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Social inequality and time trends 1991-2018

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Difficulties falling asleep among adolescents: Social inequality and time trends 1991-2018

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Summary

Sleep problems in adolescence are increasingly common and associated with adverse health and psychological outcomes. Adolescents' sleep problems may be related to the family's socioeconomic status but studies are few and no study has examined whether social inequality in sleep problems changes as sleep problems become increasingly common. This study examined trends in difficulties falling asleep among adolescents in Denmark, whether this sleep problem was associated with socioeconomic status, and whether this association changed from 1991 to 2018.

The study applied data from eight comparable surveys among 11-15-year-olds in Denmark 1991-2018, the Danish arm of the international Health Behaviour in School-aged Children study, N=30,002.

The prevalence of daily difficulties falling asleep increased from 7.0% to 13.4% in 1991-2018 with higher frequencies among girls and younger adolescents. The odds ratio (95% CI) for daily difficulties was 1.14 (1.05-1.24) in middle and 1.52 (1.37-1.69) in low compared to high socioeconomic status. The absolute social inequality in difficulties falling asleep was persistent 1991-2018 whereas the relative social inequality may have decreased. The increasing prevalence and the social inequality in difficulties falling asleep among adolescents is a serious public health concern which calls for more attention and efforts.

Key words: HBSC; insomnia; schoolchildren; sleep onset difficulties; socioeconomic status; trend study

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Introduction

Sleep quantity and quality have decreased considerably among young people in recent decades (Dollman *et al.*, 2007; Hawkins & Takeuchi, 2017; Ghekiere *et al.*, 2019; Kronholm *et al.*, 2015, Norell-Clarke & Hagquist 2017; Pallesen *et al.*, 2008). Insufficient sleep and sleep problems such as difficulties falling asleep are common among adolescents and associated with health problems, poor school performance and poor life quality (Kronholm *et al.*, 2015; McHale *et al.*, 2011; Norell-Clarke & Hagquist, 2018; Paiva *et al.*, 2015).

Few studies address the association between socioeconomic status (SES) and sleep problems in adolescence and these studies disagree about the association. Two population studies from USA found higher rates of inadequate sleep in high income families (Hawkins & Takeuchi, 2017) and higher rates of unhealthy sleep habits in families with high income and education (McHale *et al.*, 2011). Other population studies from USA and from other countries have found sleep problems such as short sleep duration, difficulties falling asleep, daytime sleepiness and presleep worries to be more common in families of low SES (Bagley *et al.*, 2015; El-Sheikh *et al.*, 2013; Felden *et al.*, 2015). Still, the review by Felden *et al.* (2015) confirms the higher rate of difficulties falling asleep in low SES families regardless of country and measure of SES; leaving the opposite association between SES and sleep problems found in the two studies from USA unexplained.

It is unknown whether the association between SES and sleep problems change with the increasing trend in sleep problems. This paper focuses on difficulties falling asleep. The aim was to examine 1) trends in difficulties falling asleep among adolescents in Denmark, 2) whether difficulties falling asleep were related to SES, and 3) whether the association between SES and difficulties falling asleep has changed between 1991 and 2018.

Methods

Design and study population: The study used data from the Danish arm of the international Health Behaviour in School-aged Children project (HBSC) (Inchley *et al.*, 2016). The design was repeated cross-sectional surveys of nationally representative samples of school children. We included data from eight surveys in 1991, 1994, 1998, 2002, 2006, 2010, 2014 and 2018. The sampling procedure was similar in all surveys, each time with a new random sample of schools drawn from complete lists of public and private schools. Each survey included all students in the fifth, seventh, and ninth grade corresponding to 11-, 13- and 15-year-olds. The total response rate was 88.0%, n=35,320.

Data collection and measurements: The participants answered the internationally standardized HBSC questionnaire in the classroom. The measurement of difficulties falling asleep was identical in all surveys: "In the last 6 months, how often have you had difficulties falling asleep?" We dichotomized the responses into daily ("about every day") vs. less frequent ("more than once a week", "about every week", "about every month", and "rarely or never"). We repeated the analyses with two other cut-points: 1) "about every day" + "more than once a week" vs. less and 2) "about every day" + "more than once a week" + "about every week" vs. less.

