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RESEARCH ARTICLE

Risk factors for insomnia and burnout: A longitudinal population-based cohort study

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Abstract

Insomnia and burnout are highly prevalent in the general population, calling for understanding of its causes. Taking a broad approach, the aim of this study was to determine various mental and somatic risk factors for development of insomnia and burnout and stratifying for sex and age group. Questionnaire data were used from a Swedish population-based sample aged 18–79 years, from which cohorts without insomnia (n = 1702) and without burnout (n = 1972) at baseline were followed-up after 3 years. Self-reports of eight mental and somatic conditions at baseline were used as independent variables in logistic regression analyses to predict development of insomnia and burnout at 3-year follow-up. All eight studied conditions were significant risk factors for development of both insomnia (odds ratio, OR = 1.62–2.73) and burnout (OR = 2.20–3.21). Burnout and poor self-rated health had the highest ORs for insomnia, and poor self-rated health, anxiety and somatic symptoms had the highest ORs for burnout. The ORs were generally similar between men and women, whereas age groups tended to differ in some of the risk factors. The study highlights the importance of a broad assessment of both mental and somatic conditions in the prevention of insomnia and burnout.

KEYWORDS
epidemiology, mental health, public health, somatic health

1 | INTRODUCTION

Sleep is maybe one of the most health bringing behaviours for the individual (Walker, 2017). Epidemiological studies show that it lowers the risk for several of the most common conditions of ill-health, such as cancer (Chen et al., 2018; Lu et al., 2013; Zhao et al., 2013), dementia (Shi et al., 2018; Xu et al., 2020), myocardial infarction and stroke (Cappuccio et al., 2011), diabetes (Cappuccio et al., 2010; Shan et al., 2015) and obesity (Erickson et al., 2012; Greer et al., 2013; Li et al., 2017; Wu et al., 2017). Sleep is also important for psychological health since it lowers the risk for depression (Tsuno et al., 2005) and anxiety (Cox & Olatunji, 2016; Marcks et al., 2010; Papadimitriou & Linkowski, 2005), and renews personal resources and mental well-being (Nägel & Sonnentag, 2013). Stress disturbs sleep, and sleep plays a critical role in restoring energy and promoting health (Akerstedt et al., 2002; Walker, 2017). Insomnia, stress and burnout are common complaints among primary care patients (Simon & Vonkorff, 1997; Wiegner et al., 2015). Therefore, a better understanding of the risk of developing insomnia and burnout in a general population is valuable, especially in the development of routines for assessment and care that are feasible, affordable and effective. Insomnia and burnout are highly prevalent in the general population,

and are associated with anxiety, depression, self-rated health and somatic disease (Bakker et al., 2000; Geiger et al., 2012; Höglund et al., 2020; Ionescu et al., 2021; Jansson-Frojmark & Linton, 2008; Koutsimani et al., 2019; Mallon et al., 2014; Mildestvedt et al., 2018; Neckelmann et al., 2007; von Känel et al., 2020). This study takes a broad approach in studying risk factors for both insomnia and burnout.

Insomnia can be defined as (1) difficulty falling asleep, staying asleep or nonrestorative sleep; (2) impairment in sleep that is associated with daytime impairment or distress; (3) sleep difficulty that occurs at least 3 times per week and (4) has been a problem for at least 3 months; and (5) difficulties despite adequate opportunity and circumstance to sleep (American Psychiatric & American Psychiatric Association, 2013). Depending on sex, country and definition of the condition, 10%–35% of the adult population suffer from disturbed sleep, and 5%–10% meet the DSM criteria for insomnia, with higher prevalence rates for women (Buysse et al., 2008; Höglund et al., 2020; Mai & Buysse, 2008; Morin et al., 2006; Ohayon, 2002). Several psychosocial and demographic factors can have an impact on sleep quality, such as major life events, bereavement, ongoing strains and stress, age and gender (Lustberg & Reynolds, 2000; Morin et al., 2003). There are also substantial associations between insomnia and somatic and psychiatric disorders (Mallon et al., 2014; Ohayon et al., 1998, 1998degård et al., 2013) as well as with burnout syndrome (Arnison et al., 2022; Grossi et al., 2003; Melamed et al., 1999). Previous studies indicate comorbidity in insomnia with negative affect, and for most individuals with insomnia much of their daytime worrying is characterised by anxiety, stress, tension and depression (Harvey, 2008). However, research has been sparse concerning whether negative affect and stress are pre-morbid risk factors. Many psychiatric and mood disorders express co-occurring abnormalities of sleep (American Psychiatric & American Psychiatric Association, 2013; Sivertsen et al., 2009; Sivertsen et al., 2012; Sivertsen, Hysing, et al., 2021) that can be explained by the interplay between sleep and emotional functioning related to cortisol dysregulation, the neurophysiological processes and impaired executive function associated with sleep disturbance (Cox et al., 2016; Harvey et al., 2011; Walker & van der Helm, 2009; Yoo et al., 2007).

Most longitudinal studies have assessed associations to insomnia with the perspective that insomnia precedes other mental disorders (Johnson et al., 2006), but the majority of studies investigating risk factors for insomnia are either retrospective or cross-sectional (Johnson et al., 2006), which makes the exact nature of this relationship unclear. Several studies indicate that insomnia is a risk factor for depression, anxiety, diabetes, and coronary artery disease mortality (Baglioni et al., 2011; Benca et al., 1992; Cox et al., 2016; Cox & Olatunji, 2015, 2020; Gregory et al., 2005, 2009; Hertenstein et al., 2019; LeBlanc et al., 2009; Mallon et al., 2000, 2002, 2005; Taylor et al., 2003), but only a few studies have examined risk factors for insomnia, subsequent to these psychiatric and somatic disorders. Some longitudinal studies on risk factors for insomnia have focussed on selected samples such as elderly (Ebben, 2021; Foley et al., 1999; Mallon & Hetta, 1997; Morgan, 2003) and patients in medical care (Hohagen et al., 1993; Isaia et al., 2010). In a longitudinal study, burnout syndrome was identified as a risk factor for sleep disturbance (Rothe et al., 2020) To our knowledge, there are relatively few longitudinal studies investigating psychiatric, psychological and somatic risk factors for insomnia in the general population (Jansson & Linton, 2006b; Jansson-Frojmark & Lindblom, 2008; Johansson et al., 2016; Klink et al., 1992; LeBlanc et al., 2009; Morin et al., 2009; Morphy et al., 2007; Savard et al., 2001; Singareddy et al., 2012; Sivertsen et al., 2012). In particular, few studies have taken a broad perspective enabling direct comparison between various health conditions, leaving a gap in knowledge. A literature review of mainly cross-sectional studies (Hartz et al., 2007) suggests that the five strongest independent factors associated with sleep problems are depression, anxiety, pain, sex, and self-rated health. Self-rated health has also been shown to be an important temporal risk factor for insomnia (Hartz et al., 2007).

