

Materials and methods

1 Study population

The participants in this study were selected from patients diagnosed with acute insomnia disorder (AID) and chronic insomnia disorder (CID) through a multi-center clinical study initiated by the Sleep Medicine Center, Nanfang Hospital, which took place from Sept. 2022 to June 2024 (ethical approval ref: NFEC-2023-371). Written informed consent was obtained from all participants. All methods were carried out in accordance with relevant guidelines and regulations. The study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines (Table 1).

Table 1 STROBE Statement—checklist of items that should be included in reports of observational studies

Checklist item	Item No.	Recommendation	Location
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found	Main text (MT)
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	MT, Section 1 (S1)
Objectives	3	State specific objectives, including any prespecified hypotheses	MT, S1
Materials and methods			
Study design	4	Present key elements of study design early in the paper	MT, S1
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Supplementary information (SI), S1
Participants	6	(a) Cohort study—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up Case-control study—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection; give the rationale for the choice of cases and controls Cross-sectional study—Give the eligibility criteria, and the sources and methods of selection of participants (b) Cohort study—For matched studies, give matching criteria and the number of exposed and unexposed participants Case-control study—For matched studies, give matching criteria and the number of controls per case	SI, S4
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	No applicable
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	SI, S5 and S6
Bias	9	Describe any efforts to address potential sources of bias	SI, S3
Study size	10	Explain how the study size was arrived at	SI, S2
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	MT, S5.1 and S5.2
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine subgroups and interactions	MT, S6 No applicable

		(c) Explain how missing data were addressed	Fig. 1
		(d) Cohort study—If applicable, explain how loss to follow-up was addressed	SI, S2
		Case-control study—If applicable, explain how matching of cases and controls was addressed	
		Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy	
		(e) Describe any sensitivity analyses	No applicable
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study, (e.g., numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analyzed) (b) Give reasons for non-participation at each stage (c) Consider use of a flow diagram	MT, Fig. 1
Descriptive data	14*	(a) Give characteristics of study participants (e.g., demographic, clinical, and social) and information on exposures and potential confounders (b) Indicate number of participants with missing data for each variable of interest (c) Cohort study—Summarize follow-up time (e.g., average and total amount)	MT, Table 1 No applicable No applicable
Outcome data	15*	Cohort study—Report numbers of outcome events or summary measures over time Case-control study—Report numbers in each exposure category or summary measures of exposure Cross-sectional study—Report numbers of outcome events or summary measures	No applicable No applicable MT, Table 1
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g., 95% confidence interval (CI)). Make clear which confounders were adjusted for and why they were included (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	No applicable MT, Table 1 No applicable
Other analyses	17	Report other analyses done (e.g., analyses of subgroups and interactions, and sensitivity analyses)	No applicable
Discussion			
Key results	18	Summarize key results with reference to study objectives	MT, S3
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	MT, S4
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	MT, S3 and S4
Generalizability	21	Discuss the generalizability (external validity) of the study results	MT, S3
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	MT, Acknowledgments

* Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies. An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of *PLoS Medicine* at <https://www.plosmedicine.org>, *Annals of Internal Medicine* at <https://www.annals.org>, and *Epidemiology* at <https://www.epidem.com>). Information on the STROBE Initiative is available at <https://www.strobe-statement.org>.

2 Sample size calculation for this study

In the determination of sample size, the formula for sample sizes within a known universe was used. The incidence rate of insomnia was set to 15% (American Academy of Sleep Medicine, 2014), and the sample size was calculated with a 95% confidence interval (CI) and 5% error margin. The sample size calculation formula was used as follows:

$$n = \frac{Z_{\alpha/2}^2 p(1-p)}{E^2}$$

where n is the required sample size, $Z_{\alpha/2}$ is the critical value from the standard normal distribution, p is the expected proportion, and E is the acceptable margin of error.

This shows the minimum number of 196 patients to be included in the sample. We finally included 600 patients in this study. No sampling methods were used, and the entire population was included in the study sample.

3 Name for the multi-centers in this study

The researchers and clinicians were trained on the study design and protocol, followed by conducting screening procedures via video conference with an experienced sleep medicine specialist and experts from the Nanfang Hospital of Southern Medical University. All names for the multi-centers in this study are provided as follows:

Name
Sleep Medicine Center, Nanfang Hospital
Hebei Provincial Mental Health Center
The Second People's Hospital of Shenzhen
Shenzhen People's Hospital
Shanghai Traditional Chinese Medicine Hospital
Guizhou Second Provincial People's Hospital
The Second Affiliated Hospital of Guangxi Medical University
Inner Mongolia Autonomous Region People's Hospital
The Affiliated Kangning Hospital of Ningbo University
Ningxia Hui Autonomous Region, Ning'an Hospital
The First People's Hospital of Yunnan Province
The Affiliated Hospital of Gansu University of Chinese Medicine
Taihe Hospital-Hubei University of Medicine
Chongqing Traditional Chinese Medicine Hospital

4 Recruitment procedure

All eligible participants were recruited through the following procedure. Initial clinical diagnosis and evaluation were conducted by physicians. Participants who met the diagnostic criteria completed a structured clinical interview for further screening, which was conducted by research staff with standardized training. The structured interview covered topics such as insomnia, anxiety, depression, and medication usage. According to Diagnostic and Statistical Manual of Mental Disorders (DSM-5) criteria, participants whose insomnia was identified as directly attributable to another psychological disorder (i.e., depression or anxiety disorder) were excluded from the study. Participants with insomnia symptoms lasting three months or less were classified as

AID, and those with symptoms persisting for three months or longer were classified as CID. After being informed about the study background, participants who met the inclusion criteria provided written informed consent and completed a questionnaire assessment.

