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Prevalence and Risk Factors of Work-Related Musculoskeletal Disorders in Central Sterile Supply Technicians, Nakhon Si Thammarat Province, Thailand

Withaya Chanchai, Ph.D.[1], Ratree Nacglud, M.N.S.[2], Keatkongkrai Bunnum, M.Sc.[3], Nureeya Promsorn, B.N.S [4], Laddawan Duangmusik, M.N.S.[5], Warunee Suwanrat, M.N.S.[6], Wichuda Chantasin, Ph.D.[7], Kritsana Thonnan, B.N.S.[8]

[1]Department of Public Health, Major in Occupational Health and Safety, Faculty of Medicine, Siam University, Bangkok 10160, Thailand.

[2]Department of Central Sterile Supply Unit, Sichon Hospital, Sichon, Nakhon Si Thammarat 80120, Thailand.

[3]Department of Central Sterile Supply Unit, Chawang Crown Prince Hospital, Chawang, Nakhon Si Thammarat 80150, Thailand.

[4]Department of Central Sterile Supply Unit, Maharaj Nakhon Si Thammmarat Hospital, Maueng, Nakhon Si Thammarat 80000, Thailand.

[5]Department of Central Sterile Supply Unit, Thasala Hospital, Thasala, Nakhon Si Thammarat 80160, Thailand.

[6]Department of Central Sterile Supply Unit, Promkiri Hospital, Promkiri, Nakhon Si Thammarat 80320, Thailand.

[7]Faculty of Public Health, Valaya Alongkorn Rajabhat University under the Royal Patronage, Khlong Luang, Pathum Thani 13180, Thailand.

[8]Center for Biomedical Innovation, Healthmedic Academy, Bangkok 10310, Thailand.

Abstract:

Objective: The study aimed to examine the prevalence of work-related musculoskeletal disorders among central sterile supply technicians (CSSTs) in Nakhon Si Thammarat Province, Thailand, and investigate the risk factors associated with these disorders.

Material and Methods: A cross-sectional study was conducted among CSSTs regarding work-related musculoskeletal disorders (WMSDs). Technicians were asked about the presence and severity of disorders throughout the whole body during the sterilization procedure. The survey was distributed to the CSSTs at the central sterilization supply departments (CSSDs) of 32 hospitals in Nakhon Si Thammarat province, Thailand.

Results: The prevalence rate of WMSDs in various bodily regions was assessed among technicians at the time of questioning (88.3%), after one week (65.4%), and after one year (59.2%). Various body parts were reported to have developed Musculoskeletal problems, with the lower back being the most frequently reported (88.8%), followed by the upper back (84.9%), and the ankles/feet (38.5%). These MSDs were influenced by age over 30 years (odds ratio [OR] 3.32, 95% confidence interval [CI] 1.59−6.93), work schedule (OR 2.58, 95% CI 1.02−4.96) and the handling of heavy−load equipment (OR 2.56, 95% CI 1.47−10.37) or carts, which significantly increased the risk of developing such illnesses. **Conclusion:** Many CSSTs from the CSSDs reported WMSDs in various locations on their bodies. Lower back pain was the most common complaint.

Keywords: central sterile supply technicians, Musculoskeletal disorders, risk factors

Introduction

Work−related Musculoskeletal disorders (WMSDs) are common among healthcare workers and include symptoms such as pain, numbness, stiffness, swelling, fatigue, and irritability[1−5]. Disorders of the Musculoskeletal system (which includes bones, nerves, tendons, ligaments, joints, cartilage, blood vessels, and spinal discs) are termed "Musculoskeletal disorders (MSDs)" by the National Institute for Occupational Safety and Health in the United States[1].

Healthcare workers face significant physical demands, including patient handling, lifting heavy objects, prolonged standing, forceful contractions, awkward postures, repetitive movements, and uncomfortable positions[2]. These activities have been linked to MSDs affecting the lower back, knees, shoulders, wrists, or hands[3−5]. Additionally, factors such as age, body weight, the duration of specific tasks[6] and psychosocial stressors in the workplace may contribute to the development and persistence of MSDs among healthcare professionals[7−9]. Many studies suggest that factors such as high workloads[6], time pressure, emotional stress, limited job control and lack of social support are associated with pain in various parts of the body[1,7−11]. However, the evidence regarding physical and psychosocial workplace stressors remains inconclusive[3]. Central sterile supply technicians (CSSTs) in central sterilization supply departments (CSSDs) in healthcare settings perform a diverse array of jobs involving sterilization activities[12]. These operations frequently entail a repetitive process encompassing cleaning, inspection, assembling, functional testing, the disinfection of medical equipment, packaging, labeling, sterilization, storage and working in highly uncomfortable positions[12−14].

