate to HH and gender, period, profession and moments recommended for HH with the size of the effect of the association calculated by Odds Ratio. For use of glove response, a mixed-effects logistic regression model was estimated with the same specifications as the previous model, except for recommended moments, for which categories from 1 to 5 were considered. The significances of Odds Ratios were verified by the Wald test. The R 4.3.1 (2023) software was used for all statistical analyzes and a significance level of 0.05 was adopted.

This study was approved by the Research Ethics Committee (REC) of HUJM, under Opinion 2.442.333 (Certificate of Presentation for Ethical Consideration (*Certificado de Apresentação para*

*Apreciação Ética*): 75169317.0.0000.5541). After being informed about the research procedures, all professionals who agreed to take part in the study signed the ICF.

## Results

Of the 41 health professionals who participated in the study, 58.5% (24) were nursing technicians, 14.6% (6) nurses, 14.6% (6) physical therapists and 12.2% (5) were physicians. Professionals' mean age was 42.22 years (SD = 8.07 years) with a minimum of 27 and a maximum of 60 years. A total of 73.2% (30) of professionals were female, 37.5% (15) had completed specialization and 35% (14) had completed higher education. A total of 1055 opportunities were observed. The general adherence rate to HH was 23.98% (253), 1.80% of actions were carried out according to the correct recommended technique. Nurses and physicians were the professionals who most adhered to HH (40.17% and 33.33%, respectively). As for technique quality, it can be seen that the recommended technique was not performed by the professionals (Table 1). Health professionals' adherence to HH was higher in the moments "before removing PPE" (82.65%), "after touching patient surroundings" (39.76%) and "after touching a patient" (33.15%). When considering using the appropriate HH technique in these moments, professionals' adherence decreased considerably (10.20% and 2.41%, respectively) (Table 1). In the binomial test, there was a statistical difference in the proportions of adherence to HH between the moments "before" (7.05%) and the moments "after" (23.82%), ( $p < 0.001$ ).

The highest frequency of glove use for HH actions not performed was found in the moments "before clean/aseptic procedures", "before touching a patient" and "after body fluid exposure/risk". Of the total number of HH actions not carried out, 60.14% were related to glove use, and the binomial test verified a significant impact of using gloves on health professionals' non-adherence to HH ( $p < 0.001$ ) (Table 2).

**Table 1.** Opportunities, actions, adherence to HH, adherence to the appropriate technique according to professional category, sex and recommended moments for HH

Variables	Opportunities	Actions	Adhesion (%)	CI %	Appropriate technique actions	Appropriate technique adhesion (%)	CI %
Professional category							
Nurses	117	47	40.17	(31.16; 49.19)	5	4.27	(0.55; 7.99)
Nursing technician	830	175	21.08	(18.30; 23.87)	12	1.45	(0.63; 2.26)
Physical therapists	54	13	24.07	(12.30; 35.85)	2	3.70	(0.00; 8.91)
Physicians	54	18	33.33	(20.35; 46.32)	0	0.00	(0.00; 0.00)
Sex							
Female	738	177	23.98	(20.90; 27.07)	11	1.49	(0.61; 2.37)
Male	317	76	23.97	(19.25; 28.70)	8	2.52	(0.79; 4.26)
Recommendation of moments for hand hygiene							
Before touching a patient	224	20	8.93	(5.17; 12.69)	1	0.45	(0.00; 1.33)
Before clean/aseptic procedures	173	8	4.62	(1.46; 7.79)	0	0.00	(0.00; 0.00)
After body fluid exposure/risk	201	31	15.42	(10.39; 20.46)	2	1.00	(0.00; 2.38)
After touching a patient	181	60	33.15	(26.23; 40.07)	3	1.66	(0.00; 3.54)
After touching patient surroundings	83	33	39.76	(29.01; 50.51)	2	2.41	(0.00; 5.78)
Before putting PPE	95	20	21.05	(12.70; 29.40)	1	1.05	(0.00; 16.30)
Before removing PPE	98	81	82.65	(75.02; 90.28)	10	10.20	(4.10; 16.30)
Total	1055	253	23.98	(21.40; 26.56)	19	1.80	(1.00; 2.60)

**Table 2.** Number of opportunities, actions not performed, frequencies of glove use, proportions and confidence interval (CI) according to hand hygiene moments