The inclusion criteria of the study were as follows: (1) meet the insomnia criteria according to the DSM-5 criteria and be treatment-naïve; (2) have stable physical diseases or mental disorders, without taking any medications known to affect sleep (i.e., hypnotics, antidepressants, antipsychotics, or corticosteroids); and (3) be aged 18 years or older. The exclusion criteria included: (1) unstable physical diseases (i.e., uncontrolled hypertension or diabetes, recent myocardial infarction, acute infections, active malignancy, or any other acute medical conditions) or mental disorders (i.e., uncontrolled anxiety disorders, depressive disorders, bipolar disorder, schizophrenia, or other major psychiatric illnesses) or other sleep disorders (i.e., obstructive sleep apnea or restless-leg syndrome shown by polysomnography examination); (2) shift work or frequently crossing time zones; and (3) pregnancy or breastfeeding for women.

5 Measurements

Demographic information was collected through online self-reported questionnaires, which participants completed with guidance provided by a researcher on site.

5.1 Sleep-related questionnaires

All patients completed the Insomnia Severity Index (ISI) and Epworth Sleepiness Scale (ESS), with total scores for the ISI ranging from 0 to 28. Scores of 0 to 7 indicated no significant insomnia, 8 to 14 indicated sub-threshold insomnia, 15 to 21 indicated moderate insomnia, and scores above 21 indicated hyper-insomnia (Bastien et al., 2001). Total scores for the ESS range from 0 to 24. A score greater than 10 generally indicates significant daytime sleepiness (Johns, 1991).

5.2 Depressive and anxiety symptoms

We used the 9-item Patient Health Questionnaire (PHQ-9) and 7-item Generalized Anxiety Disorder Questionnaire (GAD-7) to evaluate the severity of depressive and anxiety symptoms (Yang et al., 2023). Total scores for the PHQ-9 ranged from 0 to 21. Scores from 0 to 4 indicated no depression, 5 to 9 indicated mild depression, 10 to 14 indicated moderate depression, and 15 or higher indicated severe depression (Kroenke et al., 2001). Total scores for the GAD-7 ranged from 0 to 21. A total score of 0 to 4 indicated no anxiety, 5 to 9 indicated mild anxiety, 10 to 14 indicated moderate anxiety, and 15 or higher indicated severe anxiety (Spitzer et al., 2006).

5.3 Workplace impairment, daily-activity impairment, and productivity-loss costs

We used the Work Productivity and Activity Impairment (WPAI) questionnaire to assess workplace impairment and daily-activity impairment due to insomnia (Kyle et al., 2023). The Chinese version of the WPAI can be used directly without any licensing or registration (https://www.reillyassociates.net/WPAI_GH.html). The questionnaire, given in **Note for WPAI**, contained six items, five of which concerned the past 7 d. Three components can be deduced from the questions: absenteeism, presenteeism, and daily-activity impairment. All variables are expressed as a percentage, with 0% representing no impairment and 100% representing complete impairment. All participants answered questions 1 and 6, as these questions were independent of employment status. Questions 2 through 5 were conditional on the answer in question 1 and were therefore answered only by patients who were currently employed or attending college (Kyle et al., 2023).

In addition, we calculated productivity-loss costs due to insomnia through the WPAI. The value of productivity-loss costs was estimated by multiplying total working hours lost by average hourly salaries, based on median gender- and age-specific earnings obtained from the Ministry of Human Resources and Social Security of the People's Republic of China Statistics 2023. Productivity-loss costs and their associated value were estimated for patients who were employed, with calculations of total presenteeism hour wages and

absenteeism hour wages. For participants who were not employed, we assumed no productivity loss (Kyle et al., 2023). The conversion from other currency to US dollars was calculated using the exchange rate as of 2024 (<https://methods.cochrane.org/economics/workshops>).

Note for WPAI:

Instructions for WPAI

Hi! The following questions are designed to assess the impact of health issues on your ability to perform work and daily activities. By “health issues,” we mean physical or emotional problems or symptoms. Please follow the instructions to provide the requested information or select the appropriate numbers.

- 1 Are you currently employed (working for pay)?
No
Yes
I am a student
If the answer is “No,” please check “No” and proceed to question 6.
- 2 The following questions pertain to your experiences over the past seven days, excluding today.
During the past seven days, how many hours did you miss from work because of problems associated with your Insomnia?
Include hours you missed on sick days, times you went in late, left early, etc., because of your Insomnia. Do not include time you missed to participate in this study.____Hours
- 3 During the past seven days, how many hours did you miss from work because of any other reason, such as vacation, holidays, time off to participate in this study? ____Hours
- 4 In the past 7 d, how many hours did you actually work? ____Hours
- 5 Over the past 7 d, how much has insomnia affected your work efficiency? Please consider days when your workload or job performance was limited, when you accomplished less work than you intended, or when you were unable to work as attentively as usual. If insomnia had a minimal impact on your work, select the lower number; if it had a significant impact, select the higher number.

