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The Educational Intervention on People's Behavior in terms of the Microbial Contaminations of Mobile Phones and the Possible Adverse Effects of their Beam

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Abstract

Background: Mobile phone is one of the most important necessary tools in today's life which can threaten people's health in some conditions. The present study was carried out to compare the effect of educational intervention by short message and pamphlet on the behavior of steel factory staff in Ardakan, Yazd province, Iran.

Materials and Methods: The present study was experimentally carried out on 319 staff in three groups. The intended samples were selected using the cluster sapling method. The self-made questionnaire was employed as the data collection means having 15 questions about behavior assessment. The results were utilized once their validity (face and content) and reliability was confirmed. The obtained results were analyzed using the SPSS18 statistical software.

Results: The average score of people's behavior before the educational intervention in the three groups of control, intervention-short message, and intervention-pamphlet was 21.2, 21.1, and 20.7, respectively ($P = 0.714$). After educational intervention, the average behavior score of people in the control, intervention-short message, and intervention-pamphlet was increased by 27.74, 42.91, and 38.56, respectively ($P < 0.05$).

Conclusion: The educational short message and pamphlet would change the behaviors concerning the use of mobile phone among the staff members under study. However, the short message had a stronger effect on the people's behavior than the pamphlet. Considering the importance of the mobile phone and its associated behaviors, the necessity of conducting health education intervention aiming at increasing the knowledge, it demonstrates the change of attitude and behavior among other members of the society.

Key Words: Behavior, Intervention, Pamphlet, Short message, Mobile Phone.

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1- INTRODUCTION

According to the categorization of the International Agency for Research on Cancer (IARC), the mobile phone beams have been categorized in the group of factors which can cause cancer (1). Currently, the use of mobile phones can be avoided and the number of their users is growing daily (2, 3). Nevertheless, the effects of the mobile phone beam and its microbial contamination can threaten the user's health in some conditions (4, 5).

Since the mobile phone is repeatedly in close contact with the person's face and hand (6), it has worked as a suitable habitat for the growth of microbes (9-7), and can transfer the microbes (10). In a study which was carried out in Egypt (2015), 100% of the investigated mobile phones were contaminated by at least pathogen organism (11). The mobile phone microbial contaminants have also been proved by experimental findings of other studies (12-16). According to the World Health Organization (WHO), the electromagnetic radiation emitted from the mobile phones can change the electrical activity of the brain and consequently results in sleeplessness, headache, memory problems, reproductive system, etc. (17). The probability of the effect of mobile phone microwaves on triggering different cancers and negatively influencing the body organs including heart, eyes, liver, kidney, spleen, reproductive ligands, and other tissues is expressed (18-21).

The regular use of antiseptic substances to clean the eyes (22) and washing the hands are among the most important measures in reducing microbial contaminations (23) and reducing the conversation duration, keeping the phone away from the vital organs, and using special anti-wave coatings are also among the measures taken to mitigate the possible effects of the mobile phones beam. We can strengthen the observance of these preventive measures in people using educational interventions (20). Education is always regarded as one of the main approaches of change in behavior, which can also be employed in terms of the appropriate behaviors associated with the mobile phones. There are different types of teaching methods being employed in various situations. Short message is a simple and cheap method which can be used to increase the level of health knowledge in the society, proposing solutions to have a safe style of living, and presenting health education programs. In the short message-based education method, a wide variety of addressees can be accessed during a short time and these addressees can use the content of the sent short message and even resend it (24).

The effect of educational short messages in terms of adopting the useful health behaviors has been evaluated in various studies including the ones carried out by Filion et al. (2015, United States), Baghiani Moghadam et al. (2014, Iran) (26), and Goudarzi et al. (2014, Iran) (27). Pamphlet is another educational method being which is applied as a strategy to present information in different preventive levels in the health education interventions and health improvement. Moreover, it is also employed as a learning booster and a significant reminder of educational sessions. Pamphlet is widely welcome because of its low costs, low volume, and high attractiveness (24, 28).

The pamphlet has been also used in numerous educational interventions including the studies conducted by Yen et al. (2014, Malaysia) (29), Karina et al. (2015, Australia) (30), Hosseini et al (2011, Iran) (31), and Mohammadi et al. in 2014 (32). Based on what was mentioned about the importance of mobile phones and the appropriate behaviors of using them and considering the fact that the educational intervention has not been conducted about it so far in Iran and other countries, the present study was carried to

compare the educational intervention using the short message and pamphlet on the behaviors of 319 members of the steel factory staff in Ardakan- Iran, about the microbial contaminations of the mobile phones and the dangers posed by their beam, in 2015.

