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Original Article

Longitudinal Health Consequences of Insomnia Symptoms among Middle-Aged and Older Adults in Thailand

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ABSTRACT

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Introduction: Insomnia symptoms may impact on various health outcomes. It is unclear how insomnia symptoms impact on health in Thailand. In a longitudinal study of ageing adults in Thailand, the goal of the research was to evaluate the relationships between insomnia symptoms and 20 health indicators.

Methods: Prospective cohort data from the Health, Aging and Retirement in Thailand study, which included participants 45 years of age and older (N = 2863) from three successive waves in 2015, 2017, and 2020 were analyzed. Insomnia symptoms and health indicators were assessed by self-report. Generalized Estimating Equations analysis and logistic regression analysis were used to evaluate the longitudinal relationships between measures of insomnia symptoms and 20 health indicators.

Results: In 2020, 11.7% of people reported having insomnia symptoms, compared to 15.6% in 2015 and 14.6% in 2017. Insomnia symptoms were positively correlated with three poor mental health indicators (depressive symptoms, quality of life and self-rated mental health), eight poor physical health indicators (hypertension, self-rated physical health status, cardiovascular disease, diabetes, osteoporosis, chronic lung disease, kidney disease, and physical injury), and two lifestyle indicators (physical inactivity and meal skipping) in logistic regression models.

Conclusion: The study found that a number of indicators of physical and mental illness as well as lifestyle choices were linked to symptoms of insomnia. Improved detection and management of insomnia symptoms could lower indicators of physical and mental illness in Thailand.

Keywords: Health, Insomnia Symptoms, Lifestyle, Longitudinal Study, Thailand

Introduction

A significant public health burden, inadequate sleep affects approximately 25% of the world's population (1). Studies indicate that as people age, the prevalence of insomnia rises (2), and the effectiveness of their sleep falls (3), all of which

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may be related to a rise in multimorbidity, polypharmacy, and psychosocial variables (4). Studies among older adults in Thailand show a high prevalence insomnia symptoms. High prevalence of insomnia symptoms have been found among older adults in Thailand, e.g., in a national survey the prevalence of insomnia (defined as any "often or always having difficulty initiating sleep, difficulty maintaining sleep and early morning awakening") was 46.3% (5), and in local community surveys among older adults the proportion of poor sleep quality was 62.4% in Songkhla Province (6), and 44.0% in northern Thailand (7), and insomnia was 60% in Khon Kaen (8).

Increased activity of the sympathetic nervous system and the hypothalamus-pituitary-adrenal axis, proinflammatory reactions, alterations in the circadian rhythm, and metabolic effects are linked to sleep disturbances (9). According to a recent review (9), consequences of sleep disruption among adults may include physical and mental ill-health and lifestyle variables. Mental ill-health consequences of sleep disruption may include poor perceived mental health status (10), depression (9, 11, 12), poor quality of life (9, 13), memory related diseases and dementia (14-16). Physical ill-health consequences of sleep disruption can include poor perceived physical health status (10), hypertension (9, 17), cardiovascular disorder (9, 18), diabetes (9, 17, 18), bone diseases (17, 19), functional disability (20, 21) and cancer (9, 22). Lifestyle consequences of sleep disruption can include increased smoking heaviness (23), problem drinking (24-26), physical inactivity (27), and obesity (18, 28).

The majority of studies on sleep disorders and their detrimental effects on health in older adults are carried out in wealthy nations; however, middle-income nations like Thailand lack longitudinal data on these relationships. It is hypothesized that symptoms of insomnia in persons 45 years and older in Thailand are linked to both physical and mental health issues, as well as unhealthy behaviors, based on the cited research. The study's objective was to evaluate the longitudinal associations between insomnia symptoms and 20 health indicators in Thailand from 2015 to 2020 in order to enhance our understanding of the relationship between insomnia symptoms and health outcomes in that country.

Methods

Study design and participants

Thailand's Health, Aging and Retirement (HART) study's longitudinal data (analytic sample 2863) from its three successive waves—2015, 2017, and 2020—were examined. One adult (45 years of age or older) was chosen at random from each home in a nationwide multi-step sampling design; see details (29). In-person interviews were done by the skilled field workers with the participants at their homes.