Furthermore, CSSTs encounter additional physical and psychosocial ergonomic hazards while performing various routine tasks. These include handling heavy loads during manual cleaning, lifting instruments during the process of the manual and automatic cleaning of machines, transporting equipment or carts between departments, pushing equipment or carts during the sterilization process, and carrying instruments from the prep and pack process[15]. Another significant hazard involves maintaining uncomfortable postures throughout the day while moving between departments, gurneys, operating rooms, dental departments, wards, and other areas within the facility[12,15]. In addition, the nature of the work requires frequent rushing to meet deadlines because CSSTs collaborate with other healthcare professionals, including surgeons, nurses, and operating room staff, to ensure the timely availability of sterilized instruments and supplies[5,8,12,14].

One in four CSST visits to the doctor is for lower back discomfort[7,16]. MSDs on the job have been identified

as a major contributor to lost workdays and sick leave among CSSTs[16]. One main cause of these disorders is the increased exposure to the heavy physical demands of moving and transporting sterile medical equipment[16-18]. In terms of serious medical consequences, the CSSD is counted among some of the riskiest places in the hospital to work. Multiple studies have found a significant prevalence of WMSDs among high-risk healthcare professionals[7,8-12]. These injuries have often resulted in early retirement and highlight a pressing need for intervention especially when followed by inadequate workplace support[16-18].

A significant number of individuals working in the field of CSST experience MSDs and discomfort[8]. Studies in Thailand have examined the factors linked to Musculoskeletal conditions, which are limited to the healthcare industry and workforce[5,14]. However, these studies highlight a need for more in-depth knowledge and understanding of the causes of MSDs among Thai CSSTs[14]. Therefore, understanding the etiology of MSDs requires a comprehensive knowledge of MSDs, encompassing various forms of arthritis and disorders that impact muscles, bones, soft tissue, joints, and the spine, as well as job descriptions and workstations[1].

Consequently, this study aimed to assess the prevalence and factors associated with WMSDs among CSSTs in Nakhon Si Thammarat Province, Thailand.

Material and Methods

This cross-sectional study was conducted between October 2023 and December 2023 at 32 CSSD in hospitals in Nakhon Si Thammarat Province, Thailand.

Data collection

The sample population studied consisted of 195 people. This study comprised only CSSTs employed by the Central Sterilize Supply Department during the study period and met the inclusion criteria. The study included full-time CSSTs with at least one year of experience at the CSSDs. Extremity injuries were excluded from the research due to their potential to cause long-term disability, worse health-related quality of life and extended absences from work. The participating hospitals, chosen by purposive sampling, were asked to encourage CSST staff to complete a questionnaire independently. Nine participants were ruled out because they did not qualify or did not finish the questionnaire. The study's sample size was 179 CSSTs from 32 hospitals. All CSSTs at these facilities participated in a self-evaluation by filling out the questionnaire. The CSSTs had their work duties divided into 3 shifts: those between 8 a.m. and 4 p.m. were categorized as working morning shifts, 4 p.m. and 12 a.m. were afternoon shifts and 12 a.m. and 8 a.m. were night shifts. Self-reported questionnaires were used to collect the data. Data on participants' demographics, employment, and Musculoskeletal symptoms were collected using standard questionnaires. Questions about personal information and Musculoskeletal issues were included in the survey. The demographic characteristics included age, level of education, income, working hours, and tenure in the same position. Participants were asked to indicate on a body diagram chart any symptoms of MSDs they had experienced over the given body region during the preceding 12 months, the past week, and at present. Kuorinka et al.[19] validated the Nordic Musculoskeletal Questionnaire (NMQ) to assess the prevalence of MSDs. The NMQ has been translated into Thai and has satisfactory reliability[20]. In addition, the CSSTs were asked whether their symptoms were related to their work or not. Binary replies (either yes or no) were employed. The entire body, from the head down, was examined. It included the head, neck, shoulders, elbows, lower back, hands, hips, thighs, buttocks, knees, and feet. The research team used the NMQ form to evaluate research participants for symptoms

