ADVERSE EFFECTS OF EXCESSIVE MOBILE PHONE USE

MUHAMMAD MUJAHID KHAN
King Saud University, Riyadh
King Khalid University Hospital, Department of Anatomy, College of Medicine

Abstract
Introduction: Research findings indicate that the use of mobile phones may lead to a number of symptoms such as headache, impaired concentration and memory, and also fatigue. Materials and Methods: The present study was designed to investigate whether the symptoms of ill health reported by young people may be associated with the use of mobile phone (MP) and to analyze its influence on health and development of medical students. The questionnaire was designed specifically for this study and contained items regarding health condition and health complaints as well as the frequency of MP use. The response rate was 86.6% (286 of 330 forms, completed by 73.77% males and 26.22% females). Results: Most of the subjects (83.57%) had some knowledge about the adverse effects of MP use. 76.92% of the students carried one mobile, and 23.08% more than one. 55.94%, of the subjects reported the average daily MP use of less than 30 min, 27.97%, of 30–60 min, 11.53%, of 60–90 min and 4.54% of more than 90 min. 16.08% of the subjects complained of headache and 24.48% of fatigue. Impaired concentration was reported by 34.27% of respondents, memory disturbances by 40.56%, sleeplessness by 38.8%, hearing problems by 23.07%, and facial dermatitis by 16.78%. The sensation of warmth within the auricle and behind/around the ear was reported by 28.32%. Out of 286 subjects who participated in this study, 44.4% related their symptoms to mobile phone use. Conclusions: The findings of the present study indicate that mobile phones play a large part in the daily life of medical students. Therefore, its impact on psychology and health should be discussed among the students to prevent the harmful effects of mobile phone use.

Key words: Effects, Mobile phone, Excessive, Medical students

INTRODUCTION
There is a growing concern about the possible hazards that electromagnetic waves emitted by mobile phone (MP) pose to human health. Mobile phones have become commonly used throughout the world within a short period of time. The problem of the potential health risk applies particularly to young people who are the most intensive MP users. In the present study, the target population were the medical students in Saudi Arabia. The project was undertaken to investigate whether the symptoms of ill health reported by young people may be associated with MP use and to analyze its influence on their health and development. We also assessed data on the duration and frequency of MP use. The studies reported worldwide have tried to evaluate a potential link between adverse health effects and mobile phones and the broadcasting stations [1]. There are some data suggesting that exposure from mobile phones can affect the neural activity [2]. Although there is no clear evidence for adverse physiological effects of electromagnetic fields (EMF) at the levels used by mobile phones, there is a widespread public concern that EMF may have a harmful potential. As the mobile phones are usually held close to the ear, it is appropriate to study the effects on the hearing, vision, memory, concentration, sleep and other functions that may be related to headache and migraine [3]. Mobile phone users often complain of a burning or heating sensation within the auricle area [4]. The increase in temperature during MP use may be due to electric power dissipation and radio frequency (RF) exposure [4]. Several reports indicated that non-thermal electromagnetic
radiation such as from mobile phones and base stations may promote cancer [5]. The evolution of cellular phones has been one of the fastest in the history of innovation [1]. Epidemiologic, cellular and animal studies have been carried out, but none of them have reached definite conclusions. Over the last decade, the usage of mobile phones has dramatically increased [6]. They are now an essential part of business, commerce, and communication; however, their use may lead to health problems. Therefore, the present study was designed to investigate a link between the use of mobile phones and their adverse health effects in the population of Saudi medical students. Our goal was also to contribute to increasing social awareness of the health problems associated with the use of these devices. Toda et al. [7] have developed a cellular phone dependence questionnaire (CPDQ) to perform a similar study, but their project involved only female university students and had several limitations. These authors did not generally exclude a possibility of increased health risk due to MP use.

As the medical students who carry mobile phones also study and work in the hospital, these devices may have an adverse effect on the health of the patients as well as interfere with the highly sensitive electronic medical devices [8]. Therefore, this report presents an overview of the current knowledge on the impact of radiofrequency waves on the health of medical students in Saudi Arabia.