Measures

Exposure variable

Insomnia symptoms included "almost always (5-7 days) or often (3-4 days) (versus sometimes-1-2 days or very rarely/ never) having trouble falling asleep/insomnia in the past week" (30).

Outcome variables

Poor mental health outcomes

"In general, how would you rate your mental health status?" was the question used to gauge the self-rated mental health status given on a scale of "0 (very poor) to 10 (excellent)". A self-rated score of 0-7.0 (with 8.0 serving as the median) indicated poor mental health.

The question, "In general, how satisfied are you with your quality of life (or how happy do you feel)?" was used to determine happiness or quality of life given on a scale of "0 (very poor) to 10 (excellent)". A self-rated 0–7 score indicated a low quality of life or happiness (8 being the median).

Based on the CES-D-10 (30), without the insomnia symptoms item, depressive symptoms (≥ 10 scores) were assessed; in waves 1, 2, and 3, Cronbach's alpha was 0.7, respectively.

Diagnoses from reported healthcare providers were used to evaluate brain disorders, including dementia.

Consequences of physical illness

Self-assessed physical well-being: "Overall, how would you rate your physical well-being?" given on a scale of "0 (very poor) to 10 (excellent)". Physical health was classified as self-rated (poor) on a scale of 0-6.0, with 7.0 serving as the median.

Chronic physical conditions such as diabetes, hypertension, heart disease, lung disease, osteoporosis, kidney disease, cancer, and physical injuries are diagnosed by healthcare providers.

A modified 4-item activity of daily living (ADL) scale (31) that measures eating, dressing, washing, and bathing was used to determine the ADL disability. There were three response options, with 0 meaning "can do it all by myself" and 3 meaning "need help for every step." ADL disability was identified as one of the four components that requires collaboration. (Cronbach's $\alpha = 0.90$-0.93).

Lifestyle outcomes

Tobacco smoking included current smoking cigarettes.

Three to four or more and five or more alcoholic beverages units per week, respectively, for women and men, were considered hazardous alcohol use.

Physical exercise/activity was grouped into "none = inactivity, 1–149 min/week = low activity, and ≥ 150 min/week = high activity in the past week." (32)

Obesity class II (30 + kg/m2) (33) was based on self-reported body weight/height.

Meal skipping was defined as "skipping any breakfast, lunch, or dinner in the last two days."

Covariates

Marital status, age, sex, education, occupation, religion, and perceived economic status (i.e., "How satisfied are you with your economic situation?" On a scale of 1 to 10) were among the covariates.

Statistical analysis

To compare sample characteristics between study years, chi-square statistics were utilized.

We used Generalized Estimating Equations analysis (GEE) to evaluate the longitudinal relationships between insomnia symptoms and outcomes related to mental and physical illness as well as lifestyle factors across the three study waves (34). There are two models offered to explain

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how health outcomes evolve. The first model, which regresses insomnia symptoms on each health outcome without adjustment, was replaced by a second model that took lifestyle, mental and physical health, and sociodemographic factors into account for each health outcome. Additionally, correlations between the degree of insomnia symptom experience and incident health indicators (in 2017 and/or 2020, and without the condition at baseline in 2015) were evaluated using logistic regression. The choice of covariates was influenced by earlier studies (9-14, 19-21). Variation Inflation Factors (VIFs) statistics were used to evaluate the degree of collinearity, but none was found. The statistical analyses were conducted using StataSE 15.0 (College Station, TX, USA); $p < 0.05$ was considered significant, and missing values were eliminated.

Ethical considerations

The "Ethics Committee in Human Research, National Institute of Development Administration – ECNIDA (ECNIDA 2020/00012)" following the Helsinki Declaration, approved the study protocol, and participants gave written informed consent.