of fatigue from work. Musculoskeletal pain (including aches, pains, discomfort and numbness) was described in the survey as "preventing CSSTs from carrying out everyday activities (such as work, housework, or hobbies). To ensure a comprehensive interpretation of the outcomes, it is imperative to provide additional details about the data collection process, particularly the methodology used for determining the final ranks using a binary score system. This system was employed to categorize the presence or absence of Musculoskeletal symptoms, offering a clear and straightforward method for ranking the severity and prevalence of these issues among participants. The binary score system classified responses into 2 distinct categories: presence of symptoms (Yes), indicating that the participant experienced musculoskeletal pain or discomfort affecting their ability to perform daily activities, such as work, housework, or hobbies, and absence of symptoms (No), indicating that the participant did not experience significant Musculoskeletal pain or discomfort impacting their daily activities. By using this binary classification, the study effectively ranked and analyzed the prevalence and impact of Musculoskeletal symptoms among the participants. Additionally, the study considered previous experiences related to CSSDs tasks, such as lifting, transporting, pulling, pushing, carrying, and gripping, when hiring staff. Participants were presented with several activities and asked to indicate the frequency of their engagement in these tasks by marking "sometimes," "often," "always," or "never". The frequency of these tasks varied based on the specific roles and responsibilities within a CSSDs. For analysis, responses were categorized into 2 main groups: rare (responses marked "sometimes" or "never") and frequent (responses marked "often" or "always"). This detailed approach to data collection and categorization ensured a robust and consistent methodology for interpreting the study's outcomes.

Statistical analysis

There was a 91.79% response rate from the 195 CSSTs who were asked to participate in the study.

Data were analyzed using statistics package for social science version 25 (Chicago, Illinois, USA). The data were summarized using descriptive statistics (frequency and percentages). The demographic and work–related data were described using descriptive statistics, which included frequency, percentage, mean, and standard deviation. Multivariate logistic regression was used to calculate the odds ratio (OR) of factors related to the Musculoskeletal condition. The multivariate analysis model included features selected from the univariate analysis based on a significance level of p–value<0.020[21]. The study aimed to account for confounding factors such as age and working years and present adjusted OR values. The statistical analysis was conducted at a 95% confidence interval (95% CI), and the level of statistical significance was set at p–value<0.05.

Ethics approval

The Nakhon Si Thammarat Provincial Public Health Office Review Board (NSTPH No.020∕2023) in Thailand approved this study. Before beginning the evaluation, every participant signed an informed consent form stating their willingness to participate.

Results

The study population consisted of mostly female CSSTs (84.9%), with a mean age of 42.35 years and an average BMI of 26.00. In terms of level of education, 55.9 % held a lower bachelor's degree, and 82.1% received income lower than 15,000THB (approx. 406 USD) monthly. Table 1 shows that more than half (63.7%) of respondents worked the morning shift from 07:00 a.m. to 03:00 p.m. Approximately 75.9% of CSSTs reported a health status that they perceived as either fair or poor.

The prevalence of Musculoskeletal symptoms was high, with 88.3% reporting current symptoms. Lower back pain (88.8%) and upper back pain (84.9%) were the 2 most prevalent types. Refer to Table 2 for detailed data. The prevalence rate of Musculoskeletal issues among CSSTs is notably high at 86.0%. These problems stem

from cumulative fatigue, primarily due to current work, with a reported decrease in symptoms over the past week (64.2%) and year (59.2%). Lower back discomfort is the most frequently reported issue, with 88.2% of CSSTs experiencing it presently. This is followed closely by pain in the upper back (86.6%), ankles/feet (38.0%), knees (37.5%), and wrists/hands (35.2%). In recent trends, lower back discomfort remains predominant, reported by 79.3% of CSSTs in the week before the survey, followed by pain in the upper back (78.2%). Regarding experiences over the past year, upper back discomfort is most prevalent, with 77.7% of CSSTs reporting it, followed by lower back pain (71.1%).