SES was measured by the students' indication of parents' occupation. The research group coded the answers in accordance with the Danish Occupational Social Class Measurement into occupational social class (OSC) I (high) to V (low). We added OSC VI for parents outside the labour market receiving unemployment benefits, disability pension or other kinds of transfer income. The measurement of OSC was identical across surveys. Each participant was categorized by the highest ranking parent into high OSC (I-II, e.g. professionals and managerial positions), middle OSC (III-IV, e.g. technical and administrative staff, skilled workers) and low OSC (V, unskilled workers and VI, outside labour market).

Statistical analyses: The number of participants with complete information about sex, age group, OSC and difficulties falling asleep was 30,002. We calculated sex- and age standardized prevalences with exact 95% confidence limits. We applied chi²-test for homogeneity and Cochran-Armitage test for trends over time and analyzed two aspects of social inequality: 1) Absolute inequality (prevalence difference in difficulties falling asleep between low and high OSC). 2) Relative social inequality measured by odds ratio (OR) for difficulties falling asleep. The regression analyses included sex, age group and survey year as control variables and tested for statistical interaction between OSC and survey year.

Ethical issues: There is no formal agency for approval of questionnaire surveys in Denmark. We asked the school board (parents' representatives), the headmaster, and the students' council in each participating school to approve the study. The participants received oral and written information that participation was voluntary and anonymous. The study complies with national standards for data protection. The Danish Data Protection Authority granted acceptance in 2014 and 2018.

Results

TABLE 1 ABOUT HERE

Table 1 shows the study population distributed by the applied variables and the prevalence of difficulties falling asleep. In the entire study population, 10.7% reported daily difficulties falling asleep, increasing from 7.0% in 1991 to 13.4% in 2018. Although the prevalence decreased from 2014 to 2018, the overall trend

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from 1991 to 2018 was increasing (Cochran-Armitage test, $p < 0.001$). Further, 21.1% reported difficulties more than once a week, increasing from 15.8% in 1991 to 26.5% in 2018 ($p < 0.001$); 35.4% had difficulties at least weekly, increasing from 28.0% in 1991 to 40.8% in 2018 ($p < 0.001$).

The prevalence of daily difficulties was significantly higher in low than high OSC in 1994, 2002, 2006 and 2010 and in the total study population, assessed by the exact 95% confidence limits. The prevalence was 14.7% among 4,390 participants without information about OSC (not shown in table).

Table 1 also shows the prevalence of daily difficulties falling asleep by survey year and OSC. There were large fluctuations across the years, which we cannot explain, but overall the trend was increasing in all social classes, with all p -values < 0.001 . The prevalence difference between low and high OSC also fluctuated with no systematic increasing or decreasing trend. These findings suggest that the absolute social inequality in daily difficulties falling asleep was persistent 1991-2018.

TABLE 2 ABOUT HERE

Table 2 shows the mutually adjusted OR (95% CI) for daily difficulties falling asleep. The OR was significantly higher among girls than boys, OR (95% CI) = 1.26 (1.17-1.35). The OR was significantly lower among 13-year-olds 0.80 (0.73-0.87) and 15-year-olds 0.59 (0.54-0.65) compared with 11-year-olds. The OR increased by survey year and was 2.14 (1.69-2.72) in 2018 compared with 1991. The OR increased significantly by decreasing OSC: middle OSC 1.14 (1.05-1.24) and low OSC 1.52 (1.37-1.69) compared with high OSC. The statistical interaction between OSC and survey year on daily difficulties was significant ($p = 0.0096$) which suggests that survey year modifies the association between OSC and daily difficulties falling asleep, i.e. that the relative social inequality decreased 1991-2014. This conclusion is however uncertain because of the wide confidence intervals around the prevalence of daily difficulties falling asleep (see Table 1).

Finally, Table 2 shows similar analyses with two other cut-points. The direction of the associations was the same regardless of cut-point and the associations were statistically significant. The social inequality in difficulties falling asleep was robust to the frequency of difficulties but most pronounced for frequent difficulties.