0	1	2	3	4	5	6	7	8	9	10
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- 6 Over the past 7 d, how much has insomnia affected your ability to carry out daily activities (excluding work)? Daily activities include tasks such as household chores, shopping, childcare, exercise, reading, and so on. Please consider times when your level or range of activities was limited, or when you were able to do less than you had intended. If insomnia had a significant impact on your daily activities, please select a higher number.

0	1	2	3	4	5	6	7	8	9	10
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6 Statistical analysis

Continuous variables were reported as mean±standard deviation (SD) for normal distributions. Pairwise comparisons used the *t*-test for normal data and the Mann-Whitney *U* test for non-normal data. Categorical variables were presented as proportions, with comparisons made using the Chi-square test. We calculated the productivity losses over the past three months (Ohno et al., 2020). Only complete cases were used in the analyses.

Spearman’s rank correlation coefficients were used to assess the associations between WPAI outcomes and ISI, ESS, PHQ-9, and GAD-7 scores. These variables were treated as categorical in descriptive, correlation, and multiple-regression analyses using established cut-offs, and as continuous variables in restricted cubic spline (RCS) and mediation analyses to maximize statistical power and explore dose-response relationships.

Multiple linear regression models identified factors associated with workplace and daily activity impairment. We used RCS models with three knots at the 10th, 50th, and 90th percentiles (Harrell, 2002) to visualize potential non-linear associations. Analyses were stratified by group to explore subgroup differences in the RCS plots.

Mediation analysis was conducted to examine whether potential mediators of ESS, PHQ-9, and GAD-7 scores explained the association between ISI scores (the independent variable) and presenteeism, absenteeism, or daily-activity impairment (dependent variables), separately in the AID and CID groups. All variables were modeled as continuous in the primary mediation analyses. In subgroup analyses to assess heterogeneity, we used categorized variables. We estimated direct and indirect effects using 1,000 bootstrap samples to obtain 95% confidence intervals (Siew et al., 2023). The mediation analyses assumed independent observations, representative sampling, and adequate sample size (Fairchild and McDaniel, 2017).

All regression, RCS, and mediation analyses were adjusted for age, sex, body mass index (BMI), education, occupation, and income. Statistical analyses were performed using R version 4.3.2, with two-sided $P < 0.05$ considered statistically significant.

References

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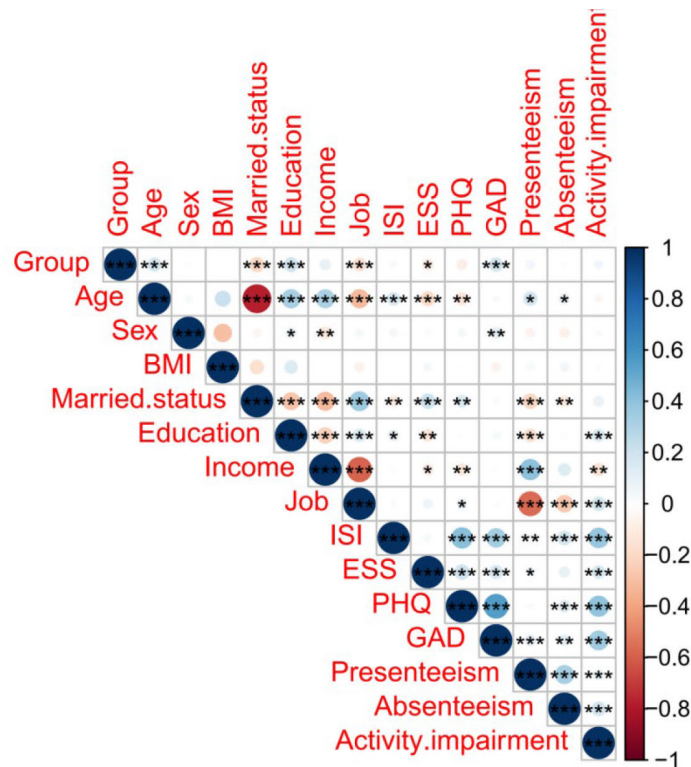


Fig. S1 Spearman's rank correlation. Correlations above 0.60 were considered strong; correlations ranging 0.30–0.60 were considered moderate, whereas correlations below 0.30 were considered weak. The Kruskal-Wallis test was used to determine whether there were differences in the distribution and degree of workplace impairment and daily activity impairment between the subgroups of the categorical data (e.g., group and sex). BMI: body mass index; ISI: Insomnia Severity Index; ESS: Epworth Sleepiness Scale; PHQ-9: 9-item Patient Health Questionnaire; GAD-7: Generalized Anxiety Disorder Questionnaire; * $P<0.05$; ** $P<0.01$; *** $P<0.001$.