Significant risk factors included age over 30 years (OR 3.32) and handling heavy loads (OR 36.45). Musculoskeletal disorder symptoms were also significantly associated with workers with over 10 years of employment (OR 3.92, 95% CI 2.00–7.70). Work schedule (OR 4.37, 95% CI 2.30–8.33), lifting instruments (OR 3.60, 95% CI 1.81–7.14), heavy-load handling (OR 36.45, 95% CI 10.75–123.55), pushing equipment or carts (OR 3.60, 95% CI 1.81–7.14), carrying instruments (OR 4.56, 95% CI 2.34–8.89), and uncomfortable postures (OR 4.61, 95% CI 2.39–8.90) were all factors influencing the frequency of MSDs. Detailed analysis is available in Table 3.

Multivariate analysis with CSSTs involves controlling for factors such as age and work experience, along with other factors like lifting instruments, handling heavy loads, transporting equipment, pushing equipment, carrying instruments, repetitive movement, and uncomfortable postures when considering back pain. It was found that workers dealing with age more than 30 years (OR 3.32, 95% CI 1.59–6.93), work schedule (OR 2.58, 95% CI 1.02–4.96), heavy load-handling equipment or carts had a greater chance of MSDs (OR 2.56, 95% CI 1.47–10.37).

Table 1 Central sterile supply technicians' demographic characteristics (n=179)

Characteristic	n (%)
Age (years), mean±S.D.	42.35±10.90
Body mass index (BMI) (kg/m^2), mean±S.D.	26.00±9.55
Years of working (years), mean±S.D.	10.80±9.98
Age (years), mean±S.D.	42.35±10.90
Body mass index (BMI) (kg/m^2), mean±S.D.	26.00±9.55
Years of working (years), mean±S.D.	10.80±9.98
Sex	
Male	27 (15.1)
Female	152 (84.9)
Education level	
Lower bachelor's degree	100 (55.9)
Bachelor's degree or higher	79 (44.1)
Marital status	
Single	53 (29.6)
Married	109 (60.9)
Divorced/separated	17 (9.5)
Income (Thai Baht, THB*)	
≤15,000	147 (82.1)
>15,001	32 (17.9)
Exercise	
<3 times/week	99 (53.3)
≥3 times/week	80 (44.7)
Current alcohol consumption	
No	146 (81.6)
Yes	33 (18.4)
Smoking	
No	158 (88.3)
Yes	21 (11.7)
Perceived health status	
Good–very good	45 (25.1)
Poor–fair	134 (74.9)
Performed shift work	
Morning shift	114 (63.7)
Afternoon	63 (35.2)
Night shift	2 (1.1)

S.D.=standard deviation, n=number
*1 USD approx. 39 THB

Table 2 The prevalence rate of the reported WMSDs in different body regions among the studied technicians (n=179)

Body region	During the last 12 months no. (%)	During the past week no. (%)	At present no. (%)
Neck	16 (8.9)	37 (20.7)	31 (17.3)
Shoulders	20 (11.2)	26 (14.5)	35 (19.6)
Elbows	10 (5.6)	14 (7.8)	21 (11.7)
Wrists/hands	22 (12.3)	28 (15.6)	62 (34.6)
Upper back	138 (71.7)	138 (77.1)	152 (84.9)
Lower back	139 (77.7)	143 (79.8)	159 (88.8)
Thighs	18 (10.1)	26 (14.5)	32 (17.9)
Knees	21 (11.7)	25 (14.0)	67 (37.5)
Ankles/feet	36 (20.1)	23 (11.7)	69 (38.5)
WMSDs in at least one body region	106 (59.2)	117 (65.4)	158 (88.3)

WMSDs=work related musculoskeletal disorders

Table 3 Univariate logistic regression analysis of risk factors of self-reported 12-month prevalence of MSDs among technicians (n=179)

