RESEARCH ARTICLE

MOBILE PHONE RELATED-SYMPTOMS AMONG PRIMARY CARE ATTENDEES IN AL-KHOBAR CITY, EASTERN SAUDI ARABIA

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ABSTRACT

Background: Several studies have shown that use of mobile phones may cause adverse health problems such as headache, sleep disturbances, ear warming and other symptoms.

Aims & Objective: To determine the prevalence of symptoms due to the use of mobile phone and to identify some factors associated with its use among primary health care (PHC) attendees in Al-Khobar city, eastern Saudi Arabia.

Material and Methods: A cross-sectional study was conducted using interviewer-administered questionnaire during the month of May 2009 in Al-Khobar city. Three PHC centers were randomly selected and 431 attendees were interviewed.

Results: About 68.0% were using mobile phones for more than five years. About 43% had a single call time of 5-9 minutes and 56.8% had a daily call time from 30 minutes to one hour. Symptoms due to use of mobile phone included ear warming (52.9%), headache (15.1%), and facial numbness (13.0%). Factors found to be statistically significantly associated with presence of symptoms due to mobile phone use were daily call time of 30 minutes or more, using mobile phone for 3 or more years, and ending the call because of medical reasons.

Conclusion: The use of mobile phones was associated with subjective symptoms. It is suggested that excessive daily use of mobile phones should be avoided. Further research is needed to establish a cause-effect relationship.

Key-Words: Attendees; Mobile Phone; Primary Care; Symptoms; Saudi Arabia

Introduction

Mobile telecommunication has developed considerably in recent years. To date approximately every individual in Saudi Arabia possesses a mobile phone. As reported in medical literature, mobile phones may cause health problems such as headache, sleep disturbances, impairment of short term memory, and more seriously, significant increase in the frequency of seizures in epileptic children, and brain tumors among users.[1-3] Mobile phones can cause discomfort, dizziness, and skin burning sensation.[2] Cox et al reported unspecified symptoms like dizziness, disorientation, and headache.[4] They suggested that these symptoms might have resulted from the direct action of the radio waves on the endolymph or the hair cells in the semicircular canals or from convection currents set up in the external auditory meatus from the heat of the mobile phone.

Hansson Mild et al in their study of symptoms associated with mobile phone use in Norway and Sweden showed that there were significant statistical associations between calling time/number of calls per day and the prevalence of warmth behind/ around or on the ear, headache and fatigue.[5] Mobile phone users showed increased levels of exhaustion and depression as reported by Johansson et al.[6] Studies on mobile phone effects in Saudi population are minimal. Al-Khlaiwi et al in their study of 437 subjects showed that symptoms experienced among Saudi mobile phone users were headache (21.6%), sleep disturbance (4.%), tension (3.9%), fatigue (3%) and dizziness (2.4%).[2] The hypothesis of this study was that the use of mobile phones is associated with health symptoms such as hearing, vision and other complaints. The aim of this study was to determine the prevalence of specific symptoms due to the use of mobile phone among primary health care centers attendees in Al-Khobar city, and to identify some factors associated with symptoms.

Materials and Methods

This was a cross sectional study conducted among attendees in Al-Khobar primary health care centers (PHCCs), Eastern Saudi Arabia, during the month of May 2009. Three primary health care centers were selected, based on the resources available for the investigators, using simple random sampling technique out of nine primary health care centers in Al-Khobar city. These centers were Aldoha, Alagrabiah, and Al Bayoniah.

The sample size was estimated according to the following equation[7]:

$$N = [(Z_{(1-\alpha/2)} + Z_{(1-\beta)})^2 P(1-P)] / d^2$$

Where, N: sample size; Z: reliability coefficient (z = 1.96 at

95% confidence interval); P: the proportion of the population who have symptoms or signs attributed to the use of mobile phones.

As there were few studies on symptoms attributed to the use of mobile phone in Saudi Arabia and Gulf countries as far as the investigators know from literature search, therefore p has been considered to be 0.5 (50%), d = 0.07, i.e. absolute precision of 7% (i.e. a range of prevalence of symptoms 43%-57%). Type I error (α) was 0.05 and type II error (β) was 0.2 (i.e. a power of 80%). The sample size was calculated as 400. With an expected response rate of 90% the sample size would be 444 individuals.

