

# Poor self-reported health in association with sleep duration and health complaints among adolescents in Latvia

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**Abstract.** Insufficient sleep and recurrent health complaints may increase the risk of poorer self-reported health in adolescence, yet the relationships between these factors are not well understood. This study aims to explore the association between poor self-reported health and insufficient sleep duration among 11, 13, and 15 years old adolescents in Latvia by assessing the moderation effects of age and gender and by considering the mediating effect of health complaints. Methods: Data from the Health Behaviour in School-aged Children Study on 2017/2018 of Latvia ( $n = 4412$ ) were used for statistical analysis. Results: On average, 19.3% reported insufficient sleep duration on schooldays and 4.4% on non-school days. Of those with insufficient sleep duration, 5.8% reported poor self-reported health while this proportion was 2% among those with sufficient sleep. Poor self-reported health was associated insufficient sleep duration on school days (OR = 3.02; 95%CI 2.02-4.49), but not on non-schooldays. The association between insufficient sleep and poor self-reported health changed considerably after adjustment with health complaints (OR = 1.58;95%CI 1.03-2.43), however, it still remained significant. Conclusions: There is significant association between insufficient sleep and poor self-reported health regardless of total burden of health complaints.

## 1 Introduction

Self-reported health is a feasible, valid and informative indicator of adolescents' general health, including physical and emotional dimensions [1, 2]. In today's society, many health problems can be described as functional limitations rather than defined as medical diseases, especially in adolescent population where morbidity and mortality are relatively low. As a result, these indicators reveal only a small proportion of the adolescent population's problems. Self-reported health status reflects the individual's overall views on health and his/her own health status rather than the assessment of separate health domains. Self-rated health encompasses the overall concept of health, which includes different dimensions of health and well-being, such as feelings about the overall functioning of the body, general well-being, interpersonal relationships with friends and family, and health behaviours

[3, 4]. According to the World Health Organization (WHO) data on 2014, Latvia shows the highest proportion of adolescents with poor or fair self-reported health (16%), followed by Armenia and Wallonic Belgium – both 15%) [5].

During adolescence, various subjective health complaints frequently occur together [6, 7], and can be viewed as an important indicator of adolescent's general well-being, including both – physical and mental health domains [8]. Self-reported health complaints can describe a wide range of symptoms experienced by an individual, including everyday health complaints, clinical illnesses and functional impairment [1, 9]. Additionally, the concept of self-reported health complaints emphasizes the role of an individual's subjective experience and interpretation of the impact of health complaints on the overall well-being, regardless of the cause of those complaints [1, 9]. Therefore, subjective complaints are often not explained by the presence of a physical illness. At the same time subjective complaints are characterized by the presence of persistent physical health complaints [10]. Thus self-reported health status and self-reported health complaints can be closely linked.

Sleep duration is the essential domain of adolescent health and wellbeing, that previously has been associated both, with self-reported health and self-reported health complaints. For example, among adolescents - insufficient sleep duration was closely associated with poorer self-reported health [11, 12] as well as with various psychosomatic symptoms [11]. In addition, the results from a recent systematic review shows, that shorter sleep duration is associated with poorer health (e.g., higher injury rates and higher levels of adiposity, anxiety, and depression) and general wellbeing (e.g., lower life satisfaction and academic achievement) in adolescence [13].

At the same time, various sleep-related problems like difficulties in getting to sleep [14, 15], late bedtimes [16], sleep disruption [17] are prevalent among adolescents, all of which may contribute to insufficient sleep duration. According to the recommendations of the National Sleep Foundation (NSF) and the Canadian 24-Hour Movement Guidelines for Children and Youth, children and adolescents aged 6-13 years are recommended to obtain 9-11 hours of sleep, while for adolescents aged 14-17 years sleep duration from 8 to 10 hours is recommended [18, 19]. On an individual level, a significant sleep duration variation may exist, representing differences in sleep needs. However, sleep duration less than seven hours for school-aged children and adolescents up to 17 years can be considered as inappropriate according to NSF guidelines [18].

