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ORIGINAL ARTICLE

Factors Influencing Presenteeism in Middle-aged and Older Workers with Chronic Kidney Disease: A Single-center Cross-sectional Study

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Objectives: Managing presenteeism among patients with chronic kidney disease (CKD) is important for balancing disease management and employment. This study aimed to investigate presenteeism, exercise self-efficacy (SE), and physical function indices in workers with CKD and to examine the factors that influence presenteeism in this patient group. **Methods:** This cross-sectional study included 36 workers with stage 3–5 pre-dialysis CKD. Presenteeism was quantified using the Work Functioning Impairment Scale (WFun). Other factors to be evaluated included exercise SE, physical function, anemia, and renal function. Exercise SE was assessed using Oka's scale. Physical function was measured through grip strength, the 10-m walk test, the short physical performance battery, the 6-min walk test, and skeletal muscle mass index. The χ^2 and independent t-tests were used to compare patient characteristics between those with and without presenteeism. The WFun score was used as the dependent variable in the multiple regression analysis. **Results:** Fourteen (38.9%) patients exhibited presenteeism. Comparisons between the two groups demonstrated significant differences in creatinine (Cr), exercise SE, and WFun and in the prevalences of CKD stage 3 and CKD stage 5 ($P<0.05$). The WFun score was significantly correlated with Cr ($r=0.36$) and exercise SE ($r=-0.41$) in a single correlation analysis. Multiple regression analysis showed that WFun was significantly related only to exercise SE ($\beta=-0.34$). **Conclusions:** Presenteeism was significantly correlated with exercise SE in working patients with predialysis CKD. Our findings provide evidence to support the development of interventions for the prevention of presenteeism in predialysis CKD patients.

Key Words: employment; exercise self-efficacy; predialysis; WFun

INTRODUCTION

The prevalence of chronic kidney disease (CKD) in Japan has steadily increased in recent years.[1)] The incidence of CKD in the workforce has also increased. Patients with CKD are at a high risk of leaving the workforce because they must manage both their disease and their job while experiencing a variety of physical and psychiatric symptoms.[2)] A previous study has indicated that 66.3% of patients undergoing hemodialysis between the ages of 18 and 98 years are not gainfully employed.[3)] To enhance the quality of life of patients with CKD, healthcare professionals must be attentive not only to disease management but also to employment-related challenges.

Among the factors that impede gainful employment in patients with CKD is the phenomenon of "presenteeism." Presenteeism is defined as attendance at work despite ill health that would normally prompt rest or absence[4)] and is

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associated with the subsequent depletion of vacation days[5] and prolonged work absence.[5] Furthermore, the economic costs incurred because of presenteeism surpass those resulting from sick leave and sick days.[6] Patients with predialysis CKD experience multifarious health impediments, including physical symptoms such as fatigue, muscle weakness, and pain,[7] as well as mental symptoms such as anxiety and depression,[8,9] which engender work constraints. In addition, workers with CKD receive scant social support from their colleagues and grapple with conflicts between the work and personal spheres.[10] Previous studies have reported that 37% of individuals with CKD experience severe fatigue, 7% anticipate withdrawal from the workforce, and 49% encounter employment limitations.[10] Managing presenteeism in patients with CKD is crucial for achieving a harmonious balance between disease management and employment, thereby bolstering the workforce and curtailing health-related costs.

The manifestation of presenteeism in patients with CKD may be associated with a complex interplay of multiple factors. A previous study reported that the presence of cardiovascular disease was associated with a significant decrease in work productivity, particularly in patients with CKD who had anemia.[11] Other previous studies have reported that lower hemoglobin (Hb) levels in patients with CKD were associated with lower work productivity.[12] In a case study involving employed patients with CKD, those grappling with presenteeism exhibited lower levels of exercise self-efficacy (SE).[13] Nevertheless, only a limited number of studies have investigated presenteeism in patients with CKD, and the factors influencing this phenomenon remain unclear. Therefore, there is a significant need to comprehensively explore the prevalence of presenteeism and factors associated with presenteeism among workers with CKD.