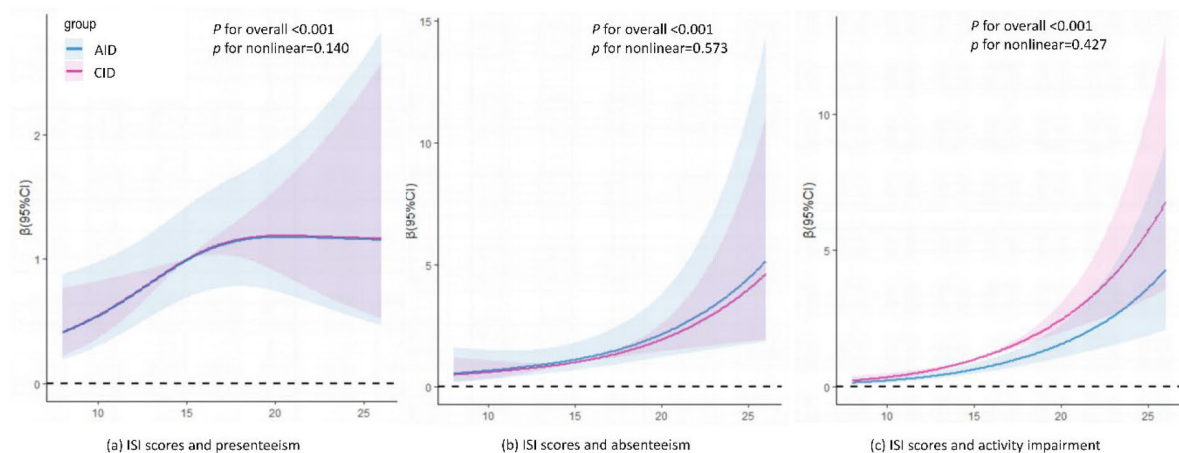


Fig. S2 Non-linear relationship with ISI scores and workplace impairment. Considering that an ISI score above 15 indicates clinical insomnia, we used an ISI of 15 as the reference threshold. AID: acute insomnia disorder; CID: chronic insomnia disorder; ISI: Insomnia Severity Index.

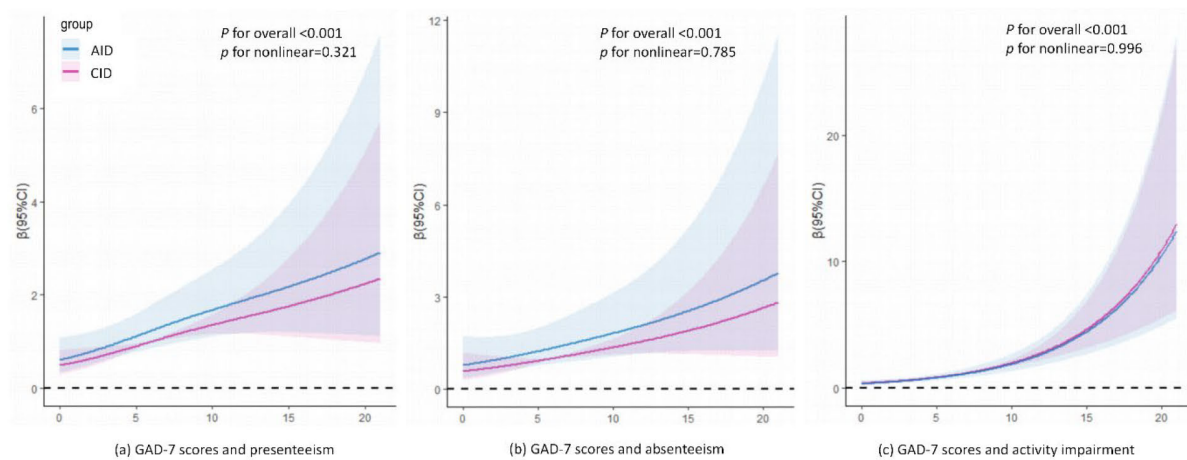


Fig. S3 Non-linear relationship with GAD-7 scores and workplace impairment. Considering that a GAD-7 score above 5 indicates clinical anxiety, we used a GAD-7 of 5 as the reference threshold. AID: acute insomnia disorder; CID: chronic insomnia disorder; GAD-7: Generalized Anxiety Disorder Questionnaire.

