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Sickness absenteeism is associated with sleep problems independent of sleep disorders: results of the 2016 Sleep Health Foundation national survey

Amy C. Reynolds, PhD [a,*], Sarah L. Appleton, PhD [b,c], Tiffany K. Gill, PhD [d], Anne W. Taylor, PhD [d], R. Douglas McEvoy, MD, PhD [e,f], Sally A. Ferguson, PhD [a], Robert J. Adams, MD, PhD [b]

[a] The Appleton Institute, CQUniversity Australia, 44 Greenhill Rd, Wayville SA 5034, South Australia, Australia
[b] The Health Observatory, Discipline of Medicine, University of Adelaide, The Queen Elizabeth Hospital Campus, Woodville Rd, Woodville, SA 5011, Australia
[c] Freemason's Centre for Men's Health, Discipline of Medicine, University of Adelaide, Adelaide, North Terrace SA 5000, Australia
[d] Population Research & Outcome Studies, Discipline of Medicine, University of Adelaide, Adelaide, SAHMRI, North Terrace SA 5000, Australia
[e] Adelaide Institute for Sleep Health, A Flinders Centre of Excellence, Flinders University, Repatriation General Hospital, Daw Park, SA 5041, Australia
[f] Sleep Health Service, Respiratory and Sleep Services, Southern Adelaide Local Health Network, Repatriation General Hospital, Daw Park, SA 5041, Australia

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ABSTRACT

Introduction: Sleep disorders are associated with sickness absenteeism (SA), at significant economic cost. Correlates of absenteeism are less well described in nonclinical samples.
Participants and methods: We determined the relationship between markers of inadequate sleep and SA in a sample of 551 working adults aged ≥18 years across Australia. We considered diagnosed obstructive sleep apnea (OSA) and insomnia symptoms, daytime symptoms, and sleepiness with respect to sickness absenteeism (missing ≥1 day of work in the past 28 days because of problems with physical or mental health).
Results: Sickness absenteeism was reported by 27.0% of participants and was more frequent in younger participants, university graduates, and those experiencing financial stress. Sickness absenteeism was independently associated with insomnia (odds ratio [OR] = 2.5, confidence interval [CI[= 1.5-4.0], OSA (OR = 9.8, CI = 4.7-20.7), sleep aid use (OR = 3.0, CI = 1.9-4.7), and daytime symptoms (OR = 3.0, CI = 2.0-4.6) and inversely associated with perception of getting adequate sleep (OR = 0.6, CI = 0.4-0.9). Associations persisted in the population free of insomnia and/or OSA.
Conclusions: In adults without clinical sleep disorders, sleep behaviors are contributing to sickness absenteeism. An increased focus at an organizational level on improvement of sleep hygiene is important to reduce lost work performance.

Introduction

Sickness absenteeism is costly to business and is an indicator of poor health and well-being of workers,[1,2] with absenteeism associated with chronic disease.[3,4] Productivity losses and costs associated with sick leave account for an estimated $32.5 billion annually in Australia.[5] The absenteeism-related cost to employers and workers reflects a need to better understand modifiable behaviors which may contribute to sickness absenteeism.

Insufficient sleep is a plausible contributor to sickness absenteeism; indeed, even a short period of insufficient sleep is associated with adverse metabolic health outcomes.[6,7] Insufficient sleep is also associated with obesity, type 2 diabetes, cardiovascular disease, and inflammation.[7,8] Thus, it is plausible that insufficient sleep may contribute to higher rates of sickness absenteeism.

To date, there is no clear picture of the relationship between sleep problems and sickness absenteeism independent of sleep disorders such as insomnia and obstructive sleep apnea (OSA), both of which have previously established relationships with sickness absenteeism.[9,10] Although a 2014 study of sickness absence and sleep duration revealed that sleep disturbance is associated with periods of sickness absence, this finding was limited to periods of medically confirmed leave >10 days.[11] This provides insight into the

* Corresponding author at: Appleton Institute, CQUniversity Australia, 44 Greenhill Rd, Wayville SA 5034, South Australia, Australia. Tel.: +61 407525047.
E-mail address: a.reynolds@cqu.edu.au (A.C. Reynolds).

