Data Article

A dataset reflecting the multidimensionality of insomnia symptomatology in adolescence using standardized questionnaires

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ABSTRACT

Insomnia is the most common sleep disorder in adolescence, and frequently emerges during this vulnerable period of profound biobehavioral maturation. Insomnia tends to be chronic, and if left untreated, could be detrimental for the teenagers’ mental and physical health, social, and emotional development. However, there is a paucity of data about insomnia in adolescence, strongly limiting the understanding and management of the disorder. In the current work, psychological and behavioral questionnaire data are provided for 95 adolescents (age range between 16-19 years, 62% female) with and without clinical or subclinical insomnia symptoms, determined from the Diagnostic and Statistical Manual of Mental Disorders (DSM-5). Data were collected as part of a larger study investigating insomnia pathophysiology and cardiovascular health in adolescence.

The data collection strategy was designed to capture the complexity of the insomnia symptomology in adolescence, and its unique clinical features, across different psychological and behavioral domains. The dataset covers a broad range of clinical measures describing sleep quality and habits, sleep-related cognitions, stress, stress reactivity, coping and emo-

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Data related to the study of sleep medicine, adolescent health, and development of psychopathology, highlighting the specific factors implicated in adolescent insomnia, as well as the heterogeneity of symptom combinations. Results can potentially inform the development of therapeutic approaches targeting key factors implicated in the insomnia pathophysiology in adolescents.

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**Specification Table**

| Subject | Clinical Psychology |
|---------|---------------------|
| Specific subject area | Sleep, insomnia disorder, subclinical insomnia, and the associated psychosocial factors |
| Type of data | Table, Chart, Graph, Figure |
| How the data were acquired | Data were acquired using a structured clinical interview and a self-reported questionnaire battery, which are part of a study investigating insomnia pathophysiology and cardiovascular health in adolescence. |
| Data format | Raw, Analyzed |
| Description of data collection | The study had a between-subjects experimental design with two groups: experimental (insomnia) group, and control group. Additionally, insomnia sub-groups (clinical insomnia diagnosis vs subclinical insomnia) are specified. Item level data, total scores and sub-total (when relevant) score of standard questionnaires are provided. Z-scores were also calculated and used in the network analysis. |
| Data source location | Institution: SRI International, Sleep lab |
| | City/Town/Region: Menlo Park |
| | Country: California, United States |
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Value of the Data

- This data highlights the unique clinical features of adolescent insomnia by focusing on a sample of adolescents with clinical and sub-clinical insomnia as diagnosed from a semi-structured clinical interview according to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) criteria, considering adolescents’ specific bio-behavioral and psychosocial aspects (e.g., preference for later bedtimes, early school start times).
- The data presented here originates from rigorous and comprehensive assessment of a broad range of clinical features (>70 psychosocial factors measured via validated questionnaires) directly and indirectly associated with insomnia disorder.
- We provide easy to digest data visualization, highlighting the severity and the complexity of insomnia symptomatology across several behavioral and psychosocial factors.
- This dataset and the associated figures have the potential to inform clinicians, data scientists and researchers from the developmental psychology and sleep domains.

1. Data Description

Data are based on self-report rating of demographic data and 19 standardized questionnaires (total of 79 item scores). These questionnaires assess insomnia-relevant domains including sleep quality and habits, sleep-related cognitions, stress, and stress reactivity, coping and emotion regulation behavior, mood, personality, and childhood trauma (see Fig. 1). The sample (N = 95) includes healthy sleepers (N = 48, 58% female), and adolescents with clinical insomnia (N = 26, 76% female) and sub-clinical insomnia (N = 21, 52% female). The clinical interview and DSM-5 insomnia diagnoses relied on current guidelines for pediatric insomnia.

The dataset (insomnia_data.csv) includes empirical self-report data assessment. The insomnia_data.csv contains 95 records with 95 fields of the questionnaire composite scores, and 95 fields of the z-scored composite scores. The first column in all data tables contains the unidentified ID of the human subjects.

The insomnia_data_dictionary.csv describes the data dictionary in 95 rows and two columns: short name of the variables and the name of the instrument.

The insomnia_item_level_data.csv contains the self-reported data of the same subjects (95 records). The first row identifies the instrument (as shown in the insomnia_data_dictionary.csv), the second row identifies the questionnaire item as seen by the participants, and the third row represents the short name of the variable (insomnia_data_dictionary.csv).