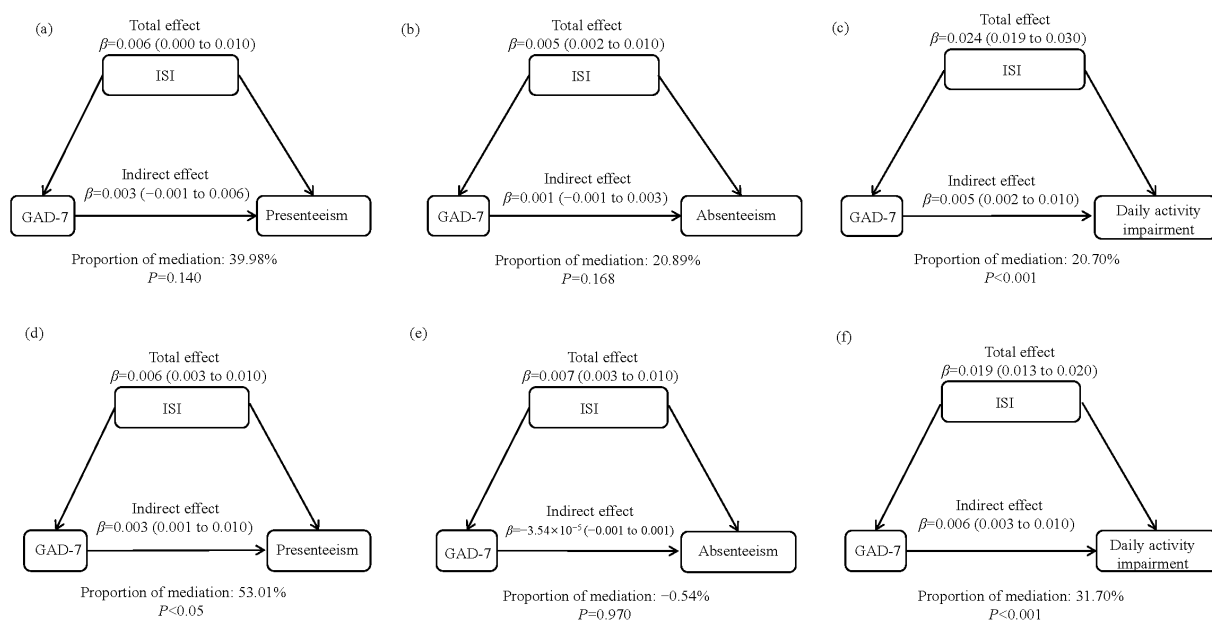


Fig. S4 Mediation analysis for associations of GAD-7 scores with workplace and daily activity impairment among AID and CID groups. (a–c) Mediation analyses in AID group. (d–f) Mediation analyses in CID group. (a, d) Independent variable: ISI score; Dependent variable: presenteeism; Mediated variable: GAD-7 score. (b, e) Independent variable: ISI score; Dependent variable: absenteeism; Mediated variable: GAD-7 score. (c, f) Independent variable: ISI score; Dependent variable: daily activity impairment; Mediated variable: GAD-7 score. The analyses were adjusted for potential confounders including sex, age, BMI, occupation, income, and marital status. AID: acute insomnia disorder; CID: chronic insomnia disorder; ISI: Insomnia Severity Index; GAD-7: 7-item Generalized Anxiety Disorder Questionnaire.

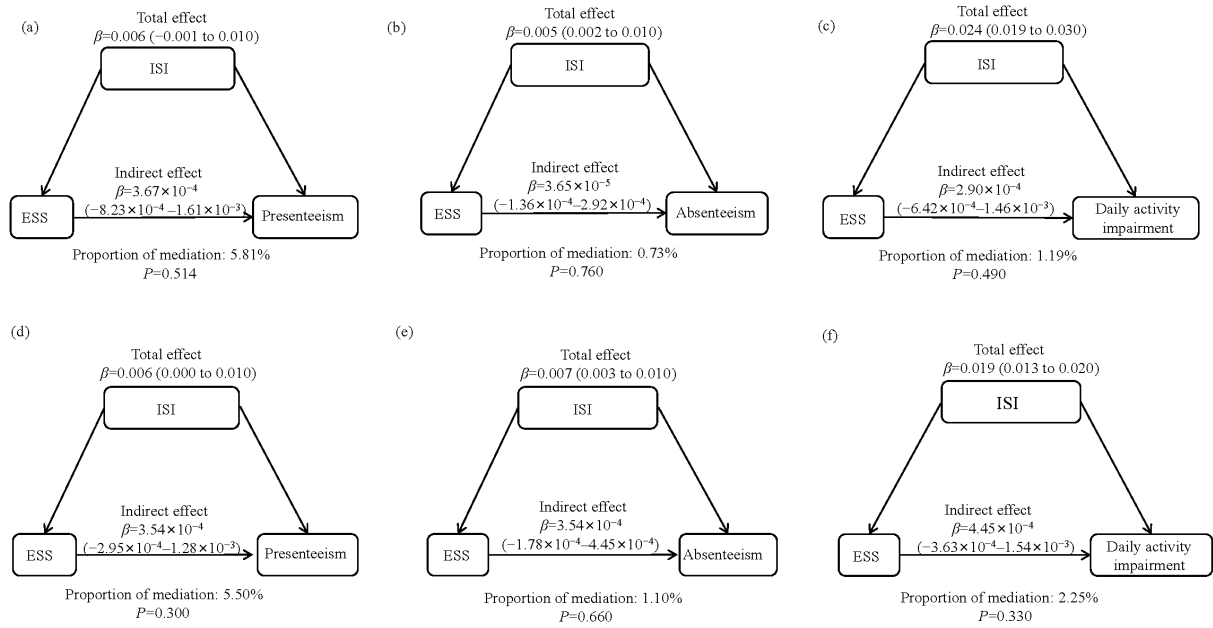


Fig. S5 Mediation analysis for associations of ESS scores with workplace and daily activity impairment among AID and CID group. (a–c) Mediation analyses in AID group; (d–f) Mediation analyses in CID group. (a, d) Independent variable: ISI score; Dependent variable: presenteeism; Mediated variable: ESS score. (b, e) Independent variable: ISI score; Dependent variable: absenteeism; Mediated variable: ESS score. (c, f) Independent variable: ISI score; Dependent variable: daily activity impairment; Mediated variable: ESS score. The analyses were adjusted for potential confounders including sex, age, BMI, occupation, income, and marital status. AID: acute insomnia disorder; CID: chronic insomnia disorder; ISI: Insomnia Severity Index; ESS: Epworth Sleepiness Scale.

