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Turbocharged trajectories in higher education: cognitive enhancement and academic performance of Medical students

Trajetórias turbinadas no ensino superior: aprimoramento cognitivo e desempenho acadêmico de estudantes de Medicina

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ABSTRACT

Introduction: The demand for performance, the cult of performance, technicality, among others, are derived from capitalist productivism and its logic. The pursuit of performance, the cult of achievement, technicism, among others, stem from productivity and its logics. Individuals in the academic environment are immersed in these processes marked by this derivation. Consequently, non-therapeutic, pharmacological or non-pharmacological interventions on brain function emerge, enhancing cognitive functions/skills/capacities to a level beyond average functioning.

Objective: To assess the use of cognitive enhancement strategies among medical students and evaluate their effects on mental health and academic performance, identifying potential interventions to optimize student well-being and the educational process.

Method: This is a qualitative field research. Semi-structured interviews were conducted with medical students to gather data, which were analyzed using the constructive-interpretation method.

Result: The data revealed that university students seek adaptive strategies to maintain productivity in academia, even if they have to face unforeseeable consequences of these mechanisms. Seeking alternatives to remain productive is linked to the students' self-esteem, also affecting their relationships with fellow students and faculty members.

Conclusion: It is revealed that medical students resort to cognitive enhancement strategies, such as consuming energy drinks and caffeine, to cope with rigorous academic demands. Although these practices may initially appear beneficial, as they enhance performance and productivity, they are intrinsically linked to significant adverse effects on the students' mental health, including increased stress, anxiety, and dependency.

Keywords: Cognition; Mental health; Medical Education.

RESUMO

Introdução: *A cobrança de desempenho, o culto à performance, o tecnicismo, entre outras, são derivadas do produtivismo capitalista e suas lógicas. As pessoas que integram o ambiente acadêmico estão imersas nesses processos marcados por essa derivação. Dessa forma, surgem intervenções não terapêuticas, farmacológicas ou não, sobre o funcionamento cerebral, ampliando a performance de funções/habilidades/capacidades cognitivas a um nível mais elevado para além da média de funcionamento.*

Objetivo: *Este estudo teve como objetivos examinar o uso de estratégias de aprimoramento cognitivo entre estudantes de Medicina e avaliar seus efeitos na saúde mental e no desempenho acadêmico, de modo a identificar intervenções potenciais para otimizar o bem-estar estudantil e o processo educativo.*

Método: *Trata-se de uma pesquisa de campo, de abordagem qualitativa. Para o levantamento de dados, foram efetuadas entrevistas semiestruturadas com estudantes do curso de Medicina. Para a análise dos dados, empreendeu-se a técnica da análise construtivo-interpretativa.*

Resultado: *Os dados mostraram que os estudantes universitários buscam estratégias adaptativas para se manterem produtivos na universidade, mesmo que precisem enfrentar consequências, nem sempre previsíveis, desses mecanismos. Buscar alternativas para se manterem produtivos está vinculado à autoestima do estudante, o que impacta também a sua relação com os outros estudantes e com os seus docentes.*

Conclusão: *Revela-se que estudantes de Medicina recorrem a estratégias de aprimoramento cognitivo, como o consumo de energéticos e cafeína, para que possam enfrentar as rigorosas demandas acadêmicas. Embora tais práticas possam inicialmente parecer benéficas ao incrementarem o desempenho e a produtividade, elas estão intrinsecamente ligadas a efeitos adversos significativos sobre a saúde mental dos alunos, incluindo aumento do estresse, ansiedade e dependência.*

Palavras-chave: *Cognição; Saúde Mental; Educação Médica.*

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INTRODUCTION

The medicalization of social relations has been an adaptive response to these pressures imposed by traditional teaching and learning models[1], leading some students from different levels of education to seek ways to meet academic performance expectations, including, for example, the non-medical use of amphetamines, such as methylphenidate. These practices have become increasingly more common in medical courses due to the high demand for activities, tests, reports and internships that students have to complete to ensure their permanence at university. Studies in the university environment[2-6] point to the use of these cognitive enhancement mechanisms to meet the aforementioned demands.