2- MATERIALS AND METHODS

2-1. Study Design and Population

The present experimental study was carried out on 319 staff members of steel factories in Aardakan, a city in Yazd province, the Centeral of Iran, in format of the control, intervention-short message, and intervention-pamphlet groups in 2015. The research samples were selected using the random allocation method. For this purpose, three factories with similar characteristics were regarded in the first step and then one factory was randomly selected the control group, one was selected as the intervention group using the short message method, and one was selected as the intervention group using the pamphlet method. In the next step, using the cluster sampling for each factory's commuter services**,** some services were chosen as the cluster and the people formed our samples in each service. According to the formula, the sample volume was estimated to be 104 people for each group. Nevertheless, 8 minibuses which could carry 16 people on the average were considered as intervention and control group.

$$n = \frac{2\left(Z_{1-\frac{\alpha}{2}} + Z_{1-\beta}\right)^2}{\left(\frac{\Delta}{\sigma}\right)^2} = \frac{2 \times 10.5}{0.2025} = 104$$

Content design: After a broad search through books, literature and data bases, various kinds of information about cell phone and its disadvantages was collected. The collected data was assessed and some of them were deleted or amended. The content included the microbial contamination of cell phones, effects of radiations and suggested preventive approaches. To make sure about validity of the content, we consulted experts in various fields including environmental engineering, occupational health, medical physics and health education and promotion and followed their corrective suggestions. The primitive pamphlet was deeply investigated several times by supervisors and advisors and eventually the final pamphlet was designed. The provided pamphlets were read by several people working in Ardakan steal factory and the understandability was assessed. The designed content was send via short message service (SMS) for the intervention group as well. The content was sent to the target group by 10 messages including 4 to 7 parts.

2-2. Methods

In order to conduct this research, the needed permissions was obtained from the research vice-chancellery of Shahid Beheshti University of Medical Sciences and also from the selected steal factories. The educational intervention was performed by using pamphlet and SMS. Before the initiation of the study, a pretest was given to control, intervention with SMS and intervention with pamphlet groups. The educational content for pamphlet intervention group encompassed two pamphlets.

The first pamphlet was given to the pamphlet intervention group after pretest and the next day, the second pamphlet was given to them. These pamphlets were given to the employees after their shifts and at the time of getting on their service buses at 15:30 to 15:45. The pamphlets were given to them by the bus drivers. A briefing meeting about the way of disseminating pamphlets and answering their probable questions was held 45 minutes before departure of buses. Then

pamphlets were given to the drivers. For intervention in SMS group, after getting the permission from the factory manager, the list of employees' phone numbers was taken. At the same time a SMS system was bought from Pars green company with the phone number of *+98500028041*. The designed content was arranged in 10 SMSs with 4 to 7 parts [70 letters or characters in one SMS in Persian language are equal to one part] and after the pre-test, 2 SMSs were sent to the target group at 15:50 every day. Two months after the educational intervention, the post test was given to them and the data was entered using SPSS 18 statistical software.

2-3. Measuring tools

The self-made questionnaire was used as the data collection tools, including 10 questions about demographic variables and 15 questions were asked about behavior assessment (**Table.1**). The behavior evaluation questions had five choices; always (4 points), often (3 points), sometimes (2 points), seldom (1 point), and never (zero point). It is worth to note that the questions 10, 11, 12, 13, and 15 are reverse and have reverse scores. The questionnaire was used after validation (face and content) and reliability (internal consistency) assessment. The Content Validity Index (CVI) and Content Validity Ratio (CVR) were employed to determine the validity of the prepared questionnaire content, while the Cronbach's alpha test was used to determine the internal consistency.