Results

Table 1 displays descriptive from the study assessments across three survey waves, while 11.7% of people reported having insomnia symptoms, compared to 15.6% in 2015 and 14.6% in 2017. Lifestyle factors (risky alcohol consumption, tobacco use, and being physically inactive) and poor mental health (like probable depressive symptoms, quality of life, self-reported mental health, and brain disease or dementia) differed significantly. From 2015 to 2017 or 2020, the number of poor physical health conditions—kidney disease, cardiovascular disease, diabetes, chronic lung disease, osteoporosis, hypertension, ADL disability, physical injury, and cancer—increased significantly. Of the 5616 individuals at baseline, 361 passed away, 336 declined, and 2056 could not be located between 2015 and 2020, leaving an analytic sample of 2863. The characteristics that set the loss to follow-up sample apart from the follow-up sample were male, older, widowed, had more education, lived in an urban area, practiced Buddhism, had a lower subjective economic status, and had more limitations with ADLs.

Insomnia symptoms and health outcomes

Insomnia symptoms were positively correlated with three poor mental health indicators (quality of life or happiness, depressive symptoms, and self-rated mental health status), seven poor physical health indicators (hypertension, self-rated physical health status, cardiovascular disorder, diabetes, chronic lung disease, osteoporosis, and physical injury), and two behavioural indicators (meal skipping and physical inactivity) in the final adjusted GEE logistic regression model. (Table 2)

Insomnia symptoms and incident health indicators

According to the adjusted regression analyses, individuals who experienced insomnia symptoms in 1 wave and/or 2-3 waves of the study were more likely to experience incident mental health problems (such as depressive symptoms, self-rated mental health, and quality of life), incident physical health problems (such as, hypertension, osteoporosis, kidney disease, physical injury, and self-rated physical health status) as well as incident meal skipping. (Table 3)

Discussion

The study's objective was to evaluate for the first time the longitudinal associations between insomnia symptoms and 20 health indicators in Thailand from 2015 to 2020. Our research revealed a positive correlation between insomnia symptoms and three mental health issues, eight physical health issues and two lifestyle factors.

In line with earlier studies (9-13), we discovered a positive correlation between insomnia symptoms and mental distress (low quality of life/happiness, depressive symptoms and low self-rated mental health status). Additionally, in line with earlier studies, we discovered in the unadjusted analysis a positive correlation between brain illness/dementia and symptoms of insomnia (14-16). The study discovered strong correlations between depressive and insomnia symptoms, which may be attributed to insomnia's co-occurring condition with depression (35) and/or potential bidirectional relationship with depressive symptoms (36).

In line with previous research (9, 10, 17-19), the study found that insomnia symptoms were positively associated with cardiovascular disorder, low self-rated physical health, diabetes, hypertension, and osteoporosis. "Activation of markers of cellular and transcriptional inflammation might contribute to the link between sleep disturbance and age-related morbidity risk." (37). Sleep disruption may also "interact directly with central pain processing mechanisms and inflammatory processes, and indirectly with mood and physical functioning to augment clinical bone diseases pain." (38). Furthermore, this study showed that having insomnia symptoms increased the odds of chronic lung disease. In a previous study (39), the rate of insomnia was higher in persons with COPD, while in another study COPD severity was associated with developing sleep problems (40), which may suggest a bidirectional relationship between COPD and sleep problems. Unlike previous research (9, 20-22) that found an association between sleep problems and functional disability and cancer, we could not find a significant association. In agreement with former research (41), this study found that insomnia symptoms were associated with incident chronic kidney disease (CKD). One possible explanation for this link could be that insomnia symptoms activate the sympathetic nervous system contributing to higher CKD risk and progression (41). Furthermore, consistent with previous research (42, 43), we found that insomnia symptoms increased the odds of physical injury (based on falls, road traffic crash and being hit by an object). This may be explained by sleep problems impairing alertness, judgment and accuracy increasing the vulnerability to sustaining physical injury (42, 43).