Cognitive enhancement constitute interventions that increase cognitive abilities, called enhancers, since their use would not have a therapeutic motivation[7]. This article analyzes how the result of several non-therapeutic interventions, pharmacological or otherwise, on brain function, increases the performance of cognitive functions/skills/capacities to a higher level beyond the average functioning.

One study[8] indicates that the field of neuroscience has advanced in recent years, enabling the creation of new technological mechanisms aimed at treating mental disorders and neurological problems. Thus, these innovations have expanded the concept of identity, self, and freedom, allowing discussions to be shared with other fields of knowledge. However, capitalism, which transforms everything into a commodity, has captured these issues, combined them with cognitive enhancement, and transformed them into a market niche.

A change was intentionally produced in the social value of the brain, an organ that came to symbolize intellectual performance, creating an environment favorable to the expansion of neuroscience, overvaluing it in relation to other disciplines. Concepts and instruments from the field of neuroscience have been introduced and popularized. The brain started to occupy the role of representing identity and the self, producing the idea that knowing the subject would correspond to knowing the brain[9]. The market for specialization courses clearly demonstrates this phenomenon of overvaluing neurosciences with the offering of courses such as neurodidactics, neuropsychopedagogy, and neuroeducation, among others.

To critically and reflectively study these mechanisms, whether pharmacological or not, that enhance cognitive performance used by university students, the concept of "pharmacological cognitive enhancement" or "intellectual doping" is used, defined as strategies to increase productive capacity, concentration, attention and accelerate the learning process[10].

In the field of social and human sciences, one of the discussions about the non-prescription use of drugs for academic purposes refers to the harmful side effects on the development process, some of which remain unknown, and the possibilities of abuse and dependence. In this sense, the medicalization of social relations, a process that transforms non-medical problems into medical ones, has been increasingly reported as one of the problems that have an impact of concern on education at several levels, including in the university environment[11].

A study revealed that students use this resource because they believe the medication can contribute to their success and the achievement of their goals, without questioning their expectations and targets[3]. Another study[12] indicated that 13.51% of the interviewed students used drugs to complete all tests and 10.81% increased the dose to maintain the effect similar to that at the start of use, which is a relevant risk factor. Exclusion in the educational system has a long history and pathologization has been one of its facets. The lack of access of a large group of young people to university and the high rates of school dropout and repetition are revealed in the statistics and in the growing complaints regarding mental health. An adaptive response may be the enhancement of cognitive performance through psychotropic or stimulant drugs.

This article aims to assess the use of cognitive enhancement strategies among medical students and evaluate their effects on mental health and academic performance, identifying potential interventions to optimize student well-being and the educational process.

METHOD

A field study was conducted with a qualitative approach. The study participants were medical students from a public university in the city of Manaus, state of Amazonas, Brazil. Individual semi-structured interviews were used to collect data. The interview script consisted of questions about their school experiences, how they understood the social environment of the university, their academic experiences and the implications of the latter for their schooling process, as well as the cognitive enhancement mechanisms used by them.

The interview sought to create a space for sharing, a moment to listen to the experiences, preserving the spontaneity of the discourse and their subjectivities evoked during the dialogue. The participants were contacted through an invitation made with the help and dissemination of the research by the Academic Medical Center (CAMED, *Centro Acadêmico de Medicina*). The interviews were conducted at the CAMED facilities. The data collection for this research took place on November 3, 2022 and fictitious names were used to preserve the anonymity of the interviewees (Chart 1).

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Chart 1. Interviewees' data.

Name	Apoena	Araquém	Iracema	Ibotira	Jaci
Age	22	23	29	30	26
Gender	Female	Male	Female	Female	Female
Skin color/ethnicity	Brown	Brown	Brown	White	Brown
Attended medical school period	Internship	5th semester	Internship	5th semester	5th semester

Source: Prepared by the authors.

The interviews were recorded and transcribed in full. The data were then submitted to analysis from a constructive-interpretation perspective[13-14]. From this perspective, the researcher, when reading the material, identifies the indicators of meaning according to the objective proposed in the research. They are then interpreted and grouped into categories. In this process, the researcher has an active role and, thus, the results do not only express the object of study, but also the historical moment of the researcher and the subject participating in the research, since the construction of knowledge is a human production. The study followed the phenomenon and its respective complexities at that time, without exhausting the topic or the resources of other possible studies.

