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Original Articles

Factors and barriers related to physical activity among patients on chronic hemodialysis: a cross-sectional study in a dialysis clinic

Fatores e barreiras relacionadas à prática de atividade física de pacientes em hemodiálise crônica: estudo transversal em uma clínica de diálise

Factores y barreras relacionados con la práctica de actividad física en pacientes en hemodiálisis crónica: un estudio transversal en una clínica de diálisis

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Keywords:
Sedentary;
Exercise;
Chronic renal failure;
Dialysis.

ABSTRACT
To evaluate barriers and predictors for physical activity in hemodialysis patients in a Cross-sectional study of hemodialysis patients in Joinville/SC. Physically inactive patients and physically active patients were defined using the Godin Leisure-Time Exercise questionnaire. Of the 107, 19 (17.8%) were physically active. Fatigue, fear of injury, and financial constraints were the most cited barriers among the physically inactive. Increasing age (OR = 0.90; *P* = 0.001), time on hemodialysis (OR = 0.99; *P* = 0.016), and number of barriers (OR = 0.61; *P* = 0.004) were associated with a greater chance of physical inactivity. In conclusion, elderly patients with longer hemodialysis vintage and with a greater number of barriers represent a population at greater risk for physical inactivity.

Palavras-chave:
Sedentarismo;
Exercício;
Insuficiência renal crônica;
Diálise.

RESUMO
Avaliar barreiras e preditores de atividade física entre pacientes em hemodiálise em um estudo transversal com pacientes em hemodiálise em Joinville, Santa Catarina. Pacientes fisicamente inativos e fisicamente ativos foram definidos pela Escala de Exercícios de Lazer de Godin. Dos 107 pacientes, 19 (17,8%) eram fisicamente ativos. Fadiga, medo de lesões e falta de dinheiro foram mais frequentemente citados como barreiras entre os pacientes fisicamente inativos. O aumento da idade (OR = 0,90; p = 0,001), o tempo em hemodiálise (OR = 0,99; p = 0,016) e o número de barreiras (OR = 0,61; p = 0,004) foram associados a uma maior probabilidade de inatividade física. Conclui-se que pacientes mais velhos, com maior tempo de hemodiálise e maior número de barreiras, representam uma população com maior risco para inatividade física.

Palabras clave:
Sedentarismo;
Ejercicio;
Insuficiencia renal crónica;
Diálisis.

RESUMEN
Para evaluar las barreras y los predictores de la actividad física entre los pacientes de hemodiálisis en un estudio transversal de pacientes de hemodiálisis en Joinville, Santa Catarina. Los pacientes físicamente inactivos y físicamente activos se definieron utilizando la escala Godin Leisure-Time Exercise. De los 107 pacientes, 19 (17,8%) eran físicamente activos. La fatiga, el miedo a las lesiones y la falta de dinero fueron citados con mayor frecuencia como barreras entre los pacientes físicamente inactivos. El aumento de la edad (OR = 0,90; p = 0,001), el tiempo en hemodiálisis (OR = 0,99; p = 0,016) y el número de barreras (OR = 0,61; p = 0,004) se asociaron con una mayor probabilidad de inactividad física. Se concluye que los pacientes de mayor edad, con mayor tiempo de hemodiálisis y un mayor número de barreras, representan una población con mayor riesgo de inactividad física.

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INTRODUCTION

Regular physical activity enhances overall physical well being and reduces the risk of developing cardiovascular disease, respiratory disease, diabetes, hypertension, and obesity (Zheng, 2022). Physical inactivity has been identified as a factor associated with the loss of strength and muscle mass (sarcopenia) in patients with end-stage kidney disease (ESKD) undergoing hemodialysis (HD) (Zhang et al., 2023; Morishita and Nagata, 2015). However, the practice of regular exercise remains challenging in this population (Kendrick et al., 2019). Although the World Health Organization recommends that adults perform an average of 150 min of moderate PA during the week to have a good quality of life (WHO, 2020), it is estimated that the prevalence of regular physical activity practice among HD patients is very low (Taryana et al., 2019). In addition to improving quality of life, studies show that patients with ESKD in HD can gain muscle mass and reduce loss of strength (Morishita and Nagata, 2015; Storer et al., 2005), which helps to minimize the impact of chronic HD-related sarcopenia (Clarkson et al., 2019).

