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RESEARCH ARTICLE

Teachers' preference for later school start times

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Summary

Early morning school start times conflict with biologically determined sleep phase preference and thus contribute to common sleep deficits. This conflict is most pronounced in adolescents, and numerous studies have confirmed that later school start times are beneficial for their sleep and health. However, the conflict continues to exist beyond adolescence and, accordingly, also teachers might benefit from later school start times, but this has gained little attention so far. Importantly, teachers' resistance to delay school start time is one of the key barriers for a successful implementation and, therefore, teachers' school start time preferences and influencing factors are important to consider. To this end, we conducted an online survey. Teachers (n = 694, 56.1% female) from 17 high schools in Zurich, Switzerland, participated in the study. They indicated their school start time preference. In addition, four predictor blocks were assessed: sociodemographic, school-/work-related, and sleep characteristics, as well as teachers' perception of students in the first morning lesson. Mixed models were applied to predict the preference. The majority (51%) endorsed later school start times (median preferred delay 25.2 min). School start time, sleep characteristics and perception of students in the first morning lesson were significant predictors for the preference. Thus, teachers with more misaligned sleep and higher awareness for students' issues in the early morning were more likely to report a preference. This suggests psychoeducation about sleep biology throughout life span to be an effective measure to increase teachers' support to delay school start time, especially because also they themselves are likely to benefit from later school start times.

KEYWORDS
circadian rhythms, first morning lesson, high school, multilevel logistic regression analysis, online survey, sleep

1 | INTRODUCTION

Obtaining enough sleep is essential for good mental and physical health, and psychological well-being (Alvarez & Ayas, 2004; Hamilton et al., 2007; Piper, 2016). However, early morning school or work start times render sufficient sleep challenging because they are often misaligned with sleep biology: a biological clock drives a circadian rhythm that specifies the time window when sleep is facilitated or, reversing

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it, prevented (Borbély, 1982; Roenneberg et al., 2019). This circadian sleep phase preference, the so called "chronotype", delays progressively until the end of adolescence, and then slowly advances again into old age (Roenneberg et al., 2004). Thus, the conflict between morning start times and chronotype is most pronounced for adolescents. Therefore, numerous postulations to delay school start times (SSTs) have been raised and have since been empirically investigated. Indeed, many cross-sectional, but also longitudinal studies showed beneficial effects of later SSTs on adolescents' sleep and health (Alfonsi, Palmizio, et al., 2020; Alfonsi, Scarpelli, et al., 2020; Boergers et al., 2014; Bowers & Moyer, 2017; Owens et al., 2014; Wahlstrom & Owens, 2017). However, questions remain as randomized-controlled studies are unfortunately difficult to conduct in this field of research, mainly due to pragmatic challenges (Illingworth et al., 2019). More so, synthetization of results is often prevented by methodological differences across studies (Marx et al., 2017).

Also most adults' chronotype remains to be later than permitted by typical work and social schedules and, thus, also adults accumulate a sleep deficit on workdays (De Souza et al., 2012; Roenneberg et al., 2007, 2019). The misalignment of biological and social or societal schedules, the so-called "social jetlag", is quantified by the difference in sleep timing on scheduled (SC) and free (FR) days (Wittmann et al., 2006). To compensate for curtailed sleep due to early wake times on work- or schooldays, sleep duration is commonly much longer on FR days and sleep timing is later—in students as well as in teachers (De Souza et al., 2012; Roenneberg et al., 2007). Accordingly, also teachers might benefit from later morning SSTs. Indeed, 63% of teachers reported improvements in their own sleep after a delay in SST (Chan et al., 2017).