Table-1: The questions about domain of behavioral

Do you clean your mobile phone every day?*
How do you usually clean your cell phone? **
Do you wash your hands after using a mobile phone?*
If you use a mobile phone before eating, will you wash your hands to eat?*
During each phone call with family members, averagely how many minutes do you speak?***
During each phone call with colleagues and strangers, averagely how many minutes do you speak?***
Do you use a wired or wireless hands-free while using your mobile phone?*
Do you use phone speaker while using your mobile phone?*
Do you use both ears, sometimes the right ear and sometimes the left ear, while using your mobile phone?*
Do you stick your mobile phone to your ear immediately after dialing before starting the conversation?*
Whether your phone is being charged when you use it?*
Do you electrically charge your phone just when your phone battery is discharged and the device is turned off?*
Do you use your mobile phone in places where cell phone network is poor?*
Do you keep your mobile phone away when you sleep?*
Do you allow the children to use your mobile phone?*

*. Always, 2. Often, 3. Sometimes, 4. Seldom, 5. Never. **. With fingers, 2. With conventional fabric, 3. With paper tissue, 4. With a microfiber cloth and sprays, 5. I am not clean my phone. ***. Less than 2 minutes, 2. 3-5 minutes, 3. 5-10 minutes, 4. More than 10 minutes, 5. I do not have any restrictions in this regard.

2-1. Ethical consideration

This study was conducted according to the Helsinki Statement (31) and has been approved by the ethics committee of Mazandaran University of Medical Sciences (IR.MAZUMS.REC.94-1806).

2-2. Statistical analysis

Data was analyzed using SPSS, 21.0 (released 2007; SPSS for Windows, SPSS Inc., Chicago, IL, USA). Mean and SD were used to evaluate the quantitative variables (age) and absolute and relative frequency was used to evaluate the gender. Independent T-test was used to assess changes in mean pain between the two

groups. The Chi-square test was used to compare pain intensity between the two groups. In this study, a significant level of $P<0.05$ was considered.

In order to measure the CVR, based on the suggestions of 14 experts, 5 statements that got less than 0.51 scores according to Lawshe table were removed and statements of the questionnaire were decreased to 58 statements. Then CVI was measured according to Walts and Basel content validity. Five statements that their CVI score was less than 0.79 based on the mean scores of Walts and Basel content validity, were removed. At the next level, according to the mean scores of content validity index of all statements of the questionnaire, the mean content validity index for the questionnaire was calculated to be 0.95 for the questionnaire assessing employees' knowledge, attitude and performance about health risks of cell phones. Obtaining the score of 0.95 and above in the mean CVI indicates the acceptability of the tool. In order to assess the reliability of the tool, the internal consistency and test-retest were used in this study. In internal consistency method, the amount that a tool measures a common characteristic is assessed. In order to have a sufficient internal consistency, the Cronbach's alpha should be at least 0.70-0.80 (33). In the current study, the Cronbach's alpha for the whole tool was 0.80 which indicates the acceptable internal consistency.

2-4. Inclusion criteria

The inclusion criterion included at least one year of factory job history.

2-5. Exclusion criteria

Unwillingness for cooperation and staying in the study was considered as the exclusion criterion in the relationship.

2-6. Ethical considerations

In the present study, the moral considerations includes making coordination and achieving the necessary certificates to conduct the research about the related centers, the people's voluntary participation in all research steps, the safekeeping the obtained information, and reporting the research reports to the participating factories.

2-7. Data analyses

The data analysis was carried out using the SPSS-18 software and the descriptive (including frequency, frequency percentage, mean and standard deviation) and inferential (Kolmogorov–Smirnov test, the paired t-test, one-way analysis of variance, and covariance anlysis) statistical tests. In order to analyze the collected data, at first normality of the distribution of variables was assessed by Kolmogorov-Smirnov test. After making sure about normality of the distribution of the data, the performance score after educational intervention among control, SMS and pamphlet groups was compared by variance and covariance analysis with the adjustment for before intervention scores of knowledge, attitude and performance and also probable confounding variables including age, job experience, job position and education level. The comparison of scores before and after educational interventions was performed by paired t-test among control, SMS and pamphlet groups.