Among the barriers that hinder the regular practice of physical activity among patients with CKD on HD are a lack of guidance and motivation, emotional factors, limitations due to pain, lack of economic resources, feeling tired, and socioeconomic factors (Socoloski et al., 2021). Studies have shown that physical activity in this population can contribute to improvements in physical capacity, cardiorespiratory capacity, muscle strength, and quality of life (Bulighin et al., 2024; Wilkinson et al., 2021). However, few Brazilian studies have yet to comprehensively investigate the barriers to physical activity among patients undergoing chronic HD, particularly in relation to their knowledge of its benefits and the fears or beliefs that may contribute to physical inactivity in this population.

Thus, although regular exercise practice contributes to positive outcomes in patients with ESKD undergoing chronic HD (Clarkson et al., 2019; Socoloski et al., 2021), promoting effective exercise in this population remains a significant challenge for healthcare teams responsible for their care. The objective of this study was to evaluate knowledge and the main barriers to exercise among patients undergoing chronic hemodialysis, and to identify factors associated with physical inactivity.

METHODOLOGY

DESIGN, LOCATION, AND SAMPLING

This observational, cross-sectional, descriptive, and analytical study consists of a non-probabilistic sample of 118 patients with end-stage CKD on chronic hemodialysis therapy at a dialysis clinic in Joinville/Santa Catarina, Brazil. From March to July 2023. All patients aged 18 to 65 years who had been on maintenance hemodialysis for over three months were included. Considering that elderly people on HD are more likely to have multiple comorbidities, sarcopenia, and musculoskeletal limitations due to mineral and bone disease in CKD, the defined inclusion age range aimed to focus on patients with the greatest potential for regular physical activity practice (Souweine et al., 2024). Patients who had physical limitations or were with the presence of limb amputation, and those with cognitive alterations or dementia were excluded. Considering that clinical decompensations requiring hospitalization could temporarily affect the patient's clinical situation and the measures analyzed in this study, patients hospitalized in the last 30 days were also excluded. All participants completed the informed consent form, and the study was approved by the ethics committee of the University of the Region of Joinville (CAAE nº 65523922.9.0000.5366).

VARIABLES COLLECTED AND INSTRUMENTS USED

To investigate the main barriers faced by patients with CKD undergoing hemodialysis concerning the practice of physical activity during their free time, a questionnaire was developed by the authors themselves, based on the study by Delgado and Johansen (2012). The questionnaire assessed fourteen possible barriers (questions 1-14) and knowledge regarding the practice of regular exercise (questions 15-16). The answers to the questionnaire were recorded in a Likert model, with the first three options (strongly disagree, disagree, or neutral) categorized as "no" and the other two options (I agree, strongly agree) categorized as "yes". The instrument *Godin Leisure-Time Exercise Questionnaire* (GLTEQ) was used to assess physical activity intensity (São-João et al., 2013). This instrument assessed physical activity intensity over a period of seven consecutive days, with a minimum of 15 min of activity per day. Based on the reported frequency for each type of physical activity, values were multiplied by 9 for vigorous, 5 for moderate, and 3 for mild intensity. The final sum of each component enabled us to estimate the metabolic coefficient of effort, also known as the metabolic equivalent of task (METs) (Rosa et al., 2015). Thus, a score of ≥ 24 was considered intense physical activity, from 14 to 23 was considered moderate, and ≤ 14 was considered insufficient physical activity or sedentary (Amireault & Godin, 2015). The researcher (P.S.S.) administered all questionnaires only once during a single HD session.

To assess the muscle strength of the upper limb muscles, handgrip strength was considered (Schlüssel et al., 2008). To evaluate the muscle strength of the lower limb muscles, the Sit-to-Stand Test (SST) was used (Crook et al., 2017). Both were performed right after the patients' HD session. For the SST, the patient was asked to sit down and stand up without supporting their arms for 30 s, starting from the initially seated position, where the number of complete repetitions was considered for analysis (Crook et al., 2017).