Burnout is considered a consequence of excessive and prolonged stress and the inability to regain lost resources and gain new ones (Aumayr-Pintar et al., 2018). Shirom (1989) defined it early as a multidimensional construct consisting of emotional exhaustion, physical fatigue, and cognitive weariness, which together may represent core components of burnout (Maslach et al., 2001; Melamed et al., 1992b; Schaufeli et al., 2009). Another definition of burnout, used in the present study, includes the components emotional/physical fatigue, cognitive weariness, tension, and listlessness (Kushnir & Melamed, 1992; Melamed et al., 1992b). Although burnout has become a widespread term in media and has reached widespread public interest, the concept of burnout is controversial and still under debate among scientist and practitioners (Bianchi et al., 2015a, 2015b; Heinemann & Heinemann, 2017; Lindsäter et al., 2022). Studies on the epidemiology of burnout are scarce and restricted by the fact that burnout can be masked by other diagnoses, such as depression or chronic fatigue syndrome (Aumayr-Pintar et al., 2018; Madsen et al., 2015, 2017). The lack of clear diagnostic criteria and heterogeneity of assessment instruments make the prevalence rates vary considerably (Rotenstein et al., 2018). Reported rates for burnout in the general population vary from 7.1% to 17.5% (4.6%–12.8% for men and 9.3%–21.1% for women), partly depending on the instrument used for assessment (Hallsten et al., 2002; Höglund et al., 2020; Norlund et al., 2010).

The research field has approached burnout from two major perspectives. One that conceives burnout primarily as an intrapsychic phenomenon, and the other, more common, that focuses on external and organisational experiences (Burisch, 2002). Possible causes of burnout are work and organisational factors such as workload, time pressure, and role conflict as well as intrapsychic factors such as personality and states of negative affect, for example, neuroticism, depression and anxiety (Aumayr-Pintar et al., 2018; Schaufeli, 1998). This study focussed on symptoms of burnout as being intrapsychic factors according to the burnout definition of Shiroms et al. (Melamed et al., 1992a).

Among professionals in healthcare, burnout has been shown to be directly related to short sleep time (Rothe et al., 2020; Tokuda

et al., 2009) and polysomnografic findings by Ekstedt et al. (2006) suggested that impaired sleep played a role in the development of fatigue and exhaustion in burnout. There is evidence for a link between stress and insomnia (Jansson & Linton, 2006a). For example, for many persons with stress, hyperarousal prevents them from falling asleep (Bastien, 2020; Bonnet & Arand, 2009), together with difficulties minimising worrying och ruminating (Berset et al., 2011; Carney et al., 2006, 2010; Querstret & Cropley, 2012). The consequences of not sleeping well results in lack of recovery, which can develop into burnout (Aumayr-Pintar et al., 2018; Nägel & Sonnentag, 2013; Sluiter et al., 2001). However, there are mixed results concerning a bidirectional association between insomnia and burnout. A longitudinal study by Armon et al. (2008) found a bidirectional association, whereas Jansson-Frojmark and Lindblom (2010) found that insomnia predicted new onsets of burnout, but not vice versa. Underlying mechanisms for burnout is largely unknown, but as for insomnia, research on regulation of emotions and their functional connection in the brain has shown promising results (Arnsten et al., 2015; Golkar et al., 2014; Savic, 2015).

As for studies of risk factors for insomnia, the number of cross-sectional studies examining burnout is comprehensive (Canadas-De la Fuente et al., 2015; Hallsten et al., 2011; Melamed et al., 1992a; Williams & Zipp, 2014), but only a few are longitudinal with a focus on psychological determinants (Armon et al., 2008; Jansson-Frojmark & Lindblom, 2010; Söderström et al., 2012). Most longitudinal studies on burnout has a focus on jobb-demand models (Maslach et al., 2001; Melamed et al., 2006, 2011; Van der Doef & Maes, 1999) and there is a gap in the research field investigating intrapsychic risk factors in particular. In addition, most studies examining burnout have been performed on occupational groups, and not on the general population, and there is a lack of studies on burnout on a general population with a broad age range regarding risk factors for development of burnout. Considerable sex- and age-related differences in prevalence of insomnia and burnout in the general population motivates studying risk factors for these subgroups (Höglund et al., 2020).

The objective of this study was to investigate to what extent various psychological conditions, somatic symptoms and self-rated health predict development of insomnia and burnout over 3 years in a general adult population when stratifying for age and sex. This was done by means of a longitudinal, population-based questionnaire study.

2 | METHOD

2.1 | Population and sample

The present study used data from the Västerbotten Environmental Health Study, which is a large-scale, longitudinal questionnaire-based prospective survey with focus on various aspects of mental and somatic health. Västerbotten is a county in northern Sweden with approximately 270,000 inhabitants, and with an age and sex distribution similar to that of the general Swedish population. Drawn from the municipal register, a sample of 8520 individuals aged 18–79 years, stratified for age and sex, was invited to participate at the first data collection (baseline) in 2010. The questionnaire was sent by mail together with written information concerning confidentiality, intended use of the data, and information about participation being voluntary. A reminder was sent to non-responders after three full weeks. An additional reminder and a new copy of the questionnaire were sent after another 3 weeks. Of the 8520 invited individuals, 3406 (40.0%) participated at baseline. At follow-up, 3 years later, in 2013, 2336 (73.4%) participated. Thus, 27.4% of the invited sample participated in both data collections. All questionnaires were responded to between March and May to avoid the impact of seasonal allergy and midnight sunlight. However, studies in the subartic have shown a small to non-existing influence of seasonal light variation on changes in duration and quality of sleep, or night awakenings (Friborg et al., 2012; Johnsen et al., 2012; Sivertsen et al., 2011; Sivertsen, Friborg, et al., 2021).