A recent study on adolescent sleep patterns from 24 countries in Europe and North America show that up to 68% of adolescents fail to meet sleep duration recommendations with Poland and Latvia showing the shortest average adolescent sleep durations. As adolescents consistently have later bedtimes and longer sleep durations on non-school days than school days [20], the association of self-reported health and sleep duration might be different over the weekdays.

The association between poor self-reported health and insufficient sleep, as well as the moderating effect of health complaints is still under-researched among adolescents. This study aims to explore the association between poor self-reported health and insufficient sleep duration (on school and non-school days) among 11, 13, and 15-years old adolescents in Latvia by assessing the moderation effects of age, gender and health complaints on association between sleep duration and self-reported health.

## 2 Methods

### 2.1 Study sample

Data from the Health Behaviour in School-aged Children survey (HBSC) 2017/2018 of Latvia were used. The HBSC survey is a school-based international study, which is conducted every four years in more than 40 countries across Europe and North America. Data are collected by following an international study protocol [21]. Representative samples of 11, 13 and 15-year-old adolescents from general schools were selected in the study by using clustered sampling. Probability proportional to size sampling of schools was used based on the state school registry and one class per each age group was randomly selected within each school. Passive parental consent was required. Data were collected using standardized anonymous paper-based questionnaires in classrooms.

The response rate on the school level was 90% and 73.5% on the student-level (based on the total amount of respondents in the eligible age categories, present at school and non-refusals). The final sample includes data of 4412 respondents (49.6% boys); mean age – (13.47).

Ethical approval was received from the Committee of Ethics of the Medical and Biomedical Researches, Riga East Clinical University Hospital (No. 11-A/17, October 5, 2017, Riga, Latvia).

### 2.2 Measurements

Self-rated health was captured by the survey question “Would you say your health is...?” with answer options “Excellent”, “Good”, “Fair” and “Poor”. Categories “Excellent” and “Good” were united into category “Good” for further statistical analysis, while rest of the answer categories remained unchanged. The proportion of missing cases was 1%.

Sleep duration was calculated separately on schooldays and non-school days by using survey questions on bedtime and wake time: “When do you usually go to bed if you have to go to school the next morning?” (missing in 1.6%) and “When do you usually wake up on school mornings?”; “When do you usually go to bed at weekends or during holidays?” and “When do you usually wake up at weekends or during holidays?”. The proportions of missing cases varied from 1% for wake-up time on school mornings and 2.5% for wake-up time for weekends.

Answer options covered the timing from 21:00 to 04:00 for bedtime and 05:00 to 14:00 for wake time divided into 30-minute periods. For each half-hour interval, the lowest time point was used in calculations (e.g., 22:00 if the bedtime response was “between 22:00 and 22:30”). For end of the scale responses, it was the minimum/maximum stated time (e.g., 14:00 if the wake time response was “14:00 or later” and 05:00 if the wake time response was “No later than 05:00”). In this study, sleep duration less than 7 hours was categorized as insufficient.

Health complaints were assessed by using HBSC symptom check-list which includes four physical (headache, abdominal pain, backache, feeling dizzy) and four psychological (feeling low, irritability or bad mood, feeling nervous, and difficulties sleeping) symptoms. The measure is designed to assess health complaints frequency using the multiple health complaints scale. For each symptom respondents had to indicate the occurrence of each by choosing from answer options “About every day”, “More than once a week”, “About every week”, “About every month” and “Rarely or never”. Symptom sum-score as a continuous variable was used for further statistical analysis (HBSC-SCL) [21]. The proportions of missing cases across health complaint types varied from 0.5% in category “Headache” to 1.1% in category “Feeling low”.

## 2.3 Statistical analysis

Descriptive statistics was used to analyse the proportions of adolescents with poor self-reported health and insufficient sleep duration. Logistic regression was used to calculate the odds of poor self-reported health in association to insufficient sleep. Five different regression models were analysed to assess main effects of insufficient sleep on poor self-reported health adjusted by adolescents' gender and age and to test the interaction effect with gender and age on the studied associations. HBSC-SCL was added in two separate models, therefore assessing the effects of insufficient sleep on poor self-reported health adjusted by age, gender and health complaints and testing interaction with health complaints.