Nonetheless, for a successful implementation of later SSTs, many other factors have to be taken into account as well. For example, conflicts with after-school programmes such as sports should be avoided, and transportation issues have to be considered (Fitzpatrick et al., 2021; Kirby et al., 2011). Crucially, teachers' and other stakeholders' resistance to delay SSTs has been identified as a key barrier for successful implementation (Fitzpatrick et al., 2021) and, thus, stakeholders' SST preferences are important to consider. Recently, we demonstrated that the majority of high school students would endorse later SSTs (Werner et al., 2021). Contrary, little is known about teachers' preference: teachers at schools that start between 07:15 hours and 07:35 hours indicated optimal SSTs between 08:00 hours and 08:30 hours, but a preference to change SST was not investigated (Wahlstrom, 2002). After SST delays, the majority of teachers indicated to appreciate the later SSTs (Chan et al., 2017; Lo et al., 2018). Hence, there is some indication for a preference for later SSTs of teachers as well, but, to the best of our knowledge, this has never been investigated in detail.

To this end, we aim to explore teachers' preference for SSTs, and test the hypotheses that teachers' own sleep behaviour and perceived sleepiness and receptiveness of students in the first morning lesson will significantly influence their preference. Additionally, based on previous findings (Werner et al., 2021), sociodemographic and school-related characteristics were controlled for in the analyses. The results of this study will fill important knowledge gaps and contribute to successful preparation for and implementation of delaying SSTs.

2 | METHODS

2.1 | Participants

The survey period of this cross-sectional online survey spanned from May to July 2017. Overall, 979 teachers from 17 public high schools in the canton of Zurich started the survey. Participants were excluded if they did not report sex, age or school ($n = 285$), resulting in a final sample of 694 teachers. The estimated median participation rate was 29% (interquartile range: 22–36); however, because many teachers work at several schools, the rate is likely underestimated.

2.2 | Measures

LimeSurvey (www.limesurvey.org/de) was used to create the voluntary and anonymous survey. The selection of measures was based on a previous publication about adolescents' preference for later SSTs (Werner et al., 2021).

2.3 | Preference for later SSTs

Teachers indicated whether they would endorse later morning SSTs (yes/no), and at what time the first morning lesson should start ideally. Additionally, they were asked how they would preferably compensate for later SSTs (shortening breaks: short morning and/or afternoon breaks, long morning and/or afternoon breaks, lunch break; cancelling a free afternoon; "don't know"; other).

Other assessed characteristics were grouped in four blocks:

1. Sociodemographic characteristics

Teachers indicated their biological sex, mother tongue (Swiss German/other) and age class (18–26/27–35/36–44/45–53/54–65 y ears). Additionally, they reported in which school they taught. Some 43 teachers (6.2%) selected more than one school and were randomly assigned to one of them afterwards.

2. School-/work-related characteristics

The actual SSTs of the schools were taken from provided timetables. The teachers indicated on how many days per week they taught in the first morning lesson, total number of lessons per week, how long their school commute was, and if they used public or private transportation. Moreover, the teachers rated their current everyday stress on a scale from none (1) to very strong (5).

3. Sleep characteristics

Bedtimes and wake times were separately assessed for SC days such as work days and FR days such as weekend days with the Munich Chronotype Questionnaire (Roenneberg et al., 2003). Using

the indicated times, sleep periods were calculated afterwards. The sleep deficit was quantified as sleep period on FR days minus sleep period on SC days. Additionally, daytime sleepiness was assessed using the Epworth Sleepiness Scale (ESS; Johns, 1991).

4. Perception of students

Finally, the teachers rated students' sleepiness and receptiveness in the first morning lesson on a scale from not at all (0) to very strong (10).

2.4 | Statistical analyses

Data were analysed in R 4.0.2 with two-tailed tests, and $p < .05$ was considered significant. Descriptives are presented with median and interquartile range (M_e (IQR)) as most variables were non-normally distributed (Kolmogorov–Smirnov test). Sleep behaviour on SC and FR days was compared by mixed models with random intercepts for participants nested in schools (lme4 package; Bates et al., 2015). Semi-partial R^2 statistics ($R^2_{\beta*}$, r2glmm package; Jaeger, 2017; Jaeger et al., 2017) are reported as the effect sizes.