12-month prevalence of MSDs	n (%)	Univariate		
		OR	95% CI	p-value
Age (years)				
Less than 30	38 (32.5)	reference		
30 or older	141 (67.5)	3.32	1.59–6.93	0.000*
Marital Status				
Single or divorced	70 (39.1)	reference		
Married	109 (60.9)	8.35	4.45–15.64	0.865
Monthly income (THB*)				
≤15,000	100 (55.9)	reference		
>15,001	79 (44.1)	1.64	0.53–2.57	0.865
Education level				
Lower bachelor's degree	100 (55.9)	reference		
Bachelor's degree or higher	79 (44.1)	1.18	0.64–2.19	0.720
Nutritional status				
Healthy weight (BMI≤24.9)	96 (53.6)	reference		
Overweight (BMI>24.9)	83 (46.4)	4.80	4.08–14.15	0.480
Current alcohol consumption				
Yes	146 (81.6)	reference		
No	33 (18.4)	4.45	1.81–10.95	0.112
Smoking				
No	158 (88.3)	reference		
Yes	21 (11.7)	5.54	1.93–15.91	0.388

Table 3 (countinued)

12–month prevalence of MSDs	n (%)	Univariate		
		OR	95% CI	p–value
Years of employment				
10 or less	71 (39.7)	reference		
More than 10	108 (60.3)	3.92	2.00–7.70	0.010*
Work schedule				
Day work	114 (63.7)	reference		
Afternoon shift work	65 (36.3)	4.37	2.30–8.33	0.017*
Instruments lifting				
Rare	70 (39.1)	reference		
Frequent	109 (60.9)	3.60	1.81–7.14	0.005*
Heavy load handling equipment or carts				
Rare	79 (44.1)	reference		
Frequent	100 (55.9)	36.45	10.75–123.55	<0.001*
Transporting of equipment or carts				
Rare	93 (48.0)	reference		
Frequent	86 (52.0)	1.08	0.58–2.00	0.928
Pulling of equipment or carts				
Rare	87 (48.6)	reference		
Frequent	92 (51.4)	1.532	0.64–2.23	0.669
Pushing of equipment or carts				
Rare	70 (39.1)	reference		
Frequent	109 (60.9)	3.60	1.81–7.14	0.005*
Carrying of instruments				
Rare	70 (39.1)	reference		
Frequent	109 (60.9)	4.56	2.34–8.89	0.030*
Griping of instruments				
Rare	94 (52.5)	reference		
Frequent	85 (47.5)	9.22	4.98–17.06	0.918
Repetitive movement				
Rare	74 (58.7)	reference		
Frequent	105 (41.3)	4.98	2.60–9.55	0.051
Uncomfortable postures				
Rare	73 (42.9)	reference		
Frequent	106 (39.3)	4.61	2.39–8.90	0.031*
Prolonged standing				
Rare	108 (60.3)	reference		
Frequent	71 (39.7)	8.65	4.62–16.20	0.771

THB=Thai Baht, BMI=body mass index, MSDs=musculoskeletal disorders, OR=odds ratio, CI=confidence interval, n=number
*p–value<0.05

Table 4 Multivariate logistic regression analysis of risk factors of self–reported 12–month prevalence of MSDs among technicians (n=179)

Risk factors	Adjusted OR	95% CI	p–value
Age	3.32	1.59–6.93	0.003*
Years of employment	0.51	0.25–1.07	0.075
Work schedule	2.58	1.02–4.96	0.045*
Lifting of instruments	0.31	0.12–2.08	0.315
Heavy load–handling equipment or carts	2.56	1.47–10.37	<0.001*
Pushing of equipment or carts	4.72	1.46–15.20	0.208
Carrying of instruments	0.85	0.32–2.25	0.743
Uncomfortable postures	1.19	0.33–4.38	0.787

OR=odds ratio, CI=confidence interval
*p–value<0.05

Discussion

Our findings are consistent with previous research indicating a high prevalence of MSDs among healthcare workers, particularly those in roles involving repetitive movements and heavy lifting (Chanchai et al., 2020; Freimann et al., 2013)[3,5]. This study found a significant prevalence of MSDs among CSSTs, with lower back pain being the most frequent complaint[20]. Our findings align with Chanchai et al. (2022), who reported similar prevalence rates of MSDs among healthcare workers, particularly those related to repetitive tasks and heavy lifting[3].

The study demonstrates that those aged more than 30 years, with over 10 years of experience in CSSDs and work schedules, are more likely to develop Musculoskeletal diseases. This is due to their extensive array of day shift duties, including the handling of heavy–load instruments during manual cleaning, lifting instruments from manual cleaning and automatic machine cleaning processes, transporting equipment or carts from the department to other wards, pushing equipment or carts during the sterilization process, carrying instruments from the prep and pack process, and maintaining uncomfortable postures throughout the day in the department. In a prior study including Thai hospital nurses, it was found that nurses with over 20 years of work experience were more prone to have poor mental health and Musculoskeletal complaints.