Discussion

Main findings: The prevalence of daily difficulties falling asleep among adolescents was increasing 1991-2018, although with large unexplained fluctuations. The prevalence of difficulties falling asleep increased
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with decreasing OSC and this association was robust to cut-point for frequency of difficulties. The absolute social inequality was persistent 1991-2018, which combined with the increasing prevalence suggests that the relative social inequality decreased.

The finding of an increasing prevalence corresponds with studies from other countries (Hawkins & Takeuchi, 2017; Ghekiere *et al.*, 2019; Kronholm *et al.*, 2015; Norell-Clarke & Hagquist, 2017; Pallesen *et al.*, 2008). The finding of higher rates of sleep problems in low SES families corresponds with studies by Bagley *et al.* (2015), El-Sheikh *et al.* (2013) and a review by Felden *et al.* (2015) including studies from USA and many other countries. Two studies from USA found an opposite social pattern, i.e. higher rates of inadequate sleep among adolescents in high income families (Hawkins & Takeuchi, 2017) and higher rates of unhealthful sleep (sleep variations) in families of higher parental income and education (McHale *et al.*, 2011). This discrepancy in findings of a social inequality is hard to explain. The review by Felden *et al.* (2015) finds similar social inequalities regardless of measures of SES so the discrepancy does not seem to relate to choice of measure. We have not been able to find other studies of time trends in social inequality in difficulties falling asleep but Dollman *et al.* (2007) found increasing social inequality in sleep duration among adolescents.

Our study did not include data to analyse possible explanations of the increasing prevalence of difficulties falling asleep. Bagley *et al.* (2015) suggest that more presleep worries may explain the increase, supported by Due *et al.*'s (2018) finding of increasing levels of self-reported anxiety among adolescents in the observation period (Due *et al.* 2018). Other explanations include the possible influences of physical inactivity (Ghekiere *et al.*, 2018), social media use (Woods & Scott, 2016), excessive screen time (Dollman *et al.*, 2007), use of electronic medias and television in the adolescents' bedroom (Bagley *et al.*, 2015), the greater public awareness of the importance of sleep in adolescence, and a greater willingness to admit sleep problems as suggested by Pallesen *et al.* (2008).

Limitations: The strength of the study is that it combines eight comparable and nationally representative studies of 11-15-year-olds conducted over 27 years. The study may underestimate the prevalence of difficulties falling asleep because students with missing data about OSC have a high prevalence of difficulties falling asleep and non-participating students may have a high prevalence of difficulties falling asleep. The study explored only one kind of sleep problems, namely "difficulties falling asleep" which is a descriptive phenomenon, in line with problems of initiating sleep as included in the defining criteria of sleep disorders.

Implications: The high and increasing prevalence of difficulties falling asleep among adolescents is a public health concern because of its association with adverse outcomes. From a research point of view we need
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more insight into the drivers of the increasing prevalence of sleep problems and into the processes which result in higher prevalence of sleep problems in lower SES groups.

The issue needs policy attention and more attention from parents, teachers and health professionals. Health education efforts may be a feasible way to address the problem (Pallesen *et al.*, 2008). Reduction of presleep worries, reduction of screentime and more physical activity are promising ways to reduce difficulties falling asleep (Bagley *et al.*, 2015; Ghekiere *et al.*, 2019).

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Table 1 Study population by the applied variables and absolute social inequality in difficulties falling asleep