Of the 2336 participants, 634 were excluded from further analyses regarding insomnia due to meeting criteria for insomnia at baseline, and 364 were excluded from further analyses regarding burnout due to meeting criteria for burnout at baseline. The 1723 participants without insomnia at baseline were categorised into two subgroups: (a) insomnia cases (having developed insomnia symptoms at follow-up), and (b) insomnia referents (not having developed insomnia symptoms at follow-up). The 1972 participants without burnout symptoms at baseline were categorised as either (c) burnout cases (having developed burnout symptoms at follow-up) or (d) burnout referents (not having developed burnout symptoms at follow-up). The participants are described on background variables in Table 1.

The study was conducted in accordance with the Helsinki Declaration and approved by the Umeå Regional Ethics Board (Dnr 09–171 M) and the Swedish Ethical Review Authority (Dnr 2022-05265-02). All participants provided informed consent to participate.

3 | MEASUREMENTS

3.1 | Outcome variables

Insomnia was assessed with seven items of the two dimensions sleep quality (four items) and non-restorative sleep (three items) of the Swedish version of the Karolinska Sleep Questionnaire (KSQ) (Nordin, Akerstedt, & Nordin, 2013). The sleep disturbance referred to the past 3 months, in accordance with the DSM-5 criteria for insomnia. The dimension of sleep quality measures 'difficulty falling asleep' and 'repeated awakenings with difficulty going back to sleep', 'premature awakening' and 'disturbed sleep'. The dimension of non-restorative sleep measures 'difficulties waking up', 'not being well rested on awakening', and 'feeling of exhaustion at the awakening'. The response alternatives are (0) never, (1) seldom (occasionally), (2) sometimes (several times per month), (3) often (1–2 times per week), (4) most of the times (3–4 times per week), and (5) always (5 times or

TABLE 1 Description in percentage at baseline of participants in the insomnia (n = 1723) and burnout (n = 1972) cohorts

	Insomnia			Burnout		
	Referents	Cases	p-Value	Referents	Cases	p-Value
Woman	51.22	59.29	0.003	51.75	68.60	<0.001
Age[a]	55.23 (14.74)	51.81 (17.21)	<0.001	54.74 (15.12)	52.21 (16.93)	<0.001
Parent of small children	8.19	12.33	0.004	9.57	11.88	0.107
Low physical activity[b]	29.97	33.55	0.036	29.26	32.46	0.118
Living alone	17.36	20.49	0.128	16.72	23.97	0.024
Low education[c]	58.67	56.70	0.618	58.20	60.65	0.305
Smoking	8.10	7.75	0.917	7.84	10.57	0.063
High alcohol consumption[d]	14.28	9.79	0.133	15.05	11.53	0.252

[a] Mean (SD).
[b] ≤2 times a week.
[c] ≤9 years.
[d] ≥2–3 times a week.

more per week). The criteria for nocturnal symptoms of insomnia were met by responding 4 or 5 on the scale for at least one of the seven items, in accordance with the DSM-5 criteria for insomnia. The KSQ has good reliability, construct validity, and criterion validity (Nordin, Akerstedt, & Nordin, 2013). The internal consistency in the present data was α = 0.78, for the group without insomnia at baseline, and α = 80, for the group without burnout.

The Shirom-Melamed Burnout Questionnaire (SMBQ) (Lundgren-Nilsson et al., 2012; Melamed et al., 1992a) was used to assess burnout, and consists of 22 items to be rated on a seven-point scale ranging from 1, 'Never or almost never' to 7, 'Always or almost always'. An average score across items was calculated, with high score representing high level of burnout. The SMBQ measures different aspects of the burnout syndrome assessable by the dimensions of emotional/physical fatigue, tension, listlessness, and cognitive weariness. The SMBQ has good construct validity and reliability (Lundgren-Nilsson et al., 2012). The internal consistency in the present data was α = 0.93, for the group without insomnia at baseline, and α = 0.90 for the group without burnout. A cut-off value of 4.0+ was used to represent a case of burnout (Lundgren-Nilsson et al., 2012).

3.2 | Predictor variables

Anxiety and depression were measured with the Hospital Anxiety and Depression Scale (HADS). The instrument has two subscales that measure symptoms of anxiety (HADS-A) and depression (HADS-D) during the past week based on seven items for each subscale. The items are rated on a scale ranging from 0 to 3. A total score of 21 can be calculated for each subscale, with high score representing high level of anxiety and depression. The HADS has satisfactory internal consistency and concurrent validity. The internal consistency of the HADS in the present data was, α = 0.86, for the group without insomnia at baseline, and α = 0.83 for the group without burnout at baseline (Evers, Muñiz, Hagemeister, Høtmælingen, et al., 2013). A cut-off score of 8+ for both subscales was used, which has been shown to be the optimal balance between sensitivity and specificity for caseness (meeting cut-off for high probability of being a case) for depression or anxiety disorders (Kjaergaard et al., 2014; Zigmond & Snaith, 1983).

The Theoretically Originated Measure of the Cognitive Activation Theory of Stress (TOMCATS) was used to assess helplessness and hopelessness. It measures response outcome expectancies by assessing an individual's level of helplessness, hopelessness, and coping (the latter not presently used) in response to a stressful situation (Odeen et al., 2013; Ursin & Eriksen, 2010). Three items measure helplessness (no response outcome expectancy; e.g. 'It doesn't matter what I do, I have no control of the outcome of my actions'), and three items measure hopelessness (negative response outcome expectancy; e.g. 'My response have effect, but they are all negative and it's my fault'). All items are rated on a 4-point Likert scale: 'not true at all' (1), 'not particularly true' (2), 'rather true' (3), and 'completely true' (4). A mean score was calculated across items. Cronbach's alpha was good, 0.80, for the sample without insomnia at baseline, and adequate, 0.79, for the sample without burnout (Evers et al., 2013) A cut-off score of 2.5+ representing 'rather true' or 'completely true' was used to define a high level of helplessness or hopelessness.