We considered that a meticulous examination of the employment status of patients with CKD may yield valuable evidence that could aid in devising strategies to enhance work productivity. Therefore, the primary objective of this study was to investigate presenteeism, exercise SE, physical function, nutritional indices, anemia, and renal function indices in a working population of patients with CKD; our aim was to discern the determinants of presenteeism within this patient cohort.

MATERIALS AND METHODS

Study Participants

This single-center, cross-sectional study was conducted at the Seirei Sakura Citizen Hospital, Japan. Thirty-eight patients with stages 3–5 CKD who were admitted for CKD education between July 2020 and March 2023 were enrolled. The following exclusion criteria were used: (1) non-working individuals, (2) uncontrolled hypertension and cardiac failure, (3) leg amputation, (4) motor paralysis caused by central nervous system disease, (5) dementia, and (6) a history of renal biopsy during educational hospitalization for CKD. Uncontrolled hypertension, heart failure, and a history of renal biopsy were used as exclusion criteria because of their potential impact on risk management and physical function outcomes during exercise. The ethics committee of Seirei Sakura Citizen Hospital approved all the procedures performed in this study (approval number 2022019). All participants provided written informed consent. Sample size was calculated for Spearman's correlation coefficient using SPSS Statistics for Windows, Version 28.0 (IBM, Armonk, NY, USA). Assuming a power of 0.8 and an expected correlation coefficient of 0.5, the required sample size was determined to be 33.

Data Collection

Data regarding patient characteristics were collected from the admission medical records. Presenteeism, exercise SE, and physical function were measured by three physical therapists who were trained to collect the relevant data beforehand, and all measurements were assessed individually for each participant.

Patient Characteristics

Data were collected for demographic characteristics [age, sex, height, weight, body mass index (BMI), marital status, living alone or not, number of household members, and employment status] and comorbidities (diabetes, hypertension, dyslipidemia, angina pectoris, myocardial infarction, heart failure, other cardiac diseases, orthopedic disease, and mental illness). The following laboratory data were collected before the physical function assessment: serum levels of total protein (TP), albumin (Alb), blood urea nitrogen (BUN), creatinine (Cr), sodium (Na), potassium (K), chlorine (Cl), calcium (Ca), phosphorus (P), Hb, C-reactive protein (CRP), and HbA1c. Estimated glomerular filtration rate (eGFR) was calculated from the Cr level and individual patient information (sex, age). The CKD stages 3–5 were classified based on the following eGFR values: stage 3, eGFR 30–59 mL/min per 1.73 m^2; stage 4, eGFR 15–29 mL/min per 1.73 m^2; stage 5, eGFR less than 15 mL/min per 1.73 m^2.[14] The geriatric nutrition risk index (GNRI), used to assess nutritional status, was calculated using the following formula based on previ-

ous studies[15]:

GNRI = [14.89 × Albumin (g/dL)] + [41.7 × (Body weight/Ideal body weight)]

where Ideal body weight (kg) = 22 × [Height (m)]^2

Body weight/Ideal body weight was set to 1 if the patient's body weight exceeded the ideal body weight.

Limb muscle mass was determined by bioelectrical impedance analysis (BIA) using a multi-frequency BIA device (Tanita MC-780; Tanita, Tokyo, Japan). Skeletal muscle mass index (SMI) was calculated as limb muscle mass divided by height squared.[16]

Presenteeism

Presenteeism was assessed using the work functioning impairment scale (WFun), developed at the University of Occupational and Environmental Health, Japan, to objectively evaluate presenteeism in individuals with health issues.[17] The WFun is a seven-item scale useful for easily assessing presenteeism in busy clinical settings. It is characterized by its presenteeism-specific assessment and its ability to identify the severity of presenteeism at four levels, which distinguish it from other assessments. Furthermore, the WFun has been correlated with other standardized tools for measuring impaired work function[18] and validated, consistent with the consensus-based standards for the selection of health measurement instruments. WFun features remain unaffected by factors such as sex, age, employment status, job type, or annual income. The WFun gives a total score ranging from 7 to 35 points, with higher scores indicating a greater degree of disability: 7–13 points, no problems; 14–20 points, mild problems; 21–27 points, moderate problems; 28–35 points, severe impairment.

