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Impact of Mobile Phone Use on Headache and Sleep among Working Adults in Surabaya Indonesia

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Indonesia is the third largest user of mobile phone (MP) in Asia Pacific Region in 2019. The vast development of MP has made it an inseparable component of everyone's life and yet little is known about its potential harmful effects. Therefore, this study aimed to assess the pattern of MP use among adults in Indonesia and its association with Headache Impact Test (HIT-6) and Pittsburgh Sleep Quality Index (PSQI). This is a cross-sectional study with convenient sampling involving 264 working Indonesian citizen who had at least one MP. Median age of respondents was 29 years old. Most respondents (60%) owned a MP exceeding 10 years. Majority (27.5%) made 0-5 calls and received 6-10 messages daily; of which 82% of calls were answered next to the ear. Call duration of 10 mins was found to increase risk of headache (OR 2.09; 95%CI 1.05 to 4.16). Also, increased incidences of poor sleep quality were reported with frequent MP checking particularly those checking around the clock (OR 3.83; 95%CI 2.80 to 5.23). In conclusion, pattern of MP use is significantly associated with headache and sleep quality. Thus, public health educational prevention strategies focusing on attitudes will be useful to reduce these issues.

Keywords: mobile phone use; headache; sleep quality

I. INTRODUCTION

Since the first inauguration of Mobile Phone (MP) in Japan, its demand had increased exponentially; more so in recent years as telecommunications' companies offer competitive pricing to its consumers (Kawasaki *et al.*, 2006). As of 2004, total of MP subscribers had exceeded 86 million (Yanokoutarou-kinenkai, 2005). The third largest demand for MP within the Asia Pacific Region is Indonesia with users exceeding 55 million in 2015 and approaching 92 million in 2019.

The vast development of MP has a major influence on interaction and communication making it an inseparable component of life impacting all ages of the society (Schoeni *et al.*, 2015). Its influence is unfathomed and incorporated into almost all aspects of life; yet, little is known about its potential harmful effects. Previous studies had shown problematic MP use habits to cause mental overloading, sleep disturbances among females, stress, declining cognitive function, depression and headache (Thomee *et al.*, 2011; Cho *et al.*, 2016a). Also, fatigue, rapid exhaustibility, physical-ill wellbeing and headaches affects MP users at night during sleeping time (Schoeni *et al.*, 2015).

In recent years, headache is one of the most common reported pain syndromes; but its underlying mechanisms due to MP use remains unclear. Some studies suggested that long term exposure to low intensity of electromagnetic fields (EMF) from MP could potentially breakdowns the blood-brain barrier leading to headache (Janigro *et al.*, 1994; Winkler *et al.*, 1995). To top, the emission of this electromagnetic energy had been associated with impairment in dopamine-opiate system (Del Zompo *et al.*, 1995; Barbanti *et al.*, 1996). Evidently, a recent meta-analysis review reported significant association between MP use and headache symptoms (Wang *et al.*, 2017).

MP use late night hours prior to bed had resulted in reduced ability to fall asleep, longer awake time and to stay asleep (Irwin *et al.*, 1996; Adams and Kisler, 2013). Positive

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association had been established between MP use in dark surroundings and four types of sleep disturbances; namely insomnia, sleep apnoea, restless leg syndrome and narcolepsy (Van den Bulck, 2007; Munezawa *et al*., 2011). Sleeplessness leads to lapse in attention, delayed response time, and daytime drowsiness (Moore and Meltzer, 2008; Goel *et al*., 2009). Also causes negative moods, depressive symptoms, poor stress management, family and peer conflicts, impulsivity and lack of self-control (Moore and Meltzer, 2008; Curcio *et al*., 2006; Smaldone *et al*., 2007).

For many years, scientific literature surrounding problematic MP use remains scanty compared to other "behavioural addictions" such as pathological gambling, over-use of internet browsing and excessive video gaming. With limited studies conducted, results were often inconclusive and controversial. Many studies were focusing on vulnerable groups such as children; discounting that working adults could potentially be more impacted due to high work-related MP use. Owning to this uncertainty, this study aimed to assess the pattern of MP use among adults in Indonesia and its association with Headache Impact Test (HIT-6) and Pittsburgh Sleep Quality Index (PSQI).

II. MATERIALS AND METHOD

A. Study Design and Population

This is a cross-sectional study involving 264 participants. Sample size was calculated based on population size of 2.1 million in Surabaya, 95% confidence level, 80% power of study and 21.6% prevalence of headache among MP users (Al-Khlaiwi and Meo, 2004). Recruitment was being carried out in public places through convenient sampling method. Participants recruited are working adults, Indonesian citizens and owning at least one MP. Informed consent was sought prior to recruitment.