The Perceived Stress Scale (PSS-10) was used to measure the degree to which a person perceives life situations as excessively stressful, and their lives as unpredictable, uncontrollable and overloading, relative to their ability to cope, according to Lazarus transactional model of stress and coping (Cohen et al., 1983; Lazarus & Folkman, 1984). A total score was calculated across its 10 items. The PSS-10 has good construct validity (Nordin & Nordin, 2013). The internal consistency for the PSS-10 in this study was α = 0.79, in the group without insomnia at baseline, and α = 0.76 in the group without burnout at baseline (Evers, Muñiz, Hagemeister, Høtmælingen, et al., 2013). A cut-off score of one SD above the mean for normative data (Nordin & Nordin, 2013) was used to define a high level of stress.

Self-rated health was measured with the single item 'In general, how would you describe your health?'. The participant was asked to rate his/her general health on a 5-point scale with the response alternatives 'poor', 'fair', 'good', 'very good' and 'excellent'. Self-rated health is the most commonly used health indicator of quality of life in sociological health research (Fayers & Sprangers, 2002; Hartz et al., 2007; Jylhä, 2009), provides valid and important information about an individual's general health status (Jylhä, 2009), and is a powerful predictor of clinical outcome (Fayers & Sprangers, 2002). 'Poor' and 'fair' were in this study considered as poor self-rated health.

The 15-item Patient Health Questionnaire (PHQ-15) was used to measure somatic symptoms. It includes 15 symptoms that account for more than 90% of the physical complaints reported in the outpatient setting (Kroenke, 2003), and indicates caseness of somatisation and somatoform disorder (Hinz et al., 2017; Kroenke et al., 2002). The items are responded to with respect to having had the symptom during the past 4 weeks. The symptoms are rated on a scale ranging from 0 (not bothered at all), to 1 (bothered a little), and 2 (bothered a lot), giving a total score range of 0–30 for women (since an item on menstrual problems is included) and 0–28 for men, with high score representing high level of symptom severity. Due to these differences in total score, the recommended cut-off score (10+; Kroenke et al., 2002; Kocalevent et al., 2013) was converted to percentage (33.3%) of total score, thus 10+ for women, and 9+ for men. The Swedish version of the PHQ-15 has satisfactory reliability and validity (Nordin, Palmquist, & Nordin, 2013). The internal consistency for the PHQ-15 in this study was $\alpha = 0.76$, in the group without insomnia at baseline, and $\alpha = 0.78$ in the group without burnout at baseline.

3.3 | Statistical analysis

Missing values were estimated with multiple imputation using fully conditional Markov chain Monte Carlo methods with 10 maximum iterations through which five imputed datasets were created, and values were averaged across datasets. The percentages of missing data in the insomnia sample at baseline was 1.6% for the SMBQ, 0.28% for the HADS, 0.91% for the TOMCATS, 1.4% for the PSS-10%, and 3.7% for the PHQ-15. Corresponding percentage missing data for the burnout sample at baseline was 1.03% for the KSQ, 0.62 for the HADS, 0.69% for the TOMCATS, 0.57% for the PSS-10%, and 2.9% for the PHQ-15. Between-group comparisons were performed using chi-square analysis and independent *t*-test.

Logistic regression analyses were conducted, providing odds ratios for each predictor variable, separately for insomnia and burnout, adjusted for sex, age, being a parent of small children (≤6 years), physical activity monthly or less often, and living alone or alone as a parent. Odds ratio, based on dichotomous variables, was chosen as outcome measure due to the easiness of interpretation that the results provide. The choice of covariates was partly based on prior research (Ahola et al., 2012; Kelley & Kelley, 2017; Maslach et al., 2001; Maslach & Jackson, 1981; Youngstedt & Kline, 2006), partly on significant group differences in the present data. The alpha level was set at 0.05. Separate analyses were conducted for the sexes (adjusted for age) and for the age groups 18–39, 40–59 and 60–79 years (adjusted for sex). All analyzes were conducted using the Statistical Package for the Social Sciences (IBM SPSS Statistics for Windows, version 27).

4 | RESULTS

The point estimate for new cases between baseline and follow-up revealed a 3-year incidence rate of 17.5% for insomnia and 9.9% for burnout. Prevalence rates for the predictor variables at baseline for those who had developed insomnia at follow-up are shown in Figure 1 for all cases, and separately for the two sexes. Figure 2 shows the prevalence rates for the three age groups. Regarding all cases, the rates were 6.3%–31.9%, with the highest rate for anxiety, and the lowest for hopelessness. Regarding sex, women had higher rates than men on all predictors, with the exceptions of depression, helplessness, and poor self-rated health. With regards to age, the rates for anxiety (45.9% and 33.0%) and stress (21.9% and 19.5%) were highest in the age groups 18–39 years and 40–59 years, respectively, and poor self-rated health (29.0%) and anxiety (25.2%) in the age group 60–79 years.

The prevalence rates at baseline for the predictor variables among those who had developed burnout at follow-up are given in Figures 3 and 4. Among all burnout cases, the rates were 5.6%–32.1%, with the highest rate for anxiety, and the lowest for hopelessness. With respect to sex, women had higher rates than men for some risk factors (e.g. insomnia and anxiety), and men for other factors (e.g. depression and helplessness). Regarding age, anxiety (42.6% and 33.1%) and insomnia (23.8% and 17.9%) showed highest rates in the age groups 18–39 years and 40–59 years, respectively, and poor self-rated health (31.1%) and anxiety (26.5%) in the age group 60–79 years.

Results from the logistic regression analyses regarding risk factors for insomnia are shown in Figures 1 and 2. For the entire insomnia group, the ORs (1.62–2.73) differed significantly from unity for all predictor variables when adjusted for confounding variables. Burnout was the strongest risk factor for insomnia and anxiety was the weakest. Regarding the sexes, except for anxiety in women and hopelessness in men, the ORs for all other risk factors for insomnia differed significantly from unity in women (1.63–2.51) and in men (1.97–3.12). In general, there were small differences in ORs between men and woman, with mostly large overlap in confidence intervals between the sexes, but women tended to have higher ORs for hopelessness and poor self-rated health, whereas men tended to have higher ORs for burnout, anxiety, stress and somatic symptoms. Regarding age, the ORs for burnout, depression, helplessness and stress (1.88–2.42) differed significantly from unity in the age group 18–39 years, all risk factors (1.60–3.27) except for hopelessness and somatic symptoms in the age group 40–59 years, and all risk factors (1.63–3.10) except for depression, stress and somatic symptoms in

