Sleep Practices among Parents and Childless Individuals[1]

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Sleep Practices among Parents and Childless Individuals. While sleep is genetically determined to some extent, it is also largely socially driven. Previous research on sleep is mostly biomedical and inconsistent since the number of analysed sleep variables is limited and it often does not distinguish between genders and parents based on the age of their child/ren. Using representative data from the Czech Household Panel Study (2018) with answers from 2,017 childless individuals and 1,022 parents and employing a method of propensity score matching, the manuscript uses a sociological lens and explores the effect of parenthood on sleep duration on workdays and free days and its effect on social jetlag; misalignment between biological and social preferences. The results show that parents have similar sleep patterns to childless individuals, but mothers, in particular, are deprived of sleep during free days. Childcare for mothers is an equivalent to having an employment seven days a week instead of the average five. Parents' sleep quality is not particularly impaired by the presence of a child/ren in comparison to childless individuals: both rate their sleep as overall rather poor.

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Introduction

Even though the evidence regarding the overall effect of parenthood on individuals is mixed, the opinion that having children comes at the price of daily strain and lowered well-being is predominant (Nomaguchi – Milkie 2003). Stress is not the only issue that emerges on becoming a parent. New parents especially, but not exclusively, are often severely sleep-deprived (Hagen et al. 2013), which may further amplify stress and deterioration in their well-being. Very short or very long sleep duration is associated with chronic physical diseases (Chen et al. 2020), and poor sleep quality is associated with higher stress levels and negative moods (Benham 2020), and both physical and mental health complaints (Pilcher et al. 1997). In addition, a consistent sleep routine is also important for overall well-being (Bates et al. 2002; Chaput et al. 2020; Fuligni – Hardway 2006).

Although 46% of the sleep duration and 44% of sleep quality is genetically determined (Kocevska et al. 2021), the rest of the variation is subjected to the environment we live in and is socially driven (Grandner 2017). Some examples of the social factors that have important roles in the daily sleep-wake rhythm

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are our environments (family, work/school) and general social interactions (Belísio et al. 2010). People suffering from sleep deprivation feel lonelier and are less likely to engage with others (Simon – Walker 2018). Sleep also plays a role in relationships: partners tend to sleep worse after conflicts (Hicks – Diamond 2011) and are also more likely to end up in a conflict after a night of poor sleep. Partners are much less satisfied with the relationship quality if either partner experiences poor sleep (Gordon – Chen 2014). Considerable attention has been devoted to the conflict between work and family, but some other aspects of life have been ignored such as sleep (Barnes et al. 2012) despite good sleep habits being a determinant of good health (Chaput – Shiau 2019; Luyster et al. 2012), physical and mental well-being (Chen et al. 2020; Fuligni – Hardway 2006; Jean-Louis et al. 2000) and overall quality of life (Groeger et al. 2004). To an extent, sleep is likely to be influenced by the family situation (Barnes et al. 2012) since childcare and related family obligations are time-consuming and demanding. Not only do sleep practices differ among childless individuals and parents, but it is also important to consider the diversity of maternal and paternal experiences (Phares et al. 2005). Even though fathers are more involved in caring for their children than ever before (Cabrera et al. 2000), family roles are still largely gendered: mothers remain more likely to be the primary caregivers, taking parental leave and taking care of the household while fathers are the breadwinners (Fletcher – Bailyn 2005). This model along with long parental leave for women is practiced and also preferred model in the Czech Republic (Robila 2012).

Despite previous research on sleep and parenthood, the comparisons of childless individuals and parents are lacking in depth and can potentially suffer from selection bias caused by the underrepresentation of parents. Using data from Czech Household Panel Survey, a different perspective is applied: an experiment-like design of propensity score matching (PMS) to essentially compare sleep-wake patterns and sleep quality of identical or very similar individuals who differ only on the basis of having or not having children.

The theory behind parenthood and sleep

The Social Zeitgeber Theory developed by Ehlers, Frank and Kupfer (1988) suggests that life events disturb social zeitgebers (social framework of daily life that provides time cues to individuals and their circadian rhythms), which further disrupt circadian/biological rhythms, thus resulting in depression and decreased psychological wellbeing. The life event in this case is represented by childbirth, inevitably a significant life change for both parents. The arrival of a baby then results in a change in the social schedule (e.g., childcare responsi-

bilities, work responsibilities, shrinkage of social life) which in turn also affects the biological clock (e.g., intermittent sleep, shorter sleep duration).

A growing body of sociological literature on sleep indicates that gendered responsibilities in families influence sleep (e.g., Burgard 2011; Ruppanner et al. 2021; Venn et al. 2008); since women do most of the household chores and take on the bigger share of childcare, their sleep is more likely to be disrupted than men's' (Maume et al. 2018) and sleep duration and satisfaction among fathers after birth is significantly less pronounced than in mothers (Richter et al. 2019).

Parental sleep practices

Sleep duration

Up until recently, it was presumed that impaired sleep is only an issue for new parents since they attend to the child waking in the night (Byars et al. 2020). However, the existing longitudinal studies show the appearance of insomnia symptoms and a decrease in sleep duration from late pregnancy (Gay et al. 2004; Sivertsen et al. 2015) that persist for up to six years after the birth (Richter et al. 2019). The breaking point of increased sleep deprivation and fragmentation is childbirth, but the sleep situation remains challenging for approximately a year after that due to caregiving demands, especially night-time care (Gay et al. 2004; Insana – Montgomery-Downs 2013; Sivertsen et al. 2015). In general, parents of minor children suffer from shorter sleep duration than childless individuals, and the younger the children, the shorter the sleep duration (Hagen et al. 2013): one study suggests that children under 2 were most likely to sleep for only about 5-6 hours per day and children between 2 and 18 years old were still unlikely to sleep for 8 hours a day (Hagen et al. 2013; Krueger – Friedman 2009); another study shows that having children between 2-5 years old means 9 minutes' less sleep nightly, and every child between 6-18 years of age was found to decrease parents' sleep by 4 minutes (Hagen et al. 2013)

While maternal sleep, especially postpartum (approximately 6-8 weeks from childbirth) has been extensively studied, less attention has been paid to the sleeping patterns of fathers. The existing research suggests the sleep of mothers is more highly fragmented (Insana – Montgomery-Downs 2013). There are some contradictory results regarding sleep duration: while some claim mothers sleep longer in comparison to fathers (Insana – Montgomery-Downs 2013), others argue that mothers spent a longer time awake (Insana et al. 2014).