As the interaction effect of gender, age and health complaints were non-significant, only the main effects - results after adjustment by age, gender and health complaints are shown in the results. The odds of poor self-reported health were calculated separately with insufficient sleep duration on school days and non-school days.

A significance level of 0.05 and confidence level of 95% was adopted for all statistical tests. IBM SPSS Statistics version 23 software was used for the statistical analysis.

## 3 Results

On average, 2.9% ( $p < 0.05$ ) of adolescents reported poor health. 19.3% of adolescents reported insufficient sleep duration on schooldays and 4.4% on non-schooldays ( $p < 0.001$ ). Of those with poor self-reported health, 40.3% (95%CI 31.4-49.7) had insufficient sleep duration on school days and 6.8% (95%CI 2.9-12.9) – on non-school days ( $p < 0.05$ ). In comparison, of those with excellent/good self-reported health insufficient sleep duration was detected in 16.0% (95%CI 14.7-17.2) of adolescents on schooldays and 4.1% (95%CI 3.5-5.0) of adolescents on non-school days.

Insufficient sleep duration on school days was associated with three times higher odds of poor self-reported health (OR = 3.02; 95%CI 2.02-4.49) regardless of adolescent's gender and age (Appendix 1). On non-school days the association was not statistically significant. The association between poor self-reported health and insufficient sleep changed considerably after adjustment with health complaints (OR = 1.58; 95%CI 1.03-2.43), however, it still remained significant (Table 1). Additionally, no interaction with health complaints was detected regarding the association between insufficient sleep duration and poor self-reported health.

**Table 1.** Odds of poor self-reported health in association with insufficient sleep duration insufficient on schooldays and weekends adjusted by gender, age and health complaints.

|                                      | Odds of poor self-reported health adjusted by age and gender <sup>a</sup> |                     | Odds of poor self-reported health adjusted by age, gender and health complaints <sup>a</sup> |                     |
|--------------------------------------|---|---------------------|--|---------------------|
|                                      | Schooldays  | Non-school days     | Schooldays   | Non-school days     |
|                                      | OR (95%CI)  | OR (95%CI)          | OR (95%CI)   | OR (95%CI)          |
| <b>Sleep duration</b>                |   |                     |  |                     |
| Insufficient sleep duration (<7h)    | 3.02*<br>(2.02-4.49)  | 2.01<br>(0.95-4.24) | 1.58*<br>(1.03-2.43)   | 1.11<br>(0.49-2.50) |
| Ref. Sufficient sleep duration (>7h) | .   | .                   | .  | .                   |

\* Statistically significant results ( $p < 0.05$ )

<sup>a</sup> Reference – Excellent/good self-reported health

## 4 Discussion

This study investigated the association between poor self-reported health and insufficient sleep duration and considered the moderating effect of age, gender and health complaints on association between self-reported health and sleep duration. Category of poor self-reported health represented adolescents with the lowest possible health self-assessment and was not aggregated with other answer categories. Sleep duration less than 7 hours was considered as insufficient for adolescents in age group 11-15 years. Sleep duration of less than 7 hours previously has been associated with poorer self-reported health in young adults (17-30 years) compared to sleep duration of 7-8 hours [22].

The results showed that almost 3% of adolescents reported poor health, which is slightly more than reported in other studies on European countries [23]. At the same time, results can be found reporting even up to 11% of adolescents with poor self-reported health [24].

Almost one-fifth of adolescents in Latvia slept fewer than seven hours per night on schooldays. This is more than reported in other populations with the same cut-off point used [25]. However, results reporting one to three fifths of adolescents not reaching seven hours of daily sleep can also be found [26, 27]. In line with other studies on European and North American countries [20], this study also found a significantly lower proportion of adolescents not reaching the sleep duration at least seven hours on weekends compared to schooldays. That might be explained by existing differences in the daily routine and obligations among school days and non-school days. In addition, a compensating mechanism can play a role, by sleeping longer on weekends in order to catch up missed sleep during the school days. However, it's been suggested that such a practice can further alter the circadian rhythm [28] leading to even deeper sleep depth during the school-days.

