Mobile Phone Use after Lights Out as a Risk Factor for Mothers' Chronic Fatigue: Cross-Sectional Survey of Japanese Mothers Rearing Toddlers and Preschoolers

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Abstract

Because of the widespread use of mobile phones today and their vast effect on communication patterns, it is important to study their possible negative effects on various aspects of family life. The aim of this study was to investigate whether there are associations between mothers' use of mobile phone after lights out and chronic fatigue in their rearing of toddlers or preschoolers. A sample of 1,127 mothers of toddlers or preschoolers was analyzed using a self-report questionnaire. A series of logistic regression analyses was conducted on the data.

Frequent (i.e., almost every day) use of mobile phones after lights out was significantly associated with chronic fatigue [OR = 1.50; (95%CI 1.05–2.14)] after controlling for the mother's age, child's age, child's sex, number of siblings, length of sleep, and irregular bed time.

The present results suggest that mobile phone use after lights out could be a risk factor related to chronic fatigue among mothers of toddlers or preschoolers. Although additional data are needed, nocturnal use of mobile phones might impair the well-being of mothers and children. Interventions related to mothers' lifestyle, including their use of mobile phones, may be warranted to reduce mothers' chronic fatigue.

Keywords: Mobile Phone Use after Lights Out, Chronic Fatigue, Mothers of Toddlers and Preschoolers

Introduction

Use of electronic devices such as mobile phones has recently become popular and prevalent among general population; for example, diffusion rate is 74.8% among the general population, 97.3% among people in their twenties, 95.0% among people in their thirties, and 94.2% among those in their forties in Japan(Bureau 2010). However, a number of studies have shown that mobile phone use may be associated with several health problems. For example, extensive mobile phone use in the morning associated with higher intensities of headache(Heinrich, Thomas, and Heumann 2010). Extensive use of mobile phones can also cause neck–and shoulder pain(Hakala and Rimpelä 2006) as well as waking-time tiredness(Punamäki, Wallenius, and Nygård 2007). In one study, persons who used mobile phones more than 15 minutes per day reported poorer perceived health (Söderqvist, Carlberg, and Hardell 2008). Even worse for users of mobile phones, nocturnal mobile phone use, especially after lights out, may cause sleep-related problems, including short sleep, subjective perception of poor sleep quality, daytime sleepiness, and insomnia symptoms (Munezawa et al. 2011).

According to these observations, the researcher

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hypothesized that nocturnal mobile phone use, particularly after lights out, may be associated with chronic fatigue among parents of young children. The particular interest in bedtime use is because mobile phone use after lights out may have the most effects on users' sleep disturbances and physical condition. The researcher chose to focus on the mothers of toddlers or preschoolers. Because as Glaser (2002) mentioned, "Children can be temperamentally difficult or provocative, or in some cases they have physical or psychological conditions that cause serious stress for the parents and challenge their ability to cope" (p. 698)(D Glaser 2002). However, if parents are not in good enough physical condition to deal with these difficulties, they cannot be responsible parents. Moreover, as a child progresses into the toddler years, his or her cognitive development begins to make substantial progress, expressed through symbolic thought, words, and play (Feldman, Eidelman, and Rotenberg 2004). For toddlers and preschoolers, mothers are instrumental in the formation of an accurate understanding of social and emotional situations. Therefore, children need to have a relationship with mothers at this stage that is free from mothers' chronic fatigue for their sound psychosocial development. In addition, mothers may tend to use their mobile phones after lights out as they lull their children to sleep.

Considering the high diffusion rate of mobile phones in the general population today, it may be worthwhile to examine the relationship between mothers' mobile phone use, especially after lights out, and chronic fatigue. Thus, in the present study, the researcher aimed to investigate the relationship between nocturnal mobile phone use, especially after lights out, and chronic fatigue among mothers rearing toddlers or preschoolers.

Materials and Methods

Subjects

The survey used to collect data for this study was performed from December 2012 to January 2013 in a metropolitan area of Japan. Eight nursery schools and eleven kindergartens were randomly selected, and the participants consisted of mothers of toddlers or preschoolers (ages of 3–6 years, as this is generally the age range of children attending nursery school and kindergarten in Japan).