Logistic mixed models with random intercepts for schools were fitted to investigate the preference for later SSTs (lme4 package; Bates et al., 2015). As in Werner et al. (2021), we investigated first which predictor blocks to include in the final analysis. Therefore, a separate model for each predictor block was calculated.

- Model 1: Preference ~ Sociodemographic characteristics
- Model 2: Preference ~ School-/work-related characteristics
- Model 3: Preference ~ Sleep characteristics
- Model 4: Preference ~ Perception of students

Predictor blocks were included in the final analysis if the AIC (Akaike Information Criterion) of the model was lower than that of the null model consisting only of the intercept. The marginal pseudo-R^2 is reported as an estimate for the explained variance (theoretical method, MuMIn package; Barton, 2020). Participants with partially missing data were excluded from the multilevel analysis, allowing to investigate associations with the preference while controlling for potential confounders (e.g. sex or school-specific features). Imputation methods deemed inappropriate due to the high proportion of participants with partially missing data.

3 | RESULTS

3.1 | Socio-demographic and school-/work-related characteristics

The teachers (56.1% female, 74.6% > 35 years) gave lessons at 17 schools with SSTs between 07:30 and 08:05 (Table 1). The majority (57.2%) indicated to teach in the first morning lesson never to max. two times per week, and 32.6% three to four times. Most teachers rated current stress as "rather strong" or higher (53.5%).

TABLE 1 Sample characteristics ($n = 694$)

Female sex, *n* (%)	389 (56.1%)
Age class, *n* (%)	
18–26 years	16 (2.3)
27–35 years	160 (23.1)
36–44 years	202 (29.1)
45–53 years	189 (27.2)
54–65 years	127 (18.3)
Mother tongue, *n* (%)	
Swiss German	495 (71.3)
Other	193 (27.8)
Missing	6 (0.9)
Frequency of teaching in first morning lesson per week, *n* (%)	
Never	85 (12.2)
Once or twice	312 (45.0)
Three or four times	226 (32.6)
Five times	17 (2.4)
Missing	54 (7.8)
Number of lessons per week, median (IQR)	17 (13–20)
Duration of school commute (hr), median (IQR)	0.58 (0.33–0.83)
Means of transport, *n* (%)	
Public	404 (58.2)
Private	284 (40.9)
Missing	6 (0.9)
Current stress, *n* (%)	
None	76 (11.0)
Small	240 (34.6)
Rather strong	206 (29.7)
Strong	119 (17.1)
Very strong	46 (6.6)
Missing	7 (1.0)

IQR, interquartile range.

3.2 | Sleep characteristics

The teachers' sleep–wake patterns were significantly later and sleep duration was on average 1 hr longer on FR than on SC days (Table 2). The median daytime sleepiness score was 7 (4–10). Elevated sleepiness (> 10; Sauter et al., 2007) was indicated by 21.3%.

3.3 | Perception of students in the first morning lesson

Perceived students' sleepiness and receptiveness were rated on average with 5 (3–7) and 6 (4–8), respectively, on a scale from not at all (0) to very strong (10).

TABLE 2 Self-reported sleep–wake patterns on SC and FR days, and for all days combined

	SC days			FR days					
	n	Median	IQR	*n*	Median	IQR	*n*	*p*-value[a]	$R^2_{\beta^*}$[b] (95% CI)
Bedtime	623	23:00	22:29–23:17	613	23:30	23:00–00.00	613	< .001	.14 (.11, .18)
Wake-up time	612	06:00	05:45–06:30	606	08:00	07:00–08:30	600	< .001	.46 (.43, .50)
Sleep period, hr	612	7.28	6.75–7.83	606	8.09	7.50–9.00	600	< .001	.24 (.20, .28)
Mid-sleep point time	612	02:27	2:04–2:50	606	03:30	03:00–04:15	600	< .001	.37 (.33, .41)

	All days combined		
	n	Median	IQR
Average sleep period[c], hr	600	7.61	7.12–8.00
Sleep deficit, hr	600	1.00	0.25–1.5
MSFsc time	600	03:15	02:47–03:49

CI, confidence interval; FR, free; IQR, interquartile range; MSFsc, mid-sleep point corrected for sleep deficit accumulated during scheduled days; SC, scheduled.