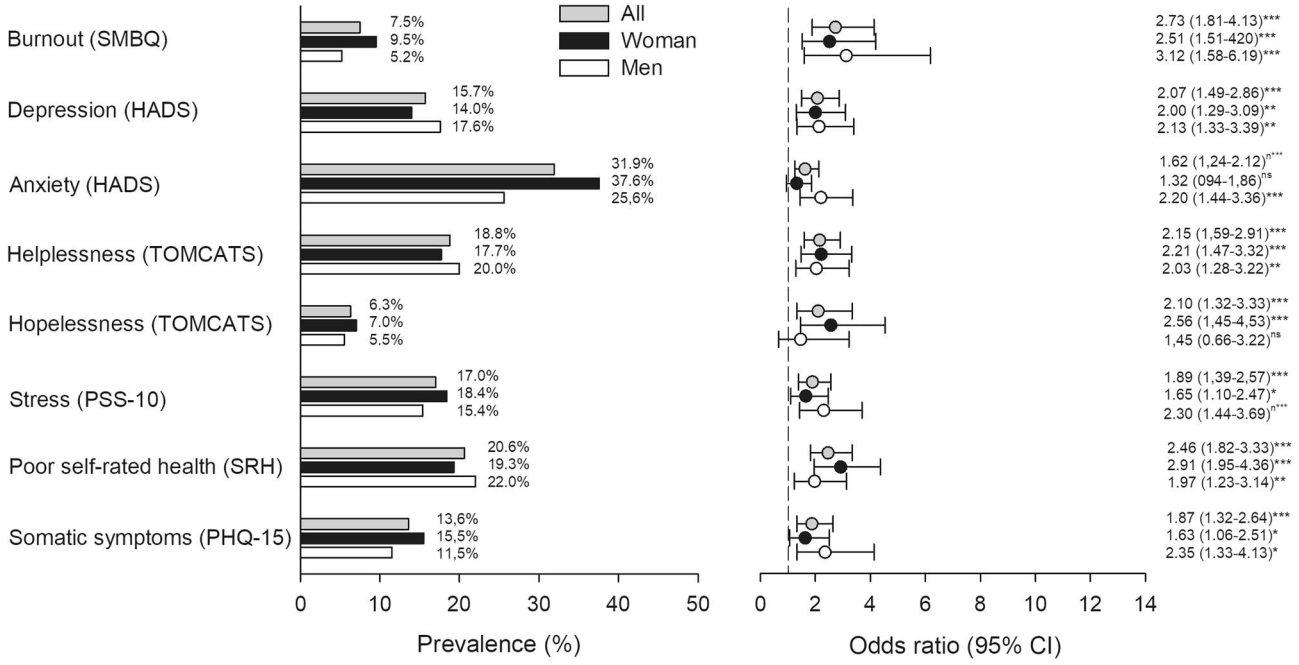

FIGURE 1 Prevalence rates and odds ratios (adjusted for confounding variables) for various conditions at baseline as risk factors for insomnia at follow-up for all participants, women and men (*$p < 0.05$; **$p < 0.01$, ***$p < 0.001$, ^{ns}non-significant)

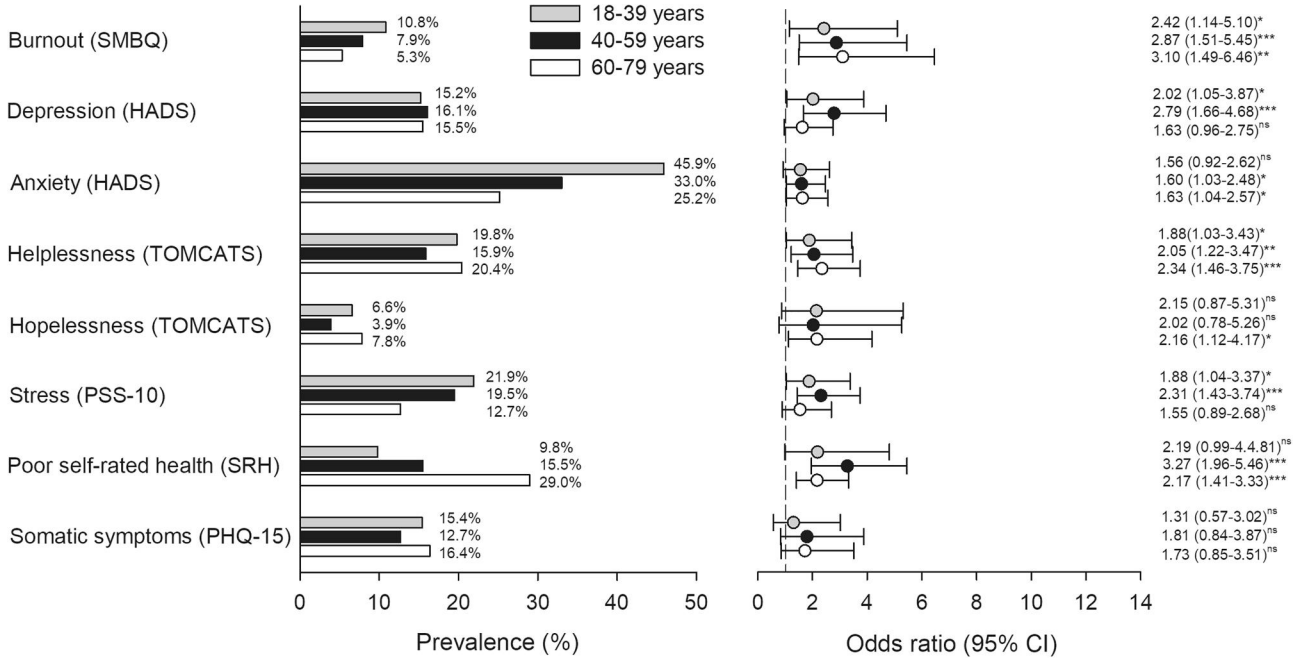

FIGURE 2 Prevalence rates and odds ratios (adjusted for confounding variables) for various conditions at baseline as risk factors for insomnia at follow-up for different age groups (*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$, ^{ns}non-significant)

the age group 60–79 years. There were generally small differences in ORs between the age groups, but depression and poor self-rated health tended to be higher in the age group 40–59 years than in the other two age groups.