Exercise SE

Exercise SE was assessed using Oka's scale.[19] The scale was designed to gauge an individual's confidence in engaging in physical activity when confronted with common obstacles, such as physical fatigue, adverse weather conditions, lack of time, and psychological stress. The participants completed self-administered questionnaires comprising four items scored on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Higher scores were indicative of higher SE. The selection of Oka's scale for assessing exercise SE in our study is supported by its previous application in older adult populations.[20] Furthermore, Oka's exercise SE scale has been utilized to measure exercise-related SE in patients with type 2 diabetes[21] and in patients undergoing hemodialysis.[22]

Physical Functions

Grip strength, the 10-m walk test, the short physical performance battery (SPPB), and the 6-min walk test (6MWT) were used to measure physical functions. Grip strength was measured using a grip strength meter (Grip D Digital Grip Strength Meter; Takei Scientific Instruments, Niigata, Japan) in the upright standing posture, and the highest value on each side was recorded. In the 10-m walk test, the time required to walk comfortably along a 10-m path was recorded, and the average walking speed was calculated. The SPPB consisted of three sub-items: balance, 4-m walk, and chair stand tests. The balance test included three 10-s standing balance tests: side-by-side, semi-tandem, and tandem standing. The 4-m walk test measured the time required to walk comfortably along a 4-m course. In the chair stand test, the patient rose five times with the arms crossed from a sitting position on an armless chair set at 40 cm and stood up with the knees and hips fully extended. Each of the three sub-items of the SPPB was scored from 0–4 points, resulting in a total score of 0–12 points. Lower SPPB scores indicated restricted physical function.[23] The 6MWT was administered by encouraging the participant to walk as quickly as possible along a marked indoor corridor. The total distance traveled after 6 min was recorded in accordance with the method described by the American Thoracic Society.[24]

Statistical Analysis

The normality of the data was assessed using the Shapiro–Wilk test. The χ^2 and independent t-tests were used to compare patient characteristics with and without presenteeism. The association between WFun scores and each parameter was analyzed using Pearson's correlation coefficient for normally distributed data and Spearman's rank correlation coefficient for non-normally distributed data. The WFun score was used as the dependent variable in the multiple regression analysis, and different explanatory variables were analyzed in two models. Explanatory variables that were significantly correlated were included in model 1. In addition to variables that were significantly correlated in the univariate correlation analysis, diabetes and Hb level were selected as explanatory variables in model 2 based on previous studies.[12,25] SPSS was used to conduct the analysis, and the significance level was set at a risk rate of 5%.

RESULTS

A total of 38 patients were enrolled in the study. One patient who declined to participate in the study and another

patient with missing data were excluded. Finally, 36 patients were included in the final analysis.

Table 1 presents patient characteristics. The mean age of the patients was 64.5 ± 10.3 years, with stage 4 CKD being the most prevalent stage (14 patients, 38.9%). The most common primary disease was diabetic nephropathy (11 patients, 30.6%), followed by nephrosclerosis (10 patients, 27.8%). Comparisons between the two groups (presenteeism vs. no presenteeism) demonstrated significant differences in Cr level, exercise SE, and WFun and in the prevalences of CKD stage 3 and CKD stage 5 ($P<0.05$). In total, 14 (38.9%) individuals experienced presenteeism: 1 (11.1%) had stage 3 CKD, 5 (35.7%) had stage 4 CKD, and 8 (61.4%) had stage 5 CKD.

Figure 1 shows the severity classification of presenteeism by WFun. The distribution of presenteeism severity was as follows: 22 patients (61.1%) had no problems, 10 (27.8%) experienced mild problems, and 4 (11.1%) exhibited moderate impairment. None of the patients had severe presenteeism.

The results of the correlation analysis between the WFun score and each evaluation item are presented in **Table 2**. The WFun score was significantly correlated with Cr level ($r = 0.36$) and exercise SE ($r = -0.41$) in the single correlation analysis ($P < 0.05$; **Table 2**). However, there was no significant correlation between the WFun score and other variables. **Table 3** shows the results of the multiple regression analysis. Only exercise SE ($\beta = -0.30$) remained a significant factor after adjusting for other explanatory variables in model 2 ($P < 0.05$).

