

R E V I E W

Sleep health in a bilingual European region: Lessons from a population-based research programme in South Tyrol, Italy

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ABSTRACT

Background: Sleep disorders, including obstructive sleep apnoea, insomnia, and restless legs syndrome, are highly prevalent among European adults, with disease-specific estimates ranging from 10% for insomnia to 18% for obstructive sleep apnoea; however, sleep health remains underrepresented in national public health strategies. Population-based evidence on sleep quality and its broader determinants is scarce in Italy, where the only nationally representative survey was conducted in 2002. This narrative review synthesizes a coordinated sleep health research program in South Tyrol, a bilingual region in Northern Italy.

Methods: Six peer-reviewed publications (2025–2026) based on a representative adult survey (n = 2,090), adolescent mental health screening (n = 1,471), and regional pharmaceutical data were reviewed following the SANRA framework. Contextual literature was identified using PubMed and the Consensus academic search engine.

Results: Among adults, 18% met the criterion for poor sleep quality (B-PSQI ≥ 6), and 28% slept six hours or less. Latent profile analysis identified a Struggling Navigators cluster (25.8%) characterized by poor sleep, low health literacy, and elevated health care utilization. Mistrust of professional health information was independently associated with poor sleep and not mediated by health behaviors. Benzodiazepine consumption was approximately half the national average, offset by higher sedating antidepressant use, mirroring the German-language prescribing culture. Among adolescents, each additional hour of sleep reduced the odds of anxiety by 31% (OR = 0.69; 95% CI: 0.56–0.84) and depression in males by 40% (OR = 0.60; 95% CI: 0.44–0.81). Patient activation partially mediated the chronic disease–sleep relationship (4.7–6.3%) with disease-specific variation.



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Discussion: The findings provide rare European population-based evidence on the health literacy–sleep and patient activation–sleep associations, introduce health information mistrust as a novel correlate of sleep quality, and document culturally shaped prescription patterns within a single national framework. The results support the integration of sleep into public health strategies and offer a replicable model for regional surveillance.

Key words: sleep quality, health literacy, patient activation, adolescent mental health, prescribing patterns, South Tyrol

Background

Sleep disorders are a major public health challenge in Europe. A systematic review covering 47 European countries estimated that obstructive sleep apnoea, insomnia, and restless legs syndrome affect approximately 18%, 10%, and 3% of the adult population, respectively (1), making sleep disorders among the most prevalent non-communicable conditions on the continent. Despite this burden, sleep health remains under-represented in national public health strategies. The annual economic burden exceeds 420 billion euros, accounting for one-quarter of the costs of neurological diseases (1). Despite this impact, sleep health remains under-represented in public health agendas. Experts recommend elevating sleep to the same status as diet and physical activity in health promotion, particularly in Italy (2). Italian National Health Service reviews show chronic disease, aging, and prevention as priorities but exclude sleep health (3).

Sleep quality: concept and measurement

Although sleep quality is common in clinical practice and research, it lacks a universal definition. The National Sleep Foundation defines sleep quality based on sleep continuity, architecture, and daytime napping (4). In the DSM-5-TR, sleep quality dissatisfaction is a criterion for Insomnia Disorder, showing an overlap between poor sleep quality and clinical insomnia (5). The framework includes sleep duration, efficiency, timing, alertness, and satisfaction (6). Owing to its subjective nature, sleep quality measurement relies on validated self-report instruments (7).

This review uses Buysse's multidimensional perspective through the Brief Pittsburgh Sleep Quality Index (B-PSQI) to measure global sleep quality.

Sleep health evidence in Italy

Population-based evidence on sleep quality in Italy is limited to a few studies. A national study by Ohayon and Smirne from two decades ago reported insomnia symptoms in 27.6% of the participants, sleep dissatisfaction in 10.1%, and DSM-IV insomnia disorder in 7.0% (8). Regional data include the MEAL study in Sicily, which found 32.1% of poor sleepers (9), and the CHRIS study, which examined sleep quality in relation to affective temperaments (10). During the COVID-19 pandemic, surveys showed an increased prevalence of poor sleep quality prevalence of 38.8-57.1% during lockdown (11,12). Current Italian evidence lacks a systematic, non-pandemic, regional assessment of the broader determinants and consequences of poor sleep. A national survey of 4,321 Italian adolescents found that 41.3% did not meet the recommended sleep duration, with earlier bedtimes in Northern versus Central and Southern Italy (13). In Lombardy, HBSC data revealed 28-34% of adolescents had sleep difficulties, which were linked to screen time, school pressure, and low social support (14,15). Poor sleep quality is independently associated with suicidal ideation among Italian adolescents (16). These findings highlight sleep as a modifiable risk factor for adolescent mental health, aligning with 24-hour movement guidelines (17), although no study has combined adolescent and adult sleep data regionally.

Research gaps: health literacy, patient activation, trust, and prescribing

Regional variation in health outcomes is well documented in Italy's health system. The Global Burden of Disease analysis showed that the northern regions have a higher life expectancy than the southern regions, with persistent economic and service quality disparities (18). Health literacy disparities exist: 40-50% of Italian adults have low health literacy, with Southern Europe showing worse outcomes than the North (19). While low health literacy correlates with poorer health and higher hospitalization rates, its relationship with sleep quality remains understudied in Europe. A Shanghai study found that lower eHealth literacy was linked to poorer sleep quality (20), and a Canadian study showed that mental health literacy improved students' sleep quality (21). Patient activation, defined as an individual's knowledge, skills, and confidence in managing their health, has received little attention regarding sleep quality in European primary care populations. While patient activation predicts better self-management and health outcomes in chronic disease (22,23), and European guidelines recommend CBT-I as a first-line treatment (24), evidence linking activation to sleep quality remains scarce. A European survey found that adults with low self-management were 2.6 times more likely to report low vitality and sleep disorders (25), yet the relationship between activation and standardized sleep quality remains understudied. Trust in health information may be a psychosocial determinant of sleep quality. Distrust of healthcare systems correlates with poorer self-rated health (26), and the information environment is considered a social determinant of health (27). In multilingual regions with multiple media environments, the relationship between trust and health outcomes is complex. The relationship between trust in professional health information and sleep quality has not been explored. Pharmacological treatment patterns for sleep disorders vary across regions, although within-country analyses are limited. An Italian study of psychotropic drug sales (1975-1984) showed higher consumption in Northern and Central regions versus the South (28), while a study of youth prescriptions (2006-2011) found minimal regional variation (29).

The regional patterns of hypnotic and sedative drug use in Italian adults remain unexamined. The European insomnia treatment guideline notes cross-country differences in hypnotic use but lacks data from Italy (24).

