Cell Phone e-mail as a Means to Collect Information on Pregnancy and Delivery : A Pilot Study in Japan

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Original Article

Cell Phone e-mail as a Means to Collect Information on Pregnancy and Delivery : A Pilot Study in Japan

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Abstract Background : The diffusion of cell phones is 91.9% in Japan. Especially, cell phone e-mail is now widely used as a media source in Japan. The authors of this research have been engaged in collecting basic data to establish a system for providing improved health information on pregnancy and delivery through cell phones for pregnant women and their family members. Objective: In this study, we classified the trends of health information of pregnancy and delivery in which people desire to obtain through cell phone based on the characteristics of the information and, of each classification we revealed the generic characteristic (age, gender, gestational weeks and any other children), any social support, the types of cell phones or/and computers and their related use. Methods : Anonymous questionnaires were distributed to the participants of delivery preparation workshops held at two places in the northern parts of Kyushu Area to collect data. The cell phone e-mail usage trends were measured by four-rated scales. To classify the characteristics of the information, a Principal Factor Analysis was conducted. To find out correlation between the information classified and the generic characteristics, Mann-Whitney's U-test was conducted. Results : Out of two hundred and fifteen (215) respondents including 117 pregnant women and 98 husbands, 208 respondents possessed cell phones. Regarding the health information of pregnancy and delivery desired to obtain through cell phone e-mail, two factors, namely "medical information" and "non-medical information" have derived. Those who did not possess computers tended to use their cell phone e-mail to obtain both "medical information" (P = .002) and "non-medical information" (P = .02). While those who use cell phone e-mail almost everyday tended to use cell phone e-mail for obtaining "non-medical information" (P = .02). Conclusion : This study indicated that providing medical information and non-medical information through cell phone e-mail is an essential service, especially in Japan, where the diffusion of cell phones is far higher than that of computers.

Key words : Cellular Phone, Electronic Mail, Medical Informatics, Pregnancy, Delivery

Introduction

Today, IT (Information Technology) is used extensively all over the world. It is now almost impossible to gather information without using IT in every aspect of our daily life. When we summarize the information availability policy in the medical and welfare fields in Japan, the main issues are "to arrange medical service systems based on individual patients" and "to improve the management efficiency of medical agencies and medical services", according to the "e-Japan Strategy II" as published by Advanced Information & Communication Network Promotion Strategy Headquarter of Japanese Cabinet in 2003[1]. This policy means that complete computer networking regarding clinical charts and receipt transaction systems should be established.

Meanwhile the information accessibility of the general public is more advanced for cell phones than in computers in Japan. According to the "Communication Usage Survey in 2004" by Ministry of General Affairs, the diffusion of cell

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phones in each household is 91.1% while that computer is only 77.5%. Therefore, for the general public, cell phones are more familiar than computers as an IT media. From this survey the rate of cell phone and PHS (Personal Handy Phone System) users is 65.1% (7.7% up from the previous year) and in all age groups the usage has increased from 0.1 to 12.9% over the past year. Especially for groups in their twenties and thirties, the rate of the former is 95.2% while that of the latter is 89.1%. As for usage details, whereas the rate of only vocal communication users is 10.5%, the rate for Internet users has now increased to 89.5%, thus showing that the role of cell phones with Internet access has dramatically increased. As a result, the number of the people who have access to internet through cell phones is now 58.25 millions[2].