DISCUSSION

To the best of our knowledge, this is the first study to examine the determinants of presenteeism, including exercise SE, physical function, nutritional indices, anemia, and renal function indices, in patients with predialysis CKD. This study revealed that in 38.9% of working patients with predialysis CKD, the severity of presenteeism exceeded the mild level. Furthermore, presenteeism was significantly associated with exercise SE. Presenteeism is concomitant with the subsequent use of vacation days,[5] protracted work absenteeism, and greater economic burdens than those stemming from sick leave and sick days.[6] Therefore, this study may provide crucial evidence that could aid in the prevention and amelioration of presenteeism through the development of care programs tailored to address presenteeism in patients with predialysis CKD.

This study has demonstrated a progressive increase in the proportion of patients with presenteeism as the CKD stage advances. Prior investigations reported that vulnerability to presenteeism was 2.36 times higher in workers with chronic diseases,[26] with a presenteeism rate of 42.7% among patients on hemodialysis.[27] Another study reported that the prevalence of work productivity loss among patients with non-dialysis CKD was 26.0%, wherein absenteeism and presenteeism accounted for 7.1% and 22.3%, respectively.[12] Moreover, the prevalence of presenteeism-driven loss in patients with CKD, both pre-dialysis and those undergoing dialysis, was 18.8% in stage 3a, 19.6% in stage 3b, 27.9% in stage 4, 21.3% in stage 5, 22.3% in all pre-dialysis patients with CKD, and 34.7% in patients on dialysis.[12] These findings support the findings of the present study, indicating that the rate of presenteeism escalates in tandem with the CKD stage. Consequently, these results underscore the prospect of a substantially elevated rate of presenteeism among employed patients with CKD and highlight the importance of attending to their care.

This study has established an association between presenteeism and exercise SE. Prior investigations have linked presenteeism among patients with CKD to cardiovascular disease[11] and Hb levels[12]; this study augments these findings by presenting novel findings regarding exercise SE. Other studies have demonstrated that low exercise SE negatively impacts exercise habits[28] and physical activity levels,[29] leading to increased fatigue and worsening psychological symptoms[30,31] such as depression and anxiety. These outcomes, in turn, can significantly impair work function and diminish motivation.[32] This chain of effects suggests that low exercise SE may contribute to presenteeism by exacerbating physical and mental challenges that hinder workplace performance. Previous studies have also indicated that patients with CKD encounter multiple barriers to exercise, including physical obstacles such as fatigue, weakness, dyspnea, and chest pain; psychological impediments such as lack of motivation, depression, anxiety, and a sense of helplessness; and environmental barriers such as adverse climatic conditions,[33] which may contribute to their low exercise SE. Conversely, regular exercise has been shown to enhance physical function,[34] improve quality of life,[35] and alleviate psychological symptoms[36] and fatigue.[37] Higher exercise SE is associated with greater likelihood of engaging in physical activity, which fosters psychological well-being and reduces fatigue. As a result, presenteeism may be indirectly linked to exercise SE, with higher SE contributing to improved mental health and energy levels, thereby enhancing work function and reducing the likelihood of presenteeism. This connection underscores