During both the prenatal and postpartum periods, the paternal sleep routine also changes (Condon et al. 2004). As with the mothers, fathers were also found to sleep less, with more disturbances occurring when compared to the

late pregnancy period (Gay et al. 2004). When comparing sleep duration between parents, contrary to what one would expect, mothers were found to have significantly longer sleep (401 min) than fathers (330 min) (Meltzer 2008). However, this study, conducted among parents of children with autism spectrum disorder, did not distinguish between free days and workdays and was conducted on a small sample of 35 mothers and 22 fathers in the US.

Catherine Leonhard and Christoph Randler (2009) explored amounts of sleep among childless women, pregnant women, mothers and pregnant mothers but did not find any statistical differences.

Social jetlag

Circadian rhythm encompasses a time period of approximately 24 hours and governs our preferences sleep and wake cycle. Individuals incline towards morningness or eveningness based on peaks of activity (Adan et al. 2010). However, the preferences based on an individual's biological rhythm often do not match actual behaviour, which is determined by social constraints. This misalignment between biological and social needs and preferences is called 'social jetlag'. The assumption is that the free days allow sleep-wake rhythm more similar according to the individual preferences when the work and school schedules are not at play. Parents may be anywhere on the chronotype spectrum, with the likelihood of being a morning chronotype increasing with age (Jankowski 2015). As for the mothers, disrupted sleep during pregnancy is quite common (Sloan 2008), and it can potentially affect maternal circadian rhythm (Hofstra – de Weerd 2008). The circadian rhythm of infants is diametrically opposite to that of their adult counterparts: it only appears during the first two months of their life, and they have different needs regarding sleep (Joseph et al. 2015). Even though one would expect that parents' chronotypes and their children's differ, and parents might therefore manifest higher social jetlag, previous research suggests the opposite (Feldman 2006; Sládek et al. 2020; Yamazaki 2007). The most recent paper exploring the social jetlag effect among employed adult individuals due to work and family commitments (Kudrnáčová – Hamplová 2022) shows, in agreement with the afore-mentioned studies, that parents with smaller children are significantly less likely to experience a misalignment between biological and social time.

Also, the majority of the past studies on social jetlag are discussed in the context of specific groups, such as adolescents (e.g., Díaz-Morales – Escribano 2015), or nightshift workers (e.g., Roenneberg – Merrow 2016). Social jetlag research in the context of parenthood, however, is scarce and the existing studies present it only as secondary findings (e.g., Sládek et al. 2020).

Sleep quality

When considering the altered sleep duration and amplified social jetlag among parents, it is not surprising that sleep quality may also change. Pregnancy and childbirth itself are complex physiological phenomena that, according to some, affects mothers' sleep significantly. In comparison, paternal sleep quality changes are less pronounced (Richter et al. 2019). However, some research suggests it is the other way around (Meltzer 2008).

There are records of maternal sleep satisfaction already decreasing three years before childbirth and perceptibly even more shortly after, while paternal sleep quality was found to slightly increase before childbirth (Krämer – Rodgers 2020). Postpartum mothers predominantly engage in night-time childcare, causing more fragmented sleep and a decrease in their sleep quality according to some (Gay et al. 2004; Richter et al. 2019). A study exploring sleep quality in parents 10-12 weeks postpartum found a slight improvement (Dørheim et al. 2009; Insana et al. 2013). Parent studies with 6-months olds that found no difference between mothers and fathers and also mothers and childless women, only fathers were reporting worse sleep quality than control men (Kenny et al. 2021), or studies suggest that mothers' sleep satisfaction steadily increases since giving birth to reach the point where there is no difference between childless women and mothers five years (Krämer – Rodgers 2020) or even six years (Richter et al. 2019) after the delivery. By contrast, fathers' sleep is said to remain constant over the course of five years after the delivery (Krämer – Rodgers 2020) or decrease but much less dramatically than for mothers (Richter et al. 2019).

The quality of sleep seems to be closely tied to the parental experience: on the one hand, some articles suggest first-time mothers are likely to have higher quality sleep than experienced mothers (Kenny et al. 2021); on the other hand, other studies report either no effect whatsoever of first childbirth on parents' sleep patterns when employing PSM (Krämer – Rodgers 2020) or contrarily suggest first childbirth (Richter et al. 2019) or even the first three childbirths impact negatively on sleep satisfaction among parents, with mothers being likely to suffer from significantly worse quality sleep than fathers (Krämer – Rodgers 2020).

Summary of the previous literature

Even though maternal sleep profiles are quite well described, sleep research is generally more often conducted solely on female samples (Dørheim et al. 2009; El Ansari – Stock 2010; Leonhard – Randler 2009). Parental sleep is not sufficiently explored. Barely any sleep studies have taken into consideration childless people as well as parents (Insana – Montgomery-Downs et al. 2013;

Kenny et al. 2021; Krämer – Rodgers 2020). Moreover, some of the sleep research focuses on a specific population such as parents with children with autism spectrum disorder (Meltzer 2008). Previous research consists of small samples of dozens or tens (Condon et al. 2004; Gay et al. 2004; Insana et al. 2014; Insana – Montgomery-Downs 2013; Kenny et al. 2021) which is too small to be reliable, only a minority can be considered representative (Krämer – Rodgers 2020; Krueger – Friedman 2009; Kudrnáčová – Hamplová 2022; Richter et al. 2019) and some of the representative studies were conducted on an employed population which also includes parents (Hagen et al. 2013; Kudrnáčová – Hamplová 2022). Michael D. Krämer and Joseph Lee Rodgers (2020) employed PSM in their article but they focused on the effect of childbirth on life satisfaction and included only one sleep variable, sleep satisfaction, in their analysis.

Overall, the previous literature on sleep among parents is often contradictory, focuses predominantly on pregnant women or parents of small children and explores a limited number of sleep variables. The current study, therefore, offers a comprehensive description of parental sleep with children of various ages in the household and distinguishes between childless people and parents, also between men and women based on PSM to eliminate selection bias.

Hypotheses

H1: The younger the children, the lower the sleep duration of both mothers and fathers.

H2: Sleep duration differs between free days and workdays.