**Table 1.** General considerations regarding mobile phone use by medical students

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Percentage of study population (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of mobile phones carried by the students</td>
<td></td>
</tr>
<tr>
<td>1 MP</td>
<td>76.92</td>
</tr>
<tr>
<td>≥ 2 MPs</td>
<td>23.08</td>
</tr>
<tr>
<td>Daily MP use</td>
<td></td>
</tr>
<tr>
<td>≤ 30 min</td>
<td>55.94</td>
</tr>
<tr>
<td>30–60 min</td>
<td>27.97</td>
</tr>
<tr>
<td>60–90 min</td>
<td>11.53</td>
</tr>
<tr>
<td>≥ 90 min</td>
<td>4.54</td>
</tr>
<tr>
<td>Self-rated health condition</td>
<td></td>
</tr>
<tr>
<td>Very good</td>
<td>30.77</td>
</tr>
<tr>
<td>Good</td>
<td>62.24</td>
</tr>
<tr>
<td>Fair</td>
<td>6.99</td>
</tr>
</tbody>
</table>

Statistical analysis performed using Z test, P < 0.0001.

MP — mobile phone.

**Table 2.** Percentage of health complaints related to MP use

<table>
<thead>
<tr>
<th>Health complaint</th>
<th>Daily MP use</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>≤ 30 min</td>
<td>30–60 min</td>
</tr>
<tr>
<td>Chronic headache</td>
<td>5.03</td>
<td>24.69</td>
</tr>
<tr>
<td>Impaired concentration</td>
<td>16.35</td>
<td>37.03</td>
</tr>
<tr>
<td>Impaired memory</td>
<td>28.93</td>
<td>49.38</td>
</tr>
<tr>
<td>Fatigue</td>
<td>16.35</td>
<td>27.16</td>
</tr>
<tr>
<td>Sleeplessness</td>
<td>30.18</td>
<td>45.67</td>
</tr>
<tr>
<td>Hearing problem</td>
<td>13.83</td>
<td>33.33</td>
</tr>
<tr>
<td>Skin disease</td>
<td>0.62</td>
<td>14.81</td>
</tr>
<tr>
<td>Warmth around the ear</td>
<td>6.91</td>
<td>40.74</td>
</tr>
<tr>
<td>Relation to MP use</td>
<td>42.76</td>
<td>45.67</td>
</tr>
</tbody>
</table>

Abbreviation as in Table 1.

**MATERIALS AND METHODS**

A survey using a self-administered questionnaire was conducted among second year medical students at the Department of Anatomy, College of Medicine, King Saud University, Riyadh, Saudi Arabia. The questionnaire was designed specifically for this study and contained 14 items regarding health condition and complaints as well as the frequency of mobile phone use (Tables 1 and 2). The number of questionnaires necessary for the study was assessed using the simple random
sampling method. A total of 330 medical students were invited to participate in the present study. Out of the 330 copies distributed among the students, 286 (86.6%) were completed (73.77% by males and 26.22% by females) and were eventually subject to analysis. The percentage of female participants is lower than that of male participants also because in this medical college, the number of female students in total does not reach 50% of the number of male students. The data from respondents who reported health problems such as neck trauma in a car accident, chronic sinusitis, or arterial hypertension, were excluded.

**Statistical Analysis**
Chi-square test was used for comparisons between daily MP use and different health-related parameters. The data were assumed to be statically significant at p < 0.05.

**RESULTS**
Most of the subjects (84.3%) admitted that they had some knowledge of the harmful effects of mobile phones on human health. 76.92% of the subjects reported carrying one mobile while 23.08% more than one. For 55.94%, the average daily MP use was found to be less than 30 min; for 27.97% it ranged between 30–60 min; for 11.53% between 60–90 min; and for 4.54% it lasted more than 90 min. 30.77% assessed their health condition as very good, 62.24% as good and 6.99% as fair (Fig. 1). Most of the subjects (83.57%) reported some symptoms of ill health: 16.08% complained of headache, 24.48% of fatigue, and 34.27% of impaired concentration. Facial dermatitis was reported by 16.78%. The most prevalent symptoms related to MP use were memory disturbances (40.56%), sleeplessness (38.8%) and hearing problems (23.07%). The sensation of warmth within the auricle and behind/around the ear was reported by 28.32% (Fig. 2). 44.4% of respondents related their symptoms to MP use. The symptoms and health complaints reported by the subjects in no case required a medical check-up or taking any medication.