[a]Mixed model was performed.

[b]Semi-partial R^2 statistic (Jaeger et al., 2017).

[c]Average sleep period defined by weighted sleep period for SC and FR days (= (5 × sleep period on SC + 2 × sleep period on FR)/7).

3.4 | Preference for later SSTs in the morning

Fifty-one percent of the teachers reported that they would endorse later SSTs (40.9% indicated no, 8.1% missing). The preferred SST was indicated at 08:00 (07:55 –08:30), corresponding to a preferred delay of 25.2 min (4.8–45 min). Earlier SSTs were preferred by only 8.2%. The preferred options to compensate for later SSTs were to shorten the lunch break (18.4%) or to cancel free afternoons (17.7%), whereas shortening breaks was less frequently selected (9.9%). Some 34.4% selected "I don't know" (19.5% missing).

3.5 | Multilevel analysis for the preference for later SSTs

As, for all four predictor blocks, adding the respective characteristics to the null model led to a decrease in AIC, all characteristics contained were included in the full model (n = 515, 25.8% had to be excluded due to partially missing data). Excluded teachers were rather female than male ($\chi^2 = 10.09$, $p = .001$), more likely from the youngest age class ($\chi^2 = 18.73$, $p < .001$), and more teachers who indicated a preference for later SSTs were excluded from the analysis ($\chi^2 = 22.05$, $p < .001$).

The full model explained 52% of the variance (pseudo-R^2 = .52; Table 3). None of the sociodemographic variables were a significant predictor for the preference, and among school-/work-related characteristics, only earlier SST significantly increased the probability of a preference. All included sleep characteristics significantly affected the preference. In addition, the preference was significantly influenced by teachers' perception of students in the first morning lesson.

4 | DISCUSSION

The majority of teachers reported a preference for later SSTs. More specifically, preferred SST was indicated 25 min later than actual SST, with only 8.2% showing a preference for earlier SSTs. Of all the assessed sociodemographic and school-related characteristics, only earlier SSTs significantly increased the probability of a preference in our analysis. In addition, we identified two main influences on teachers' preference while controlling for sociodemographic and school-related characteristics: their own sleep behaviour and perception of students in the first morning lesson. The former indicates that also teachers themselves might benefit from later SSTs, and the latter suggests psychoeducation about students' sleep biology and associated cognitive performance to increase teachers' support for delaying SSTs.

4.1 | Preference for later SSTs among teachers and students

Comparing our studies, teachers' preference was weaker than that of students (51% versus 63%; Werner et al., 2021). This difference can be explained, on the one hand, by earlier chronotypes of adults compared with adolescents and thus less misalignment between sleep biology and SST, i.e. less social jetlag (Roenneberg et al., 2007; Wittmann et al., 2006). As expected, the difference between sleep periods on FR and SC days was less pronounced in teachers than in students (De Souza et al., 2012; Werner et al., 2021). On the other hand, the frequency of having school in the first morning lesson was much lower in teachers than in students

TABLE 3 Regression coefficients of fixed effects in the multilevel logistic regression analysis with preference for later SSTs in the morning as dependent variable ($n = 515$, full model)