B. Sampling Instrument

A self-reported questionnaire which consisted of five sections; demographics (12 items), pattern of mobile phone use (7 items) as well as both validated Headache Impact Test (HIT-6) (6 items) and Pittsburgh Sleep Quality Index (PSQI) (9 items) was used to collect information from MP users (Shin *et al*., 2008; Buysse *et al*., 1989).

C. Ethical Approval

Ethical approval was granted by Health research committee, DKT Gubeng Surabaya Hospital, Kodam V Brawijaya Surabaya via approval code DKT 05.08.05/II/PE.01/2016. This study adheres to guidelines and principles outlined by the Declaration of Helsinki.

D. Statistical Analysis

Statistical analysis was done using IBM SPSS Statistics version 23.0. Odds ratios for duration of ownership, calls and frequency of MP checking with headache and poor sleep quality were calculated using logistic regression analysis with 95% confidence intervals. Associations between categorical data were analysed using chi-square crosstabulations or Fisher's exact test where relevant. A cut off p value of <0.05 is the threshold of statistical significance.

III. RESULT

A. Socio-demographic

Two hundred ninety-five respondents participated in this study. Range age of respondents is 18 to 53 years old with median age of 29. Most respondents were single (55%), received diploma education (45%) and were earning USD 70 to USD 350 (55%). Table 1 shows socio-demographic for this study.

Table 1. Socio-demographics of Respondents

Respondents' Demographics	**n**	**%**
Gender		
Male	101	34.2
Female	194	65.8
Marital Status		
Single	162	54.9
Married	121	41.0
Others	12	4.1
Education Level		
Secondary School	49	16.6
Diploma	133	45.1
Degree	65	22.0
Postgraduate	28	9.5

Others	20	6.8
Monthly income		
<USD 70	77	26.1
USD 70 to USD 350	161	54.6
USD 351 to USD 700	41	13.9
>USD 700	16	5.4

B. Pattern of Mobile Phone Use

Most respondents (63.4%) owns a MP for more than 10 years. Majority (70.2%) had call duration exceeding 5 minutes and 97.3% checked their MP at least once a day. Most respondents (27.5%) made 0 to 5 calls and received 6 to 10 messages daily; of which majority (82%) calls were answered via direct contact (next to ear). MPs were often kept within close proximity during day and night with 78% and 53.9% respectively. Table 2 shows respondents' pattern of mobile phone use.

Table 2. Respondents' Pattern of Mobile Phone Use

Pattern of Mobile Phone Use		
Duration of Mobile Phone Ownership	**n**	**%**
< 10 Years	108	36.6
≥10 Years	187	63.4
Duration of calls (per day)		
< 5 Min	88	29.8
10 Mins	93	31.5
≥ 30 mins	114	38.6
Frequency of checking Mobile Phone		
Never	8	2.7
Once or more	287	97.3
Number of Call & Message (per day)		
0 – 5 calls & messages/day	78	26.4
0 – 5 calls & 6 – 10 messages/day	81	27.5
6 – 10 calls & messages/day	48	16.3
11 – 20 calls & messages day	20	6.8
More than 20 calls & messages/day	68	23.1
Methods to answer calls		
Indirect contact (speaker/earphone)	53	18.0
Direct contact (next to ear)	242	82.0
Places to keep mobile phone during day		
Distant proximity (locker/ handbag)	65	22.0
Close proximity (pockets/ working table)	230	78.0
Places to keep mobile phone during night		
Distant proximity (bedside table/bag)	136	46.1
Close proximity (beside pillow/ within bed)	159	53.9

C. Headache

Seventy-five percent of respondents reported having some impact of headache; either moderate, substantial or severe. Results showed that risk of headache increased significantly with receiving average calls of 10 mins daily (OR 2.09; 95% CI 1.05 to 4.16) and keeping MP within proximity during sleep (OR 2.58; 1.52 to 4.37). Headache was also associated with number of calls/messages daily and method of answering calls ($p<0.05$); but these did not increase risk of having headache (Table 3).

