One-click Peer-encouragement Mechanisms for Web-based Health Promotion System to Prevent Metabolic Syndrome

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Abstract - Metabolic Syndrome has grown as one of the most serious diseases in the world. Several activities to reduce or prevent this serious disease has been conducted in many countries. In Japan, the government established the law to prevent metabolic syndrome under which many metabolic people have to try to reduce their weight under instruction of healthcare nurses. To support the activities, many computer systems have been developed to help their activities and also to keep their motivation for it. However, many people still fails to reduce their weight since the effort for it is so hard that they feel difficult to continue the effort. In this paper, we propose a peer-encouragement mechanism for SNS based health promotion systems in which users encourage one another by themselves to improve their motivation for everyday's effort. Through one-month evaluation experiment, we confirmed that the proposed peer-encouragement mechanism works effectively in practical scenes.

Keywords: Medical Systems, Peer Encouragement, SNS, Health Promotion, and Metabolic Syndrome.

1 INTRODUCTION

Currently, metabolic syndrome has been generally regarded as one of the most serious diseases over the world. Although there are several definitions per country, metabolic syndrome is generally defined as the state that people put on significant weight [1]. Unfortunately, the prevalence of metabolic syndrome is considerably high all over the world [2]. The problem is that the people of metabolic syndrome have higher risk to be cardiovascular diseases or diabetes in the future, resulting in higher medical cost. Once people come to be cardiovascular disease or diabetes, their medical cost gets far higher. The importance to prevent metabolic syndrome is widely recognized.

Therefore, various activities to reduce or prevent metabolic syndrome has been tried all over the world. Especially in Japan, the government established the law to prevent metabolic syndrome under which many metabolic people are trying to reduce their weight under instruction of healthcare nurses. Recently in the instruction scene, several information systems are applied to improve the effect over reduction of users' weight. Typically in such systems, users report everyday's effort on reducing their weight through the Internet, and healthcare nurses periodically make proper advices according to their daily report in order to motivate further continuous effort of them.

This activity is actually effective to keep users' motivation for the everyday's effort to improve their weight. However, this style of instruction still requires much labor of health care nurses if they want to keep users' motivation at high level. One of the challenges in this area is to motivate users to continue their effort to reduce weight without increasing the labor of health care nurses.

In this paper, we propose the peer-encouragement mechanisms among users in which users encourage one another to improve motivation for everyday's effort by themselves without healthcare nurses. By this peer-encouraging mechanism, more users will keep their motivation to continue their activity without increasing healthcare nurses' labor. In our method, encouragement is done with simple "one-click" operation so that people can encourage others without stress and labor. In this paper we present the concept of peer-encouragement and the system design to be applied into practice.

The rest of this paper is organized as follows: In Sec. 2 we present the background of metabolic syndrome and the current activities to prevent/cure people against it, including the related information systems to help the activities. In Sec. 3 we present the concept and the mechanism of peer-encouragements and also its intended effects. In Sec. 4 we show the design of the system that we developed and explain how they work. In Sec. 5, the evaluation results for this system are presented, and we conclude the work in Sec. 6.

2 BACKGROUND

2.1 Prevalence of Metabolic Syndrome

As mentioned above, metabolic syndrome has been generally regarded as one of the most serious diseases over the world. It brings not only the problem of public health, but also the problem of economical cost. It is known that many countries try to prevent/reduce metabolic syndrome, but as the background of the activity there are the problem of high prevalence of metabolic syndrome people in many countries [2].

In United States, the metabolic syndrome prevalence is over 20% and about 47 million U.S. residents have the metabolic syndrome [2]. In Britain, National Diet & Nutrition Survey [3] reported that the number of patients is 9.4 million and about 10.2 million people are in the spare group. In Japan, The National Nutrition Survey reports (2008) [4] that the number of patients are estimated at 25.3% and spare group people at 21.9% in male, and 10.6% and 8.3% in female, respectively. Note that the considerable part of the patients is in

working age. Further, the prevalence of diabetes, into which metabolic syndrome may grow when it gets significant, are also reported high in both U.S. and Japan [5][6].