This research is linked to a larger project called "The Meanings of the Schooling Trajectories of Young People from the Amazon", developed within the scope of the National Program for Academic Cooperation (PROCAD, *Programa Nacional de Cooperação Acadêmica*) in the Amazon region, funded by the Coordination for the Improvement of Higher Education Personnel (CAPES, *Coordenação de Aperfeiçoamento de Pessoal de Nível Superior*), and has the collaboration of three universities: Universidade Federal do Amazonas (UFAM), Universidade Federal de Rondônia (UNIR) and Universidade de Brasília (UNB). The project was approved by the Research Ethics Committee of Universidade Federal do Amazonas under Opinion number 4,082,840, Certificate of Presentation of Ethical Appreciation (CAAE, *Certificado de Apresentação de Apreciação Ética*) number 15366619.1.1001.5020.

The PROCAD Amazônia umbrella project aims to research the experiences of Amazonian students in higher education and their respective schooling processes, in order to understand their schooling trajectories, socialization conditions, experiences in higher education, participation, protagonism and how the university responds to the demands of these students.

RESULTS AND DISCUSSION

Cognitive enhancement mechanisms: the search for excellence in performance

Based on the interviews, the main strategy mentioned by the students was the consumption of energy drinks, especially on days leading up to exams or presentations in seminars. In second place was caffeine – a substance that is already part of the students' daily lives – and which is consumed routinely, but which they report no longer feeling its effect of "staying awake", as mentioned by interviewees Araquém and Jaci. Lastly, it was the consumption of methylphenidate, reported by only one student, Jaci. This medication was prescribed by the psychiatrist to keep her awake and give her energy for everyday life at the university, as she reported that she was having difficulty waking up for classes.

Interviewee Araquém talks about the consumption of substances that act in non-pharmacological cognitive enhancement mechanisms:

> *Energy drinks are like this, when I need to sleep and I can't [...] Like, sometimes for a test, for work, for example, tomorrow I have to hand in my Pibic, right? I still have a little bit to do, so I think I'll have to stay awake overnight to do it [...] because I don't usually lose focus so easily, I usually manage it until the time I go to sleep. Energy drinks have an effect that allows me to stay awake for longer and have that focus (Araquém).*

It is pointed out that there is a direct relationship between the demands of the university and the search for substances that allow the student to stay awake, to meet academic demands. The use of energy drinks emerges as a strategy to maintain the focus. A study[15] indicates that students also seek non-pharmacological strategies for cognitive improvement, with coffee, *guarana* powder and energy drinks being the most commonly used alternatives. Piracetam, a pharmacotherapeutic agent classified as a nootropic compound, which is indicated to aid learning or improve memory[16], was also mentioned.

> *When asked about the possible side effects of energy drink consumption, interviewee Araquém said: "[...] it depends, it depends. Like [...] I spent the whole night studying and I drank a one-liter bottle of*

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> *energy drink, and the next day I was shaking a little, but it was only once. I usually just have one can and spend the night studying."*

Despite the side effects experienced by Araquém when used in excess, he still consumes energy drinks to stay awake and focused when studying. It can be observed that these strategies are used mainly in moments of exhaustion, but they still need to prolong their studies to be successful in an academic activity.

Caffeine is present in the discourse of all the interviewed students. They stated that they consume caffeine throughout the day, several times a day, in small quantities, but even if it no longer has any effect, they cannot go without it, because they have headaches. This indicates routine consumption and is related to the idea of abstinence from the substance.

Another interviewee talks about the consumption of caffeine in her daily life, associated with studying from the pre-university period until nowadays:

> *I feel very sleepy. When I was taking the university entrance exam, I slept three, four hours a day. I think I have in my subconscious mind that I don't want to be tired like I was back then because I would lose my balance; man, I don't think I even drank water, I would only drink coffee. I would drink coffee in the morning, coffee at nine o'clock, coffee after lunch, coffee at two o'clock, coffee at night, seven o'clock and when I got home, I would drink coffee again. I never took any medicines to stay awake, I never took Ritalin, I never liked drinking energy drinks, but caffeine, like, my hands got sweaty. My eyes even started to twitch, like, really bad, I was sick for a week. The doctor even asked me to take a break so I wouldn't have a collapse. Today I don't think it even works anymore [...] I take it every day. If I don't take it, I get a migraine. In fact, I have a migraine now because I didn't drink coffee. I take it in the morning and I take it between classes. I'm going to take it when I get out of here (Jaci).*