South Tyrol as a study setting

South Tyrol, a bilingual region in northern Italy with 70% German-speaking and 25% Italian-speaking inhabitants, combines Italian and German-speaking Alpine cultural influences (30). Its autonomous status grants healthcare independence, with demographics differing from the Italian averages (31). These features make it ideal for studying how cultural, linguistic, and structural factors influence health behaviors, including sleep (Figure 1).

Between 2025 and 2026, the Institute of General Practice and Public Health Bolzano and the Provincial Institute for Statistics published studies on sleep health in South Tyrol. Six peer-reviewed publications, drawing on a representative adult population survey ($n = 2,090$), a school-based adolescent mental health screening ($n = 1,471$), and regional pharmaceutical dispensing data, examined the prevalence and determinants of poor sleep quality, its associations with health literacy, patient activation, trust in health information, and healthcare utilisation in adults, sleep as a protective factor for anxiety and depression in adolescents, and regional patterns of sedative psychotropic prescribing (32-37) (Tables 1 and 2).

Aim and scope of this review

This study provides a synthesis of findings, contextualizing them within Italian and European evidence, and discusses the implications for sleep health policy. This review addresses (a) the current state of sleep health in South Tyrol's adult and adolescent population, (b) how health literacy, trust in health information, patient activation, and chronic disease relate to sleep quality, (c) regional pharmacological treatment patterns compared to national norms, and (d) lessons for integrating sleep health into Italian public health strategies.

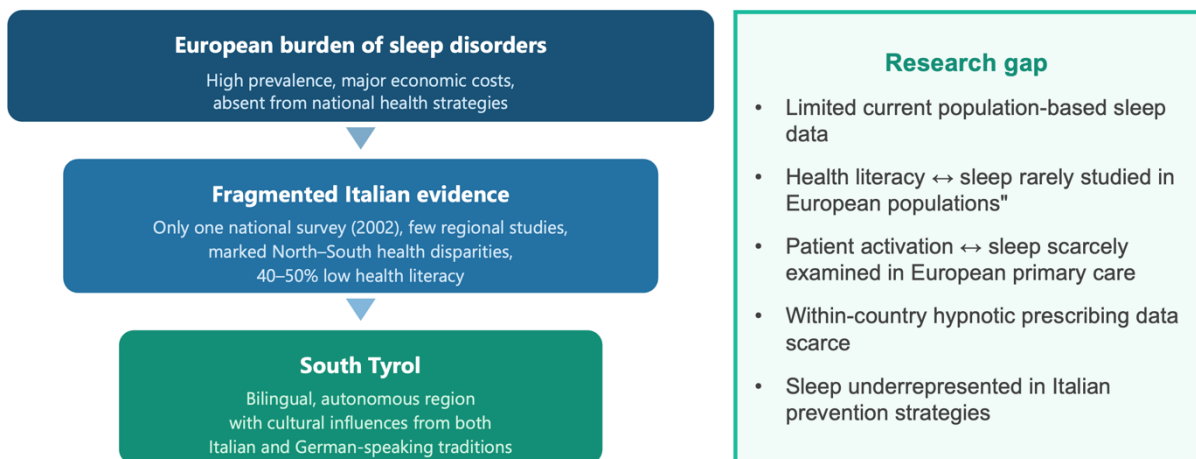


Figure 1. Rationale for a population-based sleep health research program in South Tyrol, Italy. The figure shows an argumentative framework. The left panel presents the context of the European sleep disorder burden through Italian evidence to South Tyrol as the study region. The right panel outlines the research gaps identified in the narrative review that the South Tyrolean program publications address. Research gaps are stated relatively, reflecting the narrative nature of this literature search.

Methods

Review design and reporting standard

This narrative review synthesizes findings from a sleep health research program in South Tyrol, Italy. Following the Scale for the Assessment of Narrative Review Articles (SANRA) (38), we ensured methodological transparency. SANRA evaluates reviews across six domains: importance justification, aim formulation, literature search description, referencing, scientific reasoning, and outcome data presentation. This review was structured to meet these requirements.

Literature search strategy

A contextual literature search was conducted in two phases in February 2026. First, a PubMed search was performed to identify Italian and European evidence on the prevalence and determinants of sleep disorders, regional health disparities, and pharmacological treatment patterns: (“sleep disorders” (MeSH) OR “sleep quality” (tiab) OR “insomnia” (tiab)) AND (“Italy” (tiab) OR “Italian” (tiab)) AND (“prevalence” (tiab) OR “epidemiology” (MeSH) OR “regional” (tiab) OR “prescribing” (tiab) OR “health policy” (tiab)). PubMed/MEDLINE was also searched to identify studies

reporting on the association between health literacy and sleep quality using the following strategy: (“health literacy” (MeSH) OR “health literacy” (tiab)) AND (“sleep quality” (tiab) OR “Pittsburgh Sleep Quality Index” (tiab) OR “PSQI” (tiab) OR “insomnia” (tiab) OR “sleep disturbance” (tiab)). Both searches were performed without restrictions on language or publication date. The reference lists of the retrieved articles were screened for additional relevant publications. In the second phase, a Consensus AI-powered academic search engine (consensus.app) was used to supplement the PubMed search. Eight predefined review questions guided the consensus queries: (1) prevalence of sleep disorders in the Italian adult population, (2) regional sleep studies in Italy, (3) sleep in Italian health policy, (4) regional psychotropic prescribing patterns in Italy, (5) adolescent sleep and mental health in Italy, (6) health literacy and sleep in Europe and Italy, (7) patient activation and sleep in European primary care, and (8) North-South health disparities in Italy. Consensus Pro was used to identify relevant publications that may have been missed by the structured PubMed search, particularly in interdisciplinary domains such as health literacy and patient activation. All references identified through either search tool were verified manually, and only peer-reviewed publications and official statistical reports were included.

The South Tyrol sleep health research programme

The six publications reviewed in this paper were derived from a collaborative research program between the Institute of General Practice and Public Health at the College of Health Professions Claudia, Bolzano, and the Provincial Institute for Statistics (ASTAT) of the Autonomous Province of Bolzano-South Tyrol.