3- RESULTS

In this interventional study, 319 staff members of steel companies were studied in format of three control, intervention-short message, and intervention-pamphlet groups. According to **Table.2**, which presents the mean and standard deviation (SD) of basic variables, the average age of people in the intervention-pamphlet group was 34.9 $\pm$ 8.4 years old which is higher than people's average age in the control (31.8 $\pm$ 8.4) and intervention-short message (32.5 $\pm$ 7.0) groups. This difference level was significant from the

standpoint of the Kruskal–Wallis non-parametric test (P = 0.001). The average of job history variable in the intervention-pamphlet was higher with respect to the other two groups so that its level was 9.3 ± 5.6, 8.5 ± 7.6, and 7.1 ±4.4 years in the intervention-pamphlet, control, and the intervention-short message groups, respectively. This difference was statistically significant (P = 0.009). From the standpoint of the average household size, the lowest value (3.6 ± 1.7) is for the control group being 3.7 ± 1.1 and 3.8 ±1.3 persons in the intervention-pamphlet and intervention-short message groups, respectively. This average difference was not statistically significant (P = 0.247).

In addition, the average cost of the mobile phone in the control group was higher than the two other groups so that this average was 61.2 ± 57.2, 43.3 ± 23.0, and 46.2 ± 41.5 10,000 Iranian Rials in the control, intervention-short message, and intervention-pamphlet groups. The Kruskal–Wallis test showed that this difference was not significant (P = 0.19).

According to **Table.3**, the average behavior score before the educational intervention in the three groups of control, intervention-short message, and intervention-pamphlet are 21.2 ± 4.96, 21.1 ± 4.47, and 20.7 ± 4.28, respectively. Moreover, the domain of the sum of the scores of behavioral questions was between 0 and 60. In terms of the one way variance analysis test, no significant difference was observed among the three groups (P = 0.714).

After educational intervention, the behavior scores of people in the three groups of control, intervention-short message, and intervention-pamphlet was 27.7 ± 5.50, 42.9 ± 3.21, and 38.6 ± 3.83, respectively. The highest and lowest mean change was associated with the intervention-short message group and the control group, respectively, so that the increase in the mean behavior score of the intervention-short message group was more than 3 times higher than that of the control group. According to the paired t-test, the mean difference before and after educational intervention was significant in the three groups (P < 0.001).

In addition, a significant difference was observed in evaluating the difference in the mean behavior score of people in the three mentioned groups after educational intervention according to the covariance analysis test (P < 0.001). In the next step, in order to remove the effect of the confounding variables, on the mean score of people's behavior after intervention, the mean behavior score after intervention was modified against age, job history, and previous behavior variables (only after intervention). The difference between adapted means in groups remained significant (P < 0.001). In the next step, the behavior mean after intervention together with age, job history, and previous behavior variables were adapted against the variables of education level and organizational position. Based on the covariance analysis test, the significant difference between the groups still persisted (P < 0.001).

Table-2: The mean and standard deviation of basic variables in the control and intervention group

Variables	Control group	Intervention group: short message	Intervention group: pamphlet	P-value
	Mean ± SD	Mean ± SD	Mean ± SD	
Age (years)	31.8 ± 8.4	32.5 ± 7.0	34.9 ± 8.4	0.001
Job history	8.5 ± 7.6	7.1 ± 4.4	9.3 ± 5.6	0.009
Household size	3.6 ± 1.7	3.7 ± 1.1	3.8 ± 1.3	0.247
Mobile phone costs*	61.2 ± 57.2	43.3 ± 23	46.2 ± 41.5	0.19

* The mobile phone costs in the last two months (10.000 Rials); SD: Standard deviation.

Table-3: The mean and standard deviation of the behavior domain scores, before and after intervention in the intervention and control groups

Domain	Number	Group	Before intervention		After intervention		P-value
			Mean	SD	Mean	SD	(Paired test)
Behavior	107	Control	21.25	4.96	27.74	5.50	0.000
	104	Short message	21.07	4.47	42.91	3.21	0.000
	108	Pamphlet	20.72	4.28	38.56	3.83	0.000
The Significance Value of the ANOVA test			P = 0.694		P = 0.000		
Behavior*	107	Control	21.28	4.66	27.63	2.84	
	104	Short message	21.04	4.64	42.96	2.82	
	108	Pamphlet	20.72	4.64	38.61	2.83	
The Significance Value of the ANOVA test			P = 0.686		P = 0.000		
Behavior**	107	Control	21.17	3.14	27.59	2.92	
	104	Short message	21.20	3.11	42.91	2.90	
	108	Pamphlet	20.67	3.12	38.70	2.89	
The Significance Value of the ANOVA test			P = 0.391		P = 0.000		

* Modification with respect to age, job history, and previous knowledge variables (only for post-knowledge); ** Modification with respect to age, job history, previous knowledge (only for post-knowledge) + education level and organizational position.