Variables	Opportunities	Actions not performed	Frequency of using gloves	Proportions (%) CI
Recommendation of moments for hand hygiene	224	204	133	65.20 (58.66; 71.73)
Before touching a patient	173	165	143	86.67 (81.48; 91.85)
Before clean/aseptic procedures	201	170	103	60.59 (53.24; 67.93)
After body fluid exposure/risk	181	121	42	34.71 (26.23; 43.19)
After touching a patient	83	50	6	12.00 (4.97; 25.00)
After touching patient surroundings	862	710	427	60.14 (56.42; 63.75)

In the mixed-effects logistic model for HH adherence, the variables that showed significance were professional category ( $X^2= 8.549$ ,  $df = 3$  and  $p = 0.036$ ) and recommendation ( $X^2= 172.570$   $df = 6$  and  $p < 0.001$ ). The regression model's success rate was 75.7%. Table 3 presents the Odds Ratios for HH for each level of independent variables compared with their references. Adherence to HH was significantly higher in moments "after" when compared to moments "before touching a patient", "after removing PPE" (OR 68.44,  $p<0.001$ ), "after touching patient surroundings" (OR 7.18,  $p<0.001$ ) and "af-

**Table 3.** Mixed effects logistic regression related to adherence to hand hygiene (HH) according to sex, observation period, professional category and recommendation

Variables	Odds Ratio	95% Confidence Interval		p-value
		Lower limit	Upper limit	
Intercept	0.34	0.23	0.50	<.001
Sex				
Male – Female	1.23	0.75	2.24	0.361
Observation period				
Evening – Morning	1.11	0.61	2.03	0.723
Night – Morning	1.46	0.86	2.49	0.162
Professional category				
Nursing technician - Nurse	0.41	0.21	0.81	0.010
Physician – Nurse	0.53	0.18	1.55	0.248
Physical therapist – Nurse	0.22	0.07	0.74	0.014
Recommendation of HH moments				
2 – 1	0.50	0.21	1.19	0.119
3 – 1	2.08	1.12	3.88	0.021
4 – 1	5.34	3.01	9.48	<.001
5 – 1	7.18	3.70	13.94	<.001
6 – 1	2.92	1.45	5.87	0.003
7 – 1	68.44	32.29	145.06	<.001

ter touching a patient" (OR 5.34,  $p<0.001$ ). Nurses were more likely to clean their hands when compared to nursing technicians ( $p=0.010$ ) and physical therapists ( $p=0.014$ ). Sex did not present statistical significance. Regarding HH with the use of alcoholic preparations or the use of soap and water, in the binomial test, there was a significant difference ( $p < 0.001$ ) between the rates of adherence to HH when performed with alcohol (23.70%; CI (95%): 0.186; 0.294) and soap and water (76.30%; CI (95%): 0.706; 0.814) (Table 3).



## Discussion

This is a study that allowed expanding scientific knowledge about HH adherence by health professionals and the quality of the technique used as well as discussing the factors that impact adherence. Even with solid evidence of HH effectiveness in reducing infection rates, length of hospital stay, costs related to treatment and transmission of multi-resistant microorganisms,<sup>(6,7,20)</sup> low adherence to HH by health professionals is still a global concern as it presents an imminent threat to patient safety in health institutions.<sup>(3)</sup>

Several factors may be related to low adherence to HH by professionals, such as forgetfulness, carrying out care activities with a higher risk of infection, glove use and other personal protective equipment (PPE), high workload, lack of knowledge, distance from the washbasin and also aspects related to mental health, such as anxiety, depression, impaired sleep, among others.<sup>(21)</sup> There is evidence in the international literature that these factors can constitute barriers for professionals to adhere to HH.<sup>(22,23)</sup>

The study showed that adherence to HH by health professionals was considerably low in all categories, even among those who performed the correct technique. Failure to use the appropriate HH technique is the main cause of HAI.<sup>(24)</sup> Researchers verified a decrease in the incidence of colonization of patients with multidrug-resistant bacteria after the implementation of health interventions aimed at improving the HH technique,<sup>(24)</sup> especially those that included team training, with real-time feedback on failures to execute the correct technique.<sup>(25)</sup>

In inferential analysis, nurses were more likely to clean their hands when compared to nursing technicians and physical therapists. The lack of HH by these professionals is worrying, as it compromises the safety of the care provided, leading to a greater risk of spreading HAIs.<sup>(26)</sup> A possible explanation regarding the nursing team can be attributed to the greater workload directed to mid-level professionals in that profession, when it comes to the high demand for care assistance

procedures. The findings obtained in this study reinforce the need for educational actions and incentives for HH adherence by all team professionals,<sup>(22,23)</sup> especially the nursing team, as they provide direct care to patients.