H3: Parents, in general, are more likely to have less sleep variability in the sense of sleep onset and sleep end during workdays and free days and hence lower social jetlag than childless people in general.

H4: Both mothers and fathers have lower subjective sleep quality in comparison to their childless counterparts.

H5: The older the children, the less the difference in sleep quality between parents and childless individuals.

Data and methods

Study design and participants

The study draws on data from the Czech Household Panel Survey (CHPS), which is a nationally representative sample survey repeatedly interviewing a random sample of households in the Czech Republic since 2015. A method of two-stage stratified random sampling was used and data was collected through

Standardized interview face-to-face - computer-assisted personal interviewing (CAPI), paper-and-pencil self-administered questionnaire (SAQ) and computer-assisted web interviewing (CAWI).

The fourth wave of CHPS (2018) was analysed for this study since it contains various sleep measures according to the Munich Chronotype Questionnaire (MCTQ; WEP 2020). The data for this wave were collected between 20th June and 15th October, and a total of 3,188 households were interviewed with a household retention rate of 86.4%. The overall analytical sample after listwise deletion consists of 3,039 respondents in total (2,017 childless individuals and 1,022 parents).

Dataset and complete technical information are available in the Czech Social Science Data Archive (refer to Kudrnáčová 2019).

Treatment and outcome variables

Treatment variables: parenthood

To discriminate between parents and childless individuals, binary indicators (also called outcome variables) are used. Zero value stands for non-parents, and one represents parents based on the age category of their child/ren. Based on both the theoretical framework and the available variables in the dataset, there are three categories: parents with at least one child aged ≤ 5, parents with at least one child aged ≥ 6 and ≤ 11 and parents with at least one child aged ≥ 11 and ≤ 17.

Outcome variables: sleep

Social jetlag

The measure of *social jetlag* was computed according to MCTQ (WEP 2020) as a mid-sleep difference on free days and workdays. The resulting continuous-time variable was converted into an absolute numeric variable representing the hours of social jetlag. Any value above zero represents the discrepancy between social and biological time, whereas zero means the absence of such misalignment. This measure was also employed in other studies (e.g., Jankowski 2014).

Sleep duration

The total amount of sleep obtained was also incorporated into the analysis as one of the outcome variables. Items "At what time do you usually fall asleep on workdays/free days?" and "At what time do you usually wake up on workdays/free days?" were used to compute the average daily *sleep duration*. As with social jetlag, sleep duration was calculated as a time variable and con-

verted into a numeric variable holding the number of hours. This measure was also employed in other studies (e.g., Sládek et al. 2020).

Sleep quality

The *quality of sleep* is a subjective measure obtained through the question "How would you rate the quality of your sleep?" with responses ranging from 1 to 4 ("very bad", "bad", "good" and "very good"). This measure was also employed in other studies (e.g., Ness – Saksvik-Lehouillier 2018).

Statistical analysis

The PSM is used to estimate the effect of parenthood on sleep. It is a statistical procedure that reduces selection bias by a sample compilation in which the confounders are balanced between the groups. It has similar features to an experiment: there are two groups, one control and one treatment. This method allows the assessment of social jetlag, sleep duration and sleep quality among childless individuals and parents. Individuals without children and parents are matched: a propensity score is calculated based on a set of control variables to achieve the maximum possible similarity so that childless people and parents differ only on the basis of having or not having children.

Firstly, the propensity score is estimated using a logit specification. Secondly, a matching algorithm is used to find the most similar pairs in the sample. Previous studies suggest significant differences between men and women and also among parents based on the age of their child/ren. It is therefore appropriate to create the respective number of propensity score models, which are six in total. For each of them, the most fitting matching algorithm must be used. A variety of matching algorithms was tested but the most applicable ones are listed in Table 1.

Table 1: **Propensity score matching algorithms used in analyses**

Matching group properties (control group vs. treatment group)		Matching algorithm
Childless people vs. parents with child/ren aged ≤ 5 years	Male	Nearest neighbour 2 matching with replacement
	Female	Nearest neighbour 1 matching with replacement with caliper width 0.002
Childless people vs. parents with child/red aged ≥ 6 and ≤ 11 years	Male	Nearest neighbour 1 matching with replacement
	Female	Nearest neighbour 1 matching with replacement with caliper width 0.0004
Childless people vs. parents with child/ren aged ≥ 11 and ≤ 17 years	Male	Epanechnikov kernel matching with bandwith 0.06
	Female	Nearest neighbour 1 matching with replacement

Also, common support is assessed both subjectively by examining the graphs of propensity scores across treatment and control groups (not presented in the article) and objectively by implementing it into the analyses. The common support condition ensures an overlap between the treatment and the control group, thereby guaranteeing comparability (Caliendo – Kopeinig 2008).

The outcomes of the matched treatment and the control group are compared in a weighted non-parametric mean comparison to estimate the average effect of being a parent compared to the situation of not being a parent. Standard errors were bootstrapped with 1000 repetitions because the methodological research indicates that bootstrapping performs effectively in PSM (Bodory et al. 2020). The analyses were performed using the Stata psmatch2 command (Leuven – Sianesi 2003).

Control variables

Control variables include continuous age (18-70), categorical net household income (1 “up to 29 999 CZK”, 2 “30 000 - 39 999 CZK”, 3 “40 000 - 49 999 CZK” 4 “more than 50 000 CZK”) and education (1 “Primary and secondary”, 2 “Tertiary”).

Since men and women have separate models, the sex variable was not added. Even though in the exploratory models, the couple variable explained parenthood quite well, it was not included in the final models because the vast majority of parents were either married or living with their spouse. This variable has lost its distinctiveness and was therefore eliminated.

Results

Descriptive statistics and control variables balancing

Tables 2 and 3 show the balancing of control variables before and after matching. Because the analyses are performed separately for the three-parent categories based on the age range of their child/ren and individually for each gender, there are six tables in total. Since the trends are similar among all of them, only two are described in detail below; the other four tables are provided in the supplementary material. It was not necessary to consider different outcome variables because the balancing is the same regardless of social jetlag, sleep duration on free/workdays and sleep quality.

Table 2 indicates substantial differences between the childless and fathers of the youngest child group, especially in terms of age: before matching, the mean age of fathers was 38 while for the control group of the childless, it was 49. Fathers have on average higher education and higher household income. After successful matching, however, the control variables are balanced; standardized percentage bias is reduced to below the recommended value of 5.0, and the variance ratio reaches slightly over 1.0 (Gangl 2015), representing an equal variance in the control variable for both groups among continuous variables.