4- DISCUSSION

The present experimental study was carried out to compare the effect of educational intervention, using the short message and pamphlet, on the behavior of 319 staff members of Ardakan steel factories in terms of the dangers posed by the mobile phones beam as well as its microbial contaminations in 2015. Before educational intervention, the average behavior score of people in the three groups of control, intervention-short message, and intervention-pamphlet was not statistically different (P = 0.714).

After educational intervention, the mean behavior score of people increased in the three groups of control, intervention-short message, and intervention-pamphlet. The mean difference before and after educational intervention for the control, intervention-short message, and intervention-pamphlet was 6.5, 21.8, and 17.9, respectively. The highest and lowest mean change was associated with the intervention-short message group and the control group, respectively, so that the increase in the mean behavior score of the intervention-short message group was more than 3 times higher than that of the control group. According to the paired t-test, the mean difference before and after educational intervention was significant in the three groups (P < 0.001). Moreover, a significant difference was observed (P < 0.001) in studying the mean difference of people's behavior score in the three mentioned groups after the educational intervention according to the one way variance analysis test.

In order to remove the effect of confounding variables, the mean score of post-behavior was modified with respect to age, job history, previous behavior, education level, and organizational position. As expected, the level of people's behavior after educational intervention was increased in the intervention-short message and intervention-pamphlet and the value of this increment was higher in the intervention-short message group

compared with the intervention-pamphlet group. The difference between the short message and pamphlet method also became significant indicating that the educational short message was more effective than the educational pamphlet.

Various studies have been carried out on the education method using short message and its effect on behavior change. In most of the cases, its positive effect on behavior change has been mentioned (34). Also, regular reminding about one behavior is a type of strategy which can easily be employed using the short message system, showing the intended behavior changes (35, 36). In the study carried out by Finch et al. (2015, Australia), educational intervention using the short message could cause behavioral changes in terms of preventing skin cancer and early diagnosis (37). Similarly, Speirs et al. (2015, United States) declared that the short message system can change the behavior in relevant and special issues among the mobile phone users (35). In the study carried out by Goudarzi et al., education by the use of the short message system affected the self-sufficiency among diabetes patients (27).

The educational messages and contents through the short message intervention left a positive effect on the behavior of the addresses (quitting cigarette, losing weight, controlling diabetes and asthma) (38, 39). Moreover, in the present study, the educational pamphlet caused positive changes in the behavior of the addressees. Freeman et al. used the educational brochure to increase the screening behavior of colon cancer among the African-Americans (40). According to the study carried out by Meharry et al., education by the use of educational pamphlet increased the pregnant mothers' reference to receive the flu vaccine (41).

In the same field, the study conducted by Ghanbari showed that the educational pamphlet of occupational therapy left a positive effect on many cases concerning the life quality of women with breast cancer (42). In another study, Yazdani et al. showed that education by the use of leaflet and films was effective on the oral health behavior of students (43). The effectiveness of written educations using pamphlet, leaflet, and educational booklets has been demonstrated in various studies including Unk et al., 2014, United States (44), Nascimento et al., 2015, Brazil (45), Wilson et al. (46), Greaney et al. (47), and Sirriyeh et al. (48).

Unexpectedly, the behavior level of the control group was increased after educational intervention. Although, this level of increment was lower than the intervention groups, it was statistically significant. In this regard, reasons including the pretest effect, the importance of the topic for the addressees, creation a sense of requirement in people and seeking for the answers, presenting an educational program using other media, sending short messages containing educational content from some members of the intervention group to those of the control group and the access of some of the control group members to the educational pamphlet which enhances the knowledge and perception and consequently the people's behavior.

4-1. Limitations of the study

The limitation of this study was self-declarations of Information.

5- CONCLUSION

In general, the findings showed that the educational short message and pamphlet have lead to changes in the behaviors concerning the use of mobile phone by the staff members under study. However, the educational intervention using short message was more effective on people's behavior than that using pamphlet. Since the mobile phones are one of the most important necessary means of today's life and microbial contamination and the possible adverse effects of their beam can

pose a threat to people's heath, carrying out health education interventions to improve knowledge and to change the behavior and attitude is vital.

6- CONFLICT OF INTEREST: None.

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