Given the present scenario, the multimodal strategy must be implemented in health establishments with the aim of reducing barriers to adherence to HH and valuing adequate technique, favoring the change and maintenance of behavior aimed at promoting patient safety.<sup>(22,23)</sup> Another relevant aspect for the multimodal strategy effectiveness is the need to involve management, both intersectoral and institutional, in order to assist in establishing a favorable safety climate with a view to achieving satisfactory levels of adherence to HH.<sup>(1)</sup>

The greater adherence to HH in the moments “after touching a patient” or “after touching patient surroundings” compared to the moment “before touching a patient” may be related to the culture of self-protection, i.e., professionals realize that practicing HH is a way of protecting themselves, feeling more motivated to carry it out as a way of protecting their own health.<sup>(27-29)</sup>

It can be inferred that glove use was a factor that had a negative impact on adherence to HH by professionals, as there was a significant impact of using gloves on non-adherence to HH. It is believed that some health professionals have the false impression that using gloves before contact with patients keeps their hands protected, replacing, therefore, HH practice,<sup>(30-32)</sup> incurring a serious error.

Regarding adherence to the HH technique, it was observed in this study that it is considerably low, even internationally, which recommends a minimum of three steps in 15 seconds to guarantee the technique effectiveness, which is worrying given that HH is the main strategy to reduce and prevent HAIs.

As can be identified in a randomized clinical trial that aimed to compare adherence and microbiological efficacy between the two HH techniques (WHO six steps and the three-step technique), it concluded that the 3-step technique achieved greater adherence in both in relation to the moments regarding the appropriate HH technique.<sup>(12)</sup> In a study

carried out with 60 professionals from a Brazilian ICU with the objective of observing the adherence rate to HH with the 3-step technique, it was identified that 13.69% of these workers performed the simplified technique. During microbiota analysis on the hands of these professionals after performing HH, no growth of potentially pathogenic microorganisms was identified when compared to the others, which reinforces that this technique, when carried out correctly and within the recommended time, is effective in controlling HAIs.<sup>(33)</sup>

Regarding the recommended time for performing the technique, evidence suggests that 15 seconds of hand rubbing can be as effective as 30 seconds in reducing the microbial load on the hands.<sup>(13,14)</sup>

The results of this study reinforce the need to implement health education that disseminates the rationalized HH technique, as it is more simplified, has high microbiological efficacy and greater adherence by health professionals when compared to the 6-step technique.<sup>(11,12)</sup> The proposition of this technique has been encouraged worldwide and consists of executing 3 steps, which are: 1) covering all surfaces of the hands; 2) rotational rubbing of the fingertips in the palm of the alternate hand; and 3) rotational rubbing of both thumbs.<sup>(11,12,14)</sup>

Among the limitations of this study, the fact that it was carried out with health professionals from a single ICU, from a single teaching and research hospital, stands out. Research in different health institutions and care sectors focused on identifying the factors that interfere with HH practice are necessary to support future interventions aimed at improving HH adherence behavior. The Hawthorne effect also stands out, which occurs due to possible changes in workers' behavior, when observers are present. However, the literature reinforces that techniques such as discreet and/or frequent observation can minimize this effect and should be assessed according to the object and study setting.<sup>(34)</sup>

## Conclusion

A low rate of adherence to HH by health professionals was found, especially when consider-

ing the execution of appropriate HH technique. Professionals demonstrated greater chances of adhering to HH in moments "after" when compared to moments "before", denoting low adherence to the aforementioned technique in moments and opportunities that aim to reduce and prevent HAIs. Professional nurses were more likely to clean their hands when compared to nursing technicians and physical therapists. Glove use had a negative impact on professionals' adherence to HH. The results infer that low adherence to HH may be related to the erroneous perception that glove use replaces HH. It is essential that the infection control service works together with sectoral and institutional management through multimodal strategies, in order to provide favorable conditions for patient safety and sensitize health professionals and management to adopt actions to prevent and control HAIs. Experimental studies are encouraged in order to implement multimodal strategies using educational and instrumental technologies, with the aim of making HH viable as the best strategy to combat HAIs and their serious consequences.

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## Collaborations

Valim MD, Reis GF, Santos BS, Goulart LS, Bortolini J and Cardoso JDC contributed to study design, data analysis and interpretation, article writing, relevant critical review of intellectual content and approval of the final version to be published.

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