Study population and sampling

The adult studies (32–34,36) were based on a representative cross-sectional survey of the general population of South Tyrol in 2024. ASTAT drew a stratified random sample of 4,000 residents aged 18+ from the provincial population register, stratified by age group (18–34, 35–54, and ≥55 years), sex, language group (German and Italian), and area (urban and rural). Of these, 2,090 completed questionnaires were returned (response rate: 52.2%). The questionnaires were available in German and Italian, with the choice of language left to the respondents. The sample represented the South Tyrolean adult population for all stratification variables in this study. The adolescent study (35) used data from the COP-S (Corona and Psyche South Tyrol) monitoring program, a cross-sectional screening of mental health in students aged 11–19 years in South Tyrolean schools. Data from the 2025 survey (n = 1,471) were used, with screening conducted using standardized instruments across German- and Italian-language schools. The study represented age and gender within the school-attending population. The prescribing study (37) used the IQVIA pharmaceutical database (public and private prescriptions), which captures medications dispensed by the National Health Service (SSN) and purchased privately, and analyzed defined daily doses per 1,000 inhabitants per day for psycholeptics (ATC N05) and psychoanaleptics (ATC N06) in South Tyrol and Italy from 2019 to 2023.

Instruments

The adult survey employed the following validated instruments, each available in German and Italian: Detailed information on instrument selection,

psychometric properties, and validated language versions is provided in the original publications (32–34,36).

- Brief Pittsburgh Sleep Quality Index (B-PSQI): an abbreviated version of the PSQI that assesses global sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, and daytime dysfunction over the past month. Scores of ≥6 indicate poor sleep quality.
- European Health Literacy Survey Questionnaire (HLS-EU-Q16): A 16-item instrument measuring self-perceived difficulty in accessing, understanding, appraising, and applying health information. Scores were categorized as inadequate, problematic, sufficient, or excellent health literacy.
- Patient Activation Measure (PAM-10): A 10-item instrument assessing knowledge, skills, and confidence for self-management of health. Higher scores indicated greater activation.
- Additional items assessed trust in health information sources, healthcare utilization (general practice contacts, emergency department visits), chronic disease burden, sleep hygiene behaviors, sociodemographic characteristics, and language groups.

Adolescent screening used the Patient Health Questionnaire for Adolescents (PHQ-A) for depression, the Generalized Anxiety Disorder scale (GAD-7) for anxiety, and the Strengths and Difficulties Questionnaire (SDQ) for general mental health problems (for details on instrument selection and psychometric properties, see (35)). Sleep duration was assessed using a single item.

Analytical approaches across the six publications

The six publications employed distinct analytical strategies to address different research questions using a shared data source. Table 1 provides an overview of the study.

The study populations and key findings are presented in Table 2.

Table 1. Overview of the six publications in the South Tyrol Sleep Health Research Programme.

Ref.	First author (year)	Journal	Instruments / data sources	Key analytical approach
(33)	Ausserhofer et al. (2025)	<i>Clocks & Sleep</i>	B-PSQI, sociodemographics, sleep hygiene items, chronic disease	Multivariable logistic regression
(32)	Ausserhofer et al. (2025)	<i>Behavioral Sciences</i>	B-PSQI, HLS-EU-Q16, PAM-10, healthcare utilisation (GP, ED contacts)	Latent profile analysis (Gaussian mixture modelling)
(34)	Ausserhofer et al. (2025)	<i>Healthcare</i>	B-PSQI, trust in health information sources, preventive health behaviour items	Multivariable logistic regression
(37)	Wiedermann et al. (2025)	<i>Pharmacy</i>	IQVIA pharmaceutical database (public and private prescriptions), WHO ATC classes N05 and N06	Descriptive pharmacoepidemiological analysis, DDD/1,000 inhabitants/day
(35)	Barbieri et al. (2026)	<i>Frontiers in Public Health</i>	GAD-9, PHQ-2, SDQ, GPIUS-2, HLSAC, MSPSS, sleep duration item	Stepwise logistic regression, repeated cross-sections (2021–2025)
(36)	Wiedermann et al. (2025)	<i>Clocks & Sleep</i>	B-PSQI, PAM-10, self-reported chronic diseases (by type and number)	Mediation analysis (PROCESS; direct and indirect effects)

Abbreviations: AIFA, Agenzia Italiana del Farmaco; B-PSQI, Brief Pittsburgh Sleep Quality Index; DDD, defined daily doses; ED, emergency department; GAD-9, Generalized Anxiety Disorder scale (9 items); GP, general practitioner; GPIUS-2, Generalized Problematic Internet Use Scale 2; HLSAC, Health Literacy for School-Aged Children; HLS-EU-Q16, European Health Literacy Survey Questionnaire (16 items); MSPSS, Multidimensional Scale of Perceived Social Support; PAM-10, Patient Activation Measure (10 items); PHQ-2, Patient Health Questionnaire (2 items); SDQ, Strengths and Difficulties Questionnaire.

Table 2. Key findings and novel contributions of the six publications of the South Tyrol Sleep Health Research Program.

Ref.	Focus	Sample	Key findings	Novel contribution
(33)	Prevalence and determinants of poor sleep quality	Adults, n = 2,090	Of the participants, 18.0% were poor sleepers (B-PSQI ≥ 6), and 28.0% slept ≤ 6 h. Sleep hygiene awareness was the most significant protective factor. Female sex, Italian language, lower education, and chronic disease were independently associated with poor sleep.	First population-representative, non-pandemic regional sleep survey in Italy since Ohayon and Smirne (2002). Language-group differences in circadian timing within a single administrative region.
(32)	Healthcare utilisation profiles based on sleep, HL, and PA	Adults, n = 1,645	Three latent profiles were identified: Balanced Self-Regulators (72.8%), Struggling Navigators (25.8%), and Hyper-Engaged Users (1.4%). Sleep quality was the most discriminating variable between profiles. Struggling Navigators: lower HL, lower PA, and more GP and ED contacts.	This is the first European population-based study to examine the joint distribution of health literacy, patient activation, and sleep quality.
(34)	Health information mistrust and sleep quality	Adults, n = 2,090	Lower trust in professional health information sources was independently associated with poor sleep quality. Association not mediated by preventive health behavior (vaccination, health examinations).	Novel identification of health information mistrust as an independent psychosocial correlate of sleep quality, not operating through health behavior pathways.

Table 2 (Continued)

Ref.	Focus	Sample	Key findings	Novel contribution
(37)	Regional sedative prescribing patterns	Aggregate pharmaceutical data, 2019–2023	Benzodiazepine consumption was approximately 50% of the Italian national average, with a declining trend. Proportionally higher use of sedating antidepressants (trazodone and mirtazapine). This pattern mirrors the German-speaking prescribing culture (DGSM guidelines).	First within-country analysis of regional hypnotic prescribing patterns in the adult Italian population. Documents the cultural influence of language-specific medical education on prescribing behavior.
(35)	Gender-specific adolescent mental health and sleep	Students aged 11–19, n = 1,471	A total of 33.3% were above the threshold for ≥ 1 mental health problem (39.8% females, 26.7% males). Each additional hour of sleep: OR = 0.69 (0.56–0.84) for anxiety (both sexes); OR = 0.60 (0.44–0.81) for depression (men). Anxiety prevalence stable 2021–2025; depression decreased.	Sleep was quantified as a protective factor with specific risk estimates. No differences were observed between German- and Italian-language schools, supporting universal prevention.
(36)	Patient activation, chronic disease, and sleep quality	Adults, n = 2,090	Higher PAM-10 scores were associated with better sleep ($\beta = -0.022$, $p < 0.001$). Chronic disease partially mediated the activation–sleep relationship (4.7–6.3% of the total effect). The strongest activation–sleep association was observed in hypertension ($\rho = -0.178$) and mental illness ($\rho = -0.220$).	First European population-based data on the association between patient activation and sleep quality. This demonstrates that activation benefits are condition-specific and not universal.