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Table 1. Descriptive statistics of the study variables over time, HART 2015-2020

Variables		Study year			p-value
		2015 (n = 2863)	2017 (n = 2863)	2020 (n = 2863)	
		N (%)	N (%)	N (%)	
Exposure variable	Insomnia symptoms	446 (15.6)	418 (14.6)	336 (11.7)	< 0.001
Sociodemographic factors	Age (70 plus)	1040 (36.3)	1149 (40.5)	1441 (50.3)	< 0.001
	Sex (male)	1270 (44.4)			
	Education (> elementary)	449 (15.7)			
	Residence (urban)	1392 (48.6)			
	Marital status (widowed)	802 (28.4)	786 (27.7)	937 (32.8)	0.002
	Subjective economic status (low)	762 (26.6)	1022 (35.7)	978 (34.2)	< 0.001
	Religion (Buddhist)	2619 (91.5)			
Mental ill-health	Self-reported poor mental health	798 (27.9)	824 (28.8)	685 (23.9)	< 0.001
	Emotional/psychiatric disease	12 (0.4)	9 (0.3)	22 (0.8)	0.029
	Poor quality of life/happiness	769 (26.9)	1050 (36.7)	1074 (34.2)	< 0.001
	Probable depression	334 (11.7)	279 (9.7)	160 (5.6)	< 0.001
	Brain disease/dementia	17 (0.6)	26 (0.9)	37 (1.3)	0.013
Physical ill-health	Poor self-rated physical health status	746 (26.1)	900 (31.4)	734 (25.6)	< 0.001
	Hypertension	984 (34.4)	1129 (39.4)	1303 (45.5)	< 0.001
	Cardiovascular disease	137 (4.8)	154 (5.4)	195 (6.8)	< 0.001
	Diabetes	414 (14.5)	419 (14.6)	543 (19.0)	< 0.001
	Osteoporosis	108 (3.8)	103 (3.6)	175 (6.1)	< 0.001
	Chronic lung disease	21 (0.7)	42 (1.5)	42 (1.5)	0.003
	Kidney disease	47 (1.6)	80 (2.8)	123 (4.3)	< 0.001
	Physical injury	342 (11.9)	463 (16.2)	---	< 0.001
	ADL disability	72 (2.5)	107 (3.7)	218 (7.6)	< 0.001
	Cancer	11 (0.4)	24 (0.8)	44 (1.5)	< 0.001
Lifestyle factors	Current tobacco smoking	339 (11.8)	380 (13.3)	316 (11.0)	<0.001
	Hazardous alcohol use	99 (3.5)	186 (6.5)	57 (2.0)	< 0.001
	Physical inactivity	1606 (56.1)	1256 (43.9)	1444 (50.4)	< 0.001
	BMI-obesity class II	189 (6.6)	225 (7.9)	220 (7.1)	0.333
	Meal skipping	156 (5.4)	460 (16.1)	379 (13.2)	< 0.001

Table 2. Longitudinal associations between insomnia symptoms and health indicators

Outcome variables	Model 1: unadjusted odds ratio (95% CI)	p-value	Model 2: adjusted odds ratio (95% CI)a	p-value
Mental ill-health				
Self-reported poor mental health	1.68 (1.51 to 1.87)	< 0.001	0.99 (0.85 to 1.14)	0.837
Poor quality of life/happiness	3.21 (2.88 to 3.58)	< 0.001	1.25 (1.09 to 1.42)	0.002
Depressive symptoms	4.81 (4.13 to 5.60)	< 0.001	3.96 (3.30 to 4.76)	< 0.001
Brain disease/dementia	2.03 (1.38 to 3.01)	< 0.001	0.95 (0.57 to 1.59)	0.843
Physical ill-health				
Poor self-rated physical health status	2.13 (1.92 to 2.36)	< 0.001	1.60 (1.41 to 1.83)	< 0.001
Hypertension	1.51 (1.36 to 1.68)	< 0.001	1.25 (1.09 to 1.43)	< 0.001
Cardiovascular disease	1.74 (1.44 to 2.10)	< 0.001	1.42 (1.11 to 1.82)	0.006
Diabetes	1.50 (1.31 to 1.71)	< 0.001	1.39 (1.18 to 1.63)	< 0.001
Osteoporosis	2.28 (1.86 to 2.81)	< 0.001	1.66 (1.27 to 2.17)	< 0001
Chronic lung disease	2.01 (1.43 to 2.95)	< 0.001	2.16 (1.46 to 3.20)	< 0.001
Kidney disease	1.55 (1.19 to 2.03)	< 0.001	1.18 (0.84 to 1.65)	0.345
Physical injury	1.49 (1.28 to 1.74)	< 0.001	1.38 (1.10 to 1.64)	< 0.001
ADL disability	1.23 (0.99 to 1.52)	0.058	---	
Cancer	1.30 (0.79 to 2.14)	0.305	---	
Lifestyle factors				
Current tobacco smoking	0.83 (0.71 to 0.98)	0.028	0.99 (0.80 to 1.22)	0.907
Hazardous alcohol use	0.83 (0.63 to 1.09)	0.170	---	
Physical inactivity	1.17 (1.05 to 1.29)	0.004	1.14 (1.01 to 1.30)	0.033
Body mass index (BMI)-obesity	1.07 (0.88 to 1.31)	0.500	---	
Meal skipping	1.56 (1.35 to 1.81)	< 0.001	1.68 (1.44 to 1.96)	< 0.001