Table 2: **Control variables balancing before and after matching: fathers with at least one child aged ≤ 5 years vs. childless men**

	Before matching				After matching			
	Mean				Mean			
	Treated (Fathers)	Controls (Childless)	% bias	Variance Ratio	Treated (Fathers)	Controls (Childless)	% bias	Variance Ratio
Age[1]	38.090	49.014	-85.8	0.14	38.086	37.793	2.3	1.01
Education	0.302	0.196	24.5		0.298	0.295	0.6	
Household income[1]	2.683	2.315	33.1	0.75	2.682	2.652	2.7	1.06
N	*199*	*927*			*198*[2]	*927*		

CHPS 2018. % bias = standardized percentage bias

[1]The variables of age and household income were entered in squared terms to achieve better balancing.

[2]1 treated was excluded by the algorithm due to no common support

Similar to men, women also show significant differences before and after matching. Mothers of child/ren up to the age of 5 are on average 35 years old, and childless controls are almost 51 years old before matching is performed. Mothers are also more likely to have reached a higher level of education and tend to have a higher income in comparison to women without children. After performing the matching, the differences are reduced and mean values are balanced with both standardized percentage bias and variance ratios reaching acceptable values.

Table 3: **Control variables balancing before and after matching: mothers with at least one child aged ≤ 5 years vs. childless women**

	Before matching				After matching			
	Mean				Mean			
	Treated (mothers)	Controls (Childless)	% bias	Variance Ratio	Treated (mothers)	Controls (Childless)	% bias	Variance Ratio
Age[1]	35.012	50.752	-133.1	0.10	34.370	33.997	3.1	1.08
Education	0.341	0.167	40.8		0.328	0.326	0.6	
Household income[1]	2.504	2.162	29.9	0.83	2.578	2.550	2.5	0.96
N	*252*	*1,090*			*192*[2]	*1,090*		

CHPS 2018. % bias = standardized percentage bias

[1]The variables of age and household income were entered in squared terms to achieve better balancing.

[2]60 treated were xcluded by the algorithm due to no common support

Results on sleep: parents of children up to 5 years of age

The effect of parenthood on various sleep variables is explored. When comparing almost identical pairs of childless men and fathers with children up to 5 years of age (Table 4 and graphs A1-C3 in Appendix), fathers are inclined towards lower social jetlag values, on average 1.16 hours, while childless men reach 1.39 hours of sleep debt, which is significant for the 10 % level (p=0.068). Sleep duration on free days yields a difference of 30 minutes in favour of childless people, also significant on the 10 % level (p=0.067). However, there are no notable differences in sleep quality and sleep duration on workdays.

Table 4: **Sleep among fathers of children up to 5 years of age**

	Coefficient	Bootstrapped s.e.	Z-statistics	P-value (P>|z|)
Social jetlag				
Mean outcome treated	1.16			
Mean outcome matched controls	1.39			
ATT	-0.22	0.12	-1.83	0.068
Sleep duration on free days				
Mean outcome treated	8.01			
Mean outcome matched controls	8.31			
ATT	-0.30	0.16	-1.83	0.067
Sleep duration on workdays				
Mean outcome treated	6.97			
Mean outcome matched controls	7.18			
ATT	-0.21	0.16	-1.29	0.197
Sleep quality				
Mean outcome treated	0.15			
Mean outcome matched controls	0.12			
ATT	0.04	0.05	0.78	0.436

CHPS 2018. ATT=Average Treatment Effect on the Treated s.e.=standard error. N(treated)=198, N(controls)=927. 1 treated excluded after matching due to no common support.

The contrast between childless women and mothers of small child/ren is even more pronounced (Table 5 and graphs A1-C3 in Appendix). As for social jetlag, mothers manifest 0.82 hours while for the childless, the value reaches 1.35 hours, which is statistically significant on the 0.1% level (p=0.000). Similar to fathers, mothers also tend to have shorter sleep on free days (8.12 hours) than women without child/ren (9.45 hours), with a significance level of 10% (p=0.094). There are barely any differences between the treated and controls in sleep quality and sleep duration on workdays and sleep quality.

Table 5: **Sleep among mothers of children up to 5 years of age**

	Coefficient	Bootstrapped s.e.	Z-statistics	P-value (P>|z|)
Social jetlag				
Mean outcome treated	0.82			
Mean outcome matched controls	1.35			
ATT	-0.53	0.15	-3.59	0.000
Sleep duration on free days				
Mean outcome treated	8.12			
Mean outcome matched controls	8.45			
ATT	-0.33	0.20	-1.68	0.094
Sleep duration on workdays				
Mean outcome treated	7.43			
Mean outcome matched controls	7.36			
ATT	0.07	0.21	0.31	0.755
Sleep quality				
Mean outcome treated	0.26			
Mean outcome matched controls	0.23			
ATT	0.03	0.07	0.41	0.681

CHPS 2018. ATT=Average Treatment Effect on the Treated s.e.=standard error. N(treated)=192, N(controls)=1090. 60 treated excluded after matching due to no common support.

Results on sleep: parents of children between 6 and 11 years of age

Interestingly, the sleep variables of childless men and fathers of children/ren between 6 and 11 years of age (Table 6 and graphs A1-C3 in Appendix) differ only slightly, and none of the differences is statistically significant. The matched sample of both the treated and controls manifests around 1.2 hours of social jetlag, the length of their sleep during free days being roughly 8 hours on average and on workdays almost 7 hours, with notably poor quality of sleep.

Table 6: **Sleep among fathers of children from 6 to 11 years of age**

	Coefficient	Bootstrapped s.e.	Z-statistics	P-value (P>|z|)
Social jetlag				
Mean outcome treated	1.24			
Mean outcome matched controls	1.23			
ATT	0.01	0.15	0.07	0.943
Sleep duration on free days				
Mean outcome treated	8.04			
Mean outcome matched controls	8.14			
ATT	-0.10	0.19	-0.54	0.588
Sleep duration on workdays				
Mean outcome treated	6.86			
Mean outcome matched controls	6.94			
ATT	-0.08	0.17	-0.48	0.635
Sleep quality				
Mean outcome treated	0.17			
Mean outcome matched controls	0.14			
ATT	0.04	0.05	0.68	0.493

CHPS 2018. ATT=Average Treatment Effect on the Treated s.e.=standard error. N(treated)=199, N(controls)=927.