Table S1 Multiple linear regression between the relationship of insomnia and workplace impairment and daily activity impairment

Variables	Presenteeism		Absenteeism		Daily activity impairment	
	<i>P</i>	β (95% CI)	<i>P</i>	β (95% CI)	<i>P</i>	β (95% CI)
Age	0.241	-1.00×10^{-4} (-3.20×10^{-3} – 1.20×10^{-3})	0.831	-1.00×10^{-4} (-1.3×10^{-3} – 1.1×10^{-3})	0.984	-3.1×10^{-3} (-7.60×10^{-3} – 1.30×10^{-3})
BMI	0.945	-2.00×10^{-4} (-5.10×10^{-3} – 4.70×10^{-3})	0.828	-1.00×10^{-4} (-2.80×10^{-3} – 2.60×10^{-3})	0.131	1.90×10^{-3} (-8.00×10^{-3} – 1.19×10^{-2})
Sex						
Male		0.00 (Reference)		0.00 (Reference)		0.00 (Reference)
Female	0.187	–0.02 (–0.06–0.01)	0.441	–0.01 (–0.03–0.01)	0.985	–0.01 (–0.03–0.01)
Married						
Married		0.00 (Reference)		0.00 (Reference)		0.00 (Reference)
Divorce or others	0.424	0.03 (–0.05–0.12)	0.917	-2.00×10^{-4} (-4.76×10^{-2} – 4.36×10^{-2})	0.909	0.00 (–0.08–0.09)
Unmarried	0.171	–0.04 (–0.09–0.02)	0.534	–0.01 (–0.04–0.02)	0.235	0.03 (–0.02–0.09)
Education						
College or above		0.00 (Reference)		0.00 (Reference)		0.00 (Reference)
Senior high schools or below	0.269	–0.03 (–0.08–0.02)	0.393	0.01 (–0.02–0.04)	0.003	0.08 (0.03–0.13)
Income						
<CNY 5000		0.00 (Reference)		0.00 (Reference)		0.00 (Reference)
CNY 5000–10 000	0.260	0.03 (–0.02–0.07)	0.034	–0.03 (–0.05–0.01)	0.554	–0.01 (–0.06–0.03)
CNY 10000–15 000	0.138	0.04 (–0.01–0.09)	0.055	–0.03 (–0.06–0.00)	0.731	0.01 (–0.04–0.06)
Occupation						
No job		0.00 (Reference)		0.00 (Reference)		0.00 (Reference)
Students	<0.001	–0.15 (–0.23–0.07)	0.032	–0.05 (–0.09–0.01)	0.424	0.03 (–0.05–0.11)
Full or part-time job	0.068	0.07 (–0.01–0.15)	0.555	0.01 (–0.03–0.05)	0.485	–0.03 (–0.11–0.05)
Group						
CID		0.00 (Reference)		0.00 (Reference)		0.00 (Reference)
AID	0.813	6.00×10^{-4} (-3.37×10^{-2} – 3.50×10^{-2})	0.455	–0.01 (–0.03–0.01)	0.014	–0.04 (–0.08–0.01)
Insomnia						
Subclinical insomnia		0.00 (Reference)		0.00 (Reference)		0.00 (Reference)
Moderate insomnia	0.233	0.02 (–0.01–0.06)	0.017	0.02 (0.01–0.04)	<0.001	0.08 (0.05–0.12)
Hyper-insomnia	0.042	0.06 (0.01–0.12)	<0.001	0.08 (0.05–0.12)	<0.001	0.17 (0.11–0.23)
ESS						
No daytime sleepiness		0.00 (Reference)		0.00 (Reference)		0.00 (Reference)
Daytime sleepiness	0.005	0.05 (0.02–0.09)	0.251	0.01 (–0.01–0.03)	0.035	0.04 (0.01–0.08)
GAD-7						
No anxiety		0.00 (Reference)		0.00 (Reference)		0.00 (Reference)
Mild anxiety	0.328	0.02 (–0.02–0.06)	0.507	–0.01 (–0.03–0.01)	0.162	0.03 (–0.01–0.07)
Moderate anxiety	0.057	0.06 (–0.01–0.11)	0.577	0.01 (–0.02–0.04)	0.037	0.06 (0.01–0.12)
Severe anxiety	0.005	0.11 (0.03–0.18)	0.555	0.01 (–0.03–0.05)	<0.001	0.14 (0.07–0.22)
PHQ-9						
No depression		0.00 (Reference)		0.00 (Reference)		0.00 (Reference)
Mild depression	0.093	0.04 (–0.01–0.08)	0.437	0.01 (–0.01–0.03)	0.013	0.06 (0.01–0.10)
Moderate depression	0.296	0.03 (–0.03–0.08)	0.776	0.00 (–0.03–0.03)	<0.001	0.11 (0.05–0.17)
Severe depression	0.066	–0.10 (–0.20–0.01)	0.534	0.02 (–0.04–0.08)	0.037	0.11 (0.01–0.22)

CI: Confidence Interval; AID: acute insomnia disorder; CID: chronic insomnia disorder; ISI: Insomnia Severity Index; ESS: Epworth Sleepiness Scale; GAD-7: 7-item Generalized Anxiety Disorder Questionnaire; PHQ-9: 9-item Patient Health Questionnaire; BMI: body mass index.