Inclusion criteria included registered PHCCs attendees ages 12 years and older, of both sexes, Saudis and non-Saudis. Subjects with known history of anaemia, diabetes mellitus, arterial hypertension, chronic sinusitis, chronic headache or migraine, and central or peripheral nerve disease, congenital abnormalities, computer professionals, and those using any medication were excluded from the study.

Data was collected using an interviewer-administered questionnaire. The questionnaire includes questions on: A-demographic data: age, gender, nationality, marital status, educational level, occupation; B-use of mobile phone: mobile phone possession time, years of mobile phone use, average duration of single call, average duration of calls per day, number of calls per day, ending the call because of medical reason, frequency of handsfree phone use; C-symptoms due to the use of mobile phone such as: tinnitus, visual disturbances, ear warming, headache, facial numbness, sleep disorders, difficulty in concentration, fatigability, and dizziness. The questionnaire was constructed in Arabic language and then translated into English language. The English version was translated again to Arabic to ensure the correct meaning of the questions.

Attendees to the selected PHCCs were interviewed for three weeks duration during the month of May 2009. It was decided to take a sample of 148 attendees from each center. The average number of attendees per PHCC per day was 150. Therefore a sample of 30 attendees was interviewed per day using a systematic sampling technique by interviewing every 5th attendee. Male attendees were interviewed by the first author and female attendees were interviewed by a trained female Arabic-speaking nurse.

A pilot study was administered to test questions and the logistics of the interview in one PHCC and those subjects were not included in the study proper.

Statistical analysis was carried out using SPSS version 16 (SPSS Inc., Chicago) in a personal computer. Bivariate and multivariate analyses were used to determine factors related to mobile phone use. Logistic Regression Analysis was done to show factors associated with presence of symptoms due to mobile phone use while controlling for confounding. The dependent variable was presence of symptoms = 1; no symptoms = 0. The independent variables entered into the model included gender, age group (less than 30 years; 30 years and above), educational level, income (low income = less than 4000 Saudi Riyals; middle and high income = 4000 Saudi Riyals or more), occupation (professional and government employees, skilled labourers, unskilled labourers, housewives, student, unemployed or retired), nationality (Saudi; non-Saudi), marital status (single; married, divorced or widow), number of mobile phones possessed (one mobile; two mobiles), single call time (less than 5 minutes; 5 minutes or more), duration of use/day (less than 30 minutes; 30 minutes or more), use of handsfree phone (never used handsfree phone; used handsfree phone occasionally or rarely), cause for ending the call (did not end call; ended call due to medical reason), and years of mobile use (less than 3 years; 3 years or more). A p-value of <0.05 was taken as the level of statistical significance.

The study was approved by the Saudi Board Local Training Committee and the Department of Family and Community Medicine, University of Dammam. Permission for doing the study was sought from the Directorate of Health Affairs in the Eastern Province. Attendees of the selected PHCCs were invited to participate in the study, objectives of the study were explained to them, and their consent was sought. No names were included in the questionnaire. Data collected was used for the study purpose only and was handled securely.

Results

A total of 431 attendees were interviewed out of 444 (a response rate of 97.1%). The majority of the sample were males (248; 57.5%) and of ages less than 40 years (331; 76.8%). About 372 (86%) were of Saudi nationality and 256 attendees (59.4 %) were married as shown in Table 1. Regarding their educational level, 222 subjects (51.5 %) were secondary or diploma certificates and 154 (35.7 %) were university or higher education certificates. A total of 44 attendees (10.2 %) were professionals, 146 (33.9 %) were employees in governmental sector, and 99 (23.0 %) were housewives. A total of 295 attendees (68.4 %) had their mobile phones for more than five years while 95

attendees (22 %) had their mobile phones from three to five years as shown in Table 2.

Table-1: Socio-Demographic Characteristics of Study Population (N = 431)

Characteristics		No.	%
Health Center	Aldoha	125	29.0
	Alagrabiah	142	32.9
	Al Bayoniah	164	38.1
Age Group (Years)	12-19	50	11.6
	20-29	141	32.7
	30-39	140	32.5
	40-49	73	16.9
	≥ 50	27	6.3
Gender	Male	248	57.5
	Female	183	42.5
Nationality	Saudi	372	86.3
	Non-Saudi	59	13.7
Marital Status	Single	159	36.9
	Married	256	59.4
	Divorcee	7	1.6
	Widow	9	2.1
Educational Level	Illiterate or can read and write	5	1.2
	Primary and Intermediate	50	11.6
	Secondary and Diploma	222	51.5
	University or Higher education	154	35.7
Occupation	Professionals	44	10.2
	Governmental sector	146	33.9
	Skilled labor	18	4.2
	Unskilled labor	8	1.9
	Housewife	99	23.0
	Retired and unemployed	33	7.7
	Student	83	19.3