The more popular cell phones have become the more that Internet sites with cell phone access have increased. Such use include cell phone e-mail (74.3%), ringing tones and the downloading of music, sound and visual images (50.1%), image downloading (32.9%), news & current affairs (26.4%) and information search functions (16.1%), according to a recent ranking survey[3]. On the other hand, regarding health information, only limited sites are presently available such as "First Aid" by the Japan Amateur Sports Association. The authors of this research paper have been engaged in collecting basic data to construct a system of providing health information on pregnancy and delivery through cell phones. There are several objectives for establishing such a system. Firstly pregnancy for women is a stressful life event in terms of physical, mental and social aspects, and they are very vulnerable to stress. One of the causes of this stress is physical changes such as edema due to hormonal imbalances[4]. Another is psychological factors : it is hard for pregnant women in the early stages to accept the fact of pregnancy ; thereafter they feel embarrassed to go through the scheduled various medical checks until they feel the fetus move[5]. In addition, there are also social factors, such as the burden of being expected by their families and society who want them to give birth to a healthy baby. Especially in Japan where "IE", namely the feudal family system still remains to a strong extent and women are expected excessively to produce a boy as a family successor[6]. As a result, pregnant women are under various stresses which can trigger mental illness such as depression[7~9]. Accordingly, it is necessary to establish some support system for them to maintain their mental health. Secondly cell phones have already become a widespread media source. The results of our former studies[10)11)] showed that 80% of the respondents we surveyed use cell phone e-mail to obtain information through exchanging e-mail with their friends. The results of this survey suggest that health information that is reliable and carefully selected and can also be accessed by anybody through cell phone e-mail would thus be in great demand. In the meantime, Dennis[12)] indicated that telephone-based peer support effectively decrease postpartum depressive symptom through her randomized controlled trails. Therefore, one can assume that the peer support through IT media such as cell-phone e-mail with carefully chosen information may be effective to maintain the mental health of women, especially before and after the delivery.

It is essential to conduct randomized controlled trails to obtain evidence of the effect of peer support on mental health of pregnant women through cell-phone in Japan. Aiming at the randomized controlled trials as a final goal, we should therefore obtain basic information on the information of pregnancy and delivery in which people desire to obtain through cell phone (hereafter "cell phone e-mail usage trends") based on the characteristics of the information and, of each classification we revealed the generic characteristic (age, gender, gestational weeks and any other children), any social support, the types of cell phones or/and computers and their related

use. Through this study we expected to obtain what sort of needs the users have for health information contents on pregnancy and delivery using cell phone e-mail.

Methods

The respondents of this study were 236 participants of delivery preparation workshops held at two places in the northern parts of Kyushu. The questionnaires were distributed to each participant prior to the workshop. In the beginning of the workshops, the purpose of the survey was carefully explained to the respondents and the anonymity of the respondents in order to protect their privacy was promised by the authors of this study. In addition, the authors carefully tried not to force each respondent to answer the questionnaire, assuming that a rejection to answer the questionnaire represented their wish to refuse informed consent. This procedure was agreed upon by the authors after carefully studying the Declaration of Helsinki1[3] and the Guide to Epidemiological Studies, Ministry of Health and Labor and Ministry of Education[14]. Permission for the study was obtained through Institutional Review Board of Kyushu University.

The questionnaires of the study include following items. As generic characteristics, we asked about the gestational weeks of the pregnant participants, any other children besides the fetus, age and their gender. To measure social support we asked if they had any close people who experienced recent child-birth or friends with whom they could consult easily and also if they have any family. In order to evaluate the IT media usage, we asked if they possessed a cell phone and or a computer or not, and if they did, how often they used cell phone internet access service and cell phone e-mail, based on the following frequencies "almost every day", "once every 2～3 days", "once a week", "once a month" or "never use it" in that order.

In order to determine cell phone e-mail usage trends, we established 21 items about health information of pregnancy and delivery. These items were selected from the itemized contents of information most likely to be sought by pregnant women and which could possibly be obtained through cell phone e-mails, which were based on general information from pregnant women's magazines and the results of two Focus Group Discussions, previously conducted in another survey. Then we asked : "Suppose that you have a cell phone, how often do you think you will use cell phone e-mail for information on pregnancy and delivery as stated below", followed by four different grades, ranging from "I think I will use it" to "I think I will not use it". We classified answers of 21 items using the Principal Factor Analysis.

Next, regarding the frequency of cell phone internet access service and cell phone e-mail usage and Internet and e-mail computer usage, we divided them into two groups, those who used it almost everyday and those who did not. In addition, regarding information and advice about pregnancy and delivery desired through cell phone e-mail, we divided them two, ones "I will use.", "I would rather use.", and "I do not think I will use." and "I will not use."

Thereafter to find out any correlation between the information classified by Principal Factor Analysis and the generic characteristics and the above two groups, Mann-Whitney's U test was conducted. As for the gender comparisons, the T test, the Chi-square test, and the Fisher's exact test were performed. To test the reliability of sub-scales classified by Principal Factor Analysis, Cronbach's alpha was used. SPSS 12.0J for Windows (SPSS, Japan) package for personal computers was used for all statistical analyses.