	Survey year								Total
	1991	1994	1998	2002	2006	2010	2014	2018	
Participation rate ^a	90.2%	89.5%	89.9%	89.3%	88.8%	86.3%	85.7%	84.8%	88.0%
N	1,860	4,046	5,205	4,824	6,269	4,922	4,534	3,660	35,320
Included in this study ^b	1,646	3,585	4,688	4,240	4,967	4,116	3,776	2,984	30,002
Study population									
... by sex									
% boys	49.8	49.2	49.6	48.1	48.4	49.1	47.9	48.4	48.7
% girls	50.2	50.9	50.4	51.9	51.6	50.9	52.1	51.6	51.3
... by age group									
% 11-year-olds	29.9	30.7	33.3	35.3	36.3	35.1	28.4	39.0	33.8
% 13-year-olds	34.7	34.3	35.5	33.3	35.9	34.7	36.4	34.4	35.0
% 15-year-olds	35.4	35.0	31.1	31.4	27.7	30.2	35.2	26.6	31.2
... by OSC									
% high ^c	28.0	33.1	28.0	24.9	27.6	39.0	42.5	43.2	32.9
% middle ^c	51.7	48.6	49.9	54.3	49.8	42.2	41.6	44.5	47.8
% low ^c	20.3	18.3	22.2	20.7	22.6	18.8	16.0	12.3	19.2
Pct. having difficulties falling asleep: ^c									
Daily ^d	7.0	9.4	8.2	9.3	11.2	13.5	14.6	13.4	11.0
> once a week ^d	15.8	20.7	18.9	19.5	21.9	24.8	26.4	26.5	22.1
Weekly ^d	28.0	35.5	33.8	31.8	33.5	37.6	40.3	40.8	35.4
Pct. having daily difficulties ^c									
... in high OSC ^d	4.5	7.0	8.0	8.1	9.4	9.7	14.2	13.0	9.9
(95% CI)	2.5-6.4	5.5-8.4	6.5-9.4	6.4-9.7	7.9-11.0	8.3-11.2	12.5-15.9	11.2-14.8	9.3-10.4
... in middle OSC ^d	7.6	9.1	7.5	8.7	10.8	14.9	14.1	13.2	10.6
(95% CI)	5.8-9.4	7.7-10.4	6.4-8.5	7.5-9.8	9.6-12.1	13.2-16.5	12.4-15.9	11.4-15.0	10.1-11.1
... in low OSC ^d	9.0	14.8	10.3	12.4	14.1	18.2	16.7	15.4	13.9
(95% CI)	5.9-12.1	12.1-17.5	8.5-12.2	10.3-14.6	12.0-16.1	15.5-20.9	13.8-19.7	11.7-19.1	13.0-14.7
Prevalence difference in daily difficulties (high-low OSC) ^c	4.5	7.8	2.3	4.3	4.7	8.5	2.5	2.4	4.0

^a Number of participants in the data file as percentage of schoolchildren enrolled in the participating classes.

^b Participants with full information on sex, age group, occupational social class and difficulties falling asleep.

^c Sex- and age standardized prevalences.

^d The trend from 1991 to 2018 was increasing and the increase was statistically significant, $p < 0.001$

Table 2 Mutually adjusted OR (95% CI) for difficulties falling asleep^a

Independent variable	Category	OR (95% CI) for difficulties falling asleep ...		
		... daily	... more than once a week	... weekly
Sex	Boys (ref.)	1	1	1
	Girls	1.26 (1.17-1.35)	1.27 (1.20-1.34)	1.26 (1.20-1.32)
Age group	11-year-olds (ref.)	1	1	1
	13-year-olds	0.80 (0.73-0.87)	0.91 (0.85-0.97)	0.94 (0.88-0.99)
	15-year-olds	0.59 (0.54-0.65)	0.75 (0.70-0.81)	0.87 (0.82-0.93)
Year	1991 (ref.)	1	1	1
	1994	1.37 (1.08-1.74)	1.39 (1.15-1.67)	1.40 (1.19-1.65)
	1998	1.18 (0.94-1.49)	1.24 (1.04-1.49)	1.32 (1.13-1.55)
	2002	1.36 (1.08-1.71)	1.30 (1.09-1.56)	1.22 (1.04-1.42)
	2006	1.67 (1.33-2.09)	1.52 (1.28-1.81)	1.32 (1.13-1.54)
	2010	2.09 (1.67-2.62)	1.76 (1.47-2.10)	1.52 (1.30-1.78)
	2014	2.37 (1.88-2.98)	1.96 (1.64-2.35)	1.73 (1.47-2.04)
	2018	2.14 (1.69-2.72)	1.97 (1.63-2.37)	1.79 (1.51-2.12)
Occupational social class	High (ref.)	1	1	1
	Middle	1.14 (1.05-1.24)	1.08 (1.02-1.16)	1.03 (0.98-1.09)
	Low	1.52 (1.37-1.69)	1.26 (1.17-1.37)	1.13 (1.05-1.21)

^a Multivariate multilevel logistic regression analyses using SAS PROC GLIMMIX to account for the cluster sampling.

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