Table-2: Mobile Phone Characteristics and Calling Time of Attendees (N = 431)

Characteristics		N	%
Number of mobile phones	One	401	93.0
	Two	30	7.0
Mobile phone possession time	Less than one year	9	2.1
	One to three years	32	7.4
	More than three to five years	95	22.0
	More than five years	295	68.4
Single call time	Less than five minutes	235	54.5
	From five to 9 minutes	184	42.7
	10 minutes and more	12	2.8
Daily call time	Less than 30 minutes	150	34.8
	From 30 to one hour	245	56.8
	More than one hour	36	8.4
Frequency of handsfree phone use	Never	282	65.4
	Occasionally	40	9.3
	Rarely	109	25.3

Table-3: Symptoms due to Mobile Phone Use Reported by Attendees

Symptoms	N	%
Ear warming	228	52.9
Headache	65	15.1
Facial numbness	56	13.0
Sleep disorders	10	2.3
Difficulty in concentration	3	0.7
Fatigability	3	0.7
Dizziness	2	0.5
Memory defect	1	0.2
No symptoms	63	14.6
Total	431	100

A total of 235 attendees (54.5 %) spent less than 5 minutes in a single call, while 184 attendees (42.7 %) spent from 5 to 10 minutes in a single call. More than half of the attendees (245; 56.8 %) spent between 30 minutes to one hour using mobile phone daily while 36 (8.4%) spent more than one hours daily. More than half of the attendees (282; 65.4 %) never used handsfree phone, and no attendee reported that he or she always used handsfree phone (Table 2).

More than half of the attendees (228; 52.9%) reported having ear warming as a result of use of mobile phone as shown in Table 3. Other symptoms reported by attendees included headache (65; 15.1%), and facial numbness (56; 13.0%). About one-third of the attendees (145; 33.6%) never ended their call because of medical reason while 249 (49.7%) ended their call because of ear warming, and 42 (9.7%) because of facial numbness as shown in Table 4.

Table 5 shows the results of the logistic regression analysis. Factors found to be significantly associated with presence of symptoms due to mobile phone use were years of mobile phone use, daily call time, and ending the call because of medical reason. Attendees who had been using mobile phone for three years or more were five times more likely to have symptoms than those who had been using mobile phone for less than three years (OR = 5.205; 95% C.I. 1.993–13.595; p-value 0.001). Similarly, attendees who had been using mobile phone for 30 minutes or more daily were six and a half times more likely to have symptoms than those who had been using mobile phone for less than 30 minutes daily (OR = 6.525; 95% C.I. 2.869–14.841; p-value <0.001). Attendees who had symptoms due to mobile phone use were 127 times more likely to end their call because of medical reason than those who had no symptoms (OR = 127.08; 95% C.I. 16.997–950.219; p-value <0.001).

Table-4: Reasons for Ending Call

Reasons	N	%
Ear warming	214	49.7
Numbness	42	9.7
Headache	28	6.5
Blurred vision	1	0.2
Excessive sweating	1	0.2
Never ended call	145	33.6
Total	431	100

Table-5: Logistic Regression Analysis showing Factors associated with Presence of Symptoms due to Mobile Phone Use

Variables	B coefficient	S.E. of B	p-Value	Odds Ratio	95 % CI Lower	95 % CI Upper
Years of mobile phone use	1.65	0.49	0.001	5.21	1.99	13.60
Daily call time	1.88	0.04	< 0.001	6.53	2.87	14.84
Ending the call because of medical reason	4.85	1.03	< 0.001	127.08	17.00	950.22
Constant	- 4.25	1.24	0.001	-	-	-

Discussion

The study population of attendees comprised both males

and females of different age groups and different educational levels. Thirty (7%) of attendees had two mobile phones. In addition 22% had mobile phones for more than three to five years while 68.4% possess mobile phones for more than five years. This result was similar to Khan study at King Khalid university hospital in Saudi Arabia where 76.92% of medical students carried one mobile and 23.08% more than one mobile.[8] Balikci et al study in Turkey reported that 23.7% of 695 people possessed mobile phones for three years.[9]