Abbreviations: B-PSQI = Brief Pittsburgh Sleep Quality Index; DGSM = Deutsche Gesellschaft für Schlafforschung und Schlafmedizin (German Sleep Society); ED = emergency department; GP = general practitioner; HL = health literacy; OR = odds ratio; PA = patient activation; PAM-10 = Patient Activation Measure.

Results

Prevalence and determinants of poor sleep quality in the adult population

The first population-based sleep quality assessment in South Tyrol surveyed 2,090 adults using the Brief Pittsburgh Sleep Quality Index (B-PSQI) (33). Of the respondents, 18.0% were poor sleepers (B-PSQI ≥ 6), and 28.0% reported sleeping six hours or less nightly. Sleep maintenance difficulties affected 13.0% of respondents, while 9.0% reported sleep onset delays exceeding 30 min. Marked sociodemographic differences were observed. Women reported sleep issues twice as frequently as men did. Older adults (≥ 55 years) had more sleep maintenance problems, whereas younger adults (18–34 years) experienced sleep onset difficulties due to screen use. Italian speakers reported poorer sleep quality than German speakers, with one-third having bedtimes after 23:00

compared to one-seventh of the German speakers. Sleep hygiene awareness emerged as the strongest protective factor in the logistic regression analysis. Those who paid attention to sufficient sleep had lower odds of poor sleep quality. Sleep medication use alone was linked to poor sleep quality, aligning with guidelines favoring cognitive behavioral approaches. After adjustment, female sex, Italian background, lower education, and chronic disease were associated with poorer sleep quality.

Sleep quality, health literacy, and healthcare utilisation

A latent profile analysis using Gaussian mixture modelling identified adult subgroups based on sleep quality (B-PSQI), health literacy (HLS-EU-Q16), patient activation (PAM-10), and total primary healthcare contact (32). Data were available for 1,645 participants. A three-cluster solution best fit

the model (Bayesian Information Criterion = 19,518; silhouette coefficient = 0.130). The profiles were as follows: “Balanced Self-Regulators” (72.8%) with adequate sleep, higher literacy and activation, moderate healthcare use; “Struggling Navigators” (25.8%) with poor sleep, lower literacy and activation, above-average healthcare use; and “Hyper-Engaged Users” (1.4%) with high service contact. Sleep quality was the key differentiator between Balanced Self-Regulators and Struggling Navigators ($p < 0.001$). Struggling Navigators had lower literacy and activation, higher chronic disease rates, and more healthcare contacts than the other groups. Multinomial logistic regression showed that poor sleep and inadequate literacy were strong predictors of high-utilization profiles. This is the first European study to examine the combined effects of health literacy, patient activation, and sleep quality on healthcare use.

Health information mistrust as a direct correlate of sleep quality

An analysis of adult survey data examined whether trust in health professionals was independently associated with sleep quality (34). Respondents with lower trust in professional sources showed poorer sleep quality in multivariable regression after adjusting for demographic factors and chronic disease status. While individuals with lower trust reported less participation in preventive examinations and vaccination, these behaviors did not mediate the trust-sleep association. This suggests that health information mistrust may directly affect sleep quality as a psychosocial stressor. This novel finding indicates that trust-building information strategies may improve both preventive program adherence and sleep outcomes.

Regional prescribing patterns for sedative psychotropic drugs

An analysis of pharmaceutical sales data from South Tyrol’s provincial health service and the Italian Medicines Agency (AIFA) revealed distinct regional prescribing patterns for sedative psychotropics (37). Using defined daily doses per 1,000 inhabitants per

day during 2019–2023, benzodiazepine consumption in South Tyrol was half the Italian national average and was declining. Sedating antidepressant usage, particularly trazodone and mirtazapine, exceeded the national average, in contrast to Italy’s predominant use of benzodiazepines for insomnia. South Tyrol’s prescribing pattern aligns with German-speaking countries, where German Sleep Society guidelines prefer sedating antidepressants and cognitive behavioural therapy for insomnia over benzodiazepines. This is likely due to the influence of German-language medical education in the region, marking the first regional analysis in Italy.

Patient activation, chronic disease, and sleep quality

The relationship between patient activation (PAM-10) and sleep quality (B-PSQI) was examined using mediation analysis, with chronic disease burden as a mediator (36). Among the 2,090 adult respondents, 918 (44.0%) had at least one chronic disease. Those with chronic disease showed poorer sleep quality (B-PSQI mean: 5.05 ± 3.26 vs. 3.66 ± 2.65 ; $p < 0.001$) and lower patient activation (PAM-10 mean: 54.4 ± 12.7 vs. 57.2 ± 12.5 ; $p < 0.001$), with small effect sizes. Higher activation was correlated with better sleep across most chronic disease groups, with significant associations in hypertension ($\rho = -0.178$, $p < 0.001$) and mental illness ($\rho = -0.220$, $p = 0.015$). Multiple regression analysis showed that chronic disease, female sex, older age, and Italian language predicted poorer sleep, whereas higher PAM-10 scores and university education predicted better sleep quality. Patient activation partially mediated the chronic disease–sleep quality relationship, accounting for 4.7% of the total effect in the age-adjusted model. Higher patient activation showed a modest association with better sleep quality but did not offset the direct impact of chronic diseases on sleep. Sleep disturbances persisted in conditions with physical symptoms, whereas stronger activation-sleep associations appeared in patients with hypertension and mental illness. This suggests that patient activation support must be combined with targeted symptom control for effective sleep management in chronic diseases.