	Prediction of the preference for later school start		
Fixed effects	***B***	**SE *B***	**OR, 95% CI**
Intercept	16.30*	8.24	
Sociodemographic characteristics			
Age class	0.13	0.12	1.14 (0.90, 1.44)
Male sex	0.16	0.26	1.18 (0.71, 1.96)
Non-Swiss German mother tongue	0.26	0.27	1.29 (0.76, 2.20)
School-/work-related characteristics			
SST, hr	−3.19**	1.06	0.04 (0.01, 0.33)
School first lesson, frequency per week	−0.10	0.13	0.90 (0.70, 1.16)
Number of lessons per week	−0.04	0.03	0.96 (0.91, 1.02)
Commute to school, duration hr	0.79	0.46	2.21 (0.90, 5.40)
Private transport	−0.19	0.28	0.82 (0.48, 1.43)
Current stress, scale 1–5	0.03	0.12	1.03 (0.82, 1.29)
Sleep characteristics			
Average sleep period, hr	0.53**	0.18	1.70 (1.19, 2.43)
Sleep deficit, hr	0.28*	0.12	1.33 (1.05, 1.68)
MSFsc, hr	0.90***	0.16	2.45 (1.81, 3.33)
Daytime sleepiness score, range 0–24	0.07*	0.03	1.07 (1.01, 1.14)
Perception of students in first morning lesson			
Students' sleepiness, scale 0–10	0.37***	0.06	1.45 (1.29, 1.64)
Students' receptiveness, scale 0–10	−0.21***	0.06	0.81 (0.71, 0.92)

B = regression coefficients; CI, confidence interval; MSFsc, mid-sleep point corrected for sleep deficit accumulated during scheduled days; OR, odds ratio; SD, standard deviation; SE B = standard error of regression coefficient; SST, school start time.
*$p < .05$; **$p < .01$, ***$p < .001$.

(32.6% versus 54.1% three–four times a week; Werner et al., 2021) and, thus, teachers were less affected by SST than students of the same schools.

4.2 | Later SSTs might improve teachers' sleep and health

Teachers' sleep periods were longer and timed later on FR than on SC days (De Souza et al., 2012; Roenneberg et al., 2007; Wittmann et al., 2006). Thus, as expected, we observed social jetlag in teachers. The median wake-up time on workdays was at 06:00 hours and, in fact, less than 10% of the population's chronotype goes along with wake times before or up to 06:00 hours, assuming a sleep need of 8 hr (Roenneberg et al., 2019). This mismatch between social schedules and chronotype might be even more pronounced during summer in countries that change social time from winter to summer time, including Switzerland (i.e. 1 hr forward in spring and 1 hr back in autumn, respectively; Kantermann et al., 2007): at 06:00 hours, it is then actually only 05:00 hours.

Importantly, all teachers were assessed during summer time. Crucially, about a fifth of teachers presented with elevated levels of sleepiness (ESS score > 10; Sauter et al., 2007). In the multilevel analysis, all sleep-related variables were significant predictors for the preference for later SSTs: the higher the average sleep period (as a proxy for sleep need), the higher the sleep deficit, the later the chronotype, and the higher daytime sleepiness, the more likely a preference was indicated. Summarized, the more problematic a teachers' sleep behaviour, the higher was the probability for a reported preference for later SSTs. Social jetlag and poor sleep are associated with impaired mental and physical health and decreased psychological well-being (Alvarez & Ayas, 2004; Hamilton et al., 2007; Piper, 2016; Wittmann et al., 2006) and, therefore, teachers are likely to benefit from later SSTs as well. These associations warrant further experimental studies focusing on sleep and health of teachers.

4.3 | How to increase teachers' support of delaying SSTs?