Handgrip strength was measured using an analog Jamar hand-held dynamometer (Jamar Hydraulic Hand Dynamometer; Sammons Preston, USA), with a range of 0-90 kg and adjustable grip positions. The device features a metallic structure and anatomical handle, with measurements displayed in kilograms (up to a maximum of 100 kg-force, kgf). It features a needle that remains at the peak value throughout the test, allowing for easy reading. The evaluation was conducted with the patient seated, who was instructed to squeeze the dynamometer handle and hold the contraction for approximately two seconds. This procedure was performed three times on each hand, and the highest value obtained was recorded for analysis. In addition to these variables, the mean values of Kt/V (a laboratory parameter used to assess the adequacy of the hemodialysis dose, with values above 1.2 indicating good adequacy), phosphorus, albumin, and parathyroid hormone over the last three months were considered. These parameters were collected monthly by the treatment center before a hemodialysis session. High-sensitivity C-reactive protein and bicarbonate levels were also measured during the same period, with pre-dialysis samples analyzed in a reference laboratory using the immunoturbidimetry method for high-sensitivity C-reactive protein and the potentiometric technique for bicarbonate.

STATISTICAL ANALYSIS

Categorical variables are presented by frequency and percentage, and numerical variables by mean and standard deviation or median and interquartile variation. Patients with a GLTEQ score greater than 14 (active and moderately active) were considered physically active, while those with a GLTEQ score of 14 or less were considered physically inactive (Wang et al., 2020; Sheshadri, 2021). The chi-square test was used to compare categorical variables, and the Mann-Whitney test was used to compare the means of quantitative variables, after verifying their normality by the Kolmogorov-Smirnov test, between the physically active and physically inactive patients. The presence of altered strength was determined for all dynamometry values below the 50th percentile, adjusted for gender and age groups from a Brazilian reference sample (Schlüssel et al., 2008), and SST in 30 s was lower than the median found in the sample by sex (<10 for women or < 11 for men). The prevalence of each barrier between groups was compared using the chi-square test or Fisher's exact test. Subsequently, we sought to analyze the variables associated with physical inactivity using univariate logistic regression. In this analysis, the presence of barriers to physical activity was considered a continuous variable, examined by summing the 14 barriers reported by the patients (questions 1-14 of the questionnaire, where each reported barrier was assigned a point value). All variables associated with the outcome with a value of $P < 0.100$ were considered in the multivariate model, with sex and age remaining fixed. The analysis considered a p-value of less than 0.05 to be statistically significant. The analyses were performed using IBM SPSS Statistics, version 27.

RESULTS

Of the initial sample of 118 patients, 11 (9.4%) were excluded. Of the 107 patients in the final sample, 19 (17.8%) were physically active (11 moderately active and eight intensely active). The median age of the total sample was 50 years, and 64.5% of the participants were male. The most prevalent comorbidity was systemic arterial hypertension (78.7%), and the median time on dialysis was 71.1 months. When the sample was stratified by the presence of regular practice of exercise, physically active patients, compared to those inactive, were younger (median 49 vs. 52 years; $P = 0.001$), higher prevalence of men (84.2% vs. 60.2%; $P = 0.039$); shorter HD vintage (44.9 vs. 70.2 months; $P = 0.005$) and higher prevalence of physical activity before the start of chronic HD treatment (84.2% vs. 55.7%; $P = 0.017$). Additionally, physically inactive patients had a lower mean Kt/V value, but a higher median albumin value. Other characteristics are presented in Table 1.

Table 2 presents the barriers to and knowledge about physical activity in the total sample, as well as stratified by physical activity status, inactive vs. active. The most frequently mentioned barrier by the participants was the fear of harming the arteriovenous fistula, at 46.7%. The presence of tiredness (43.2% vs. 15.8%; $P = 0.021$), greater fear of getting hurt (28.4% vs. 5.3%; $P = 0.025$), and lack of financial conditions (38.6% vs. 15.8%; $P = 0.047$) were more frequently reported as barriers among physically inactive patients compared to those who were active. Regarding knowledge about physical activity, there was no difference between the groups.

Table 3 presents the variables associated with the practice of regular exercise in the sample studied. In the univariate analysis, younger age, shorter time on hemodialysis therapy, and fewer barriers were associated with a higher likelihood of the patient engaging in regular physical activity. In the multivariate analysis, younger age remained significantly related to physical activity practice (OR = 0.90; 95% CI, 0.84-0.96; $P = 0.001$), as well as the shortest HD vintage (OR = 0.99; 95% CI, 0.98-0.99; $P = 0.016$). The lower number of barriers evaluated in the study remained associated with a higher chance of performing regular physical activity after adjusting for other confounding variables (OR=0.61; 95% CI 0.43-0.86; $P = 0.004$).