Results

Generic Characteristics and Social Support of the Respondents

The number of retrieved questionnaires was 215 (effective retrieval rate : 91.1%). The result

Table 1 Generic Characteristics of the Respondents

		mean	sd	n	%
Age		31	4		
Gender	Female			117	54.4%
	Male			98	45.6%
Getational weeks		29	5		
Any other child	Yes			15	7.0%
	No			200	93.0%
Any senior mums and / or their families	Yes			173	80.8%
	No			41	19.2%
Possession of Cell Phone	Yes			208	97.7%
	No			5	2.3%
Use cell phone internet access service almost everyday	Yes			38	18.3%
	No			170	81.7%
Use cell phone e-mail almost everyday	Yes			128	63.1%
	No			75	36..9%
Possession of computer	Yes			168	78.9%
	No			45	21.1%
Use Internet almost everyday	Yes			88	52.1%
	No			81	47.9%
Use e-mail almost everyday	Yes			68	40.5%
	No			100	59.5%

showed that the respondents were 117 female (54.4%) and 98 male (45.6%). Their average age was 31 (SD4) and by gender, females were 30 years old (SD4) and males, 32 years old (SD4), the average age of the men was significantly higher ($p < .001$).

As for the gestational weeks, according to the answers of pregnant participants of the delivery preparation workshop, they were 29 weeks in average (SD5), with a minimum 10 weeks and a maximum of 38 weeks. Regarding the question of whether they had any other children (hereafter "any other children"), 200 respondents answered "no" (93.0%). The results are shown in Table 1.

In this survey, to find out whether they had social support with respondents can ask for help when necessary, we asked if the respondents had any people who have experienced recent pregnancy and delivery, and with whom they could consult easily, such as senior mums and/ or their families. One hundred seventy-three (173) respondents said "yes" (80.8%). By gender 104 females (88.9%) and 69 males (71.1%) said "yes". The ratio of females was significantly higher ($p < .001$).

Possession and Usage of Cell Phone and Computer and Their Usage

In this survey, 208 respondents answered "they have cell phones", by gender, 112 females (95.7%) and 96 males (100.0%) ($P = .04$). To respondents who said "possess cell phones", we asked how often they use cell phone internet access service, 38 respondents answered "use it almost everyday", by gender, 17 females (15.2%) and 21 males (21.9%). For the respondents who said they "possess cell phones", we asked how often they use cell phone e-mail, 128 respondents answered they "use it almost everyday", 78 females (71.6%) and 50 males (53.2%), the ratio of females was significantly higher. ($P = .005$)

One hundred and sixty eight (168) respondents answered they "have computer with Internet access either at home or at work", by gender, 89 females (76.1%) and 79 males (82.3%). To respondents who said they "have computer", we asked how often they use the Internet, 88 respondents answered they "use it almost everyday", by gender 39 females (43.8%) and 49 males (61.3%), the ratio of males was significantly higher ($P = .01$). For the respondents who said they "have computer", we asked how often they use

e-mail, 68 respondents answered they "use it almost everyday", by gender 24 females (27.0%), 44 males (55.7%), the ratio of males was significantly higher ($p < .001$).

Cell Phone e-mail Usage Trends by Each Item Regarding Health Information

Regarding cell phone e-mail usage trends, the result showed : Yes when we want to know ; "about maternity school sessions" (66.0%), "about the maternal welfare system (i.e. infant medical system) (61.7%)", "about opinions regarding certain baby goods from the respondents who use them" (61.2%), in this order. The number of respondents who answered "I will use it" and "I think they will use it" was extremely high. The results are shown in Fig. 1.

Factor Analysis of Cell Phone e-mail Usage Trends

We selected common factors which exist in the background of pregnancy and delivery information, and based on them we classified the information. The method for Principal Factor Analysis with varimax rotation was performed to classify cell phone e-mail usage trends. We next selected two factors with a value of higher than a 1.0 eigen value, furthermore we chose those which had a more than 0.60 factor loading and in which tas higher than 0.1, and, excluding those which did not meet the conditions, the items which were chosen by this process we judged suitable for our analysis and again we performed the Principal Factor Analysis with varimax rotation. The results are shown in Table 2.