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potential impact of sleep disturbance on long periods of absence but does not clarify whether shorter periods of sickness absenteeism are associated with sleep disturbance. Further, such associations in workers without OSA or insomnia have received little attention, limiting our capacity to provide evidence-based advice on suitability of sleep education for the workforce to improve productivity and reduce costs associated with sickness absenteeism.

The primary aim of the present study was to determine the association between sleep behaviors and clinical sleep disorders with sickness absenteeism in a sample of Australian adults. The secondary aim was to determine whether these associations differed in those free of OSA and insomnia while accounting for important influencing factors including age, shift work (SW), and sociodemographic factors.

Participants and methods

Survey methodology

The survey was conducted in March 2016 in a national sample of 1011 adults (≥18 years) across Australia, with representativeness for age, sex, location, and an indicator of socioeconomic status.[12] Final analyses were conducted in participants who answered the sickness absenteeism question (n = 551 of 554 workers). Survey questions were drawn from the 2002 US National Sleep Foundation Sleep in Adults survey[13] with some additional questions from the Australian 2010 survey.[14] The survey was conducted online by the Survey Sampling International research organization using a 3-stage randomization process to minimize risk of bias and has been described previously.[12] The survey methodology was approved by The University of Adelaide Office of Research Ethics (H-2016-029).

Sickness absenteeism and indicators of sleep problems

Participants indicated the number of days in response to the question "In the past 4 weeks (28 days), how many days did you miss an entire work day because of problems with your physical or mental health?" Daytime symptoms were defined as experiencing ≥1 of 3 daytime consequences a minimum of 3 times a week, assessed by asking "In the past month how often have you....

1. experienced sleepiness that interfered with your daily activities,
2. felt fatigue or exhaustion, or
3. felt irritable or moody?"

Adequate sleep ≥3 nights per week was determined with the question "In the past month how often have you felt you got adequate or satisfactory sleep?" Sleep aid use was determined with "How frequently do you use the following sleep aids specifically to help you sleep"? (1) Over-the-counter or store-bought sleep aids; (2) sleep medication prescribed by a physician; (3) alcohol, beer, or wine; (4) an eye mask or ear plugs; or (5) melatonin. For questions on adequate sleep and sleep aid use, response options included (1) rarely or never, (2) a few nights a month, (3) a few nights a week, and (4) every or almost every night. Sleep aid use was analyzed using 2 approaches: (*a*) using at least 1 of the 5 sleep aids ≥3 nights a week (prescribed and nonprescribed) and (*b*) using prescribed sleep medication only ≥3 nights a week.

Respondents were asked to estimate usual sleep duration on the night preceding work and nonwork days in hours and minutes. Short sleep duration on work days was categorized as ≤5 hours per night according to categories used in existing published literature.[15–17] Excessive daytime sleepiness was determined as ≥11 on the Epworth Sleepiness Scale (ESS).[18] Self-reported physician-diagnosed medical conditions were recorded. Body mass index was calculated from self-reported height and weight; overweight and obesity were classified according to World Health Organization criteria.

Diagnosed OSA was determined with "Have you been diagnosed with sleep apnoea with an overnight sleep study?" Possible undiagnosed OSA was subsequently defined in those reporting "no"/"don't know" as (1) witnessed breathing pauses at least 3 times a week or (2) witnessed breathing pauses a few times per month with loud snoring at least 3 times a week. Insomnia was classified with the *International Classification for Sleep Disorders-3* criteria as follows[19]: (1) sleep initiation or maintenance problems at least 3 times a week (≥1 of difficulty falling asleep, waking a lot during the night, waking too early, can't get back to sleep), (2) adequate opportunity and circumstances to sleep ("Does your current work schedule or typical weekday routine, including your duties at home, allow you to get enough sleep?), and (3) daytime consequences at least 3 times a week (≥1 of sleepiness interfered with activities, felt fatigue/exhaustion, felt irritable/moody).