The above report shows that the search for strategies for cognitive improvement and enhancement can occur before entering university. It is clear throughout the report that there is a marked consumption of caffeine, to the point of causing physiological consequences, such as sweating and eye twitching, characterizing a side effect of excessive consumption of the stimulant. Despite experiencing this moment, the student continues to use caffeine as a strategy for improvement. The literature indicates that excessive caffeine negatively impacts cognitive processes, mood, sleep and energy[17].

It was identified through the interviews that the study routine is exhausting and stressful and that the consumption of stimulants began in the pre-university period until entering university. When they entered university, the study routine intensified due to the subjects and the high workloads.

It is understood that the dynamics of entering and remaining in the university pushes students towards this path, causing them to resort to these methods. The study data show that the excessive consumption of caffeine and energy drinks to endure the study discipline is seen as natural among the interviewees. The side effects, such as "shaking all over" and "headaches", experienced by these students, are also considered natural, as part of medical training, varying between justifying the use or stating that it only happened once.

The value of excellence in performance begins at the university in today's society. As a result, the aim is only for profit, to the detriment of mental health, allowing students to use chemical substances to increase concentration and productive capacity. This search for chemical enhancement of performance results reflects the need to achieve high levels of productivity and efficiency in a society that prioritizes performance as a measure of success[18].

In general, among the interviewees, it was observed that only one student used methylphenidate prescribed by the psychiatrist to help with the university routine. Iracema reported that "she was feeling tired, without energy and having difficulty waking up to go to university and attend classes. Therefore, the psychiatrist found it reasonable to prescribe the medication". The other participants use caffeine and energy drinks as cognitive enhancement resources. In turn, there is a search for resources that improve the prolongation of cognitive capacity and mental alertness among these students.

Self-demand, performance and students' mental health

It was identified that students have the self-perception that they do not study enough, that they need to go without sleep to incorporate all the content presented by teachers and be successful in the evaluations. The need to review after classes is clearly evident in the interviewees' statements. It is worth noting that all interviewees mentioned mental health as a latent issue in their academic life. There are reports that, after joining the academy, they began to suffer from mental health problems, triggering episodes of anxiety and depression, requiring psychiatric care and medication, as well as psychological support:

> *I have classes every day from seven in the morning until eight at night, except on Tuesdays, when they are from seven to ten (at night). This semester, if you ask people, is the most stressful one. And if you ask people, there is a lot of burnout, anxiety, and it even triggers depression. But the first, second, third and fourth [semesters] were not difficult to get through; this is the one I feel the most tired about, now. Like, when you arrived, I had just woken up, so it is a really demanding semester (Ibotira).*

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The interviewee stated that there is a great deal of workload in the fifth semester, and that other students often have mental health issues, such as anxiety attacks, depression and burnout. In addition to taking nine disciplines, Ibotira also participates in college projects, which further increase the demand for studying, reading, dedication and, consequently, fatigue. This may be one of the factors that cause the workload and physical and mental illness of these students.

Studies[19-20] indicate that medical students become ill, increasing with each semester, as they progress in the course, as can be seen in Ibotira's statement above. Possibly, the six years of academic trajectory may impact the quality of life of students. This has been a hypothesis raised by the results of assessments that show the decline in the psychological domains of the health status of medical students[21].