[a]Adjusted for age group, sex, education, marital status, subjective economic status, area of residence, religion, all variables in the table, and study wave; ***$p < 0.001$; **$p < 0.01$; *$p < 0.05$; ADL: Activities of Daily Living; CI: Confidence Interval

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Table 3. Longitudinal associations between insomnia symptoms and incident health indicators

Outcome variables	Insomnia symptoms	Model 1: unadjusted odds ratio (95% CI)	p-value	Model 2: adjusted odds ratio (95% CI)[a]	p-value
Mental ill-health					
Incident self-reported poor mental health	0 waves	1 (Reference)		1 (Reference)	
	1 wave	1.41 (1.14 to 1.73)	< 0.001	1.39 (1.12 to 1.72)	0.003
	2-3 waves	2.10 (1.44 to 2.06)	< 0.001	1.97 (1.33 to 2.92)	< 0.001
Incident poor quality of life/happiness	0 waves	1 (Reference)		1 (Reference)	
	1 wave	1.17 (0.94 to 1.45)	0.169	1.15 (0.92 to 1.44)	0.227
	2-3 waves	1.67 (1.15 to 2.44)	0.008	1.77 (1.18 to 2.64)	0.005
Incident depressive symptoms[b]	0 waves	1 (Reference)		1 (Reference)	
	1 wave	2.53 (1.83 to 3.51)	< 0.001	2.45 (1.74 to 3.44)	< 0.001
	2-3 waves	5.26 (3.43 to 8.06)	< 0.001	5.27 (3.36 to 8.27)	< 0.001
Incident brain disease/dementia	0 waves	1 (Reference)			
	1 wave	1.32 (0.72 to 2.44)	0.373	---	
	2-3 waves	2.12 (0.92 to 4.90)	0.078		
Physical ill-health					
Incident poor self-rated physical health status	0 waves	1 (Reference)		1 (Reference)	
	1 wave	1.50 (1.22 to 1.84)	< 0.001	1.41 (1.14 to 1.75)	0.002
	2-3 waves	2.96 (2.00 to 4.38)	< 0.001	2.66 (1.75 to 4.05)	< 0.001
Incident hypertension	0 waves	1 (Reference)		1 (Reference)	
	1 wave	1.23 (0.98 to 1.56)	0.081	1.20 (0.94 to 1.54)	0.114
	2-3 waves	1.82 (1.20 to 2.76)	0.005	1.65 (1.06 to 2.57)	0.025
Incident cardiovascular disease	0 waves	1 (Reference)			
	1 wave	0.99 (0.70 to 1.41)	0.951	---	
	2-3 waves	0.95 (0.52 to 1.76)	0.881		
Incident diabetes	0 waves	1 (Reference)		1 (Reference)	
	1 wave	1.22 (0.90 to 1.66)	0.205	1.20 (0.87 to 1.65)	0.270
	2-3 waves	1.65 (1.03 to 2.64)	0.039	1.60 (0.97 to 2.63)	0.064
Incident osteoporosis	0 waves	1 (Reference)		1 (Reference)	
	1 wave	1.81 (1.33 to 2.48)	< 0.001	1.63 (1.18 to 2.25)	0.003
	2-3 waves	3.79 (2.51 to 5.71)	< 0.001	2.99 (1.93 to 4.63)	< 0.001
Incident chronic lung disease	0 waves	1 (Reference)		1 (Reference)	
	1 wave	2.09 (1.15 to 3.01)	0.016	2.19 (1.16 to 4.12)	0.006
	2-3 waves	3.46 (1.59 to 7.56)	0.002	4.12 (1.79 to 9.46)	< 0.001
Incident kidney disease	0 waves	1 (Reference)		1 (Reference)	
	1 wave	1.86 (1.28 to 2.71)	< 0.001	1.86 (1.26 to 2.74)	0.002
	2-3 waves	2.32 (1.33 to 4.03)	0.003	2.06 (1.14 to 3.69)	0.016
Incident physical injury	0 waves	1 (Reference)		1 (Reference)	
	1 wave	1.39 (1.09 to 1.77)	0.008	1.43 (1.10 to 1.84)	0.007
	2-3 waves	1.93 (1.33 to 2.81)	< 0.001	1.81 (1.22 to 2.69)	0.003
Incident ADL disability	0 waves	1 (Reference)		1 (Reference)	
	1 wave	1.32 (1.01 to 1.73)	0.041	1.48 (0.86 to 1.62)	0.309
	2-3 waves	1.53 (1.00 to 2.33)	0.048	1.21 (0.74 to 1.96)	0.451
Incident cancer	0 waves	1 (Reference)			
	1 wave	1.07 (0.55 to 2.06)	0.846	---	
	2-3 waves	0.60 (0.14 to 2.52)	0.482		
Lifestyle factors					
Incident current tobacco smoking	0 waves	1 (Reference)			
	1 wave	1.16 (0.83 to 1.63)	0.377	---	
	2-3 waves	0.95 (0.52 to 1.71)	0.854		
Incident hazardous alcohol use	0 waves	1 (Reference)			
	1 wave	0.85 (0.60 to 1.19)	0.344	---	
	2-3 waves	0.76 (0.42 to 1.40)	0.379		
Incident physical inactivity	0 waves	1 (Reference)			
	1 wave	1.15 (0.87 to 1.51)	0.337	---	
	2-3 waves	0.80 (0.51 to 1.26)	0.339		
Incident body mass index (BMI)-obesity	0 waves	1 (Reference)		1 (Reference)	
	1 wave	1.45 (1.00 to 2.09)	0.049	1.34 (0.90 to 1.99)	0.154
	2-3 waves	0.42 (0.15 to 1.16)	0.095	0.44 (0.17 to 1.33)	0.158
Incident meal skipping	0 waves	1 (Reference)		1 (Reference)	
	1 wave	1.37 (1.12 to 1.68)	0.002	1.34 (1.07 to 1.68)	0.010
	2-3 waves	2.00 (1.46 to 2.74)	< 0.001	2.15 (1.51 to 3.06)	<0.001