Sociodemographic characteristics included sex, age (10-year categories), gross household income, highest education level obtained, and financial stress (assessing a participant's family money situation and ability to save). SW was determined with the question "Thinking about the past 3 months, which of the following best describes your work schedule?" Options included regular day, evening, or night shift, rotating or "other." Responses were categorized as either day work (regular day) or SW (all shift types) for analysis. Work hours were obtained by the question "On average, how many total hours per week do you work at a job for which you are paid?" and categorized to reflect part time (≤35 hours per week), full time (35–44 hours per week; in line with Australian Bureau of Statistics definition of full-time work), and long hours (45+ hours per week).[20]

Data were analyzed using IBM SPSS version 24.0 (IBM Corporation, Armonk, NY). Differences in distribution of study participant characteristics by absenteeism status were determined with the Pearson χ^2 statistic or Mantel-Haenszel test of trend. A series of logistic regression models determined associations of sickness absenteeism with each of the primary independent sleep disorder/behavior/perceptions variables adjusted for age, SW, financial stress, and education. Subsequent models determined the contribution of sleep problems to sickness absenteeism in a population free of OSA and insomnia.

Results

Representativeness of the study sample

Characteristics of the workers in this sample were compared with data from the Australian Bureau of Statistics (ABS) from August 2016.[20] Representativeness of the workers in this sample to current Australian estimates was confirmed with a comparable percentage of male respondents (cohort, 52.3%; ABS, 53.7%), age (cohort: 18-44, 59.2%; 45-64, 35.4%; 65+, 5.4%; ABS: 15-44, 60.5%; 45-64, 35.6%; 65+, 3.8%), and full-time workers (cohort, 45.2%; ABS, 46.0%). Workers with a bachelor's degree or higher were slightly overrepresented in our cohort (43.2%) compared with national data (31.8%). This is consistent with findings from the overall survey sample of n = 1101.[12]

Sickness absenteeism (missing ≥ 1work day in the past 4 weeks) was reported by 27.0% (n = 149) of the eligible sample; 7.3% reported missing 4 or more days. Sickness absenteeism was associated with younger age, tertiary education, and financial stress (Table 1). Sickness absenteeism was also more common in shift-workers, but this was not statistically significant. No significant associations were seen for sex or work hours. All specific health conditions except arthritis and hypertension occurred with significantly increased frequency in those reporting sickness absenteeism compared with

Table 1
Sociodemographic, work, and health characteristics (n, %) of participants missing ≥1 work day in the last 4 weeks due to physical or mental health problem

	Total		Absenteeism (≥1 d in last 4 wk)				
			Yes (n = 149)		No (n = 402)		
Participant characteristic	n	%	n	%	n	%	P[a]
Age (y)							
18-44	326	59.2	99	66.4	227	56.5	.029
45-64	195	35.4	47	31.5	148	36.8	
65+	30	5.4	3	2.0	27	6.7	
		100%		100%		100%	
Sex							
Female	263	47.7	76	51.0	187	46.5	.388
Male	288	52.3	73	49.0	215	53.5	
		100%		100%		100%	
Education							
Still studying	17	3.1	8	5.4	9	2.2	.042
High school or less	86	15.6	14	9.4	72	17.9	
Trade certificate	29	5.3	6	4.0	23	5.7	
Certificate/diploma	180	32.7	47	31.5	133	33.1	
Bachelor degree or higher	238	43.2	74	49.7	164	40.8	
		100%		100%		100%	
Financial stress							
Saves a lot/some	341	61.9	79	53.0	262	65.2	<.001
Spending > income	177	32.1	67	45.0	110	27.4	
Don't know	33	6.0	3	2.0	30	7.5	
		100%		100%		100%	
SW status							
Standard day worker	415	78.7	104	70.7	308	78.4	.069
Shift worker	112	21.3	43	29.3	85	21.6	
		100%		100%		100%	
Working h/wk							
<34 h/wk	190	36.7	49	35.3	141	37.2	.533
35-44 h/wk	234	45.2	68	48.9	166	43.8	
45+ h/wk	94	18.1	22	15.8	72	19.0	
		100%		100%		100%	
Health conditions (n, %)							
Heart disease	29	5.3	17	11.6	12	3.0	<.01
Diabetes	36	6.6	17	11.7	19	4.8	<.01
Hypertension	103	19.0	34	23.3	69	17.4	.12
Depression	119	22.0	51	35.4	68	17.2	<.01
Anxiety disorder	89	16.5	36	25.4	53	13.3	<.01
Gastroesophageal reflux disease	59	10.7	25	17.6	34	8.5	<.01
Arthritis	85	15.7	28	19.3	57	14.3	.16
BMI ≥30.0 kg/m^2	126	25.4	34	27.2	92	24.8	.59
≥1 Cardiometabolic condition[b]	131	23.8	47	31.5	84	20.9	<.01
≥1 Mental health condition[c]	148	26.9	57	38.3	91	22.6	<.01
≥ 2 Health conditions	153	27.8	64	43.0	89	22.1	<.01