The different health-related parameters were compared with the daily MP use. A significant relationship was found for daily MP use of a longer duration (Table 2). The health problems were also compared between male and female students and a significant difference was observed with respect to some health complaints (Table 3).

**Table 3.** Percentage of health complaints related to MP use, by gender

<table>
<thead>
<tr>
<th>Health complaint</th>
<th>Males</th>
<th>Females</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronic headache</td>
<td>14.21</td>
<td>20.00</td>
<td>&lt; 0.159</td>
</tr>
<tr>
<td>Impaired concentration</td>
<td>34.12</td>
<td>36.00</td>
<td>&lt; 0.437</td>
</tr>
<tr>
<td>Impaired memory</td>
<td>41.23</td>
<td>37.33</td>
<td>&lt; 0.326</td>
</tr>
<tr>
<td>Fatigue</td>
<td>21.80</td>
<td>32.00</td>
<td>&lt; 0.049</td>
</tr>
<tr>
<td>Sleeplessness</td>
<td>41.23</td>
<td>30.66</td>
<td>&lt; 0.069</td>
</tr>
<tr>
<td>Hearing problem</td>
<td>21.32</td>
<td>28.00</td>
<td>&lt; 0.154</td>
</tr>
<tr>
<td>Skin disease</td>
<td>16.11</td>
<td>18.66</td>
<td>&lt; 0.365</td>
</tr>
<tr>
<td>Warmth around the ear</td>
<td>30.80</td>
<td>21.33</td>
<td>0.077</td>
</tr>
<tr>
<td>Relation to MP use</td>
<td>44.07</td>
<td>45.33</td>
<td>&lt; 0.476</td>
</tr>
</tbody>
</table>

Abbreviation as in Table 1.
show no statistically significant differences between the
audiological signals recorded for different study groups.
However, the present findings are inconsistent with their
results, as 23.07% of the students in our study reported
a hearing problem of some kind and associated it with
MP use (Table 2).

It should be noted that the auditory system is the first
biological structure to be entered by the electromagnetic fields from mobile phones. There are many animal
studies showing that electromagnetic waves have a wide
range of damaging effects on different body systems [14].
However, similar studies in humans are rather limited,
and the results of the animal studies should be inter-
preted with caution when considering their application
to humans. Large controlled studies are required before
confirming the effects of EMF on humans. In the present
study, 16.78% of the medical students suffered from skin
problems which they related to MP use (Table 2). These
data are supported by Ozguner et al. [15] who observed
histopathologic changes in the skin of EMF-exposed ani-

mals. They reported such findings as increased thickness
of the stratum corneum, atrophy of epidermis, papillao-
matosis, basal cell proliferation, increased granular cell
layer in epidermis, impairment in collagen tissue distri-
bution and separation of collagen bundles in the dermis.
As reported by Yuasa et al. [16], a 30-min daily use of MP
produced no short-term effects on the human sensory
cortex, and some data is available to support the safety
of MP use [17].

These studies, however, are limited to the short-term use
of mobiles. Most of the long-term studies conclude that
the use of MP is a health risk factor, and thus it is sug-
gested that excessive use should be avoided and social
awareness of the potential health effects be increased
through health promotion activities [18,19]. Based on the
limited studies available, there is a valid evidence for an
association between impaired well-being and exposure
to EMF from mobile phones among young people. The
findings of the present study indicate that mobile phones
play a large part in the daily life of medical students, and
therefore its impact on psychology and health should be
discussed with the students to prevent the harmful
effects of their use. One has to note, however, that this research field is still immature with regard to the quantity and quality of available data.

ACKNOWLEDGEMENT

The author is thankful to Dr. Sultan Ayub Meo for a critical review of the manuscript and to Mr. Amir S. Marzouk (MSc) for the statistical analysis of data. He is also indebted to medical students: Tareq Al-Salamah, Abdulsalam Madkhali, and Yousef Khojah from the King Saud University, Riyadh, KSA, for their technical assistance. The author extends deep appreciation to Dr. Musaed Al-Fayez, Chairman, Anatomy Department, King Saud University, for his immense support to this project.

REFERENCES