Sleep as a protective factor for adolescent mental health

The COP-S survey screened 1,471 students aged 11-19 years across German- and Italian-language schools in South Tyrol using the PHQ-A, GAD-7, and SDQ (35). Eleven% screened positive for depression and 28% for anxiety, with one-third showing elevated psychological distress. Gender differences were significant: 40% of females versus 27% of males screened positive for mental health problems ($p < 0.05$), with 45% of females and 35% of males showing comorbidities. Each additional hour of sleep reduced anxiety odds by 31% (OR = 0.69; 95% CI 0.56-0.84; $p < 0.001$) for both sexes, with stronger depression protection in males (OR = 0.60; 95% CI 0.44-0.81). Regular physical activity reduced the odds of anxiety (males: OR = 0.63; females: OR = 0.60). High school burden (OR = 3.48-3.72) and problematic Internet use (OR = 2.46-2.75) were major risk factors. For girls, low health literacy (OR = 0.53) and single-parent status (OR = 1.77) predicted mental health problems, whereas low social support affected boys (OR = 0.58). Anxiety levels remained stable from 2021-2025 to, while depression decreased. No differences emerged between the German- and Italian-speaking populations, suggesting that universal prevention approaches are suitable.

Discussion

This review synthesises six population-based studies on sleep health in South Tyrol using adult surveys, adolescent screening, and pharmaceutical data (Table 2). The findings show that 18% of adults have poor sleep quality, with over 25% sleeping six hours or less nightly (33); 25% show poor sleep with low health literacy and high healthcare use (32); mistrust of health information correlates with poor sleep (34); benzodiazepine use is half of Italy's average, with higher sedating antidepressant use (37); one-third of adolescents show psychological distress, with sleep protecting against anxiety and depression (35); and patient activation correlates with better sleep quality (36). These findings link sleep health to sleep hygiene, health literacy, trust, prescribing practices, and mental health.

Contextualisation within Italian and European evidence

ADULT SLEEP QUALITY

The prevalence of poor sleep quality among South Tyrolean adults (18%) is lower than that reported for the Italian population (27.6% insomnia symptoms) (8) and the MEAL study (32.1% poor sleepers) (9). While comparisons are limited by methodological differences, this aligns with Italy's North-South health gradient, showing better health indicators in the northern regions (18). However, with 28% of the population reporting six hours or less of sleep and notable sex- and language-group differences, a significant proportion of the population falls below the recommended thresholds. Italian-speaking respondents' later bedtimes and poorer sleep quality compared to German speakers suggest cultural differences in circadian behavior beyond socioeconomic factors. The Cooperative Health Research in South Tyrol (CHRIS) study assessed sleep quality using the 19-item PSQI in 3,701 adults aged 18-65 from the German-speaking Vinschgau valley (10). Their mean PSQI score of 4.18 ± 2.52 suggests sleep quality comparable to that in our survey. However, direct comparisons are limited by differences in instruments, age range, and population coverage: CHRIS focused on a rural German-speaking valley, while our study sampled the entire province, including Bolzano and both language groups. The CHRIS study found that cyclothymic temperament was associated with poorer sleep quality, whereas hyperthymic temperament showed protective effects, highlighting personality-related sleep determinants that complement the factors examined (10). The 18% prevalence of poor sleep quality in South Tyrol is lower than the disease-specific estimates reported in the pan-European systematic review, which found prevalences of 10% for insomnia and 18% for obstructive sleep apnoea (1), although direct comparison is limited by differing outcome definitions: the South Tyrolean data capture subjective sleep quality (B-PSQI ≥ 6), whereas the European estimates refer to specific diagnostic categories. This regional survey uniquely combines measurements of sleep quality, health literacy, patient activation, and healthcare utilization.

Health literacy, patient activation, and sleep

Latent profile analysis (32) provides the first European population-based evidence of health literacy, patient activation, and sleep quality distribution. The Struggling Navigators cluster, characterized by poor sleep, low health literacy, low patient activation, and high healthcare use, identifies a subgroup that is poorly equipped for health management while heavily relying on healthcare. This complements a Chinese study linking lower eHealth literacy to poor sleep (20) and a Canadian study in which mental health literacy improved sleep outcomes (21). The South Tyrolean data demonstrate this association using the HLS-EU-Q16, showing health literacy as part of a broader profile of health competencies and resource use. A mediation analysis of patient activation (36) showed that higher activation was associated with better sleep quality, although the effects were modest (4.7–6.3% mediation) and varied across chronic diseases. Stronger activation-sleep links appeared in conditions where behavioral self-management is crucial (hypertension and mental illness), while in conditions dominated by physical symptoms (renal disease, pulmonary disease, and cancer), sleep disturbances persisted regardless of activation. This pattern aligns with findings showing that angina, arthritis, and depression have the strongest associations with severe sleep problems, with clear relationships between the number of chronic conditions and sleep disturbance severity (39,40). The activation literature indicates the strongest effects for health behaviors and the weakest for disease severity-determined outcomes (22,23). Clinically, activation interventions should complement targeted symptom management, supported by evidence that cognitive behavioral therapy produces meaningful sleep improvements in chronic diseases (41).

Health information mistrust

Mistrust of professional health information sources is independently associated with poor sleep quality beyond health behaviors (34), introducing a novel psychosocial dimension to sleep determinants. Lower trust was not mediated by reduced preventive health behaviors, suggesting that mistrust may act as

a chronic psychosocial stressor that directly impairs sleep. This aligns with evidence that healthcare system distrust is associated with poorer self-rated health, independent of access and behaviors (26), and the broader view of institutional mistrust as a social health determinant (27). The mechanism parallels the effects of discrimination on sleep quality, with studies showing persistent associations across multiple sleep outcomes (42,43). In South Tyrol's bilingual health system with dual media exposure, trust may be affected by mixed messaging. Therefore, building trust may directly contribute to improved health outcomes, including sleep.

Regional prescribing patterns

A prescribing analysis (37) revealed a unique regional pattern in Italy. Benzodiazepine consumption in South Tyrol is half the national average, while sedating antidepressant usage is higher, reflecting German-speaking countries' practices, where guidelines recommend cognitive behavioral therapy first and limit benzodiazepines to four-week use (44). A European consensus reinforces this position, highlighting the risks of long-term benzodiazepine use (45). While European guidelines show cross-country variation in prescribing (44), South Tyrolean data indicate that cultural and linguistic influences on medical education affect prescribing within the national frameworks. This aligns with English studies showing that physicians' training region predicts prescribing patterns (46), and that cultural background influences benzodiazepine prescribing (47). The 2019–2023 decline in benzodiazepine use matches global trends (48). South Tyrol's low benzodiazepine use and shift to sedating antidepressants reflect German-language prescribing practices, exceeding most European settings' progress (49). However, the clinical impact of this finding requires further investigation.