[a] All dichotomous relationships reported with exact significance (2-sided); others with asymptotic significance (2-sided).
[b] One or more of self-reported physician-diagnosed hypertension, diabetes, or heart disease.
[c] Self-reported physician-diagnosed depression and/or anxiety.

participants not missing work. Diagnosed depression was the most frequently reported condition (35%) associated with sickness absenteeism. Reporting at least 2 health conditions was significantly associated with sickness absenteeism, but obesity was not.

OSA, insomnia, and excessive daytime sleepiness (ESS ≥11), daytime symptoms, and sleep aid use (including prescribed sleep medication use) were significantly associated with sickness absenteeism in both univariate and adjusted analyses (Table 2). Sickness absenteeism was also inversely associated with respondents feeling that they were "getting adequate sleep." A relationship with short sleep did not achieve statistical significance. Furthermore, sickness absenteeism showed a very strong relationship with comorbid insomnia and OSA (Table 3). In these models, financial stress (spending exceeds income) and postsecondary school levels of education were consistently associated with sickness absenteeism.

When participants with (1) insomnia or (2) either insomnia or OSA were excluded from the analyses, the observed relationships between sleep medications and perception of sleep adequacy with sickness absenteeism persisted, except for the relationship with excessive daytime sleepiness (Table 2). Adjusting for depression and/or anxiety did not alter the observed associations (data not shown).

Discussion

Self-reported sickness absenteeism due to a physical or mental health problem was common in a national sample of Australian workforce participants. Sickness absenteeism was independently associated with both clinical sleep disorders (OSA and insomnia) and with sleep disturbance including not getting adequate sleep, use of sleep aids, daytime symptoms, and excessive sleepiness. After exclusion of participants with OSA and insomnia, sickness absenteeism was lower in those respondents who perceived they had adequate sleep, higher in those reporting sleep aid use (including use of prescribed sleep medications), and positively associated with daytime symptoms of insufficient sleep. These findings highlight that the relationship between sleep and sickness absenteeism encompasses more than the impact of clinical sleep disorders. It also indicates that this relationship is not limited to prolonged periods of sickness absenteeism as seen in previous research[11] but occurs in association with brief or recurrent episodes of sickness absenteeism. Thus, education as to the benefits of consistently obtaining sufficient sleep may have positive impacts for reducing workplace absenteeism.

Sleep problems remained associated with sickness absenteeism after excluding respondents with OSA and insomnia. It is possible that these indicators of sleep problems may reflect undiagnosed OSA; however, the potential that sleep problems impact sickness absenteeism for members of the population without sleep disorders remains an important consideration. Interestingly, not getting adequate sleep was associated with sickness absenteeism, but short sleep (≤5 hours) was not. This suggests that duration and adequacy of sleep duration are not the same construct because, for some workers, 5 hours of sleep may represent an "adequate" sleep opportunity. Given that extremely short sleep durations are consistently associated with adverse health outcomes in some studies,[21-24] our finding is somewhat unexpected in light of a dependent variable operationalized as sickness-related absenteeism. Ours is a relatively small sample of respondents with ≤5 hours of sleep per night (and more than half of the short sleepers were <44 years of age), which may contribute to a lack of statistical significance in any relationship.

Our findings suggest that an increased focus on sleep problems in the general population may be a modifiable approach to reducing the worker and workplace costs of sickness absenteeism. The increased odds of sickness absenteeism in those with prescription sleep aid use (≥3 times a week), even in those without insomnia or OSA, indicate that difficulties with sleep onset and maintenance may contribute to sickness absenteeism. A better understanding of activities in the evening would shed light on whether evening work or family demands are contributing to the sleep problems identified in this sample, particularly given the relationship between interactive media and sleep problems.[25] Workplace education strategies should be promoting and prioritizing sleep health across all workers, potentially with a focus on adequacy of sleep rather than prescribed sleep durations. Workplace policies including rostering and SW schedules should take greater account of sleep and circadian science. Demands made on workers for out-of-hours work, particularly involving screen time, also warrant rethinking. Such an approach may have positive outcomes for both reducing productivity costs of sickness absenteeism and simultaneously improving health and well-being in workers. Sleep strategies promoting indicators of sleep health, including