The researcher's procedure was to approach the principal of each nursery school or kindergarten about participating in the survey; the consenting principals then contacted the children's teachers and guardians. Teachers in the participating schools handed self-report questionnaires and envelopes to guardians. When they did so, the teachers explained to the guardians that (a) participation in the study was anonymous and voluntary and (b) strict confidentiality would be maintained. The guardians were requested to complete the questionnaire and return it in the envelope provided. The researcher collected the sealed questionnaires at each nursery school or kindergarten. The study was approved by the ethics committee of the University of Tokyo.

Measures

Mothers were asked to fill a questionnaire that included (a) questions on the mothers' chronic fatigue, (b) the Japanese version of the 12-item General Health Questionnaire (GHQ-12), and (c) other questions covering demographic characteristics and nocturnal lifestyle patterns, such as sleep duration, irregular bedtime, and the use of mobile phones. The researcher created the questions used to measure chronic fatigue

and the questions were “Did you feel chronic fatigue last week?” The question was answered “Yes” or “No.”

The General Health Questionnaire (GHQ-12)

The General Health Questionnaire(GHQ) is well-known rating scales for the detection of nonpsychotic psychiatric symptoms, particularly symptoms of anxiety or depression(Goldberg et al. 1976). The 12-item GHQ(GHQ-12) is extensively used self-administered questionnaire. The validity and reliability of the Japanese version of the GHQ-12 have been confirmed(Minowa 2003). A four-point scale with binary scoring (i.e., 0011) was used for each of the questions. Responses of “1” were added together to shape the total score, with a range from 0 (best possible) to 12 (worst possible). We defined respondents whose total score was major than or equal to 4 as in poor mental health, consistent with previous studies (Shimbo, Nakamura, and Shi 2005).

Other variables

The survey also contained questions about nocturnal sleep duration, irregular bedtime, e-mail exchange or calling activity using a mobile phone after lights out, and subjective perception of poor sleep quality. The length of sleep was measured by asking “How many hours and minutes have you regularly slept at night recently?” The answers were classified into three categories as done in other studies: short sleep (less than six hours), average sleep (six to eight hours), and long sleep (more than eight hours) (Kaneita and Ohida 2006). Irregular bedtime was measured by asking “How often is your bedtime irregular?” This question had four possible replies: “always,” “sometimes,” “seldom,” and “never.” If the response to this question was “always,” then the mother was defined as having a practice of irregular bedtime, consistent with a previous study (Tochigi et al. 2012). The frequency of mobile phone use after lights out was measured by the question as follows: “How often have you talked or sent e-mails using a mobile phone after lights out recently?” Possible answers were “never,” “sometimes,” and “almost every night,” as in previous studies that used this question (Oshima et al. 2012; Tochigi et al. 2012). The question about subjective sleep assessment was “How do you assess the quality of your sleep during the previous month?” This question had four possible replies: “very bad,” “bad,” “good,” and “very good.” If the response to this question was “bad” or “very bad,” then the mother was defined as having poor sleep quality, again following the practice of a previous study (Munezawa et al. 2011).

The questionnaire also included items on demographic variables, including the mother’s age, child’s sex, child’s age, number of siblings, single parent status, family structure, family economic status, mother’s education, type of work, smoking, and drinking alcohol. Possible answers regarding family economic status were “poor,” “slightly poor,” “normal,” “comparatively rich,” and “rich.” Both “poor” and “slightly poor” answers were classified as poor. Smoking was measured by asking “Are you smoker?” Drinking alcohol was measured by asking “How many times do you drink alcohol within a month?” Possible answers were “always,” “sometimes,” “seldom,” and “never.” As observed above, sleep duration was classified into three categories: short, average, and long. In this study, six and eight hours corresponded to 21.4% and 84.6% of the population, respectively. Odds ratios for

respondents who sleep less than six hours were calculated in comparison with mothers who sleep between six and eight hours (Kaneita and Ohida 2006). All statistical analyses were performed using SPSS version 21.0 J for Windows (SPSS Inc., Tokyo, Japan).

Results

A total of 1,446 legal guardians answered the questionnaire (response rate: 58.9%). Out of 1,376 responses by mothers (excluding 70 responses from fathers or other legal guardians), 249 were excluded because of missing data. The number of instances of missing data for each variable was 46 for the mother's age, 29 for the child's sex, 11 for the child's age, 2 for the number of siblings, 10 for the family economic status, 22 for type of work, 32 for the single parent status, 29 for the family structure, 4 for the mother's education, 32 for the length of sleep, 1 for irregular bedtime, 17 for mobile phone use after lights out, and 12 for the GHQ-12 score. Consequently, the responses from 1,127 mothers (mean age = 37.2 years, SD = 4.4 years) were analyzed (or 45.9% of the total number of forms distributed).