Table S2 Subgroup analysis for the mediators

Dependent variable	Mediator	Total effect		Direct effect		Indirect effect		Proportion mediated (%)
		β (95% CI)	<i>P</i> value	β (95% CI)	<i>P</i> value	β (95% CI)	<i>P</i> value	
AID without symptoms								
Presenteeism	PHQ-9 score (0–4)	0.002 (−0.011–0.010)	0.790	0.001 (−0.011–0.010)	0.870	2.98×10^{-4} (−2.81×10 ^{−3} –3.83×10 ^{−3})	0.790	18.71
Absenteeism	PHQ-9 score (0–4)	−0.001 (−0.002–0.000)	<0.001***	−0.001 (−0.002–0.000)	<0.001***	-1.72×10^{-6} (−6.95×10 ^{−5} –1.32×10 ^{−4})	0.530	0.31
Activity impairment	PHQ-9 score (0–4)	−0.011 (−0.298–0.480)	0.070	0.010 (−0.001–0.002)	0.080	-1.12×10^{-4} (−1.89×10 ^{−3} –2.90×10 ^{−3})	0.910	−1.10
Presenteeism	GAD-7 score (0–4)	0.006 (−0.004–0.020)	0.280	0.006 (−0.004–0.020)	0.290	-2.29×10^{-6} (−1.45×10 ^{−3} –1.34×10 ^{−3})	0.970	−0.04
Absenteeism	GAD-7 score (0–4)	4.43×10^{-3} (−5.45×10 ^{−5} –0.10×10 ^{−2})	0.068	0.004 (−0.001–0.010)	0.138	1.10×10^{-4} (−6.59×10 ^{−4} –1.24×10 ^{−3})	0.754	2.50
Activity impairment	GAD-7 score (0–4)	0.021 (0.012–0.030)	<0.001***	0.020 (0.010–0.030)	<0.001***	1.29×10^{-3} (−3.54×10 ^{−4} –4.50×10 ^{−3})	0.130	6.20
Presenteeism	ESS score (0–10)	0.009 (−0.003–0.010)	0.058	0.004 (−0.003–0.011)	0.052	-3.72×10^{-4} (−1.47×10 ^{−3} –4.02×10 ^{−4})	0.634	7.38
Absenteeism	ESS score (0–10)	0.008 (0.003–0.010)	<0.001***	0.009 (0.003–0.010)	<0.001***	-2.43×10^{-6} (−3.05×10 ^{−4} –3.20×10 ^{−4})	1.000	−0.25
Activity impairment	ESS score (0–10)	0.024 (0.016–0.030)	<0.001***	0.023 (0.015–0.030)	<0.001***	-1.50×10^{-4} (−8.77×10 ^{−4} –5.07×10 ^{−4})	0.650	1.90
CID without symptoms								
Presenteeism	PHQ-9 score (0–4)	1.14×10^{-4} (−1.21×10 ^{−2} –0.10×10 ^{−2})	0.930	−0.001 (−0.014–0.010)	0.990	7.88×10^{-4} (−1.32×10 ^{−3} –4.35×10 ^{−3})	0.490	69.40
Absenteeism	PHQ-9 score (0–4)	0.005 (−0.002–0.010)	0.190	0.005 (−0.001–0.010)	0.150	-5.17×10^{-4} (−2.39×10 ^{−3} –6.17×10 ^{−4})	0.470	11.11
Daily activity impairment	PHQ-9 score (0–4)	0.007 (−0.007–0.020)	0.350	0.007 (−0.008–0.020)	0.390	5.74×10^{-4} (−1.96×10 ^{−3} –4.13×10 ^{−3})	0.730	8.61
Presenteeism	GAD-7 score (0–4)	0.009 (−0.001–0.020)	0.098	0.009 (−0.002–0.020)	0.090	3.13×10^{-3} (7.33×10 ^{−4} –5.96×10 ^{−3})	0.814	−2.54
Absenteeism	GAD-7 score (0–4)	4.58×10^{-3} (1.97×10 ^{−4} –1.10×10 ^{−2})	0.030*	4.66×10^{-3} (3.30×10 ^{−4} –1.12×10 ^{−2})	0.034*	2.05×10^{-5} (−1.50×10 ^{−3} –1.73×10 ^{−3})	0.882	1.66
Daily activity impairment	GAD-7 score (0–4)	0.015 (0.004–0.030)	0.004**	0.016 (0.004–0.030)	0.006**	-5.45×10^{-4} (−3.03×10 ^{−3} –1.32×10 ^{−3})	0.626	−3.57
Presenteeism	ESS score (0–10)	6.85×10^{-3} (−1.01×10 ^{−4} –1.38×10 ^{−2})	0.054	6.95×10^{-3} (−1.31×10 ^{−4} –1.40×10 ^{−2})	0.054	-1.02×10^{-4} (−9.15×10 ^{−4} –2.61×10 ^{−4})	0.644	−1.49
Absenteeism	ESS score (0–10)	0.007 (0.003–0.010)	<0.001***	0.007 (0.003–0.010)	<0.001***	-2.59×10^{-5} (−3.40×10 ^{−4} –2.15×10 ^{−4})	0.890	−0.35
Daily activity impairment	ESS score (0–10)	0.017 (0.011–0.020)	<0.001***	0.017 (0.011–0.020)	<0.001***	-2.48×10^{-5} (−6.63×10 ^{−4} –4.20×10 ^{−4})	0.940	−0.14
CID with depressive, anxiety or daytime sleepiness symptoms								
Presenteeism	PHQ-9 score (>4)	0.004 (−0.003–0.010)	0.270	0.003 (−0.004–0.010)	0.430	-1.43×10^{-3} (−4.09×10 ^{−3} –7.04×10 ^{−4})	0.570	23.59
Absenteeism	PHQ-9 score (>4)	0.005 (0.002–0.010)	0.006**	0.007 (0.003–0.010)	0.034*	5.84×10^{-4} (−1.14×10 ^{−3} –2.58×10 ^{−3})	0.140	25.52
Daily activity impairment	PHQ-9 score (>4)	0.022 (0.016–0.030)	<0.001***	0.017 (0.011–0.020)	<0.001***	0.005 (0.001–0.006)	<0.001**	20.55
Presenteeism	GAD-7 score (>4)	0.002 (−0.007–0.010)	0.640	0.001 (−0.009–0.010)	0.910	1.77×10^{-3} (−3.35×10 ^{−5} –4.07×10 ^{−3})	0.360	68.43
Absenteeism	GAD-7 score (>4)	0.005 (0.001–0.010)	<0.001***	0.003 (0.001 to 0.010)	0.012*	2.03×10^{-4} (−1.10×10 ^{−3} –1.47×10 ^{−3})	0.056	29.30
Daily activity impairment	GAD-7 score (>4)	0.023 (0.016–0.030)	<0.001***	0.019 (0.011–0.030)	<0.001***	0.004 (0.002–0.007)	0.014*	16.83
Presenteeism	ESS score (>10)	0.010 (−0.003–0.020)	0.150	0.009 (−0.005–0.020)	0.210	4.90×10^{-3} (−5.68×10 ^{−5} –1.23×10 ^{−2})	0.600	9.21
Absenteeism	ESS score (>10)	0.004 (−0.001–0.010)	0.190	0.004 (−0.001–0.010)	0.200	-7.49×10^{-5} (−2.33×10 ^{−3} –1.40×10 ^{−3})	0.800	3.28