DISCUSSION

The present study showed that less than one-fifth of the sample analyzed engaged in regular physical activity at moderate or vigorous intensity levels, according to the validated classification. Although most patients undergoing hemodialysis are aware of the importance of physical activity, the main barriers identified were physical fatigue, fear of injury, and a lack of financial resources to engage in regular exercise. In addition, younger age, shorter time on hemodialysis treatment, and fewer barriers were associated with a higher likelihood of these patients engaging in regular physical activity.

Table 1. General characteristics of the sample.

	Total Sample		Physically inactive		Physically active		p-value
	n = 107 (100%)		*n* = 88(82.2%)		*n* = 19 (17.8%)		
Age, years; median, IQR	50	44/58	52	46/60	44	30/51	0.001
Sex, male; total, %	69	64.5%	53	60.2%	16	84.2%	0.039
Comorbidities, yes; total, %							
Diabetes, *n* = 99	24	24.2%	24	27.3%	3	15.8%	0.230
Hypertension	85	78.7%	70	79.5%	15	78.9%	0.585
Vascular access; total, %							0.415
Fistula	85	79.4%	69	78.4%	16	84.2%	
Catheter	22	20.6%	19	21.6%	3	15.8%	
HD shift, total, %							0.096
Morning	46	43.0%	40	45.5%	6	31.6%	
Afternoon	34	31.8%	24	27.3%	10	52.6%	
Night	27	25.2%	24	27.3%	3	15.8%	
HD vintage, months; median, IQR	71.1	26.7/133.7	70.2	28.8/132.7	44.9	14.7/102.2	0.005
Physical activity before starting HD, yes; total, %	65	60.7%	49	55.7%	16	84.2%	0.017
Kt/v, mean, ±SD; *n* = 98	1.4	± 0.3	1.4	± 0.3	1.2	± 0.4	0.001
Phosphorus, mg/dL; median, IQR	5.6	4.6/6.6	5.5	4.5/6.6	5.6	4.4/6.3	0.496
Albumin, mg/dL; median,IQR	4.1	3.9/4.4	4.1	3.9/4.3	4.3	4.1/4.6	0.018
PTH, pg/ml; median, IQR	331.7	182.9/683.6	403.0	207.4/829.2	302.0	184.6/407.3	0.275
Hemoglobin, g/dL, median, IQR	11.1	9.9/12.3	11.2	10.2/12.5	11.0	10.4/12.7	0.565
hs-CRP, mg/L; median, IQR	0.38	0.21/1.1	0.45	0.2/1.4	0.36	0.2/0.5	0.077
Bicarbonate, mEq/L; median, IQR	21.0	19.3/22.9	20.9	19.3/23.0	19.9	18.6/22.8	0.415
Dynamometry < percentile 50, yes	75	70.1%	63	71.6%	12	63.2%	0.651
30s SST, median, IQR, *n* = 103	11	8/14	11	8/13	12	7/15	0.769
Altered strength, yes; total, %, *n* = 103	41	39.8%	34	40.5%	7	36.8%	0.974
BMI kg/m^2 ; median, IQR, *n* = 98	24.1	21.7/28.3	23.6	21.5/28.2	24.9	22.6/28.4	0.381

SD = standard deviation; IQR = interquartile range 25/75th percentile; HD = hemodialysis; PTH = parathyroid hormone; hs-CRP = ultrasensitive C-reactive protein; 30s SST = sit-to-stand test; BMI = body mass index.
Source: Authors.

Table 2. Barriers, knowledge, and attitudes about physical activity in the total sample and stratified by *physical activity* status.