The current study's findings may be inconsistent with those of other studies because of differences in research methodologies, protocols, and sample strategies. Previous research has linked MSDs to activities like age, years of employment, work schedules, the lifting of instruments, uncomfortable postures[1–4], as well as positions that are too awkward or exhausting[24,25], awkward grasping and hand movements[2,20,26], repetitive movements[2,20,25] and lengthy shifts[16,26]. Tasks involving heavy lifting, awkward postures, and repetitive movements significantly contribute to MSD risk among CSSTs[16,27–29].

Other research suggests that individual inner trays in the CSSDs should never weigh more than 7 kg. Loaded cases should always be kept on their platform for convenience and transport. For stability, heavier cases should be placed toward the bottom of the stack. Equipment can be put on top of a stack of cases during handling and transportation. The stack's height should not exceed 1,350

mm, and its total weight should not exceed 80 kg[29]. These movements cause excessive strain on the lower back in the sacral vertebral region, leading to uncomfortable posture and movement. This conclusion is consistent with Holtermann[30], who linked MSDs to the heavy lifting involved in the healthcare setting and the sterilization process from various departments to other hospital departments.

The present study revealed that pushing equipment or carts, carrying instruments, and uncomfortable postures significantly contribute to the risk of developing MSDs. This agrees with earlier research showing that bending, twisting, pushing, and carrying objects are among the leading causes of lower back discomfort[1-3,20,30]. All the factors mentioned above involve performing actions that are not natural, leading to muscle exhaustion. This can include twisting the arm or wrist, exerting too much force, and assuming uncomfortable positions. Because of the constant need for repetitive motion in caring for, lifting, and moving equipment, it is not shocking that the CSSTs in this study suffered from MSDs. Therefore, it is unsurprising that the CSSTs involved in this study experienced MSDs, given that their jobs involve lifting, transferring, carrying, and uncomfortable postures that necessitate frequent repetitive movements[29,31-32]. Improving work conditions, such as providing ergonomic workstations and promoting healthier work habits, can reduce the prevalence of MSDs. CSSTs expressed a greater inclination to resign from their current employment.

Therefore, workstations should be modified according to engineering principles to have an ergonomic table for wrapping medical equipment, antifatigue mats, suitable chairs, short break adjustments and policy changes from the organization, all of which will help reduce the incidence of fatigue. In addition, it suggests that it would be beneficial to promote intervention programs for CSSTs based on the participatory ergonomic approach and coping methods for Musculoskeletal illnesses[33, 34].

Despite these findings, the statistical examination of the current data did not uncover any significant correlation between years of employment, the lifting of instruments, pushing of equipment or carts, carrying of instruments, uncomfortable postures, and the incidence of MSDs. These factors may result in MSDs, requiring further in-depth study.

Limitations

This study was limited by several factors that could potentially decrease the occurrence of MSDs in CSST workers. These factors include medical treatment, spontaneous recovery, and rehabilitation activities. The participants were selected from a specific province within a chosen area. Furthermore, there was a lack of a standardized scale for quantifying the level of pain or discomfort stated by the participants. This research only used the NMQ to measure work-related MSDs. The next study should measure muscle response or electrical activity in response to a nerve's stimulation of the muscle using a device by Electromyography. The test is used to help detect neuromuscular abnormalities. In addition, in the next study, the prevalence of MSDs in every province of Thailand should be studied in order to know the broader trends of disease occurrence.

Conclusion

The study identified lower back discomfort as the most common work-related injury among Thai CSSTs in Nakhon Si Thammarat Province, Thailand. This finding underscores the necessity for further research in order to examine the impact of workstyle on WMSDs. Given the prevalence of these injuries, it is imperative to institute educational initiatives aimed at promoting awareness of the risk factors associated with WMSDs. Such initiatives are essential to reducing the incidence of these disorders while enhancing the overall productivity of CSSTs. Addressing the high prevalence of MSDs among CSSTs is critical

for improving worker health and productivity. Targeted interventions and ongoing research are essential in order to mitigate these occupational hazards.

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Conflict of interest

There is no conflict of interest, according to the authors.

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