1.1. Questionnaires

Standardized questionnaires were used to characterize insomnia symptomatology and assess specific domains. Different domains were assessed. The secure web-based electronic platform REDCap (Research Electronic Data Capture) delivered the questionnaires and collected the data for this study.

Insomnia severity index (ISI) [1] is a 7-item questionnaire that assess the current (i.e., preceding 2 weeks) sleep difficulty, perceived severity of insomnia, and associated functional impairment in the previous week. Answers are ranks across a 5-point Likert scale, with 4 representing highest severity and 0 representing lowest severity. The sum of the ranks represents a total severity score that falls within a respective category:0–7 = No clinically significant insomnia; 8–14 = Subthreshold insomnia; 15–21 = Clinical insomnia (moderate); 22–28 = Clinical insomnia (severe).

Pittsburgh sleep quality index (PSQI) [2] assesses sleep quality and disturbances over a 1-month time interval. The questionnaire consists of 19 items that sum up to seven “component”
Fig. 1. Questionnaire battery of standardized and validated instruments covering various clinical, behavioral, and psychosocial domains related to insomnia disorder.

scores: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. Each component corresponds a score ranging from 0 to 3, with 3 indicating the highest level of dysfunction.

A global sleep quality score is obtained by summing the individual component scores (range 0 to 21), with higher scores indicative of poorer sleep quality during the previous month. Participants with global scores > 5 are classified as poor sleepers.

The morningness-eveningness questionnaire (MEQ-R) [3] is a 19-item instrument, designed to assess the respondent’s morningness/eveningness preferences. The participant is instructed to indicate when he/she would prefer to wake up or start sleep, rather than when he/she does. All questions have a selection of answers (q1, q2: 5 to 0; q3, q9, q11, q13, q15: 4 to 1; q4-8, q12, q14, q16: 1 to 4; q10, q17-18: 5 to 1; q19: 6, 4, 2, 0). The scores are added together, and the totals are scaled from 16-86 into five categories: definitely morning type (70-86), moderately morning type (59-69), neither type (42-58), moderately evening type (31-41); definitely evening type (16-30).
The sleep hygiene scale (ASHS), [4] is modified from the Children’s Sleep Hygiene Scale [5]. The questionnaire is constructed of 28 items measuring sleep practices in 9 domains: physiological (5 items), cognitive (6 items), emotional (3 items), sleep environment (4 items), daytime sleep (1 item), substances (2 items), bedtime routine (1 item), sleep stability (4 items), and bed/bedroom sharing (2 items). Adolescents report how often sleep hygiene behaviors have occurred over the past month along a 6-point scale: “always,” “frequently—if not always,” “quite often,” “sometimes,” “once in a while,” and “never”. Individual domain scores and a total sleep-hygiene score (ASHS total- mean of 9 domain scores) can be obtained. All domain scores and ASHS total scores range from 1 to 6, where higher scores correspond to better sleep hygiene.

Cleveland Adolescent Sleepiness Questionnaire (CASQ) [6] is a 16-item instrument that measures daytime sleepiness and alertness during a usual week. Each item consists of a range of situations when an adolescent might feel sleepy or fall asleep (e.g., I fall asleep during the last class of the day). In response to each situation, the adolescent ranks the frequency of each behavior along the 5-point Likert-scale: never (0 times per month); rarely (<3 times per month); sometimes (1–2 times per week); often (3–4 times per week); almost every day (>5 times per week). CASQ responses were assigned a numerical value (from 1 = never, to 5 = almost every day) and then summed to produce an overall score. Items (q2, q5, q7, q11, q13) involving alertness or feeling “wide awake” were reverse coded before summing. Higher scores on the CASQ reflect greater sleepiness/alertness.

Glasgow content of thoughts inventory (GCTI) [7] is a 25-item questionnaire used to evaluate cognition in the moments prior to sleep onset, and assess the insomnia related intrusive cognitions that may lead to increased sleep-onset latency among adults. The response sections for each of the 25 questions is a 4-point Likert-scale: 1=Never, 2=Sometimes, 3=Often, 4=Always). The higher the score the greater the intrusiveness and frequency of dysfunctional thoughts at bedtime (with a cutoff score of 42). Total scores (sum of the individual items) may range from 25 to 100.