Questions	Total Sample		Physically inactive		Physically active		p-value
	n = 107 (100%)		*n* = 88 (88,2%)		*n* = 19 (17,8%)		
	Total	%	Total	%	Total	%	
Situations reported as barriers to physical activity, yes:							
1. Tiredness	41	38.3%	38	43.2%	3	15.8%	0.021
2. Shortness of breath	25	23.4%	23	26.1%	2	10.5%	0.120
3. Lack of will	26	24.3%	24	27.3%	2	10.5%	0.101
4. Feels pain	36	33.6%	33	37.5%	3	15.8%	0.056
5. Lack of time	8	7.5%	7	8.0%	1	5.3%	0.567
6. Fear of getting hurt	26	24.3%	25	28.4%	1	5.3%	0.025
7. Fear of impairing vascular access	50	46.7%	43	48.9%	7	36.8%	0.485
8. Lack of company	18	16.8%	16	18.2%	2	10.5%	0.335
9. Lack of money	37	34.6%	34	38.6%	3	15.8%	0.047
10. Age does not allow it	6	5.6%	6	6.8%	0	0%	0.300
11. There is a lack of place to do physical activity	14	13.1%	13	14.8%	1	5.3%	0.240
12. Feel sad, discouraged	31	29.0%	28	31.8%	3	15.8%	0.264
13. The HD routine gets in the way	10	9.3%	9	10.2%	1	5.3%	0.437
14. Feels bad after HD	37	34.6%	33	37.5%	4	21.1%	0.134
Knowledge about physical activity, yes:							
15. Physical activity brings health benefits	105	98.1%	86	97.7%	19	100%	0.675
16. Patients on HD can do physical activity	94	87.9%	76	86.4%	18	94.7%	0.282

HD = hemodialysis.
Source: Authors.

Table 3. Univariate and multivariate analysis of variables associated with the practice of physical activity in patients on chronic hemodialysis.

	Univariate			Multivariate		
	OR	**IC 95%**	**p-value**	**OR**	**CI 95%**	**p-value**
Age, years, per unit increase	0.93	0.89-0.98	0.002	0.90	0.84-0.96	0.001
Gender, male vs. female	3.52	0.95-12.99	0.059	2.19	0.47-10.21	0.317
HD vintage, months, per unit of increase	0.99	0.98-0.99	0.042	0.99	0.98-0.99	0.016
Diabetes, yes	0.50	0.13-1.87	0.303			
Hypertension, yes	0.96	0.28-3.26	0.953			
Hemoglobin, per unit increase	0.96	0.72-1.28	0.772			
Albumin, per unit of increase	6.83	1.48-31.53	0.014			
hs-CRP, per unit of magnification	0.61	0.29-1.28	0.193			
Physical activity before starting HD, yes	4.24	1.15-15.62	0.030			
Number of barriers, per unit of increase	0.71	0.55-0.92	0.010	0.61	0.43-0.86	0.004

HD = hemodialysis; hs-CRP = high sensitive C-reactive protein; OR = odds ratio; CI = confidence interval.
Source: Author.

The study considered a sample with similar characteristics to the population undergoing chronic HD in Brazil (Nerbass et al., 2025). It is known that physical inactivity contributes to the loss of muscle mass and can be a risk factor for higher mortality among patients with CKD (van Vilsteren et al., 2005). An extensive study involving patients at various stages of chronic kidney disease in England, with over 5,000 participants, found a progressive decrease in the prevalence of physical activity as kidney disease severity increased (Wilkinson et al., 2021). Among the 1,155 in chronic HD, with a median age of 65 years, approximately 80% patients were classified as physically inactive, similar to the prevalence found in our study. A progressive increase in physical inactivity was observed across chronic kidney disease stages, ranging from 40% in stages 1-2 to 75% in stages 4-5, highlighting the strong association between disease severity and reduced physical activity levels in this population (Wilkinson et al., 2021). For some nephrologists, the lack of adequate guidance on physical activity practice represents a significant barrier to patient adherence with ESKD undergoing HD to regular exercise programs. Therefore, implementing strategies for exercise practice is crucial, involving family, social, counselling, and community support. According to Kendrick et al. (2019), educating health professionals can be essential to overcoming these barriers and encouraging the regular practice of guided exercises, thereby contributing to the improvement of patients' health and quality of life (Socoloski et al., 2021).