The ORs for the risk factors for burnout are shown in Figures 3 and 4. When including all cases with developed burnout, the ORs (2.20–3.37) for all risk factors differed significantly from unity. Somatic symptoms was the strongest and insomnia was the weakest risk factor. Except for hopelessness in men, the ORs for all risk factors for burnout differed significantly from unity in women (2.08–3.90) and in men (2.49–4.31). Women tended to have higher OR than men for hopelessness, and men higher OR than women for somatic

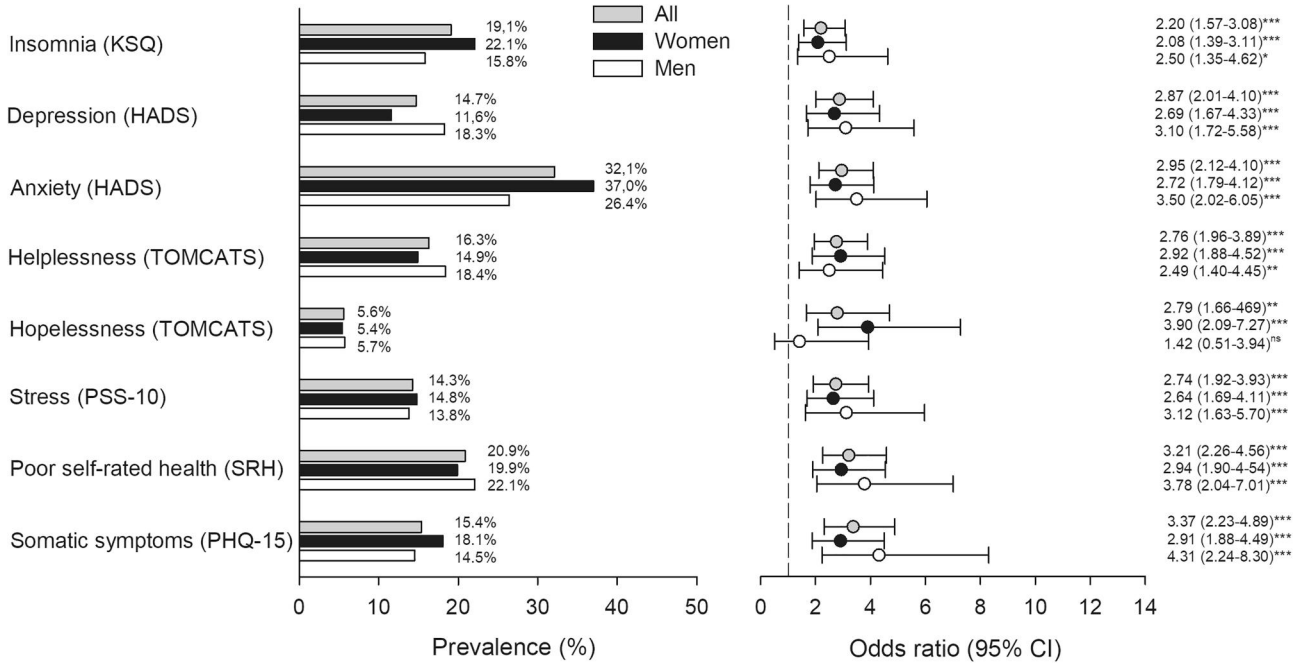

FIGURE 3 Prevalence rates and odds ratios (adjusted for confounding variables) for various conditions at baseline as risk factors for burnout at follow-up for all participants, women and men (*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$, ^{ns}non-significant)

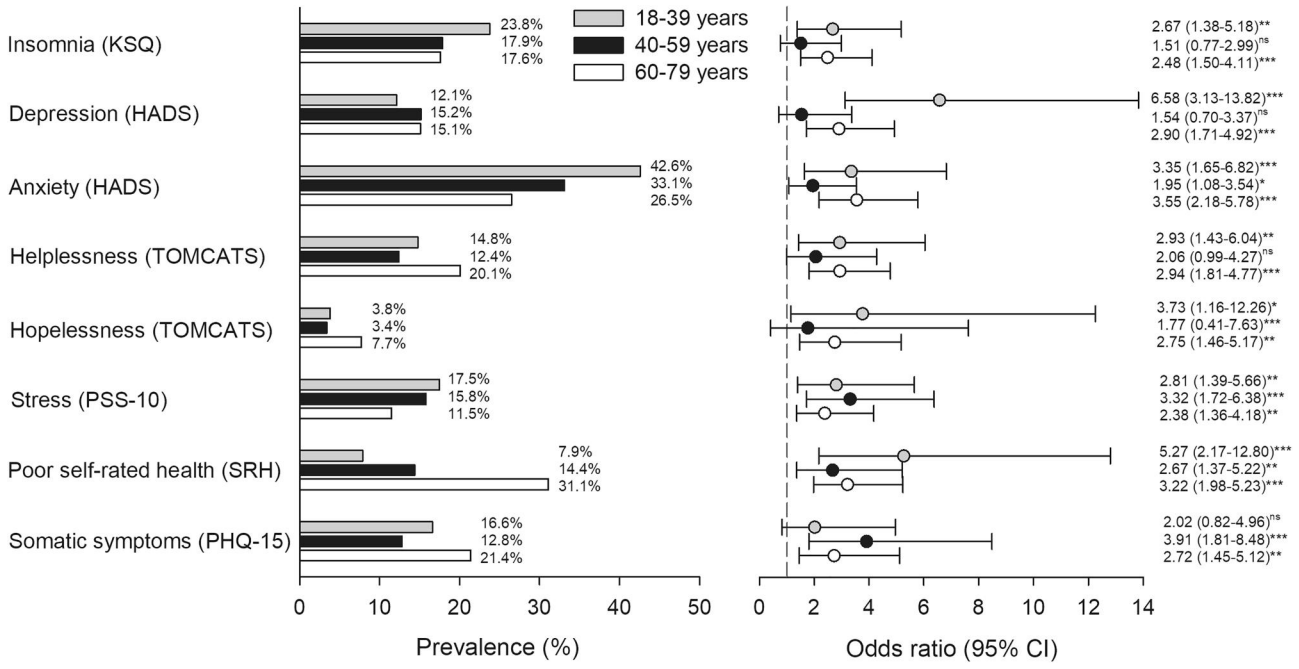

FIGURE 4 Prevalence rates and odds ratios (adjusted for confounding variables) for various conditions at baseline as risk factors for burnout at follow-up for different age groups (*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$, ^{ns}non-significant)

symptoms. Except for somatic symptoms in the age group 18–39 years, depression, helplessness and hopelessness in the age group 40–59 years, the ORs for all risk factors differed significantly from unity in the age group 18–39 years (2.67–6.58), 40–59 years (1.95–3.91), and 60–79 years (2.38–3.55). Depression and poor self-rated health tended to be higher in the age group 18–39 years than in the other two age groups.