Daily activity impairment	ESS score (>10)	0.029 (0.019–0.040)	<0.001***	0.030 (0.019–0.040)	<0.001***	4.67×10^{-3} (-7.76×10^{-5} – 9.96×10^{-3})	0.850	–1.33
AID with depressive, anxiety or daytime sleepiness symptoms								
Presenteeism	PHQ-9 score (>4)	0.005 (–0.002–0.010)	0.170	0.005 (–0.001–0.010)	0.110	-1.63×10^{-4} (-1.71×10^{-3} – 1.30×10^{-3})	0.170	28.31
Absenteeism	PHQ-9 score (>4)	0.008 (0.003–0.010)	<0.001***	0.007 (0.003–0.010)	<0.001***	-1.9×10^{-5} (-3.41×10^{-4} – 2.99×10^{-4})	0.470	7.78
Daily activity impairment	PHQ-9 score (>4)	0.018 (0.018–0.020)	<0.001***	0.015 (0.008–0.020)	<0.001***	1.24×10^{-4} (1.26×10^{-3} – 8.62×10^{-4})	0.002**	16.53
Presenteeism	GAD-7 score (>4)	0.004 (–0.003–0.010)	0.254	0.001 (–0.007–0.010)	0.768	1.57×10^{-3} (1.08×10^{-3} – 5.68×10^{-3})	0.014*	75.99
Absenteeism	GAD-7 score (>4)	0.007 (0.002–0.010)	0.004**	0.007 (0.002–0.010)	0.002**	1.44×10^{-3} (-6.48×10^{-5} – 3.54×10^{-3})	0.930	0.31
Daily activity impairment	GAD-7 score (>4)	0.017 (0.010–0.020)	<0.001***	0.012 (0.004–0.020)	0.004**	3.89×10^{-3} (5.47×10^{-4} – 8.26×10^{-3})	<0.001** *	30.94
Presenteeism	ESS score (>10)	0.007 (–0.006–0.020)	0.270	0.003 (–0.011–0.020)	0.682	0.001 (–0.003–0.005)	0.056	65.50
Absenteeism	ESS score (>10)	0.002 (–0.006–0.010)	0.690	0.002 (–0.006–0.010)	0.660	1.24×10^{-4} (-9.95×10^{-4} – 1.45×10^{-3})	0.830	–4.90
Daily activity impairment	ESS score (>10)	0.024 (0.010–0.040)	0.002**	0.019 (0.005–0.030)	0.014*	-3.9×10^{-4} (-3.73×10^{-3} – 2.97×10^{-3})	0.056	19.50

AID: acute insomnia disorder; CID: chronic insomnia disorder; PHQ-9: 9-item Patient Health Questionnaire; GAD-7: 7-item Generalized Anxiety Disorder Questionnaire; ESS: Epworth Sleepiness Scale; CI: confidence interval.