Patients undergoing hemodialysis face multiple barriers to physical activity, broadly categorized as physical, psychological, social, and environmental. Physical barriers are prominent and include fatigue, muscle weakness, and shortness of breath, all of which are highly common in this group and directly limit exercise capacity (Moorman et al., 2019; Li et al., 2021). Pain and fear of falls are also significant concerns, especially in older patients or those with mobility impairments (Sutherland et al., 2021). Disease-related distress, such as comorbidities and complications of ESKD, further contributes to physical inactivity (Li et al., 2021). Social and environmental factor also include limited access to suitable exercise facilities, lack of time due to the demanding dialysis schedule, and restrictions imposed by the dialysis environment itself (Li et al., 2021). Fatigue, pain, psychological concerns such as fear of injury and lack of motivation, and social obstacles such as lack of support or adequate professional guidance have been found in other studies as physical limitations (Li et al., 2021; Delgado and Johansen, 2012). These factors, when combined, contribute to low patient adherence to exercise programs, highlighting the need for more targeted interventions to overcome such challenges and promote a more active lifestyle among this population (Zheng, 2022; Clarkson et al., 2019; Ethgen et al., 2017; van Vilsteren et al., 2005).

In this study, fatigue, fear of injury, and lack of financial resources were the most prevalent barriers to physical activity among those who did not engage in it. Although no association was found between anemia and physical inactivity, the presence of cardiovascular comorbidities, which are more prevalent among inactive individuals (Wathanavasin et al., 2022), could not be ruled out, which may explain fatigue as a barrier. Fear of injury may be related to the high risk of falls among these patients and the lack of systematic guidance on physical activities adapted to their condition (Gute and Zimbudzi, 2023). Due to the lack of financial resources, there are unfortunately no public gyms in the city, and public health system funding for hemodialysis sessions does not include the hiring of physical educators. Studies also indicate that regular physical exercise helps increase muscular strength, regardless of the type of exercise performed (Ethgen et al., 2017; Zhang et al., 2023).

Therefore, some authors emphasize the importance of a multidisciplinary approach to promoting physical activity in patients with ESKD undergoing HD, considering the health benefits and the need to overcome institutional and individual barriers (Saz-Lara et al., 2024; Abe et al., 2023).

According to the literature, patients in the early stages of HD are more likely to adhere to exercise programs than those on dialysis for an extended period. This may be linked to fewer disease-related complications and less accumulated physical exhaustion. Conversely, patients on dialysis for an extended duration often develop significant muscle weakness, reduced functional capacity, and symptoms of fatigue, making exercise more difficult (Baião et al., 2023). Other relevant factors include physiological and psychological effects, as patients are generally more active and motivated to adapt to treatment and medical guidelines at the beginning of dialysis, including engaging in exercise (Afshar et al., 2011). However, progressive muscle and bone deterioration, common in advanced stages of chronic kidney disease, can further reduce motivation and functional capacity to perform exercises (WHO, 2020).

This study has some limitations. Although the characteristics of this sample are similar to those reported for dialysis patients in the last Brazilian Dialysis Survey, it is a sample restricted to a single dialysis center, which may have different physical activity guidance practices than other centers. Furthermore, the small sample size may have limited statistical power to account for other barriers or factors associated with physical activity. Regarding the generalizability of our findings, it is worth noting that the study focused on patients within the age group most likely to engage in physical activity, excluding very elderly patients. We also cannot rule out the possibility that the method used to measure lower limb muscle strength, which consisted of an adapted 30-s test, may be influenced by patient motivation and interest in the research, generating observation bias with lower values, especially among those who are physically inactive. Finally, it was not possible to perform a detailed cardiopulmonary assessment that would identify patients with a recognized functional inability to exercise.

The study presents relevant contributions to a better understanding of the difficulties that patients undergoing chronic HD face in practicing exercise, which can help guide more focused health education interventions. In addition, it highlights the need for health professionals caring for these patients to provide information that minimizes false fears, which may limit the practice of physical activity in these patients. It also reinforces the importance of programs, including those led by physical educators, to stimulate and promote exercise practice among patients with more physical limitations and those undergoing extended hemodialysis therapy.

CONCLUSION

It is concluded that physical inactivity, due to the barriers pointed out in patients with ESKD in HD, primarily associated with aging, contributes significantly to the loss of mass and FM, both before and during HD treatment. Therefore, targeted interventions to encourage physical activity by these patients are essential to mitigate the deleterious effects of inactivity and promote better clinical outcomes.

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CONFLICTS OF INTEREST

The authors have declared that no competing interests exist.

DATA AVAILABILITY

The datasets generated and/or analyzed during the current study are not publicly available due to ethical restrictions but are available from the corresponding author on reasonable request.

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