Bivariate analysis between a mothers' feeling chronic fatigue and attributable variables of the subjects are summarized in Table 1. Regarding the number of siblings, only six mothers had three children each, and just one mother had four children. Bivariate analysis between a mothers' feeling chronic fatigue and nocturnal life style, subjective perception of poor sleep quality, and mental health status of the subjects are summarized in Table 2. Poor mental health (GHQ-12 ≧ 4) showed an elevated rate by mothers' feeling chronic fatigue group.

With regard to the relationship between mobile phone use after lights out and subjective perception of poor sleep quality, mobile phone use generally had a statistically significant association with subjective perception of poor sleep quality ($x2 = 21.3$, $df = 2$, $p = 2.33\times10^{-5}$), as did using the phone almost every day($x2 = 20.4$, $df = 1$, $p = 6.30 \times 10^{-6}$). And mobile phone use generally had a statistically significant association with chronic fatigue ($x2 = 9.4$, $df = 2$, $p = 0.0089$), as did using the phone almost every day($x2 = 8.4$, $df = 1$, $p = 0.0037$). With regard to the relationship between mobile phone use after lights out and sleep duration, there was no statistically significant association. With regard

Table1 Bivariate analysis between a Mothers' Feeling Chronic Fatigue and Attributable Variables.

	Feeling Chronic Fatigue		
	No(n=806)	Yes(n=321)	p
Mother's age	37.3(±4.4)	36.7 (±4.6)	n.s.
Toddlers (age 3-4)	350(43.4)	158(49.2)	n.s.
Preschoolers (age 5-6)	456(56.6)	163(50.8)	
Male child	360(44.7)	149(46.4)	n.s.
Female child	446(55.3)	172(53.6)	
Number of siblings			
0	249(30.9)	108(33.6)	
1	466(57.8)	175(54.5)	n.s.
≧2	91(11.3)	38(11.8)	
Single parent	25(3.1)	6(1.9)	n.s.
Family structure			
extended	69(8.6)	39(12.1)	n.s.
nuclear	737(91.4)	282(87.9)	
Mother's education			
under 12 years	136(16.9)	64(19.9)	
13-15 years	362(44.9)	140(43.6)	n.s.
over 16 years	308(38.2)	117(36.4)	
Type of work			
full-time job	143(17.7)	61(19.0)	
part-time job	195(24.2)	65(20.2)	n.s.
housewife	468(58.1)	195(60.7)	
Family economic status			
rich	684(84.9)	257(80.1)	n.s.
poor	122(15.1)	64(19.9)	

Note. The number of the participants and percentage (in brackets) are shown in each column, except for mother's age in which case the figures represent mean and SD (in brackets). Each variable was tested by t-test or Pearson's chi-square test.
ns; not significant.

Table2. Bivariate analysis between a Mothers' Feeling Chronic Fatigue and Nocturnal life style, Subjective perception of Poor Sleep Quality, and Mental health status

		Feeling Chronic Fatigue		
		No(n=806)	Yes(n=321)	p
Length of sleep (hours)		7.2(1.2)	7.0(1.3)	n.s.
	< 6hr	82(10.2)	51(15.9)	
	6-8hr	596(73.9)	225(70.1)	*
	> 8hr	128(15.9)	45(14.0)	
Irregular bed time	never	58(7.2)	22(6.9)	
	seldom	510(63.6)	178(55.5)	n.s.
	sometimes	195(24.2)	95(29.6)	
	always	43(5.3)	26(8.1)	
MPU	Never	437(54.2)	149(46.4)	
	Sometimes	225(27.9)	90(28.0)	**
	Almost every day	144(17.9)	82(25.5)	
Drinking alcohol	always	68(8.4)	32(10.0)	n.s.
Smoking		62(7.7)	34(10.6)	n.s.
Subjective perception of poor sleep quality		175(21.7)	112(34.9)	***
GHQ-12 score		2.5(2.6)	4.0(3.2)	***
GHQ ≧ 4		219(27.2)	155(48.3)	***

Note. The number of the participants and percentage (in brackets) are shown in each column, except for mother's age, length of sleep, and GHQ-12 score, in whose column mean and SD (in brackets). Each variable was tested by t-test or Pearson's chi-square test.

to the relationship between other sleep patterns and mothers' chronic fatigue, sleep duration had a statistically significant association with chronic fatigue ($x2 = 7.3$, $df = 2$, $p = 0.03$), as did having short sleep duration ($x2 = 7.2$, $df = 1$, $p = 0.0073$), however, irregular bedtime had no statistically significant association with chronic fatigue. In Table 3, the associations between mobile phone use after lights out and chronic fatigue analyzed by logistic regressions, are shown. In the analysis, factors including the mother's age, child's age, child's sex, number of siblings, length of sleep, and irregular bed time are accounted for.