Table 1. Patient characteristics

Characteristic	All (n=36)	Presenteeism		P value
		Yes n=14 (38.9%)	No n=22 (61.1%)	
Age (years)	64.5±10.3	64.1±11.7	65.2±9.5	0.75
Sex (male/female)	29/7	13/1	16/6	0.14
Height (cm)	165.6±8.7	166.8±10.5	164.9±7.5	0.51
Weight (kg)	69.2±14.3	72.8±18.7	66.9±10.3	0.23
BMI (kg/m^2)	25.1±3.8	26.0±4.5	24.6±3.3	0.29
Married	27 (75.0)	9 (64.3)	18 (81.1)	0.24
Living alone	7 (19.4)	4 (22.7)	3 (9.0)	0.27
Number of household members	2.3±1.0	2.1±1.2	2.5±0.9	0.38
Comorbidity				
Diabetes mellitus	12 (33.3)	6 (42.9)	6 (27.3)	0.33
Hypertension	26 (72.2)	10 (71.4)	16 (72.7)	0.93
Hyperuricemia	7 (19.4)	3 (21.4)	4 (18.2)	0.81
Dyslipidemia	9 (25.0)	3 (21.4)	6 (27.3)	0.69
Cardiovascular disease	1 (2.8)	1 (7.1)	0 (0)	0.20
Orthopedic disease	9 (25.0)	2 (14.2)	7 (31.8)	0.23
Mental illness	1 (2.8)	1 (7.1)	0 (0)	0.20
Primary renal disease				
Chronic glomerulonephritis	6 (16.7)	2 (14.2)	4 (18.2)	0.76
Nephrosclerosis	10 (27.8)	4 (28.6)	6 (27.3)	0.93
Diabetic nephrology	11 (30.6)	6 (42.9)	5 (22.7)	0.20
Unclear, others	9 (25.0)	2 (14.2)	7 (31.8)	0.24
CKD stage				
Stage 3	9 (25.0)	1 (25.0)	8 (36.4)	0.048
Stage 4	14 (38.9)	5 (38.9)	9 (40.9)	0.76
Stage 5	13 (36.1)	8 (36.1)	5 (22.7)	0.04
Laboratory data				
TP (g/dL)	6.8±0.5	6.6±0.6	6.9±0.4	0.07
Alb (g/dL)	3.8±0.4	3.6±0.5	3.9±0.3	0.08
BUN (mg/dL)	38.7±19.2	42.3±16.7	36.4±20.6	0.38
Cr (mg/dL)	2.8±1.7	3.6±1.6	2.3±1.7	0.03
eGFR (mL/min per 1.73 m^2)	23.2±12.6	18.4±10.7	26.2±12.9	0.07
Na (mEq/L)	139.1±2.2	139.4±1.8	138.8±2.4	0.43
K (mEq/L)	4.9±0.7	4.8±0.6	5.0±0.7	0.53
Cl (mEq/L)	108.3±3.0	109.1±3.2	107.9±2.8	0.24
Ca (mEq/L)	8.9±0.5	8.7±0.5	9.0±0.5	0.10
P (mg/dL)	3.9±0.8	3.8±0.5	4.0±0.9	0.53
Hb (g/dL)	12.5±1.9	12.1±2.1	12.7±1.7	0.34
CRP (mg/dL)	0.1±0.1	0.1±0.1	0.1±0.1	0.64
HbA1c (%)	6.1±0.7	6.2±0.9	6.0±0.5	0.56
GNRI	104.4±9.3	103.2±11.2	105.2±8.0	0.43
SMI (kg/m^2)	8.3±1.3	8.5±1.4	8.1±1.2	0.31

Table 1. Continued

Characteristic	All (n=36)	Presenteeism		P value
		Yes n=14 (38.9%)	No n=22 (61.1%)	
Employment status				
Full time	16 (44.5)	8 (57.1)	8 (36.4)	0.22
Self-employed	6 (16.7)	2 (14.2)	4 (18.2)	0.76
Non-regular employee	5 (13.9)	1 (7.1)	4 (18.2)	0.35
Part time	7 (19.4)	2 (14.2)	5 (22.7)	0.53
Company officer	2 (0.6)	1 (7.1)	1 (4.5)	0.74
Physical function				
Grip strength (kg)	35.5±9.2	33.3±5.8	36.2±9.6	0.31
SPPB	12 (12-12)	12 (11-12)	12 (12-12)	0.54
10-m walk test (m/s)	1.2±0.2	1.2±0.3	1.2±0.2	0.56
6MWT (m)	449.3±95.0	434.6±91.5	458.3±98.2	0.51
Self-efficacy				
Exercise SE	12.9±4.5	10.0±3.7	14.7±4.0	0.00
Presenteeism				
WFun	12.7±5.2	17.9±4.1	9.3±1.9	0.00

Data are expressed as mean ± standard deviation or number (%).

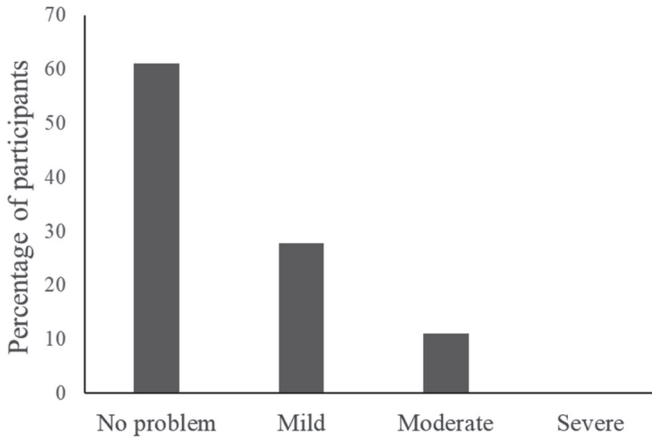

Fig. 1. Severity classification of presenteeism based on WFun.