Adolescent mental health and sleep

The COP-S 2025 data (35) show elevated adolescent mental health problems in the post-pandemic period. The prevalence of anxiety (27.9%) aligns with the 25% reported in the German COPSYS study through late 2022 (50). A European meta-analysis of 750,000

children confirmed increased anxiety during the pandemic, particularly in countries with extended school closures (51), including the Philippines. COP-S data showed stable anxiety across survey waves (2021–2025) (35,52,53), while depression decreased, indicating partial post-pandemic recovery. Each additional hour of sleep reduced anxiety odds by 31% in both sexes (OR = 0.69; 95% CI: 0.56–0.84), aligning with meta-analysis findings that insufficient sleep increases mood deficits by 55% (54). A Norwegian cohort study showed that longer sleep predicted lower anxiety and depression (55). Sleep, school stress, Internet use, and physical activity are key modifiable factors for adolescent mental health. Males showed stronger protection against depression (OR = 0.60; 95% CI 0.44–0.81), highlighting the importance of sleep within the 24-hour movement guidelines (55). A review found that meeting all movement recommendations reduced depressive symptoms (17), with US data showing 21% depression probability in guideline-adherent teens versus 38% in non-adherent teens (56). Gender-specific patterns suggest differentiated prevention approaches, whereas language differences were insignificant.

Policy implications

The South Tyrolean findings support the integration of sleep health into public health strategies. The Lancet Public Health identified Italy among the countries needing better sleep health policy incorporation (2), as sleep remains absent from the Italian National Health Service's prevention priorities (3). The data suggest several key interventions. The Struggling Navigators cluster (32), representing 25% of adults, requires targeted interventions that combine health literacy promotion and primary care coordination. Given that low trust correlates with poor sleep (34), culturally adapted communication strategies are necessary to improve sleep quality. Prescribing data (37) show that reducing benzodiazepine use is achievable when it is aligned with evidence-based recommendations. The South Tyrolean model could guide national efforts to deprescribe benzodiazepines. Adolescent data (35) supports integrating sleep promotion into school mental health programs, given the protective effect of sleep on anxiety and depression. Language group

differences in adult sleep quality (33,36), but not in adolescent outcomes (35), suggest that cultural influences on sleep develop during adulthood, warranting further investigation.

Strengths and limitations

This review integrates six methodologically coherent studies that used shared data sources and validated instruments. Population-based sampling (ASTAT for adults; COP-S screening for adolescents), established German and Italian instruments, and combined survey, pharmaceutical, and screening data provide comprehensive evidence beyond typical single studies. The SANRA-guided structure ensures methodological transparency of the review. This study has several limitations. The six publications use data from South Tyrol, a region with unique demographic, cultural and administrative characteristics. Its autonomous status, bilingual population, and high socioeconomic level limit the generalizability to other Italian regions, especially southern regions with different conditions. The adult survey uses self-reported data, including B-PSQI sleep quality assessment rather than polysomnography, and its cross-sectional design prevents causal inferences. The 52.2% response rate may have introduced selection bias if non-respondents differed in sleep quality or health literacy. Adolescent data rely on screening instruments rather than clinical diagnoses, with a 23% response rate in the COP-S 2025 survey. The prescribing analysis uses aggregate sales data and does not capture individual patterns or diagnostic indications. While comprehensive, this review is not systematic, lacking formal risk-of-bias assessment, and uses PubMed and AI-supported literature identification rather than an exhaustive systematic search.

Conclusions

The South Tyrolean Sleep Health Research Programme shows how a population-based approach to sleep epidemiology can provide evidence across prevalence, health system determinants, pharmacoepidemiology, and adolescent mental health. Poor sleep quality correlates with modifiable factors, including health

literacy deficits, mistrust of health information, limited self-management capacity, and prescribing patterns. This study provides European evidence on health literacy-sleep associations, identifies health information mistrust as a sleep quality correlate, documents regional prescribing aligned with European guidelines, and shows the protective effect of sleep on adolescent mental health. The variation in patient activation-sleep relationships indicates that self-management promotion requires targeted symptom control, especially for physical conditions. These findings support the integration of sleep health into Italian and European public health strategies through health communication, school prevention, and primary care. The program offers a model for regional sleep surveillance that is adaptable to other health systems.

Conflict of Interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

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References

1. Bassetti CLA, Welter LS, Montes-Martinez M, Mühlberger N, Boon P, Berger T, et al. Epidemiology and economic burden of sleep disorders in Europe. *Eur J Neurol.* 2026;33:e70463. doi:10.1111/ene.70463
2. Lim D, Najafi A, Affi L, Bassetti C, Buysse D, Han F, et al. The need to promote sleep health in public health agendas across the globe. *Lancet Public Health.* 2023 Oct;8(10):e820–e826. doi: 10.1016/S2468-2667(23)00182-2.
3. Ricciardi W, Tarricone R. The evolution of the Italian National Health Service. *Lancet.* 2021;398:2193–206. doi:10.1016/S0140-6736(21)01733-5
4. Ohayon M, Wickwire EM, Hirshkowitz M, Albert SM, Avidan A, Daly FJ, et al. National Sleep Foundation's sleep quality recommendations: first report. *Sleep Health.* 2017;3:6–19. doi:10.1016/j.sleh.2016.11.006
5. American Psychiatric Association. Diagnostic and statistical manual of mental disorders: DSM-5-TR. 5th ed. Washington, DC: American Psychiatric Association Publishing; 2022.
6. Buysse DJ, Reynolds CF, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry Res.* 1989;28:193–213. doi:10.1016/0165-1781(89)90047-4
7. Fabbri M, Beracci A, Martoni M, Meneo D, Tonetti L, Natale V. Measuring subjective sleep quality: a review. *Int J Environ Res Public Health.* 2021;18:1082. doi:10.3390/ijerph18031082
8. Ohayon M, Smirne S. Prevalence and consequences of insomnia disorders in the general population of Italy. *Sleep Med.* 2002;3(2):115–20. doi:10.1016/S1389-9457(01)00158-7
9. Godos J, Ferri R, Caraci F, Cosentino FII, Castellano S, Galvano F, et al. Adherence to the Mediterranean Diet is Associated with Better Sleep Quality in Italian Adults. *Nutrients.* 2019 Apr 28;11(5):976. doi: 10.3390/nu11050976.
10. Favaretto E, Gögele M, Bedani F, Giovannini S, Pramstaller P, Perugi G, et al. The influence of affective temperaments on sleep quality in a general population sample. Data report from the CHRIS study. *J Affect Disord.* 2025 Jul 1;380:162–170. doi: 10.1016/j.jad.2025.03.055.
11. Amerio A, Lugo A, Stival C, Fanucchi T, Gorini G, Pacifici R, et al. COVID-19 lockdown impact on mental health in a large representative sample of Italian adults. *J Affect Disord.* 2021;292:398–404. doi:10.1016/j.jad.2021.05.117
12. Casagrande M, Favieri F, Tambelli R, Forte G. The enemy who sealed the world: effects quarantine due to the COVID-19 on sleep quality, anxiety, and psychological distress in the Italian population. *Sleep Med.* 2020;75:12–20. doi:10.1016/j.sleep.2020.05.011
13. Breda M, Belli A, Esposito D, Di Pilla A, Melegari M, Delrosso L, et al. Sleep habits and sleep disorders in Italian children and adolescents: a cross-sectional survey. *J Clin Sleep Med.* 2023;19:659–72. doi:10.5664/jcsm.10400
14. Varghese N, Santoro E, Lugo A, Madrid-Valero J, Ghislandi S, Torbica A, et al. The Role of Technology and Social Media Use in Sleep-Onset Difficulties Among Italian Adolescents: Cross-sectional Study. *J Med Internet Res.* 2021 Jan 21;23(1):e20319. doi: 10.2196/20319.
15. Benzi I, Gallus S, Santoro E, Barone L, Cavallo F, Coppola L, et al. Psychosocial determinants of sleep difficulties in adolescence: the role of perceived support from family,