Table 2
Univariate- and multivariable-adjusted associations of sleep disorders, sleep characteristics, and perceptions of participants (n, %) with sickness absenteeism in all workforce participants and in those without insomnia or OSA

Participant characteristics	Sickness absenteeism (≥1 d in last 4 wk)					
	Yes (n = 149)		No (n = 402)			
All participants	n	%	n	%	P	OR (95% CI) for absenteeism[a]
OSA					<.001	
No OSA	91	61.1	350	87.1		1.0
Diagnosed OSA	29	19.5	14	3.5		**9.8 (4.7-20.7)**
Possible undiagnosed OSA	29	19.5	38	9.5		**2.5 (1.4-4.4)**
Insomnia	40	26.8	54	13.4	<.001	**2.5 (1.5-4.0)**
Short sleep (≤5 h)[b]	27	18.4	47	12.3	.070	1.5 (0.9-2.5)
Gets adequate/satisfactory sleep	87	58.4	286	71.1	.006	**0.6 (0.4-0.9)**
ESS ≥11	45	30.2	69	17.2	.001	**1.8 (1.2-2.9)**
Sleep aid use ≥3×/wk	58	38.9	63	15.7	<.001	**3.0 (1.9-4.7)**
Prescribed sleep medication use ≥3×/wk in past month	25	16.1	23	5.7	<.001	**2.7 (1.4-5.2)**
Any daytime symptoms[c]	94	63.1	143	35.6	<.001	**3.0 (2.0-4.6)**
Participants without insomnia						
	Yes (n = 109)		No (n = 348)			OR (95% CI) for absenteeism[a]
	n	%	n	%	P	
OSA					<.001	
No OSA	71	65.1	310	89.1		**1.0**
OSA	19	17.4	11	3.2		**8.5 (3.6-20.4)**
Possible undiagnosed OSA	19	17.4	27	7.8		**2.3 (1.1-4.6)**
Short sleep (≤5 h)[b]	20	18.3	39	11.6	.059	1.6 (0.9-3.0)
Gets adequate sleep	47	43.1	232	66.7	<.001	**0.4 (0.3-0.6)**
ESS ≥11	29	26.6	56	16.1	.014	1.5 (0.9-2.6)
Sleep aid use > = 3x/week	38	34.9	45	12.9	<.001	**2.9 (1.7-4.9)**
Prescribed sleep medication use ≥3x/week in past month	16	14.7	12	3.4	<.001	**4.2 (1.8-10.0)**
Any daytime symptoms[c]	54	49.5	89	25.6	<.001	**2.7 (1.7-4.4)**
Participants without insomnia or diagnosed OSA						
	Yes (n = 90)		No (n = 337)			OR (95% CI) for absenteeism[a]
	n	%	n	%	P	
Short sleep (<5 h)[b]	16	18.0	38	11.7	.16	1.5 (0.8-3.0)
Gets adequate sleep	36	40.0	227	67.4	<.001	**0.4 (0.2-0.6)**
ESS > =11	24	26.7	54	16.0	.020	1.4 (0.8-2.5)
Sleep aid use ≥3×/wk	27	30.0	44	13.1	<.001	**2.0 (1.1-3.8)**
Prescribed sleep medication use ≥3×/wk in past month	11	3.3	12	13.3	<.001	**3.7 (1.4-9.8)**
Any daytime symptoms[c]	46	51.1	84	24.9	<.001	**2.8 (1.7-4.7)**

Boldface reflects OR(CI) that are significant at $P < .05$.
[a] Logistic regression models determined associations of sickness absenteeism with each of the primary independent sleep disorder/behavior/perceptions variables adjusted for age, SW, financial stress, and education.
[b] Usual sleep/night preceding work days.
[c] Reporting ≥3×/wk feelings of 1 or more of fatigue, sleepy, or moody.

satisfaction with sleep, daytime alertness, sleep timing, efficiency, and duration,[26] may be particularly useful.