Table 2. Correlation coefficients of WFun scores

Characteristic	R	P value
Age	0.25	0.14
BMI	0.28	0.10
Alb	−0.29	0.09
BUN	0.18	0.29
Cr	0.36	0.03
eGFR	−0.24	0.16
Hb	0.09	0.51
GNRI	−0.03	0.86
SMI	0.29	0.08
Grip strength	−0.04	0.82
SPPB	−0.10	0.56
10-m walk test	−0.06	0.74
6MWT	0.04	0.81
Exercise SE	−0.41	0.01

Table 3. Results of multiple regression analysis

Characteristic	Model 1		Model 2	
	β	P value	β	P value
Cr	0.81	0.47	1.24	0.09
Exercise SE	−0.30	0.03	−0.34	0.03
Diabetes mellitus			1.26	0.47
Hb			−0.19	0.74

the potential benefit of targeting exercise SE as a means of mitigating the impact of presenteeism in individuals with chronic health conditions.

This study showed no association between presenteeism and Hb levels or physical function. Prior investigations have reported an association between presenteeism, anemia,[12] BMI, and maximum voluntary contraction,[38] postulating that anemia and diminished physical function engender work-related fatigue. Nonetheless, the mean Hb level in this study

was 12.5 g/dL, which surpassed the standard value (11.0 g/dL) indicative of anemia.[39] In addition, the median SPPB score measuring physical function was 12 points, which surpassed that in prior studies.[40] Presenteeism may not have been linked to Hb levels and physical function because of the patients' preserved physical function and well-managed anemia. Accordingly, further validation is required regarding the manifestation of presenteeism in patients with anemia or frailty and reduced physical function.

Evidence on effective interventions for ameliorating presenteeism in patients with CKD remains limited. The influencing factors that foster continued employment include the significance of the work environment, work content, and social institutions.[26] Interventions for mitigating presenteeism include digital health programs,[41] mental health care,[42] and sleep interventions.[43] In addition, the beneficial effects of exercise therapy on presenteeism have been documented. A cross-sectional study indicated that workers participating in aerobic and resistance exercises exhibit diminished presenteeism when compared with their less physically active counterparts.[44] Several randomized controlled trials have reported improvements in presenteeism with aerobic exercise and physical activity,[45] as well as with cognitive, aerobic, and resistance training.[46] Nonetheless, patients with CKD face a myriad of barriers hindering exercise,[47] and workers exhibit a low level of engagement in exercise habits.[48] Presenteeism in CKD may be associated with a complex interplay of multiple factors, necessitating intricate presenteeism-related care and interventions. Future investigations are warranted to gain more insight into interventions aimed at ameliorating presenteeism in patients with CKD.

This study has some limitations. First, the small sample size limits the generalizability of our results for comparison with other study populations. Larger sample sizes are needed to account for potential confounders, such as physical activity levels, as well as diabetes and Hb levels. Second, because of the cross-sectional design, a causal relationship between presenteeism and other variables could not be established, underscoring the need for prospective observational and interventional studies. Third, the absence of a control group composed entirely of healthy workers precludes a definitive conclusion regarding the specificity of the study results to patients with predialysis CKD. Fourth, pain may be related to exercise habits, but this was not shown in the present study. Fifth, both the WFun and Oka's exercise SE are subjective evaluations based on questionnaires, which may be subject to self-reporting bias. Sixth, Oka's exercise SE scale is used only by Japanese populations, which may limit its generalizability. Therefore, a more comprehensive examination of these effects is essential in future research.

CONCLUSION

This study has effectively demonstrated the prevalence of presenteeism among workers with CKD and has highlighted the significant association between presenteeism and exercise SE. Our findings provide evidence to support the development of interventions for the prevention of presenteeism in patients with predialysis CKD.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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