The more the mobile phones a person possesses and the longer the duration of their use, the higher the possibility of being exposed to electromagnetic radiation which might cause these symptoms. This hypothesis is supported by the longer time of single call (45.5% had single call time of more than 5 minutes) and a higher proportion of attendees having a daily call time of from 30 minutes to one hour or more in this study. This result was similar to Gandhi et al[10], Meo et al[11], and Oftedal et al[12] studies. Gandhi et al[10] reported that the use of mobile phones per day varied between 1-18 hours, while Meo et al[11] showed that 11.45% of the total 873 subjects used mobile phones for more than 30 minutes per day. Khan in his study of adverse effects of excessive mobile phone use reported that 11.53%.of subjects used mobile phone for 60-90 minutes per day.[8]

The use of mobile phone without a hand-free equipment, and for longer periods of time, is thought to exert more heating effect and more radiation exposure. In this study more than half of the attendees never used handsfree phone and only 25.3% rarely used it. Chia et al community study of 808 men and women in Singapore showed that there was a significant increase in the prevalence of headache with increasing duration of usage of mobile phones per day.[3] They also reported that the prevalence of headache was reduced by more than 20% among those who used hand-free equipment for their cellular telephones as compared to those who never used the equipment.

The main symptoms due to mobile phone use reported by attendees in this study were ear warming, headache, facial numbness and sleep disorders. This result was similar to many other studies.[2,3,8-13] Al-Khlaiwi et al reported that the main symptoms associated with the use of mobile phone among 437 Saudi subjects were headache (21.6%), sleep disturbance (4.0%), tension (3.9%), and fatigue (3.0%).[2] Khan in his study of 286 subjects reported similar results, mainly fatigue (24.48%), hearing problems (23.07%), facial dermatitis (16.78%), and headache (16.08%) and out of the 286, 44.4% related their symptoms to mobile phone use.[8] Impaired hearing, ear ache and/or warmth on the ear, were the main problems associated with the use of mobile phone as reported by Meo et al.[11] Chu et al showed that among 214 medical students, 40 (18.9%) students experienced headache associated with mobile phone use and of those forty, 37 (97.4%) reported that headache was triggered by prolonged mobile phone use.[14]

The high proportion of subjects reporting ear warming, headache, and facial numbness in this and many other studies might, most probably, be related to prolonged use of mobile phone as a result of microwave absorption or phone heating. Further prospective cohort studies are needed to clarify these issues.

In this study attendees were questioned if they had ended their calls suddenly and the reasons for ending the call without any leading answers to avoid bias. The results of this question added further support to the adverse health effects of prolonged use of mobile phone as shown in Table 4. Ear warming was the main reason for ending the call among attendees.

In this study the longer duration of mobile phone use and the longer the daily call time were statistically significantly associated with subjective symptoms while controlling for confounding. This result was in agreement with many other studies.[12,15,16] Sandstrom et al in their Swedish-Norwegian survey among people using the digital (GSM) system and those using the analogue (NMT) system of mobile phones found a statistically significant association between calling time/number of calls per day and the prevalence of warmth behind/around or on the ear, headaches, and fatigue.[15]

Similarly Wilen et al study among mobile phone users in Sweden, using specific absorption rate (SAR) measurements showed that subjective symptoms, especially dizziness, discomfort, and warmth sensations behind the ear were correlated with high SAR_{1g} values in combination with longer calling time per day.[16] Roosli et al in their systematic review of 5 randomized human laboratory trials and 12 epidemiological studies did not detect any association between exposure to mobile phone base stations radiation (MPBS) radiation and the development of acute symptoms during or shortly after exposure.[17] Another systematic review also found little evidence that short-term exposure to a mobile phone or base station causes symptoms.[18] Other studies also did not show statistically significant association between use

of mobile phone and subjective symptoms such as headache, fatigue, dizziness, and difficulties in concentration.[19-21] Koivisto et al, in two single-blind experiments, showed that pulsed radiofrequency electromagnetic field of digital GSM mobile phones did not produce any consistent subjective symptoms or sensations in the subjects studied.[21] Further research is thus needed to settle this debate.

Conclusion

Use of mobile phone leads to some subjective symptoms such as ear warming, headache, facial numbness and sleep disorders. Bias in relating symptoms to the use of mobile phone was minimized by excluding subjects with known diseases that cause similar symptoms. However, this was a cross-sectional study that definitely cannot confirm a causal association. Further large prospective cohort studies are needed to establish a cause-effect relationship. Meanwhile, long term or excessive use of mobile phone should be avoided by educating the public and raising their awareness using mass media, electronic, and print media sources.

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