The relationships observed between OSA, insomnia, and sickness absenteeism in this study are largely in agreement with an existing body of literature linking sleep disorders with SA. One systematic review[9] highlighted that insomnia is linked with a raft of poor work outcomes, including reports of prevalent absenteeism and reduced job satisfaction, with increased odds of sick leave in those experiencing insomnia even after adjustment for confounding factors. In contrast, higher presenteeism with insomnia—but no association with absenteeism—was found in US workers.[27] It is plausible that the insomnia prevalence criteria used for the latter study (which the authors identified revealed a significantly higher prevalence rate) may account for the difference with the existing study. OSA is similarly associated with sickness absenteeism,[10,28] and this finding was reflected in our sample. A recent randomized controlled trial of CPAP treatment for OSA in patients with cardiovascular disease showed a 20% reduction in work days lost due to sickness.[29] Our findings confirm a negative association between insomnia, OSA, and sickness absenteeism and the likely significant impact on workplace productivity posed by sleep disorders.

The increased odds of sickness absenteeism with comorbid insomnia and OSA were profound. Odds of sickness absenteeism were 17.7 times higher after adjusting for age, SW, education, and financial

Table 3
Sleep disorders (n, %) in relation to sickness absenteeism (≥1 work day missed in last 4 weeks due to physical or mental health problem) and adjusted odds ratios (ORs) and 95% confidence interval (CI) for sickness absenteeism

Sleep disorder	Absenteeism (≥1 d in last 4 wk)				P	OR (95% CI) for absenteeism[a]
	Yes (n = 109)		No (n = 348)			
No disorder	90	60.4	337	83.8	<.001	1.00
OSA only	19	12.8	11	2.7		**7.9 (3.3-18.7)**
Insomnia only	30	20.1	51	12.7		**2.2 (1.3-3.8)**
Insomnia and OSA	10	6.7	3	0.7		**17.7 (4.4-70.7)**

[a] Adjusted for age, SW, education, and financial stress.

stress in respondents with comorbid insomnia and OSA. Although Sivertsen et al have previously identified comorbid insomnia and OSA as a risk factor for absenteeism,[10] the additive interaction of these sleep disorders was not significant after adjustment for confounders, which differed from our findings. However, this relationship in our data was in a relatively small subsample and adjusted for fewer potential confounders. Sleep disorders such as insomnia and OSA do contribute to sickness absenteeism, and their potential additive interaction may be a factor to consider in future interventions.

The strengths of this study include use of a self-reported sickness absenteeism variable, which was not reliant on workplace records; thus, we were able to include indications of sickness absenteeism as short as 1 day in the preceding month, in contrast with other investigations of sleep problems and sickness absenteeism. Sickness absenteeism and sleep variables were identified by questions concerning the previous month, suggesting that recall bias is unlikely to be a problem in our sample. The sample was composed of people enrolled in the online panel; this may introduce selection bias. The sample was closely matched to the general population on most demographic criteria, although respondents were on average better educated than the general population,[12] which may have influenced the study results. Sleep duration was self-reported; however, most adults estimate sleep time within 1 hour of sleep from actigraphy.[30] Although the odds of sickness absenteeism were substantially higher in those with comorbid OSA and insomnia, this was in a relatively small subsample of the study. Consideration in larger samples is required to confirm this finding; however, this strong association suggests that individuals with comorbid insomnia and OSA demonstrate increased odds of sickness absenteeism compared with those with no disorders or with 1 sleep disorder.

In conclusion, this study highlights that sleep problems are associated with increased odds of sickness absenteeism, which has implications for both worker well-being and workplace productivity. Long-term sleep problems are associated with adverse health outcomes, and sickness absenteeism has implicit costs for workplaces related to reduced productivity and costs associated with compensating for an absent worker. Thus, both workers and employers can benefit from addressing factors, which may contribute to self-reported sleep problems. An important consideration in future studies will be to explore factors contributing to the daytime symptoms associated with SA in this study to adequately inform potential behavioral strategies at the individual, occupational, and broader societal levels.

Author contributions

RA, AT, TG, DM, SA, and AR contributed to the study design. SA contributed to data collection, and SA and AR conducted the data analyses. AR and SA drafted the manuscript. All authors contributed to the interpretation of the data and to the critical revision of the final manuscript, and approved the final version of the manuscript.

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