5 | DISCUSSION

To our knowledge, this is the first large-scale longitudinal study that takes a broad approach by comparing various psychological and somatic risk factors for both insomnia and burnout. The purpose was to investigate whether various psychological conditions, somatic symptoms and self-rated health can predict the incidence of new

cases of insomnia and burnout at 3-year follow-up in a general adult population. When including all cases, the results show that all studied conditions were risk factors for development of both insomnia and burnout. A general tendency was that psychological risk factors were larger for insomnia, whereas somatic risk factors were larger for burnout.

The results indicate that emotional suffering, such as burnout, anxiety and depression, together with poor self-rated health and feelings of helplessness and hopelessness and somatic symptoms can explain the development of new cases of insomnia.

In contrast to findings of a bidirectional association between insomnia and burnout Armon et al. (2008), Jansson-Frojmark and Lindblom (2010) reported that insomnia predicts burnout, but not vice versa. The present results supporting those of Armon et al. (2008) also suggest that burnout was the strongest among several risk factors for insomnia. From a clinical perspective, looking out for burnout symptoms may be important in the assessment of patients at risk for insomnia.

Insomnia is a known risk factor for depression (Baglioni et al., 2010; Ohayon & Roth, 2003), whereas earlier retrospective studies have indicated that depression might not be associated with the risk of insomnia (Baglioni et al., 2011; Johnson et al., 2006; Ohayon & Roth, 2003). However, the present prospective study showed that depression doubles the risk to develop insomnia at 3-year follow-up, offering support for depression as a precipitating mechanism, to some extent a greater risk factor in middle age. The results are in line with other prospective longitudinal studies using the HADS as an instrument of measure of depression (Jansson & Linton, 2006b; Jansson-Frojmark & Lindblom, 2008).

The prevalence of anxiety at baseline in this study was high (31.9%) and particularly for women (37.6%), whereas the increased risk of insomnia (OR = 1.62) was moderate at 3-year follow-up, and a tendency of higher OR for men. In a cross-sectional study (Ohayon & Roth, 2003), insomnia appeared at the same time or after the anxiety disorder, indicating that the place of anxiety in the course of insomnia is rather close in time. A time-period of 3 years, as in this study, might be a long follow-up period. Still anxiety was found to be associated with a higher risk for insomnia. As a comparison, anxiety was the most prominent mechanism for predicting insomnia in a 1-year prospective study (Jansson-Frojmark & Lindblom, 2008). It is reasonable to assume that the difference in OR can be explained by the timespan from baseline to follow up, one versus 3 years (Lenze & Wetherell, 2011).

Regarding depression and anxiety as risk factors for insomnia, the overlap in diagnostic criteria in the DSM system between depression, anxiety, and sleep disturbance should be emphasised. Thus, all three diagnoses include criteria related to sleep difficulties and lack of energy/feeling tired (American Psychiatric & American Psychiatric Association, 2013). Harvey et al. (2011) suggest underlying mechanisms that include serotonergic and dopaminergic systems that are involved in a range of diagnoses (e.g. insomnia, anxiety, depression). These systems generate problems with fundamental cognitive and emotional regulation. Transdiagnostic interventions that focus on emotion regulation and reducing limbic activity may be helpful in both anxiety and insomnia (Harvey et al., 2007; Ong et al., 2007). Although burnout is not a DSM-5 diagnosis the same reasoning regarding underlying mechanism and emotional regulation can be applied to burnout caseness.

The results further suggests that helplessness, hopelessness and stress were associated with a two-fold increased risk of developing insomnia in this study. Women with hopelessness at baseline had a relatively high risk of developing insomnia. The present results indicate that cognitions about helplessness and negative beliefs and attitudes may be influential in developing insomnia by highlighting the importance of giving attention to the client's appraisal. Examples of this are expectations and monitoring for sleep-related threat, unhelpful beliefs about sleep, and worries/rumination (Harvey et al., 2007; Lazarus & Folkman, 1984; Thomsen et al., 2003). In a therapeutic context it is important for the client to get new experiences that can active behaviour that promotes and leads to other than negative outcomes (e.g. sleep restriction, stimulus control, and sleep hygiene recovery in insomnia, and improving coping skills for stress reduction, relaxation training, mindfulness, physical exercise, and making healthy choices regarding career and personal life in burnout). Emerging a cognitive shift is also important that weakens the association to hopelessness and increases the presence of locus of control, motivation, engagement and hope (Harvey et al., 2007; Lambert, 2013; Nowakowski, 2022; Ong et al., 2007; Ursin & Eriksen, 2010, van Dam, 2021; Vincent et al., 2010).

The subjective health experience (self-rated health), in this study examined with a single question, predicted insomnia as well as multi-question instruments measuring psychological and somatic suffering, making it an appropriate standard question for healthcare practitioners. Worries about somatic health and emotional exhaustion are early signs that need to be addressed in the prevention of insomnia (Espie, 2002; Mavaddat et al., 2011). Our results are in line with prior research (Kawada et al., 2003) (Silva-Costa et al., 2015), showing that self-rated health is associated with onset of insomnia. However, these two studies were cross-sectional, implying associations rather than causality.

Having somatic symptoms was also found in this study to be a risk factor for insomnia, indicating that pain and other somatic symptoms are important in this respect. Since pain involves subjective perception and experience it plays a crucial part of the assessment of psychosomatic risk factors for insomnia. Prior research have also proposed a bidirectional relationship between pain and sleep, since pain can cause difficulties initiating sleep, but pain can also be exaggerated by lack of sleep (Arnison et al., 2022; Ohayon, 2005). The results imply that presence of somatic symptoms in old ages was not a significant contributor to the increased risk for insomnia, and underlies the argument that healthy elderly sleep as well as younger people (Ohayon, 2002).

Regarding burnout as outcome variable, the results indicate that all eight variables were significantly associated with the incidence of new cases of burnout. The inquiry in this study considered whether various psychological conditions and somatic symptoms predict burnout.