2.2 Activities to Reduce Metabolic Syndrome

To reduce or prevent metabolic syndrome, various activities are going on in several countries. Specifically in Japan, the government has established laws in which companies are responsible to make efforts to reduce weighted staff, and are executed from April 2008. Consequently, many companies started to pay for the effort to reduce the level of metabolic syndrome of their employees, not to be penalized for it. As a result, now it is commonly seen that healthcare nurses continuously make instruction to improve health of the employees of companies.

Now we focus on how the healthcare nurses make instruction to people. In fact, the main method that the health care nurses apply in order to improve health of the metabolic syndrome candidates is the decision of small daily goals that they try to pursuit every day at their home. Note that the daily goals are determined individually under instruction of a healthcare nurse not too difficult to pursuit. In many cases, the daily goals are selected and many of them are intended to do daily moderate exercise or improve nutrition balance of daily meals. But in practice, many people in fact are not able to continue to pursuit the goals every day since it is difficult to keep their willing to continue for such personal home activities. The problem is that many people tend to stop such activities before long, which significantly degrades the performance of the instruction of healthcare nurses.

2.3 Assisting Health Promotion using Information Systems

As one of the ways to make people continue their health promoting activities, there are various web services which intend to have such people informed about or interested in their health promoting activities [7][8][9]. For instance, Matsumoto et al. [7] proposed an information system to assist to improve dietary habit, by recording user's meal history and providing users nutritionally well-balanced menus based on medical information. This system would help users improve their daily nutritional balance without healthcare nurses. As another instance, an web system K-zoku [8] tries to help users build their health promoting plans and visualize the daily achievements to motivate users to continue diet activities. In K-zoku users can determine their daily goals under the guide of provided medical information, and record daily achievements. Users always check their achievement level of their activities to motivate to continue their plans. Those systems are useful to help users promote their health, but healthcare nurses do not related with the system. Since users have to try to lose weight alone without professional knowledge, the effect of this kind of systems is limited.

On the other side, several information systems exist which try to help healthcare nurses instructing users health promoting [10] [11] [12]. This kind of systems typically try to help communications via the Internet between healthcare nurses and users in home who are trying to achieve daily goals i.e., users input their daily achievement in pursuing goals into the system. then their healthcare nurses check them and provide advices periodically. There are several success cases of this kind of systems in Japan and consequently it is now regarded that the advices from healthcare nurses are actually effective to motivate users to continue their health promoting activities. For example, Yoshihiro et al. [10] proposed a system to support healthcare activity of (relatively light) diabetes people. In this system users input daily cure records into the system via mobile phones and nurses send back advices periodically. As another example, Harasuma Diet by Hitachi co.ltd. [11] is a commercial web system which supports healthcare nurses instructing users health promoting. In this system "100 kcal card," which shows a small goal to reduce energy of 100 kilo calories, is prepared to help instruction, and once the daily goals to try are determined, users records the daily achievements of the goals. By using 100 kcal cards, the labor of healthcare nurses to determine users' daily goals is considerably reduced and also periodical advice improves the health promotion effect of the users.

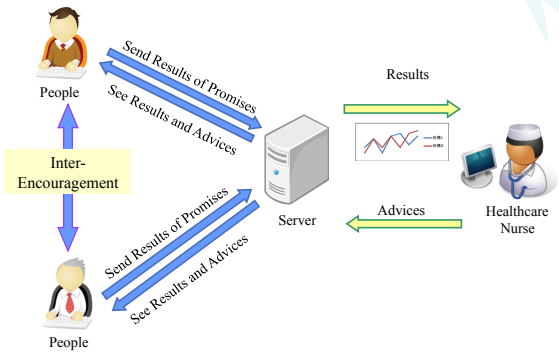

Figure 1: Overview of Our System Scenario

However, in fact, the effect to keep users' motivation to continue their health promoting activity is still limited so that considerable part of the people quit their activities. One solution for this problem would be that healthcare nurses pay more effort to communicate with users, but it is not practical. To improve the health promoting effects without increasing healthcare nurses, some systems introduces a mechanisms to promote communication among users using the mechanisms of SNS (Social Network Services) [13]-[18], i.e., they allow users to send messages to other users. This mechanism actually increase user's communication, however, the number of users who send messages are quite limited since sending message is so time consuming.