The first factor was named "non-medical information" because it has no direct correlation with pregnant women and infant health information. The second factor was called "medical information" because it has a possible direct correlation with pregnant woman and infant health. Based on these results, we made a new scale and obtained points by simply adding up the items which composed each scale. Namely "non-medical information points" were drawn from "non-medical information scale" of 9 items. "Medical information points" were drawn from a "medical information scale" of 8 items. Cronbach's alphas of these new scales are .96 in "non-medical information scale" and .96 in the "medical information scale" and both scales are considered to be reliable. Furthermore 23 "non-medical information points" were identified (SD9) on average, with a minimum 9 points and maximum 36 points. Nineteen "Medical information points" were identified (SD8) on average, with a minimum of 8 and a maximum of 32.

Relationship between Cell Phone e-mail Usage Trends for "Non-medical information Points" & "Medical Information Points" with General Characteristics, Social Support and IT Media Usage

We checked if there is any relationship between "non-medical information points" & "medical information points" and the generic characteristics. Before the analysis we divided them into two groups using the average figures of age and the gestational weeks as cutoff points. We also divided them into two groups based on gender and the existence of any other children. Mann-Whitney's U test was conducted to find if there was any relationship between the categories divided and "non-medical information points" & "medical information points".

As a result, we did not find any significant correlations between the information and either the generic characteristics or the social support.

We did not find any significant correlations between "possession of cell phone", "use cell phone internet access service almost everyday" and "non-medical information" & "medical information". However, there is a significant relationship between "use cell phone e-mail almost everyday" and "non-medical information" ($P = .02$). The mean rank of the respondents who use cell phone e-mail almost everyday was significantly higher than their counterparts.

Fig. 1 Cell Phone E-Mail Usage Expectation Trend by Item

The mean rank of respondents who did not possess computers was significantly higher than the respondents who owned computers, in "non-medical information" (P = .02) and "medical information" (P = .002), respectively.

We did not find any significant correlations between the respondents who use Internet almost everyday, use of e-mail almost everyday and "non-medical information points" & "medical information points". The results are shown in Table 3.

Discussion

Features of the Study

In Japan, pregnancy and delivery information is usually unilaterally supplied from doctors, nurses and midwives. In addition, pregnant women normally receive such information passively[15].

Table 2 Factor Analysis of Pregnancy and Delivery Information Desired Through Cell Phone E-Mail

	Non Medical Information F1	Medical Information F2	Communality
Information about maternity leave systems (i.e. maternity and childcare)	**.79**	.31	.72
Information about how other persons take childcare leave	**.75**	.32	.67
Information about what diets other pregnant women follow	**.75**	.48	.79
Information about types and prices of baby goods	**.73**	.39	.68
Information about calories of foodstuffs	**.69**	.41	.65
Information about maternal welfare system (i.e. infant medical system)	**.69**	.54	.78
Information about what other people think about certain baby goods	**.68**	.48	.70
Information about how other pregnant women control their weight during pregnancy	**.68**	.54	.76
Information about reputation of books about pregnancy & delivery in choosing one	**.65**	.48	.67
Consultation on if it is safe to take some medicine such as cold medicine	.28	**.83**	.78
Consultation on if there are any foodstuffs they should not take	.41	**.80**	.82
Consultation about details of examinations during pregnancy	.41	**.75**	.73
Consultation about any physical changes during pregnancy	.44	**.74**	.74
Consultation about gestational toxicosis	.51	**.69**	.75
Consultation about the growth of the fetus	.51	**.69**	.74
Information about the reputation of certain hospitals in choosing a hospital for delivery	.49	**.66**	.69
Information about the equipment and characteristics of certain hospital in choosing a hospital for delivery	.50	**.63**	.66
Eigenvalue	6.3	6.1	12.4
R^2(%)	37.1	35.9	73.0

Table 3 Cell Phone E-Mail Usage Trends for "Non Medical Information" and "Medical Information"