Somatic symptoms (OR = 3.37) and poor self-rated health (OR = 3.21) were the strongest risk factors for the development of burnout, which is in line with other studies on perceived health (Hyman et al., 2011). There is extensive literature on the physical consequences of burnout (Salvagioni et al., 2017), but a lack of community-based surveys investigating risk factors of somatic symptoms leading to burnout, making our results rather pioneering. A clinical consequence of the results of this study is that practitioners for a valid assessment should pay attention to patients' somatic symptoms, mental suffering, their appraisals of resources and their everyday functioning.

Having depressive symptoms increased the risk of burnout almost three-fold compared to the referents. Other studies have suggested that burnout under certain conditions may develop into depression (Glass & McKnight, 1996). However, the present study indicates that depression is also an important risk factor to burnout. The younger age group (18–39 years) had higher OR (6.58) than the older age groups for depression. These findings raise the urge to assess depressive symptoms thoroughly in young people at risk for burnout.

There was almost a threefold increased risk of burnout when having anxiety scores above cutoff at baseline, and burnout and anxiety may share similar presenting symptoms, such as sleep disturbance and irritability. Results from Metlaine et al. (2017) showed higher OR (9.8) than in our study, but their study was cross-sectional and examined employees at a company rather than a general population.

Consistent with the results of other studies, our findings support insomnia being a risk factor for burnout at 3-year follow-up (Metlaine et al., 2017; Soderstrom et al., 2012). A prospective study of clinical burnout (Söderström et al., 2012) found that 'too little sleep' was a risk factor for burnout. Over all, insomnia, depression, and anxiety appear to be important clinical markers for development of burnout.

Stress, hopelessness and helplessness showed a two-fold risk for burnout. This suggests that mediating processes including cognitive appraisals of stressful situations, lack of control and low self-efficacy may be important mechanisms for the development of burnout (Caron et al., 1983; McMullen & Krantz, 1988). It is reasonable to conclude that the attributional style of hopelessness and helplessness can increase vulnerability to develop burnout.

The results from the present study imply that possible actions from health care may involve early assessment and treatment of the associated derangements in order to prevent insomnia and burnout. An interpretation of the results offers a possible explanatory model for the development of insomnia and burnout. The model proposes that a precipitating factor, such as stress, is mutually amplified and moderated by emotions intertwined with depression and anxiety, and perpetuating cognitive appraisal and helplessness (Riemann et al., 2001; Thomsen et al., 2003). Overlap in symptoms are arguments that emphasise that many psychiatric disorders are not 'pure' (American Psychiatric & American Psychiatric Association, 2013; Ohayon & Roth, 2003), but instead comorbid and interactive in multiple ways. They have similar vicious circles and processes that maintain them (A. G. Harvey et al., 2011; Harvey et al., 2004). DSM-diagnostic disorder-focussed research might have the flipside of neglecting the interesting and marked common features across disorders.

The strengths of the present study include the use of a prospective design in the general population, and examining the role of various psychological and somatic conditions in insomnia and burnout. The broad approach makes it possible to directly compare the strength of each risk factor. A majority of studies on factors associated with insomnia and burnout are cross-sectional and retrospective. So far, studies have predominantly examined the consequences of poor sleep and insomnia, but not risk factors for insomnia (Benca et al., 1992; Johnson et al., 2006; Lustberg & Reynolds, 2000; Morin et al., 2006; Pagnin et al., 2014). Most studies on burnout have used selected occupational samples and studied one risk factor at the time, and their results may not be representative for the population as a whole. A general population study, as of this kind, contributes to a more generalisable understanding about risk factors (LeBlanc et al., 2009). Burnout is here conceived as a intrapsychic phenomenon. This study, on the other hand, does not answer the question as to whether variables related to burnout regarding external experiences (e.g. workload and role conflicts) contribute to the development of burnout (Burisch, 2002).

There are also methodological limitations to consider. A shortcoming in this study is that only 40% of the sample responded to the baseline questionnaire, compromising the representativeness, although 74% responded at follow-up. The representativeness of young men is weakest, making the interpretation of results from this sub-cohort more uncertain. However, whereas weak representativeness can have considerable consequences for responsiveness regarding prevalence rate, it may be less so for risk factors. Another shortcoming of this study is that the dependent variables were not assessed based on clinical interviews and objective measurements, but instead on self-ratings (KSQ and SMBQ) to identify insomnia and burnout cases. However, the use of self-report instruments with reasonable validity in larger population studies is common and feasible (Nordin, Akerstedt, & Nordin, 2013). In this study, there is a limited number of risk factors examined and it is likely that other potential risk factors (generic factors, previous history of insomnia and burnout, etc.) may contribute to the knowledge of risk factors for insomnia and burnout.

In summary, our results suggest that general disposition towards negative affect, as in states of stress, anxiety, depression, burnout, and insomnia, may be important indicators of risk of the development of insomnia and burnout. Thus, insomnia and burnout are risk factors for each other, which addresses earlier inconsistency on this issue. Moreover, the risk factors for insomnia are quite consistent across sexes and age groups, whereas there are possible age-related variations in certain risk factors for burnout. Stress and negative coping style such as helplessness and hopelessness are also associated with this development. Moreover, a novel result of this study is that somatic symptoms are as important risk factors in developing burnout, but less so in insomnia. In particular, stress-related symptoms and burnout should be targeted in the prevention of insomnia. In addition,

how individuals appraise stress and perceive their health (self-rated health) are also risk factors that need to be assessed in insomnia and burnout prevention. This study contributes with longitudinal data of risk factors for both insomnia and burnout from the population at large. This knowledge can guide how to improve effective public health prevention- and intervention programs to promote better sleep and reduce burnout.

AUTHOR CONTRIBUTIONS

Per Höglund, Maria Nordin, Steven Nordin and Camilla Hakelind and conceptualised and designed the study. Steven Nordin contributed to data acquisition. Per Höglund, Steven Nordin and Camilla Hakelind planned the statistical analyses. Maria Nordin has contributed expert knowledge about insomnia in the manuscript. Per Höglund draughted the manuscript preparation and all co-authors contributed to interpretation and critically revising the manuscript for important intellectual content. All authors have read and approved this final version and are guarantors.

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

DATA AVAILABILITY STATEMENT

Data at group level are available from the corresponding author at reasonable request.

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