Dysfunctional beliefs and attitudes about sleep scale (DBAS-16) [8] is the shortened version of the original 30-item scale developed to determine the type of individual beliefs and attitudes about sleep and insomnia, and found to be reliable in both younger and older adults. The items of the questionnaire were derived from clinical experience with insomnia patients, and literature-based psychological conceptualizations of insomnia disorder. The sleep related attitudes are clustered around 5 areas of interest: (a) misconceptions about the causes of insomnia, (b) misattribution or amplification of the consequences of insomnia, (c) unrealistic sleep expectations, (d) diminished perception of control and predictability of sleep and (e) faulty beliefs about sleep-promoting practices. We used a 10-point Likert scale to assess the adolescents’ sleep related beliefs (0: strongly disagree, 10: strongly agree). The totals were averages taken from the 16 reported Likert scores. Subscale scores were computed by adding the sum of scores for the items and dividing by the number of items making up each subscale. The questionnaire did not refer to a specific time window in the past.

Thought control questionnaire insomnia (TCQI-R) [9] is the 35-item version of the original TCQI, which asks respondents to indicate the frequency of thirty different thought control strategies. The attempted management of unwanted thoughts are clustered around 6 factors: aggressive suppression, cognitive distraction, reappraisal, social avoidance, behavioral distraction, and worry. Items were rated using a Likert scale between 1 (almost never) and 4 (almost always) points, yielding a minimum total score of 35 and a maximum total score of 140.

Perceived stress scale (PSS) [10] is a self-report instrument that scores perceived stress related to current life events (starting from the most recently completed month).Items are constructed to reveal how unpredictable, uncontrollable, and overloaded respondents find their lives. The 10 items were rated using a Likert scale between 0 (“Never”) and 4 (“Very often”). PSS scores (or global stress scores) are obtained by reversing responses (e.g., 0 = 4, 1 = 3, 2 = 2,
3 = 1 & 4 = 0) to the four positively stated items (q4, q5, q7, & q8), and then summing across each scaled item.

Adolescent stress questionnaire (ASQ) [11] measures 10 different adolescent-specific stress components or domains: home life, school attendance, school performance, peer pressure, emerging adult responsibility, school/leisure conflict, romantic relationships, teacher interaction, future uncertainty, and financial pressures. The 58-item version, which is used in this work, refers to the period of the last year and contains five-point Likert-type scale answers (1 = Not at all stressful (or is irrelevant to me), 2 = A little stressful, 3 = Moderately stressful, 4 = Quite stressful, 5 = Very stressful). E.g., “Keeping up with schoolwork”. Scale scores were calculated by summation of items.

Perceived stress reactivity scale (PSRS) [12] is a 23-item questionnaire that measures typical stress responses to different generalized situations (reactivity to social evaluation, reactivity to failure, reactivity to social conflicts, reactivity to work overload, and prolonged reactivity). It is a 23-item questionnaire with 5 subscales and 1 overall scale. Each item presents a potentially stressful stimulus (e.g. ‘When I speak in front of other peoples.’) and offers a choice of three response options for the participant to choose from (e.g. ‘I often get very nervous, I often get somewhat nervous’ or ‘In general, I stay calm’). Responses are coded on a scale of zero to two, with the answer representing the least reactivity scoring zero, and the answer representing the most reactivity scoring two. The sum of the mean scores on each subscale indicates the participant’s total stress reactivity.

Ford insomnia response to stress test (FIRST) [13] is a standardized self-reported questionnaire evaluating vulnerability to sleep disturbance. The questionnaire consists of 9 specific stressful situations. The items ask respondents to rate the likelihood of sleep disruption due to specific stressful situations and more broadly described periods of stress occurring during the day or evening. The possible responses and corresponding score included: not likely = 1, somewhat likely = 2, moderately likely = 3, and very likely = 4. The total score (sum of item scores) ranges from 9 to 36.

Beck Depression Inventory (BDI-II) [14] is the second version of the Beck Depression Inventory (BDI). This 1996 version is consistent with the revised criteria for depressive disorders in the DSM-IV. The BDI-II is a 21-item questionnaire developed to identify probable attitudes and symptoms of depression (in the past two weeks). The BDI items include a variety of symptoms and attitudes commonly found among clinically depressed individuals like indecisiveness (“I have trouble making any decisions”), loss of interest (“It’s hard to get interested in anything”), and social guilty feelings (“I feel guilty all the time”). The items receive a rating of zero to three to reflect intensity, and are summed to create a total score (ranging from 0 to 63).