	Age			Gender			Gestational weeks		
	-30 years	31 years-	*P*	Female	Male	*P*	-29 weeks	30 weeks-	*P*
Non Medical Information	99.2	108.4	.28	104.0	106.3	.79	105.8	101.8	.64
Medical Information	96.8	110.3	.11	106.3	103.4	.73	108.1	100.1	.34
	Any other child			Any senior mums and / or their families					
	Yes	No	*P*	Yes	No	*P*			
Non Medical Information	93.3	105.9	.43	101.7	119.5	.10			
Medical Information	85.4	106.5	.19	101.5	120.2	.08			
	Posession of Cell Phone			Use cell phone internet access service almost everyday			Use cell phone e-mail almost everyday		
	Yes	No	*P*	Yes	No	*P*	Yes	No	*P*
Non Medical Information	105.2	97.5	.78	98.9	103.3	.68	92.6	112.5	.02
Medical Information	105.1	101.7	.90	96.3	103.9	.48	94.1	110.0	.06
	Posession of computer			Use Internet almost everyday			Use e-mail almost everyday		
	Yes	No	*P*	Yes	No	*P*	Yes	No	*P*
Non Medical Information Point	110.0	86.3	.02	85.0	81.9	.68	89.6	79.3	.17
Medical Information Point	111.8	79.7	.002	83.6	83.4	.98	90.4	78.7	.12

Analysis: Mann-Whitney's U Test
Figures shown in the Table 3: Mean Rank

Therefore, it is not difficult to understand that studies on health information on pregnancy and delivery has been conducted by medical professionals in order to measure the effects of information that was supplied by medical professionals and that was thought to be necessary from a medical and nursing point of view. Accordingly it is rare to consider the concept of how pregnant women are able to solve their problems by themselves and to collect health information actively ; consequently very few studies have ever been made based on this point of view. Therefore, in studies of children and maternal health, our studies are very unique because they are based on the supposition that decision making lies in pregnant women and their families if they want to collect health information through cell phone e-mail.

Desired Contents

This study showed the characteristics of desired health information contents using cell phone e-mail. The result of cell phone e-mail usage trends by item revealed : "they want to know about maternity school sessions" ranked first, showing that 66% of answerers replying "I think I will use it" and "I rather think I will use it". This indicates that respondents of this study would likely to use cell phone e-mail for information not so big in volume as available on in computers and which also can be obtained without too much browsing. The information about maternity school session corresponds to "a notice from medical agency" which had been pointed out as desired health information content in an analysis of free answers in a previous study[11]. Since this health information also ranked the highest in this study as desired content to be obtained through cell phone e-mail, the requirement for this content is indicated to be quite high. The second ranking item of "Information about maternal welfare system (i. e. infant medical system)" is information about the welfare system regarding delivery, which can be arranged through government agencies. This is information that is not well misunderstood when supplied one-sidedly and that can be controlled by inputting in advance and their revising regularly ; its possibility of realization is rather high for the health information content.

Meanwhile the results of the study brought up the users' trend of putting emphasis on two-way communication between information suppliers and its receivers, shown as "Information about what other people think about certain baby goods" which ranked third in their replies. Through an analysis of free answers of the previous study[11], we pointed out that pregnant women would feel comforted by communicating each other pregnant women through cell phone e-mail, the result of this study also shows that pregnant women want some health information contents through which they can exchange their own information. As cell phone e-mail is expected to be one method of developing friendship[16], it is necessary to make contents which meet their expectation.

Classification of Health Information

The results of a Principal Factor Analysis of the study showed two groups of health information to be obtained through cell phone e-mail ; one is "non-medical information" and the other is "medical information". "Medical information" is represented by items of direct health matters of mother and fetus such as pregnant women want to consult "whether it is safe to take some medicine such as cold medicine", "if there are any foodstuffs they should not take", "about details of examinations during pregnancy", "about any physical changes during pregnancy", "about gestational toxicosis" or "about the growth of the fetus". "Medical information" also contains items such as they want to know "about the reputation of certain hospitals in choosing a hospital for delivery" or "about the equipment and characteristics of certain hospital in choosing a hospital for delivery". These items are considered to be

supplied by doctors and midwives through direct communication to satisfy pregnant women.

"Non-medical information" consists of ; information regarding to the welfare system of delivery such as "maternity leave system (i.e. maternity and childcare)", "maternal welfare system (i. e. infant medical system)", information which can be obtained by communicating with other pregnant women and mothers who are in the middle of caring infants such as "how other persons take childcare leave", "what other people think about certain baby goods", "how other pregnant women control their weight during pregnancy", "what diets other pregnant women follow", "Information about reputation of books about pregnancy & delivery in choosing one" and "Information about types and prices of baby goods" and information regarding pregnancy and delivery which can be obtained by themselves not necessary through professionals such as "Information about calories of foodstuffs". Accordingly, as for "non-medical information", it is not necessary to require comments from doctors or midwives but it is possible to exchange information by just setting up a network of pregnant women.