- peers, and school in an Italian HBSC sample. *Eur J Pediatr.* 2023;182:2625–34. doi:10.1007/s00431-023-04934-0
16. Gesi C, La-Torraca-Vittori P, Madonia N, Segù M, Salvi V, Cerveri G, et al. Exploring suicidal ideation and its correlates among Italian adolescents: the role of sleep quality. *Sleep Med.* 2026 Jan;137:106897. doi: 10.1016/j.sleep.2025.106897.
 17. Sampasa-Kanyinga H, Colman I, Goldfield G, Janssen I, Wang J, Podinic I, et al. Combinations of physical activity, sedentary time, and sleep duration and their associations with depressive symptoms and other mental health problems in children and adolescents: a systematic review. *Int J Behav Nutr Phys Act.* 2020 Jun 5;17(1):72. doi: 10.1186/s12966-020-00976-x.
 18. Naghavi M, Zamagni G, Abbafati C, Armocida B, Agodi A, Alicandro G, et al. State of health and inequalities among Italian regions from 2000 to 2021: a systematic analysis based on the Global Burden of Disease Study 2021. *Lancet Public Health.* 2025;10(4):e309–e320. doi:10.1016/S2468-2667(25)00045-3
 19. Baccolini V, Rosso A, Di Paolo C, Isonne C, Salerno C, Migliara G, et al. What is the prevalence of low health literacy in European Union member states? A systematic review and meta-analysis. *J Gen Intern Med.* 2021;36:753–61. doi:10.1007/s11606-020-06407-8
 20. Liu Y, Xue W, Sheng Y, Wang S, Gong R, Liu S, et al. Age-specific associations between eHealth literacy and sleep quality among adults: cross-sectional study. *J Med Internet Res.* 2025;27:e75813. doi:10.2196/75813
 21. Duffy A, King N, Rivera D, Pankow K, Cunningham S, Tetzlaff E, et al. A longitudinal quasi-experimental study of a pedagogical approach to supporting undergraduate well-being and mental health: digital interdisciplinary accredited elective mental health literacy university course. *BJPsych Open.* 2026;12:e64. doi:10.1192/bjo.2025.10960
 22. Hibbard J, Stockard J, Mahoney E, Tusler M. Development of the Patient Activation Measure (PAM): conceptualizing and measuring activation in patients and consumers. *Health Serv Res.* 2004;39(4 Pt 1):1005–26. doi:10.1111/j.1475-6773.2004.00269.x
 23. Greene J, Hibbard J, Sacks R, Overton V, Parrotta C. When patient activation levels change, health outcomes and costs change, too. *Health Aff (Millwood).* 2015;34(3):431–7. doi:10.1377/hlthaff.2014.0452
 24. Riemann D, Baglioni C, Bassetti C, Bjorvatn B, Grošelj LD, Ellis J, et al. European guideline for the diagnosis and treatment of insomnia. *J Sleep Res.* 2017 Dec;26(6):675–700. doi: 10.1111/jsr.12594.
 25. Tardy A, Marguet S, Costantino H, Stewart A, Mackie D, Saba G, et al. Profile and quality of life of the adult population in good health according to the level of vitality: European NHWS cross sectional analysis. *BMC Public Health.* 2023 Jun 5;23(1):1061. doi: 10.1186/s12889-023-15754-0.
 26. Armstrong K, Rose A, Peters N, Long JA, McMurphy S, Shea JA. Distrust of the health care system and self-reported health in the United States. *J Gen Intern Med.* 2006;21:292–7. doi:10.1111/j.1525-1497.2006.00396.x
 27. Palmer A, Gorman S. Misinformation, trust, and health: the case for information environment as a major independent social determinant of health. *Soc Sci Med.* 2025;381:118272. doi:10.1016/j.socscimed.2025.118272
 28. Williams P, Bellantuono C, Fiorio R, Tansella M. Psychotropic drug use in Italy: national trends and regional differences. *Psychol Med.* 1986;16:841–50. doi:10.1017/S0033291700011855
 29. Piovani D, Clavenna A, Cartabia M, Bonati M. Psychotropic medicine prescriptions in Italian youths: a multiregional study. *Eur Child Adolesc Psychiatry.* 2016;25:235–45. doi:10.1007/s00787-015-0726-0
 30. Colletti N, Lombardo S. Südtiroler Sprachbarometer: Sprachgebrauch und Sprachidentität in Südtirol 2025 [German]. Bozen: Landesinstitut für Statistik (ASTAT), Autonome Provinz Bozen-Südtirol; 2025.
 31. Dekret des Präsidenten der Republik vom 31. August 1972, Nr. 6701 [German]. 1972.
 32. Ausserhofer D, Barbieri V, Lombardo S, Gärtner T, Eisendle K, Piccoliori G, et al. Primary and emergency care use: the roles of health literacy, patient activation, and sleep quality in a latent profile analysis. *Behav Sci (Basel).* 2025 May 24;15(6):724. doi: 10.3390/bs15060724.
 33. Ausserhofer D, Piccoliori G, Engl A, Marino P, Barbieri V, Lombardo S, et al. Sleep problems and sleep quality in the general adult population living in South Tyrol (Italy): a cross-sectional survey study. *Clocks Sleep.* 2025 May 8;7(2):23. doi: 10.3390/clockssleep7020023.
 34. Ausserhofer D, Wiedermann CJ, Barbieri V, Lombardo S, Gärtner T, Eisendle K, et al. Health information mistrust is directly associated with poor sleep quality: evidence from a population-based study. *Healthcare (Basel).* 2025 Jun 10;13(12):1385. doi: 10.3390/healthcare13121385.
 35. Barbieri V, Piccoliori G, Engl A, Wiedermann CJ. Gender specific mental health among adolescents in Northern Italy: a cross-sectional study. *Front Public Health.* 2026 Jan 16;13:1705580. doi: 10.3389/fpubh.2025.1705580.
 36. Wiedermann CJ, Barbieri V, Lombardo S, Gärtner T, Eisendle K, Piccoliori G, et al. Sleep quality and patient activation in chronic disease: a cross-sectional mediation analysis. *Clocks Sleep.* 2025 Aug 22;7(3):44. doi: 10.3390/clockssleep7030044
 37. Wiedermann CJ, Sangermano K, Marino P, Ausserhofer D, Engl A, Piccoliori G. Distinct regional pattern of sedative psychotropic drug use in South Tyrol: a comparison with national trends in Italy. *Pharmacy (Basel).* 2025 Feb 21;13(2):32. doi: 10.3390/pharmacy13020032.
 38. Baethge C, Goldbeck-Wood S, Mertens S. SANRA: a scale for the quality assessment of narrative review articles. *Res Integr Peer Rev.* 2019;4:5. doi:10.1186/s41073-019-0064-8
 39. Koyanagi A, Garin N, Olaya B, Ayuso-Mateos JL, Chatterji S, Leonardi M, et al. Chronic conditions and sleep problems among adults aged 50 years or over in nine countries: a multi-country study. *PLoS One.* 2014;9:e114742. doi:10.1371/journal.pone.0114742