The sleep routines of childless women and mothers of children/ren in the same age group vary (Table 7 and graphs A1-C3 in Appendix). Mothers once again exhibit lower social jetlag in comparison to their peers without children on a 5% significance level (p=0.035). Even though the sleep duration on free days does not differ greatly among the treated and the controls, the difference is notable on the 10% significance level (p=0.086). Besides that, sleep duration on workdays and sleep quality are comparable.

Table 7: **Sleep among mothers of children from 6 to 11 years of age**

	Coefficient	Bootstrapped s.e.	Z-statistics	P-value (P>|z|)
Social jetlag				
Mean outcome treated	1.10			
Mean outcome matched controls	1.39			
ATT	-0.28	0.13	-2.11	0.035
Sleep duration on free days				
Mean outcome treated	8.25			
Mean outcome matched controls	8.58			
ATT	-0.34	0.20	-1.72	0.086
Sleep duration on workdays				
Mean outcome treated	7.10			
Mean outcome matched controls	7.27			
ATT	-0.16	0.17	-0.97	0.331
Sleep quality				
Mean outcome treated	0.24			
Mean outcome matched controls	0.18			
ATT	0.06	0.06	1.06	0.287

CHPS 2018. ATT=Average Treatment Effect on the Treated s.e.=standard error. N(treated)=189, N(controls)=1090. 98 treated excluded after matching due to no common support.

Results on sleep: parents of children between 12 and 17 years of age

Last but not least, the comparison of childless men and fathers of child/ren older than 11 but still before reaching adulthood (Table 8 and graphs A1-C3 in Appendix) show statistical differences on a 10% level in the amount of social jetlag (p=0.079) and sleep on free days (p=0.096), with fathers once again suffering less from sleep debt but also manifesting less sleep during the weekends. Sleep duration during the week, however, is almost 7 hours and the sleep quality tends to be poor for both groups.

Table 8: **Sleep among fathers of children from 12 to 17 years of age**

	Coefficient	Bootstrapped s.e.	Z-statistics	P-value (P>|z|)
Social jetlag				
Mean outcome treated	1.16			
Mean outcome matched controls	1.32			
ATT	-0.16	0.09	-1.76	0.079
Sleep duration on free days				
Mean outcome treated	8.00			
Mean outcome matched controls	8.21			
ATT	-0.21	0.12	-1.67	0.096
Sleep duration on workdays				
Mean outcome treated	6.92			
Mean outcome matched controls	6.97			
ATT	-0.06	0.11	-0.52	0.601
Sleep quality				
Mean outcome treated	0.21			
Mean outcome matched controls	0.15			
ATT	0.05	0.04	1.38	0.169

CHPS 2018. ATT=Average Treatment Effect on the Treated s.e.=standard error. N(treated)=285, N(controls)=927. 3 treated were excluded after matching due to no common support.

As for women (Table 9 and graphs A1-D3 in Appendix), motherhood has a notable effect of 1% significance on social jetlag (p=0.008), suggesting that mothers suffer from lower levels of sleep debt. However, mothers of older child/ren also get less sleep than their childless peers on a 5% significance level (p=0.017). Sleep duration during the week and rather bad sleep quality are comparable for both women with and without child/ren.

Table 9: **Sleep among mothers of children from 12 to 17 years of age**

	Coefficient	Bootstrapped s.e.	Z-statistics	P-value (P>|z|)
Social jetlag				
Mean outcome treated	1.13			
Mean outcome matched controls	1.48			
ATT	-0.35	0.13	-2.64	0.008
Sleep duration on free days				
Mean outcome treated	8.09			
Mean outcome matched controls	8.53			
ATT	-0.44	0.18	-2.38	0.017
Sleep duration on workdays				
Mean outcome treated	7.15			
Mean outcome matched controls	7.24			
ATT	-0.09	0.15	-0.60	0.548
Sleep quality				
Mean outcome treated	0.22			
Mean outcome matched controls	0.16			
ATT	0.06	0.05	1.09	0.277

CHPS 2018. ATT=Average Treatment Effect on the Treated s.e.=standard error. N(treated)=342, N(controls)=1090. 18 treated excluded after matching due to no common support.

Discussion

Contributing to the theory of the Social Zeitgeber, which suggests disturbed sleep by life events such as childbirth, and to the theories of gendered responsibilities influencing sleep among parents, this manuscript explores sleep duration, social jetlag and sleep quality among childless individuals and parents.

The results do not fully support the hypothesis (H1) that parents of younger children will have the shortest sleep length. For fathers, sleep duration on both free and workdays remains relatively stable in all three age categories of their children. This is likely because fathers traditionally do not participate in childcare and housework to the same extent as mothers and their sleep is not affected as much. On free days, mothers and fathers also have a similar amount of sleep no matter the age of their children, suggesting that having a child no matter their age is comparably demanding in terms of sleep duration. However, on workdays, mothers of child/ren up to 5 years of age get the most sleep. This is in opposition to previous research that suggests sleep impairment for those with child/ren up to six years of age (Richter et al. 2019). The possible explanation might be that since most women do not work at this life stage, their sleep is mainly subjected to the housework responsibilities and their children's needs. In Czechia, maternity and parental leave can take up to four years and

are likely to be prolonged with the timing of another baby (Šťastná et al. 2019). Later on, however, there are often work responsibilities, and the length of sleep becomes shorter as the child ages. Or that the longer sleep is subjected to this age group, given that there is no difference between mothers' and childless women's sleep duration during workdays. When comparing childless individuals and parents, parents of the youngest child/ren and mothers of child/ren from 6 to 11 years are observed to sleep less on free days on a 10% significance level, fathers of child/ren from 12 to 17 years get less sleep, and mothers have significantly less sleep than their childless peers from the same age group even on a 5% level of significance. This is likely because parents, especially mothers, have the child as a reason to get up earlier during the free days than they might have preferred if they were childless. There are no differences between childless people and parents on workdays in any child age group, suggesting that while parents do not choose to cut off on sleep to make sure they are handling other areas of their life (e.g., work) as they were before the child, they are likely to neglect other areas such as time for themselves or leisure. This idea is also supported by an empirical study (Aalto – Varjonen 2014) showing that parenthood comes with a decrease in free time, which is especially pronounced in mothers, but fathers, in addition, experience an increase in workload. This finding partially confirms those of Erika Hagen et al. (2013) in that parents of minor children, in general, have a shorter sleep length as opposed to those without children (Hagen et al. 2013). However, this study did not differentiate between free days and workdays. While sleep duration on free days is on average almost the same among mothers and fathers, women tend to get about half an hour more sleep on workdays, which is partially confirmed (Insana – Montgomery-Downs 2013) and partially contrasts with previous research results (Insana et al. 2014). Lower sleep duration of parents during free days is likely to be an effect of parenthood: parents may not have to go to work on free days, but they have children to take care of, which gives them a reason to get up earlier than they might have preferred.