Cell Phone e-mail Usage Trends by Characteristics of Information

Interestingly, this study indicated a significant correlation between cell phone e-mail usage trends and IT media use, rather than generic characteristics such as gender, age, gestational weeks, any other children, or being in a situation to obtain support such as social support.

It is natural that cell phone e-mail users tend to utilize cell phone e-mail much more frequently than those who do not use it everyday. This is particularly true for collecting non-medical information. This tendency does not contradict the fact obtained from our previous study, which indicated that pregnant women and their family members have a strong desire to contact their peers in order to exchange non-medical information[11]. Therefore, providing content such as chat-rooms in which they can communicate with their peers through cell phone e-mail may therefore satisfy a large number of eligible users.

On the other hand, there are significant correlations between cell phone e-mail usage trends for "non-medical information" & "medical information" and possession of computer. The results of our study indicated that those who did not possess computers tend to use cell phone e-mail for obtaining "non-medical information" & "medical information" to a far greater degree than their counterparts. Throughout the study, it can be assumed that cell phone e-mail can thus be a valuable alternative to computers in providing both medical and non-medical information. Presently in Japan, some information on pregnancy and delivery is now available through computers, however, there remains a huge digital divide between those who are regular computer users and those who are not. Therefore, due to the fact that the diffusion of cell phones is far higher than that of computers in Japan, it is thus considered to be highly useful to utilize cell phone e-mail as a tool to provide both medical and non-medical information to the large number of individuals who still do not possess computers.

Conclusion

Through this study we classified the types of desired health information of pregnancy and delivery to be sought through cell phone e-mail. We also examined the social background of users who seek for health information. The results showed that the respondents of this study took a serious view of two-way communication which is a characteristic of cell phone e-mail and that they expected health information contents of pregnancy and delivery to be constructed making the most of its characteristics. We also find that such contents are essential, especially for those who do not possess computers.

One limitation of this study is that the respondents are only attendants of delivery

preparation workshops. Since there are more pregnant women and their husbands who are unable to attend such a workshop, in the future it will be necessary to conduct more surveys by selecting respondents through various new methods.

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（和文抄録）

妊娠出産情報収集手段としての携帯メール：日本におけるパイロット・スタディ

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平野（小原）裕子，平　田　伸　子

日本における携帯電話の普及率は91.9%であり，特に携帯メールは日本でも最もよく使われているメディアである．著者は，かように普及率の高い携帯メールを使い妊産婦及びその家族にも適切な健康情報を発信するためのコンテンツを作成し，その評価を行うことを最終目標としているが，本研究は，まずどのようなコンテンツを作成すべきかを明らかにする目的で，携帯メールで健康情報を収集するためにどのような属性（年齢，性，妊娠期間，上の子どもの有無）や社会的支援，ITメディアの使い方をしているユーザによって，どのような情報が現実的に収集されているのかを分析したパイロット・スタディとして位置づけられる．

本調査の研究対象は，九州地域２箇所で行われている出産準備教室の参加者である．妊娠出産情報を入手するために携帯電話を利用する傾向（携帯電話利用傾向）は情報の種類毎に４件法にて測定し，主因子法によって類型化し，マン・ウィットニーのＵ検定により，属性・社会的支援・ITメディア使用パターンとの関連を明らかにした．

対象者は215人（うち，妊婦117人，その夫・パートナー98名）であった．うち208名が携帯電話を保有していた．因子分析の結果，妊娠出産情報は「医学関連情報」「非医学関連情報」の二つに類型化された．パソコンを保有していない者は，携帯メールで「医学関連情報」（P=.002）「非医学関連情報」（P=.02）を収集する傾向があった．また，毎日携帯メールを使う者はそうでない者に比べ「非医学関連情報」（P=.02）を収集する傾向があった．

本研究を通して，「医学関連情報」および「非医学関連情報」を携帯メールで発信することの意義が示された．