D. Sleep Quality

Slightly more than half of respondents (58%) were poor sleepers; 45% reported to have fairly good sleep, 40% having average sleep of more than 7 hours and 46.8% requiring 16 to 30 minutes to fall asleep. Respondents had significantly increased incidences of poor sleep quality with frequent MP checking; particularly those who check now and then (OR 2.12; 95% CI 1.65 to 2.73), daily (OR 1.93; 95% CI 1.61 to 2.31), and around the clock (OR 3.83; 95%CI 2.80-

5.23). Duration of MP ownership, duration and number of calls, method of answering calls and place to keep MP were not associated with sleep (p>0.05) as shown in Table 3.

Table 3. Associations between pattern of MP use, headache and poor sleep quality

PATTERN OF MP USE		HIT-6			PSQI		
	Score	n (%)	p^	OR (95% CI)	n (%)	p^	OR (95% CI)
Duration of MP Ownership	<10 Years	81 (38)	0.501	1.00 (reference)	64 (38)	0.714	1.00 (reference)
	≥10 Years	133 (62)		0.82 (0.48-1.41)	106 (62)		0.82(0.48-0.58)
Duration of Calls (per day)	5 Mins	60 (28)	0.057	1.00 (reference)	52 (31)	0.908	1.00 (reference)
	10 Mins	76 (36)		2.09 (1.05-4.16)*	52 (31)		0.88 (0.49-1.58)
	≥ 30 mins	78 (36)		1.01 (0.56-1.84)	66 (39)		0.95 (0.54-1.67)
Frequency of MP checking	Never	8 (4)	0.169	1.00 (reference)	0 (0)	<0.001	1.00 (reference)
	Now and then	45 (21)		1.51 (1.28-1.79)	36 (21)		2.12 (1.65-2.73)*
	Daily	77 (36)		1.40 (1.25-1.58)	52 (30)		1.93 (1.61-2.31)*
	Around the clock	84 (39)		1.32 (1.19-1.47)	82 (48)		3.83 (2.80-5.23)*
Number of calls & messages (per day)	0-5 calls & messages	22 (24)	<0.001	1.00 (reference)	18 (22)	0.002	1.00 (reference)
	0-5 calls & 6-10 messages	30 (33)		0.29 (0.12-0.69)	20 (24)		0.17 (0.08-0.3)
	6-10 calls & messages	12 (13)		0.16 (0.06-0.41)	16 (20)		0.26 (0.12-0.57)
	11-20 calls & messages	8 (8)		0.46 (0.12-1.71)	4 (5)		0.17 (0.6-0.49)
	>20 calls & messages	20 (22)		0.19 (0.08-0.45)	24 (29)		0.47 (0.23-0.99)
Method to answer calls	Indirect contact	45 (21)	0.027	1.00 (reference)	33 (19)	0.540	1.00 (reference)
	Direct contact	169 (79)		0.41 (0.18-0.92)	137 (81)		0.79 (0.43-1.45)
Places to keep MP (day)	Distant proximity	122 (57)	0.896	1.00 (reference)	105 (62)	0.075	1.00 (reference)
	Close proximity	92 (43)		1.04 (0.62-1.75)	65 (38)		0.65 (0.41-1.04)
Places to keep MP (night)	Distant proximity	85 (39.7)	<0.001	1.00 (reference)	80 (47.1)	0.724	1.00 (reference)
	Close proximity	127 (60.3)		2.58 (1.52-4.37)*	90 (52.9)		0.91 (0.57-1.45)

p^ obtained through $\chi 2$ test
*p<0.05

IV. DISCUSSION

Self-reported median headache scores in this study were higher than study conducted in South Korea (Cho *et al.*, 2016b). In this study, respondents with longer call duration reported to have severe impact headache; 59% for calls of 30 mins or longer. Similar findings were reported by Zheng *et al.* (2015). Use of mobile phone causes heat sensation within the auricle and surrounding areas of the ear; it was associated with increased headache complaints (Chu *et al.*, 2011).

Prevalence of poor sleepers (58%) was comparable with study conducted in Iran (61.5%); however, lower than Saudi Arabia (75%) (Mohammadbeigi *et al.*, 2016; Ibrahim *et al.*, 2018). Our respondents' sleep quality was affected by intense MP checking habits. Thus, postulating possible anxiety disorder as suggested by Visnjic *et al.* (2018). Several studies attributed poor sleepers to blue light (~450 nm) emitted by MP particularly during its use prior to bed; this habit suppress melatonin production leading to increased sleep onset latency and acute alertness (LeBourgeois *et al.*, 2017).

The increasing trend of MP use demands for larger, more comprehensive longitudinal research. Also, other well-being symptoms such as fatigue, stress and depression could be included.

V. CONCLUSION

Problematic pattern of MP use was associated with headache and poor sleep quality.

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