40. Hsu MF, Lee KY, Lin TC, Liu WT, Ho SC. Subjective sleep quality and association with depression syndrome, chronic diseases and health-related physical fitness in the middle-aged and elderly. *BMC Public Health*. 2021;21:164. doi:10.1186/s12889-021-10206-z
41. Scott AJ, Correa AB, Bisby MA, Chandra SS, Rahimi M, Christina S, et al. Cognitive behavioral therapy for insomnia in people with chronic disease: a systematic review and meta-analysis. *JAMA Intern Med*. 2025;185:1350–61. doi:10.1001/jamainternmed.2025.4610
42. Slopen N, Lewis TT, Williams DR. Discrimination and sleep: a systematic review. *Sleep Med*. 2016;18:88–95. doi:10.1016/j.sleep.2015.01.012
43. Grandner MA, Hale L, Jackson N, Patel NP, Gooneratne NS, Troxel WM. Perceived racial discrimination as an independent predictor of sleep disturbance and daytime fatigue. *Behav Sleep Med*. 2012;10:235–49. doi:10.1080/15402002.2012.654548
44. Riemann D, Espie CA, Altena E, Arnardottir ES, Baglioni C, Bassetti CLA, et al. The European insomnia guideline: an update on the diagnosis and treatment of insomnia 2023. *J Sleep Res*. 2023;32:e14035. doi:10.1111/jsr.14035
45. Palagini L, Brugnoli R, Dell’Osso BM, Di Nicola M, Maina G, Martinotti G, et al. Clinical practice guidelines for switching or deprescribing hypnotic medications for chronic insomnia: results of European neuropsychopharmacology and sleep expert’s consensus group. *Sleep Med*. 2025;128:117–26. doi:10.1016/j.sleep.2025.01.033
46. Nicodemo C, Orso CE, Tealdi C. Overseas general practitioners (GPs) and prescription behaviour in England. *Health Policy*. 2024;140:104967. doi:10.1016/j.healthpol.2023.104967
47. Chan FKI, Moraga MT, Habib B, Girard N, Boulet JR, Tamblyn R. Does physicians’ clinical competence, communication ability, or cultural background influence potentially inappropriate prescribing of benzodiazepines and Z-drugs among older adults with insomnia? *Pharmacoepidemiol Drug Saf*. 2024;33:e70068. doi:10.1002/pds.70068
48. Ma TT, Wang Z, Qin X, Ju C, Lau WCY, Man KKC, et al. Global trends in the consumption of benzodiazepines and Z-drugs in 67 countries and regions from 2008 to 2018: a sales data analysis. *Sleep*. 2023;46:zsad124. doi:10.1093/sleep/zsad124
49. Soyka M, Wild I, Caulet B, Leontiou C, Lugoboni F, Hajak G. Long-term use of benzodiazepines in chronic insomnia: a European perspective. *Front Psychiatry*. 2023;14:1212028. doi:10.3389/fpsy.2023.1212028
50. Ravens-Sieberer U, Devine J, Napp AK, Kaman A, Saftig L, Gilbert M, et al. Three years into the pandemic: results of the longitudinal German COPSYS study on youth mental health and health-related quality of life. *Front Public Health*. 2023;11:1129073. doi:10.3389/fpubh.2023.1129073
51. Ludwig-Walz H, Dannheim I, Pfaenhauer LM, Fegert JM, Bujard M. Anxiety increased among children and adolescents during pandemic-related school closures in Europe: a systematic review and meta-analysis. *Child Adolesc Psychiatry Ment Health*. 2023;17:74. doi:10.1186/s13034-023-00612-z
52. Barbieri V, Wiedermann CJ, Kaman A, Erhart M, Piccoliori G, Plagg B, et al. Quality of life and mental health in children and adolescents after the first year of the COVID-19 pandemic: a large population-based survey in South Tyrol, Italy. *Int J Environ Res Public Health*. 2022;19:5220. doi:10.3390/ijerph19095220
53. Barbieri V, Wiedermann CJ, Piccoliori G, Mahlknecht A, Plagg B, Ausserhofer D, et al. Evolution of youth’s mental health and quality of life during the COVID-19 pandemic in South Tyrol, Italy: comparison of two representative surveys. *Children (Basel)*. 2023;10:895. doi:10.3390/children10050895
54. Short MA, Booth SA, Omar O, Ostlundh L, Arora T. The relationship between sleep duration and mood in adolescents: a systematic review and meta-analysis. *Sleep Med Rev*. 2020;52:101311. doi:10.1016/j.smrv.2020.101311
55. Evanger LN, Saxvig IW, Pallesen S, Gradisar M, Lie SA, Bjorvatn B. Associations between sleep patterns, circadian preference, and anxiety and depression: a two-year prospective study among Norwegian adolescents. *Clocks Sleep*. 2025;7:26. doi:10.3390/clockssleep7020026
56. López-Gil JF, Solmi M, García-Hermoso A, Vancampfort D, Fabiano N, Schuch FB, et al. Twenty-four-hour movement guidelines and depressive symptoms: association, temporal trends and moderators over a ten-year period among 45,297 US adolescents. *Eur Child Adolesc Psychiatry*. 2025;34:2507–20. doi:10.1007/s00787-025-02663-3

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