The NEO Five-Factor Inventory (NEO-FFI) [15] is a self-reported five-factor personality inventory designed to measure personality traits (neuroticism, extraversion, openness, agreeableness, and conscientiousness) in nonclinical populations. It is constructed by 60 items (12 per trait). The items include self-descriptive statements (“Too often, when things go wrong, I get discouraged and feel like giving up”) that participants respond to using a 5-point Likert-scale, from 1 (strongly disagree) to 5 (strongly agree) Likert-type scale. Scores for each domain are calculated by summing the 12 item responses. A total of 28 NEO FFI items are reverse-worded.

Adverse Childhood Experiences (ACE) [16] is a 10-item tool used developed to measure childhood trauma (e.g. “Did you live with anyone who was a problem drinker or alcoholic or who used street drugs?”). The items are scored by binary code (Yes/No). The sum of the score corresponds to the ACE score.

COPE inventory (COPE) [17] was developed to assess a broad range of coping responses. The respondents are asked to indicate what they generally do and feel, when they experience stress-
ful events. The response options range between 1 ("I usually don’t do this at all") and 4: "I usually do this a lot."). The scale does not have a composite score.

Difficulties in Emotion Regulation Scale (DERS) [18] is a 36-item self-reported tool developed to measure respondents’ tendency to regulate their emotions and to assess their attitudes towards their emotions. The questionnaire has six subscales: (a) Nonacceptance of emotional responses, (b) Difficulty engaging in goal-directed behavior, (c) Impulse control difficulties, (d) Lack of emotional awareness, (f) Limited access to emotion regulation strategies and (g) Lack of emotional clarity. Respondents answer each item on a 5-point Likert-type scale ranging from 1 (almost never) to 5 (almost always). The measure yields a total score (SUM) as well as scores on six sub-scales Higher scores indicate more difficulty in emotion regulation. We calculated total score by summing the individual items. Higher scores also suggest greater problems with emotion regulation. Reverse-scored items q1, q2, q6, q7, q8, q10, q17, q20, q22, q24 and q34. For subscale scoring we summed the following items: Nonacceptance of emotional responses (NONACCEPT): q11, q12, q21, q23, q25, q29; Difficulty engaging in Goal-directed behavior (GOALS): q13, q18, q20R, q26, q33; Impulse control difficulties (IMPULSE): q3, q14, q19, q24R, q27, q32; Lack of emotional awareness (AWARENESS): q2R, q6R, q8R, q10R, q17R, q34R; Limited access to emotion regulation strategies (STRATEGIES): q15, q16, q22R, q28, q30, q31, q35, q36; Lack of emotional clarity (CLARITY): q1R, q4, q5, q7R, q9.

State-Trait Anxiety Inventory (STAI-Y2) [19] is a validated, 20-item scale measure of trait anxiety, widely used measure in personality and psychopathology research. The original STAI consists of two separate scales to measure state and trait anxiety. The STAI Form Y-1 consists of items that measure the respondent’s feeling in that moment, while the STAI Form Y-2 measures how the respondent generally feels. Subjects are asked to rate the intensity of their anxious feelings on a four-point scale as to their experience of feelings from 1 (“Almost Never”) to 4 (“Almost Always”). The total score sums each item and ranges from 20-80. Higher scores reflect higher levels of anxiety.

A network approach was implemented to investigate the relationship between self-reported symptoms and behaviors. We define separate networks for the insomnia and control groups, where symptoms represent nodes of the network, and edges indicate the relationships between them. With this approach, we can identify common patterns of connections and the potential restructuring of the psychological factors in the clinical condition. The visualization of the network topology shows how the estimated network of the control group differs from that of the insomnia group in their overall structure.