In line with Ibotira's testimony, another student reported the consequences of having gone through a period of sleep deprivation in order to study and meet the demands of university:

> *When I'm sleepy, I really go to sleep, I don't force it. When I was in college [she is attending internship and students who are at this stage of their course make this separation], I forced myself because of the exams. Now I don't because I think it will do me harm. So, I don't want to stay up late to study. I try to organize the next day to study, but I don't try to stay up anymore. I only did that before, but it was also very bad for me, so I learned my lesson. It was a time in the first semesters [...] when I would do that a lot, I think that may have been the reason. When I lose a lot of sleep, I've already noticed that I become very emotionally unstable with everything. That was one of the reasons that made me see a psychiatrist, I had to drop some subjects, I couldn't keep it up anymore. I think it was mostly due to sleep deprivation, because I was alone, my family was far away. I felt really bad. That's why I fell behind in college. So, I kind of don't do it anymore, for health reasons (Apoena).*

These issues further confirmed the problems pointed out by students in the interviews, in which they report the exhausting routine of studies, tests, and productivity demands with illness. The literature[19] shows that the characterization of mental illness is linked to social conditions – institutional, group and collective ones – that constitute illness in medical students and raise several hypotheses to explain this illness, the stress, pointing to the relationship between medical training-subject-illness.

All interviewees expressed dissatisfaction with their level of production and studies:

> *In terms of performance, it's not what I wanted, no. It's too much. In theory, I have to see what I've seen all day and it's not possible. So, I end up only seeing half of it and I get really tired [...] and I don't study [...] I try to study on the weekend and everything piles up, it gets crazy. Then, when the test gets closer, we cram up the content in a very short time. Just to take the test [...] Going further is not possible because it's too much. Like it or not, we study more for the test than for life and that's frustrating [...] Why am I going to fight that? Man, I'm just going to get through this period and life goes on. There's not much dialogue [...]. It's like this and it's like this (Jaci).*

This educational structure intensifies the feeling and the relationship with guilt and impotence, as well as the questioning of the ability to perform and the expectations that students create about their education. Furthermore, the interviewees stated that there is competition among some students due to grades and positive performance in disciplines, as well as in their relationship with teachers. There are situations, as reported by Jaci, in which these conflicts with teachers occur because they require students to pay for lunch or bring breakfast, resulting in the constraint of students or classes that do not agree with this practice. This clearly shows the power relationship between teacher and student. In her narrative, Jaci pointed out that *"[...] you have to pay for the teacher's lunch, you have to bring cake, you have to do this, you have to do that [...].*

Study performance is a latent topic in the interviews. The statements of students Jaci and Iracema reflect how students see themselves in their academic development, which can be a generator of stress, anxiety and impact on their mental health:

> *It's shit. It's really bad because this semester I'm taking nine disciplines. And I keep putting pressure on myself because my resume isn't good, because "oh, I have to join more leagues. Oh, I have projects, I have to do a project" and I don't even want to be a researcher, but I know I need to have that on my resume. "Oh, I have to do this and do that". I keep worrying about the things I have to do, plus the things I already have to do, and all of this makes me upset. I think about so many things that I end up doing nothing (Jaci).*

> *When I started, I didn't know how to study the way I should study and I wasn't doing very well. And my grades weren't satisfactory, not for college, but for me. I put a lot of pressure on myself. Every time I put more pressure on myself, I got more and more frustrated, my grades started to get worse and I started to have a lot, too much stress. That's when I started having trouble sleeping, I went three days without sleeping, without anything. I could take any medication, but I just couldn't sleep. After those three days, I would sleep for two days straight. I would only wake up to go to the bathroom. So, it was affecting my college schedule, my attendance, because of this stress. I was very stressed, that was a time when I gained a lot of weight, I lost a lot of hair, my skin got really bad [...] I had all kinds*

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> *of problems, my menstrual period became irregular. It was all because of this stress. [...] I didn't rest, not even on vacation, I was always getting involved in something. I always thought I couldn't stop. If I stopped, I wouldn't be productive and I didn't deserve to be in college (Iracema).*

Iracema has a psychiatric diagnosis and is undergoing treatment due to the use of psychotropic drugs. In addition to the burden of the disorder, she also has to deal with stress due to the dynamics of college. Iracema's speech accurately portrays the students' thoughts about the merit of belonging to the university. That said, what is the role of the university in the face of this social pressure that students face? Does the university influence or encourage this process in any way? What has been done to ensure that the medical training process is not accompanied by the physical and mental illness of students? The relationship between producing and deserving to be in college is something that directly impacts the mental health of students, when their capabilities, skills, and knowledge are being questioned, with a view to the future as professionals. Many things were said informally after the interviews. One of the things that Iracema highlighted is that, during her period of crisis, one of the teachers said that a "sick/crazy" person could not be a medical student, that the university is not a place for people like that. This event, in Iracema's words, marked and worsened her mental health condition, which led her to question whether she should be there or not.