Regarding amount of sleep and its variance between free days and workdays (H2), the results support the hypothesis: generally, sleep is about an hour longer on free days than on workdays, which also applies to the childless. This result is not surprising since sleeping longer on free days is quite a common practice. Previous literature has yet to consider the differences between workdays and weekends. The sleep duration differences in the analysis are most significant for parents with the most minor children which is logical since tiny babies are more demanding than older children.

Even though, based on previous research (Feldman 2006; Kudrnáčová – Hamplová 2022; Sládek et al., 2020; Yamazaki 2007), parents were expected to suffer from lower social jetlag (H3), the results are mixed. Mothers consistently

have significantly lower social jetlag when compared to their childless peers, as suggested by the previous literature. Fathers in the youngest and oldest child groups have a lower sleep debt but on a 10 % significance level, while the middle group shows no difference at all. The reason might be that since mothers are the primary caregivers, their workdays and free days are quite similar in terms of sleep routine, while fathers, as the breadwinners, are more likely to have an ordinary week, which means getting up early on workdays and little later on free days. Even though their sleep is influenced by parenthood, it does not seem to be affected to the same extent as the sleep of mothers. Also, findings regarding the decrease in social jetlag of fathers of the oldest children suggest that they are more likely to step into the childcare later on when mothers return to employment and when the children are "more fun" (LOM 2020). There is also another possible explanation for the decreased social jetlag among parents: a recent study shows that parents leave home earlier in the morning than childless and are therefore exposed to the morning sunlight, which advances their sleep phase (Jankowski et al. 2014). Interestingly, there are no differences at all among parents in sleep quality, which is in opposition to both previous research and hypothesis (H4) and subsequently also to the assumption (H5) that there would be more pronounced differences between childless individuals and parents in the youngest age groups. Sleep quality is comparable in all groups with barely notable differences. This finding is in compliance with one of the previous studies (Krämer – Rodgers 2020). This is possibly due to parents' sleep quality not being particularly impaired by the presence of a child/ren: both the childless and parents rate their sleep as overall rather poor.

Limitations

There are several strengths to this article: firstly, given that sleep is influenced by the temporal organization of social life and inevitably affects the quality of life, it is a valuable contribution to the sociological debate. Yet, with rare exceptions, sleep research has been dominated by biomedical approaches. Secondly, the presented data are representative of the Czech population and the use of the PMS method helps to eliminate bias in observational studies.

The limitations include the constrains of the measurement tools used in CHPS. This survey relies on subjective, self-reported measurements. Moreover, the social jetlag has to be interpreted with care. While it is a valid and reliable scale, it measures the actual individual sleep schedule and not the sleep-wake preferences, which might be slightly different. However, MCTQ is the only existing questionnaire tool that enables the computation of social jetlag. Nor does the study allow for longitudinal observation: there are not enough new parents between the three CHPS waves (2018-2020) containing sleep variables to observe both within and between differences. Also, the household structure

is not taken into account: while there are only a few parents who are not married or living with a spouse which would hardly alter results, the analyses do not consider e.g., number of children in the household. The effect of this variable is yet to be determined in future studies.

Conclusion

The current study explores the effect of parenthood on sleep patterns using an experiment-like method of PSM. Since the previous literature indicated that the experience might differ based on gender and age of the children, these factors were considered in the models. Analysing the effect of various sleep variables (sleep duration on workdays and free days, social jetlag and sleep quality) on childless individuals and parents and taking into account the previous literature – in many cases inconsistent – some interesting findings emerge: the longest sleep phase seems to be reached among mothers of small children. Overall, childless individuals and parents have similar sleep patterns, getting less sleep during workdays and more sleep during the weekends. But parents are deprived of sleep on free days, especially when their child or children are 12 or older. This is also connected to mothers exhibiting lower social jetlag, which suggests that the child/ren are the equivalent of full-time employment. Children, however, seem to be a disadvantage to sleep duration on free days because parents and especially mothers cannot sleep as long as they might prefer. Intriguingly, no difference was found regarding sleep quality.

Sleep is often an underestimated but essential part of our lives, one which should be given more attention, especially given the fact that healthy sleep patterns are necessary for both physical and mental wellbeing and in general high quality life. The data analysed here are cross-sectional and pre-pandemic; future studies should ideally focus on extending the investigation into sleep and how it changes at various points in time.

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Appendix

Table A1: **Control variables balancing before and after matching: fathers with at least one child aged ≥ 6 and ≤ 11 years vs. childless men**

	Before matching				After matching			
	Mean				Mean			
	Treated (Fathers)	Controls (Childless)	% bias	Variance Ratio	Treated (Fathers)	Controls (Childless)	% bias	Variance Ratio
Age[1]	41.834	49.014	-56.9	0.12	41.834	42.322	-3.9	0.95
Education	0.281	0.196	20.0		0.281	0.296	-3.5	
Household income[1]	2.809	2.315	44.2	0.77	2.809	2.749	5.4	1.24
N	*199*	*927*			*199*	*927*		

CHPS 2018. % bias = standardized percentage bias

[1]The variables age and household income were entered in squared terms to reach a better balancing.

Table A2: **Control variables balancing before and after matching: mothers with at least one child aged ≥ 6 and ≤ 11 years vs. childless women**

	Before matching				After matching			
	Mean				Mean			
	Treated (Mothers)	Controls (Childless)	% bias	Variance Ratio	Treated (mothers)	Controls (Childless)	% bias	Variance Ratio
Age[1]	39.209	50.752	-97.1	0.11	39.376	39.423	-0.4	1.0
Education	0.286	0.167	28.6		0.243	0.228	3.8	
Household income[1]	2.610	2.162	39.0	0.84	2.566	2.550	1.4	1.0
N	*287*	*1,090*			*189*[2]	*1,090*		

CHPS 2018. % bias = standardized percentage bias

[1]The variables age and household income were entered in squared terms to reach a better balancing.