[a]Adjusted for age group, sex, education, marital status, subjective economic status, area of residence, religion, all variables in the table; ***$p < 0.001$; **$p < 0.01$; *$p < 0.05$; ADL: Activities of Daily Living; CI: Confidence Interval; [b]without sleep issues

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In line with a former study (27), this survey showed a positive association between insomnia symptoms and physical inactivity. Exercise has been shown to be beneficial to improve sleep quality (44). Furthermore, we found an association between insomnia symptoms and meal skipping. Poor sleep and meal skipping may be interrelated (45). Unlike some previous studies (18, 23-28), we did not find an association between insomnia symptoms and smoking, hazardous alcohol use and obesity. Alcohol and tobacco use by older adults in Thailand may not be used as a coping mechanism for sleep issues (46).

Conclusion

Our research revealed a positive correlation between insomnia symptoms and three mental health issues, eight physical health issues and two lifestyle factors. Improved detection and management of insomnia symptoms could lower a number of detrimental health consequences in Thailand.

Study limitations

The study's limitations include the use of self-reporting to evaluate variables and the use of a single item to measure insomnia symptoms; nevertheless, strong correlations with multiple item measures have been found (47). One more drawback is the significant loss at follow-up.

Conflict of interest

The authors declare no conflict of interest.

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Authors' contribution

"SP, KP and DA contributed to the design and implementation of the research. KP analyzed the results. SP, KP and DA wrote the manuscript. All authors contributed to the article and approved the submitted version."

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