Thus, the social construction of the medical profession as a noble professional, who saves lives, who gives of themselves, who will have a successful career can generate pressure and expectations that are perhaps unattainable and contradictory and can lead to frustrations[19]. Since there is a high prevalence of psychological illness, it is possible to think of spaces that promote the embracement of these students, offering psychological support, aiming at the promotion of mental health and the prevention or reduction of the impact of the stress of training.

Moreover, it is important to raise awareness about the process of illness, because, since it is a course in the health area, there is a social imaginary that they cannot get sick or show fragility, since they will be professionals who will treat/cure sick people, as if it were a kind of contradiction or paradox. Therefore, initiatives from higher education institutions are important, targeting students and teachers.

Thus, we understand that it is necessary to reflect on this phenomenon in higher education, considering the dynamics of undergraduate medical studies and the promotion of students' mental and physical health, since a training process cannot occur to the detriment of the students' health. That said, it is necessary to analyze what can be done by the university to change this process.

The importance of teacher training in medical education is evident, given that all interviewees reported that there is a gap in the teaching methods of some teachers, and that this directly impacts the assimilation of content and their performance in the discipline. The student-teacher relationship appears as an issue that affects these students' sense of belonging and the way they idealize their training process, envision their future as professionals, and can generate episodes of stress and frustration. Interviewee Jaci reports an event that occurred in her class during the semester:

> *I'm taking a subject that is very difficult [...]. He [the teacher] is very harsh. He asked us to do something last week and [...] he said, "what you are doing is not enough, if you keep doing this, you will be average and don't conform to the average". And there is a downside to being held accountable like this, but it is reality. Life is not going to be easy on us, you know? So, like this [...] there is the teacher's methodology [...] we are tired, sleepy, there is all this [...].*

We observed that the student-teacher relationship is surrounded by conflicts and harassment. There is an expressly drawn power relationship here, in which the student occupies a subservient role, cannot question, and must comply with the teacher's demands, causing problems in the university environment and in the students' training process. The correlation of these events with the productivist and meritocratic logic supported by neoliberalism is highlighted. From this perspective, the subject is just another one in the production line, regardless of their demands and needs, whether they are related to the teaching-learning process or health.

Medical education takes on this technical aspect when it is influenced by the market interests of the hegemonic socioeconomic system, capitalism. This reinforces issues of competitiveness and individualism throughout the education process as an invisible requirement. The students reproduce these behaviors as a way of meeting the social expectations that are imposed[22]. Therefore, institutions that offer medical education must critically consider their structure and organization, designing an education that does not promote mental illness among their students.

FINAL CONSIDERATIONS

The study has advanced our understanding of students' trajectories in medical education by revealing that medical students use cognitive enhancement strategies, such as energy drinks and caffeine, to cope with rigorous academic demands. While such practices may initially appear beneficial in terms of

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improving performance and productivity, they are intrinsically associated to significant adverse effects on the students' mental health, including increased stress, anxiety, and addiction.

The results indicate a correlation of concern between performance pressures and the students' well-being, suggesting that the current academic culture may inadvertently foster unhealthy and unsustainable habits. This study highlights the urgent need for educational institutions to review their pedagogical and assessment approaches, fostering a more balanced educational environment that supports both academic success and students' mental health.

We recommend implementing educational policies that integrate robust psychological support and well-being initiatives, as well as teaching methods that encourage effective learning without imposing an excessive workload. The development of pedagogical skills among teachers should also be a priority, so they can adequately support their students without resorting to excessive demands or practices that induce stress.

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AUTHORS' CONTRIBUTIONS

Camila Ribeiro da Silva: study conception and design; data collection and analysis; and writing of the manuscript. Iolete Ribeiro da Silva: study supervision and funding; literature review; theoretical contributions; guidance and development of methods; writing and review of the manuscript. André Luiz Machado das Neves: study conception and design; data collection and analysis; and writing of the manuscript; literature review; theoretical contributions; guidance and development of methods; and editing and review of the manuscript.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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