[2]98 treated were excluded by the algorithm due to no common support

Table A3: **Control variables balancing before and after matching: fathers with at least one child aged ≥ 12 and ≤ 17 years childless men**

	Before matching				After matching			
	Mean				Mean			
	Treated (Fathers)	Controls (Childless)	% bias	Variance Ratio	Treated (Fathers)	Controls (Childless)	% bias	Variance Ratio
Age[1]	42.656	49.014	-49.7	0.15	42.653	42.970	-2.5	0.95
Education	0.278	0.196	19.2		0.270	0.284	-3.4	
Household income[1]	2.847	2.315	47.6	0.77	2.846	2.891	-4.0	1.02
N	*288*	*927*			*285*[2]	*927*		

CHPS 2018. % bias = standardized percentage bias

[1]The variables age and household income were entered in squared terms to reach a better balancing.

[2] 3 treated were excluded by the algorithm due to no common support

Table A4: **Control variables balancing before and after matching: mothers with at least one child aged≥ 12 and ≤ 17 years vs. childless women**

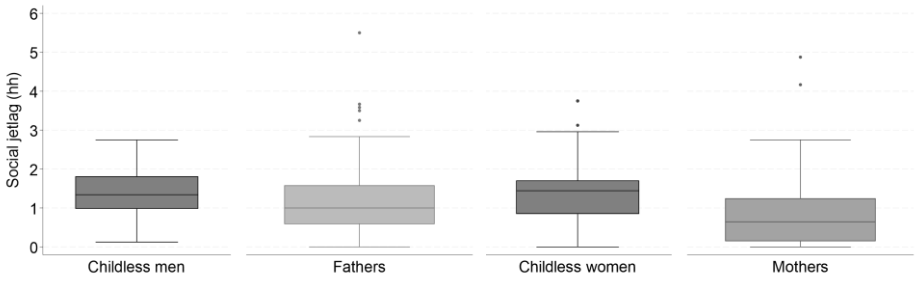
	Before matching				After matching			
	Mean				Mean			
	Treated (Mothers)	Controls (Childless)	% bias	Variance Ratio	Treated (Mothers)	Controls (Childless)	% bias	Variance Ratio
Age[1]	41.081	50.752	-80.4	0.13	41.102	41.056	0.4	0.98
Education	0.328	0.167	37.9		0.292	0.278	3.4	
Household income[1]	2.725	2.162	49.4	0.82	2.725	2.725	0.0	1.03
N	*360*	*1,090*			*342*[2]	*1,090*		

CHPS 2018. % bias = standardized percentage bias

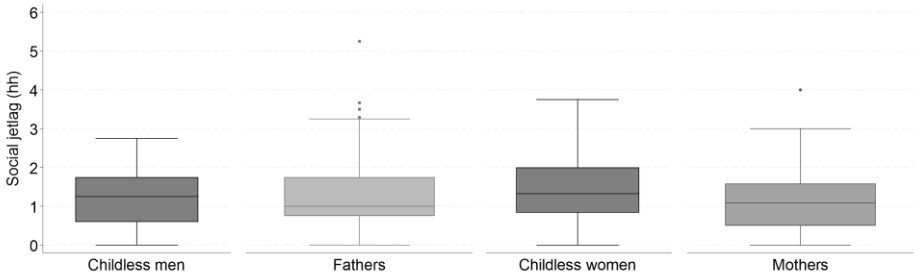
[1]The variables age and household income were entered in squared terms to reach a better balancing.

[2]18 treated were excluded by the algorithm due to no common support

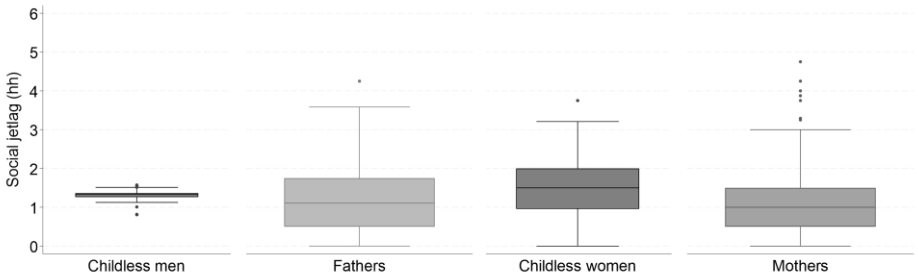
Graph A1: **Social jetlag among childless and parents of children up to 5 years of age**



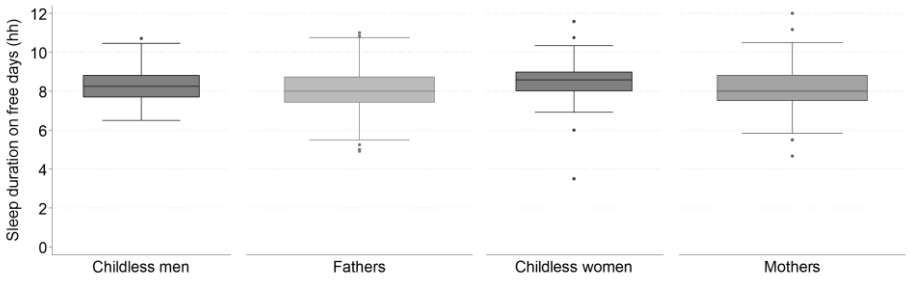
Graph A2: **Social jetlag among childless and parents of children from 6 to 11 years of age**



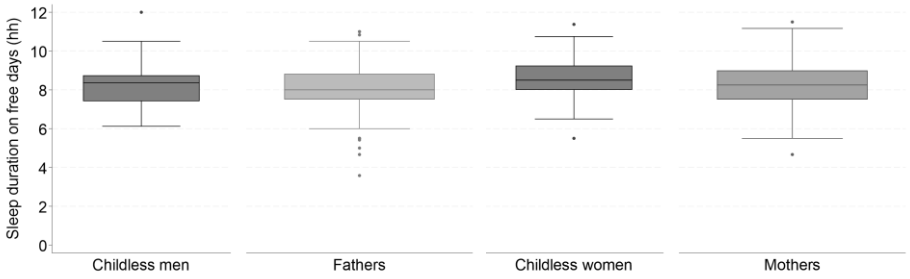
Graph A3: **Social jetlag among childless and parents of children from 12 to 17 years of age**