This study established a strong association between poor self-reported health and insufficient school day sleep duration, with those with insufficient sleep duration having a threefold increased risk of poor self-reported health. The association was not significant with non-school day sleep, as majority of adolescents meets sleep duration recommendations on weekends and holidays. These results are in line with other study in the adolescent population [29]. It has also been hypothesised, that individuals with poorer self-reported health could be less accurate in estimating their sleep duration [30], which might alter the associations observed.

For both adults and adolescents, multiple non-specific health complaints have been associated with a lower self-reported health status [31, 32]. As a result, insufficient sleep can be viewed as a significant independent factor that is associated with self-reported health and general well-being.

This extends to the possibility of multidirectional and complex relationships between self-reported health, sleep duration, and subjective health complaints [33, 34]. Insufficient sleep duration may be associated with more health complaints, including pain, and/or increase health complaint sensitivity through dopaminergic pathways [35]. Further, health complaints can contribute to lower self-reported health by serving as mediating factor. Therefore, triangular relationships between these domains might be an issue.

In this study, subjective health complaints not fully explained the association between insufficient sleep duration and poor self-reported health. As a result, insufficient sleep can be viewed as a significant independent factor that is associated with self-reported health and general well-being. However, it should be noted that due to the cross-sectional nature of this study, conclusive evidence regarding the causal relationship between poor self-reported health, sleep duration, and subjective complaints is not possible.

Moreover, self-reported health is a broad concept that most likely encompasses numerous possible pathways in various combinations. Longitudinal studies are necessary to gain a better understanding of the causal relationship between these domains.

## 5 Strengths and limitations

This study used of a large nationally representative sample of adolescents that was studied by following the standardised protocol of the HBSC study by using validated measurements [21].

Our results showed a strong association between poor self-reported health and insufficient sleep duration among adolescents in Latvia, regardless of age, gender or subjective health complaint burden. However, further studies, by including more country data, would be necessary to increase statistical power and advance knowledge on the relationship between self-reported health and sleep, and additional effects of subjective health complaints among adolescents.

In the HBSC study, sleep duration estimates were based on self-reported bed time and wake-up time. Such an approach is considered to be a feasible and valid measure for studying sleep duration on a population level [36]. However, studies show that there might be considerable differences in bedtime and wake time interpretation on an individual level. Interpretation of answers to the question “When do you usually go to bed [...]” may include any point from starting to prepare for bed (for example, having a shower, getting dressed etc.) to getting into bed but still being awake and finally – falling asleep which is a point that is impossible to self-report precisely. Also, the question “When do you usually wake up [...]” may include the period of time from waking up from sleep, but staying in bed to getting out of bed [37]. The described differences in interpretation of timeouts can result in an overestimation of the total sleep duration. Thus, the proportion of adolescents with insufficient sleep duration may be even higher, that may subsequently alter the association observed between self-reported health and sleep duration. Another aspect that should be mentioned – sleep quality has been considered to have even stronger association with self-reported health [38]. However, sleep quality issues are out of the scope of this study.

The measure of subjective health complaints in the HBSC study is designed to assess health complaints by using the multiple health complaints scale. Health complaints also tend to cluster together and it is not possible to define a clear “cut-off” point or threshold for separate health complaint total count or/and severity that could differentiate “acceptable” complaint level from intolerable conditions. The sensitisation of health complaints is strongly related to psychobiological mechanisms of the individuals differentiating the tolerance and acceptance of common health complaints, where the threshold also is individual and subjective [39].

## 6 Conclusions

Adolescents with insufficient sleep shows higher odds of poor self-reported health on schooldays by adjusting for their gender, age and health complaint status. Therefore, insufficient sleep may have a negative effect on self-reported health that cannot be fully explained by having more health complaints.

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