The concentration graphs in Fig. 2 shows which clusters of symptoms tend to be strongly connected in the insomnia and control groups. The network is a visual representation of the insomnia symptoms’ partial correlation matrix (nodes: insomnia symptoms - total scores of the questionnaire battery; edges: Spearman’s rho – ρ pairwise correlations between pairs of symptoms that remain significant (α = 0.05 for) when all other symptoms are controlled for– see Fig. 3 for more details). Self-loops, and edges connecting a node to itself, were removed from the networks. The centrality measures (Fig. 4) were calculated based on a node’s relation to every other node in the network and reflect structural changes between the insomnia and control groups. Degree centrality measures the number of edges attached to a node. Betweenness centrality measures the number of times that a given node is part of the shortest path between two other nodes. Closeness centrality measures the mean distance from one node to any other node. The NetworkX package [20] was used to estimate the weighted - undirected concentration graph, and to compute the centrality metrics.
Fig. 2. Symptom networks for the N=95 post-pubertal adolescents with and without insomnia diagnosis. Nodes in the network represent the symptoms associated with the insomnia condition. The edges between connecting the nodes represent the connection strength between symptoms based on partial correlations ($\rho$). Isolated nodes are listed at the bottom. The direction of the $\rho$ is indicated by the color of the line (red: positive, grey dashed line: negative). The stronger the correlation, the thicker the edge. The position of the nodes in the network is based on the Fruchterman-Reingold algorithm (Fruchterman & Reingold, 1991), which calculates the optimal layout such that symptoms with strong correlations cluster in the middle, whereas symptoms with weaker connections are placed further apart. The node colors are defined by the clustering Girvan-Newman algorithm, (Girvan & Newman, 2002), of the control network. The sizes of nodes indicate the degree centrality, with larger nodes representing a higher degree centrality in the networks.

2. Experimental Design, Materials and Methods

2.1. Participants

122 adolescents were recruited from schools and community events in the San Francisco Bay area.

Data of 95 adolescents (age range: 16-19 years, 62% female), enrolled in the Study of sleep and cardiovascular health in adolescence study (R01HL139652) is included here. Exclusion criteria for this study was: non-compliance, a current and past diagnosis of mental health problems for the control group (e.g., Major Depressive Disorder, Post-Traumatic Stress Disorder), current mental health problems for the insomnia group, medical conditions affecting brain function or behavior including diabetes, cancer, neurological diseases, use of medications known to affect sleep (e.g., hypnotics) and/or the cardiovascular system (e.g., antihypertensives), recent time-zone travel (within the past month), recurrent migraine, cardiovascular diseases (e.g., Hypertension), traumatic brain injury with loss of consciousness >30 minutes, pregnancy, or loss of follow-up due to the start of COVID-19 quarantine and isolation measures. Following this procedure, 27 adolescents were excluded. Based on the pubertal development scale (PDS) [21], all participants were in the post-pubertal stage.
Fig. 3. Distribution of significant partial correlations ($\rho$) that were used to construct the symptom networks.

2.2. Procedure

After a short phone screen interview and consenting, the participants completed a semi-structured diagnostic interview with a clinical psychologist (DP). The interview included the assessment for DSM-5 insomnia disorder. After the interview, participants completed a battery of self-report measures about their sleep behavior, mood, personality, potential childhood trauma, coping style and emotion-regulation.

Both the structured clinical interview and the self-reported measures were collected during an in-lab single study visit (between 01/04/2019 and 03/04/2020). During the COVID-19 pandemic (after 07.15.2020) thirty-two participants completed the clinical assessment via remote face-to-face clinical interviews (using a secure “Zoom” platform - Zoom Video Communications, Inc.).
Fig. 4. Changes in the ranks of the nodes in the networks of adolescents with and without insomnia symptomatology based on their centrality values. Red lines represent a relatively high change (drop or increase >5 places), and blue lines highlight the nodes that kept their relative place in both graphs (change <5). (1. a, b) Variables are sorted based on degree centrality, (2. a, b) Variables are sorted based on closeness, and (3. a, b) Variables are sorted based on betweenness.

Ethics Statements

The study was approved by the Advarra International Institutional Review Board (Pro00042640). Minor participants provided written assent along with informed consent from a parent/legal guardian. Data has been fully anonymized.

CRediT Author Statement

Orsolya Kiss: Writing – original draft preparation, Methodology, Visualization; Devin Prouty: Conceptualization, Writing – review & editing, Investigation; Dilara Yuksel: Conceptualization, Data curation, Writing – review & editing; Fiona C. Baker: Conceptualization, Writing – review & editing; Massimiliano de Zambotti: Funding, Conceptualization, Writing – review & editing.
Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data Availability

Insomnia in adolescence (Original data) (Figshare)
Insomnia in adolescence (Original data) (Figshare)

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Supplementary Materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.dib.2022.108523.

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