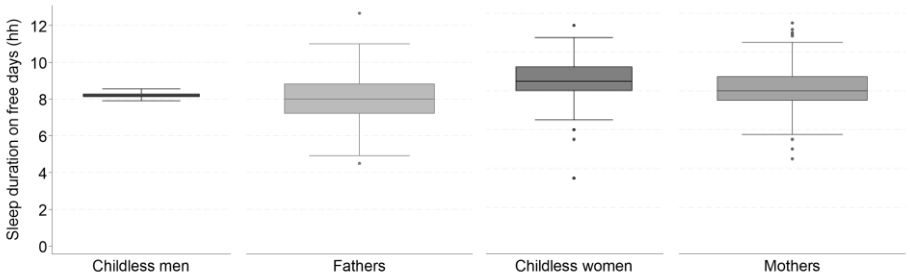
Graph B1: **Sleep duration on free days among childless and parents of children up to 5 years of age**



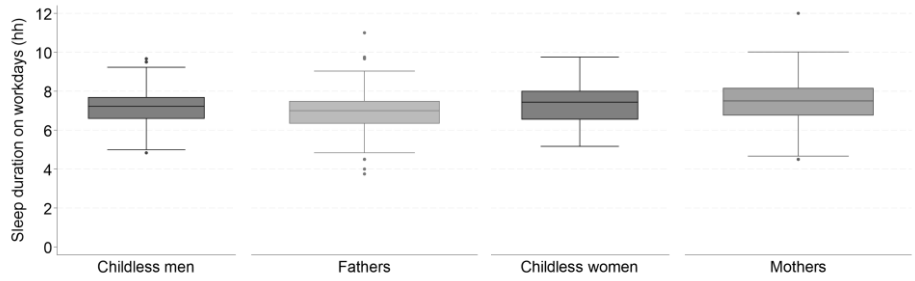
Graph B2: **Sleep duration on free days among childless and parents of children from 6 to 11 years of age**



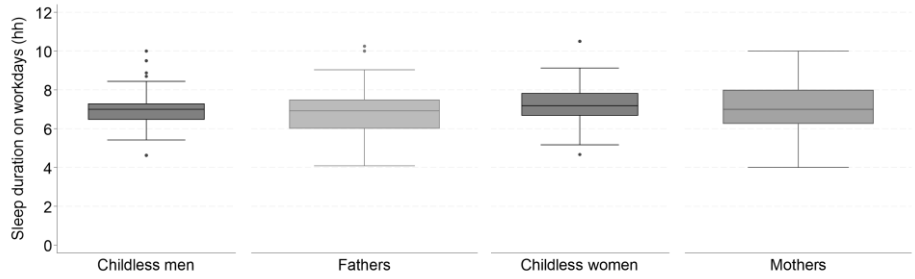
Graph B3: **Sleep duration on free days among childless and parents of children from 12 to 17 years of age**



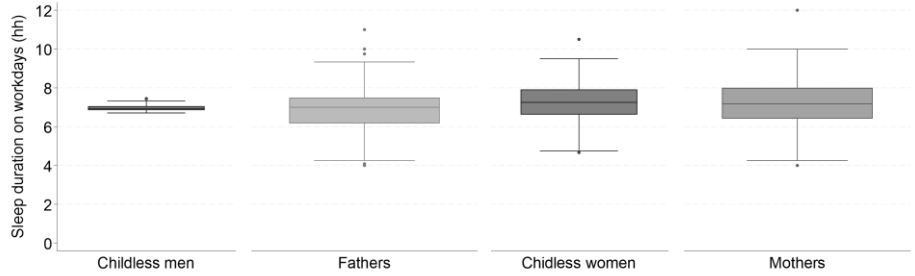
Graph C1: **Sleep duration on workdays among childless and parents of children up to 5 years of age**



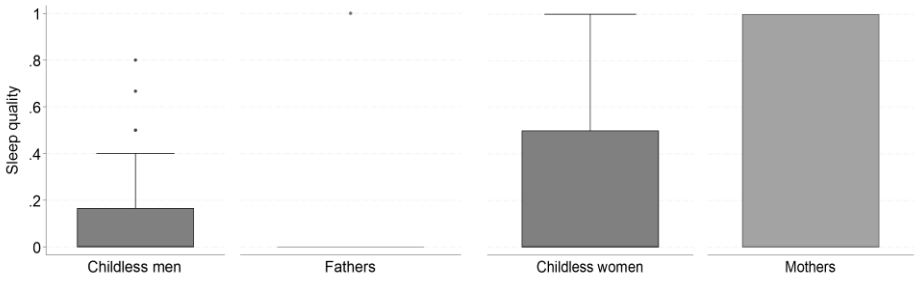
Graph C2: **Sleep duration on workdays among childless and parents of children from 6 to 11 years of age**



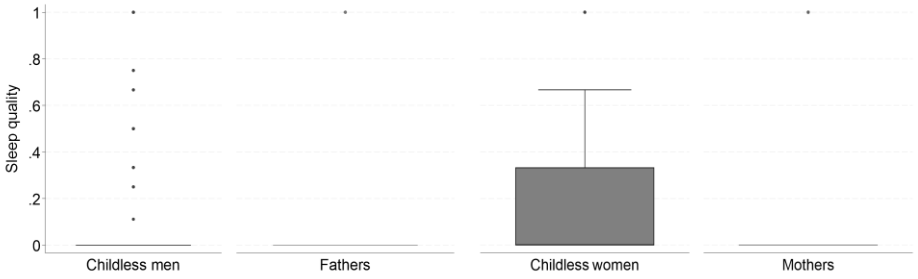
Graph C3: **Sleep duration on workdays among childless and parents of children from 12 to 17 years of age**



Graph D1: **Sleep quality among childless and parents of children up to 5 years of age**



Graph D2: **Sleep quality among childless and parents of children from 6 to 11 years of age**



Graph D3: **Sleep quality among childless and parents of children from 12 to 17 years of age**