Discussion

The present study investigated the relationship between mobile phone use after lights out and chronic fatigue among mothers of toddlers or preschoolers. Using the phone almost every day after lights out was significantly associated with chronic fatigue after controlling for the mother's age, child's age, child's sex, number of siblings, length of sleep, and irregular bed time. Nocturnal mobile phone use therefore may be associated with increased risk of chronic fatigue, even when it does not reduce the mother's length of sleep. One mechanism of the association might be the worsening of the quality of sleep and may lead to for mothers' chronic fatigue. Frequent mobile phone use after lights out was significantly associated with chronic fatigue in mothers of toddlers, in contrast, mobile phone use was not significantly associated with chronic fatigue in mothers of preschoolers. It may be likely that toddlers can be temperamentally more difficult than preschoolers and the mothers of toddlers were easier to be affected by the effects of nocturnal mobile phone use.

Why might mobile phone use after lights out be associated with greater risk of mother's chronic fatigue? Reported adverse effects of mobile phone use after lights out are physiological and emotional. In the physiological aspect, the electromagnetic field emitted from mobile phones could delay the onset time of melatonin secretion (Jarupat and Kawabata 2003) and this may affect mothers' little sleep latency and have an effect on sleep electroencephalograms (Loughran, Wood, and Barton 2005). In the psychological aspect, one study has found that exchanging e-mail messages using a mobile phone may be a stressful experience (Imamura and Nishida 2009), and another study has reported that spending time in waiting for and not receiving e-mail replies can be related to poor mental health, including suicidal feelings (Katsumata and Matsumoto 2008). If mothers use their mobile phones every night before falling asleep, this practice could

Table3. Relationship between Mobile Phone Use After Lights Out and Mother's Chronic fatigue.

	Toddlers (n=508)		Preschoolers(n=619)		All (n=1127)	
Chronic fatigue	N(%)	Adjusted OR	N(%)	Adjusted OR	N(%)	Adjusted OR
MPU (never)	66(41.8)	reference	83(50.9)	reference	149(46.4)	reference
(sometimes)	49(31.0)	1.44(0.91-2.27)	41(25.2)	0.88(0.56-1.37)	90(28.0)	1.12(0.82-1.53)
(every day)	43(27.2)	1.83(1.09-3.09)*	39(23.9)	1.28(0.78-2.10)	82(25.6)	1.50(1.05-2.14)*

Note. The number of the participants and percentage (in brackets) are described in each column. Missing data were excluded in each statistical analysis. Odds ratios were calculated by logistic regression analysis adjusted for mother's age, child's age, child's sex, number of siblings,length of sleep, and irregular bed time.

*; p,0.05

worsen their sleep quality and may lead to chronic fatigue.

However, the present study does have three specific limitations to be noted. First, this is a cross-sectional survey, and therefore, cause and effect relationships were not clear when significant associations were observed. A longitudinal follow-up study is required to address causal questions. Second, the researcher performed a self-report questionnaire with small number of items to assess the presence of sleep duration, irregular bedtime, the nocturnal use of mobile phones, subjective perception of poor sleep quality, chronic fatigue. This method could be less reliable and could result in over reporting or underreporting of behaviors when compared with interview-based studies. Future studies in a larger number of subjects and a more

detailed analysis of behaviors could examine more details related to a problematic sleep pattern or mobile phone use, such as the amount of time

spent using the phone or any differences in behavior between weekdays and weekends. Third, responses from mothers who chose not to participate in the study were obviously not available. If a portion of them were absent due to chronic fatigue by using mobile phone, their exclusion might have affected the results. Therefore, careful attention is required when making generalizations of the findings. In conclusion, the present study suggests that mobile phone use after lights out might be risk factors for chronic fatigue among mothers of toddlers or preschoolers. The trend toward extensive use of mobile phone could impair the well-being of mothers and children. Lifestyle-related interventions with mothers of nursery school-age or kindergarten-age children, including intervention specifically with regard to nocturnal mobile phone use may be warranted to reduce mother's negative parenting for their children.

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