However, only a small majority indicated a preference for later SSTs. This is critical because teachers' resistance to change schedule was rated as one of the key barriers for changing SSTs (Fitzpatrick et al., 2021). On the one hand, the weak preference might be related to uncertainty of how later SSTs will be compensated: a third of teachers indicated that they did not know how to compensate for later SSTs. Consequently, teachers should be actively involved in the planning process, which was identified as an important facilitating factor for delaying SST (Fitzpatrick et al., 2021). Importantly, students' suggestions should be considered (Werner et al., 2021). Potentially, online teaching, which was highly promoted since the beginning of the COVID-19 pandemic and, thus, considerably advanced due to the COVID restrictions, might serve as an alternative to delaying SST. Interestingly, pandemic high school closures can be viewed as a naturalistic delay in SST because students did not need to commute to school anymore and could thus sleep longer, and studies support beneficial effects as expected from SST delay literature (Albrecht et al., in press; Bruni et al., 2021; Gruber et al., 2020; Lim et al., 2021; Socarras et al., 2021). These benefits can also be presumed for teachers, though this has not been investigated yet.

On the other hand, the sleepier and the less receptive a teacher judged students in the first morning lesson, the likelier a preference was reported. Thus, teachers' awareness of students' sleep biology and consequences for their cognitive capacity are important drivers for a preference. Indeed, adolescents' cognitive and school performance is better in the afternoon than in the morning (Escribano & Díaz-Morales, 2014; Hansen et al., 2005; Kim et al., 2002; Williams & Shapiro, 2018). Therefore, the more the cognitive consequences of early SSTs for students were recognized, the more likely later SSTs were endorsed in our analysis. Providing education on adolescent sleep biology for teachers has been recommended to facilitate SST changes (Fitzpatrick et al., 2021). We suggest complementing psychoeducation with information about consequences of the misalignment between chronotype and early morning start times on cognitive functions, health and well-being—both for adults and, even more pronounced, for adolescents.

4.4 | Limitations

The anonymous survey approach allowed to investigate self-reports of a large sample of 694 teachers, but also involved several limitations. Biases such as social desirability might influence the answers and, because of the cross-sectional design, only associations could be analysed. Also, a selection bias cannot be excluded: more female than male teachers started the survey, but also provided incomplete answers and thus had to be excluded from the multilevel analysis. More objective and longitudinal data would complement the existing evidence. Additionally, teachers completed a shortened form of the survey we used in students (Werner et al., 2021). It did not include leisure time activities and health-related characteristics, which were important predictors for adolescents' preference, but could thus not be investigated in teachers. Also, further characteristics that were not collected (e.g. subject of teaching) might have an influence on the preference for later SSTs. Lastly, in our survey, the assessment of SST preference was not dependent on how later SSTs would be implemented (e.g. longer school day or shorter lunch break), which might have impacted the preference for SST. However, preferred options to compensate and preferred magnitude of change in SST were investigated in separate questions, allowing future studies to obtain more detailed insights by providing additional information about the hypothetical change in SST.

5 | CONCLUSION

The majority of teachers reported a preference for later SSTs with a preferred shift of about half an hour. The probability for a preference increased with signs of problematic sleep behaviour such as higher daytime sleepiness and later chronotype. Thus, teachers are likely to benefit from delaying SSTs themselves as a way of reducing social jetlag and sleep deficit accumulated on workdays. Additionally, the sleepier and the less receptive teachers perceived their students in the first morning lesson, the more likely they indicated a preference. Consequently, we suggest providing teachers with psychoeducation about social jetlag and consequences of sleep deficit both in adolescents as well as in adults as an effective means to increase teachers' support to delay SST.

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CONFLICT OF INTEREST

All authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

MSc Albrecht carried out the analyses, drafted the manuscript, and critically reviewed and revised the manuscript. Dr Werner designed the study, coordinated and supervised data acquisition, and critically reviewed the manuscript. MSc Yaw acquired the data, carried out the initial analyses, and reviewed the manuscript. As principal co-investigators, Drs Huber and Jenni conceptualized the study, supervised the study team, and critically reviewed the manuscript for important intellectual content. All authors had full access to all the data, approved the final manuscript as submitted, and agree to be accountable for all aspects of the work.

DATA AVAILABILITY STATEMENT

The data underlying this article may be shared on request to the corresponding author.

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