Thus in this paper, to help healthcare nurses to assist users' health promotion activities, we propose a mechanism which enable users to encourage one another among them (which we call peer-encouraging mechanisms) with simple one-click action. By this peer-encouraging mechanism, users will keep their motivation by themselves without increasing labor of healthcare nurses.

3 PROPOSED MECHANISMS

3.1 The Concept

We firstly describe the base system structure that we intend to extend, and to introduce the peer-encouragement mechanisms. Figure 1 shows the basic functions of such systems. In the Internet there is a web server in which our server programs are installed. Since we suppose to extend typical healthcare supporting systems, it is expected that healthcare nurses consult users to determine their daily goals to achieve, and the daily goals are set into the system. Then, users input their daily achievements into the web server everyday, and check the achievement history by themselves at home. Note that in the typical systems, the healthcare nurses are able to check the achievement history of users at the hospital, and also able to send some advices if needed. Some practical systems provide SNS based functions to motivate users continuing their activity, where users can communicate with one another via text messages. However, such text-based mechanisms are used only a part of people who are accustomed with computers. The mechanisms to motivate more people to continue their health promoting activity are desired.

In this paper, instead of such text-based communication functions, we propose the mechanism called "peer-encouragement" by which user can encourage other users with a single "one-click" operation. In our system, a user checks other users' daily achievement histories, and if he/she feels like encouraging one, then he/she makes an encouragement by one-click action to raise motivation of other users. Note that we prepare two sorts of encouragement, i.e., "encouragement" and "admiration" that we can select case by case (both of those are called "encouragement" in the following.) Note that we do not think that only this simple mechanism would make effect in the health promoting activities. Several environmental mechanisms which work together with this one-click action is essential.

Our idea is to create cycle of encouragements among users. If a user is encouraged by others, the user's motivation would be raised a little, and then he not only goes to continue his health promoting activities, but also he would feel like encouraging other users. This phenomenon makes a chain of encouragements, and it grows to be a cycle after all. In this way, we expect a sustainable cycles among users which always raise their motivation to continue their activities. Figure 2 illustrates the phenomenon: once an user first "encourage" someone, then he not only encourages the user as a reply, but also encourages others in turn. Chain of this phenomenon would create cycles. In this way the first single encouragement would be augmented to be circulated among users.

To create cycles stably, several environmental mechanisms are essential. First, the encouragement operation should be sufficiently simple and clear so that users can make encouragements without labor and stress. Next, sufficient number of encouragements is necessary to keep stable cycles of encouragements. Finally, the encouragements should result in some kind of connectivity between users so that users can compare themselves with other users. Over those points we will discuss in the next subsections.

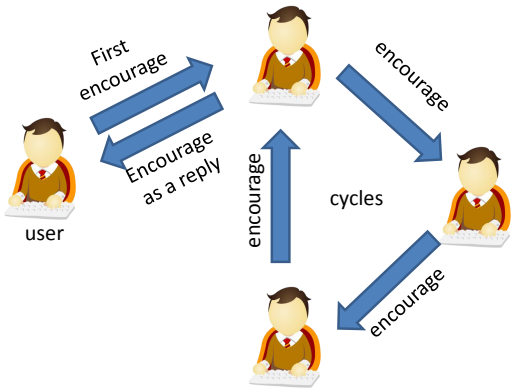

Figure 2: Cycles of Encouragements among Users

3.2 Classifying Daily Goals

Now we consider about the scene that an user makes encouragement to other users. To create encouragement chain as many as possible, the interface should be simple and clear not to have users feel labor or stress. Therefore, we propose "one-click encouragement," which is done by simply pressing "encourage" button in the screen. However, not only simple enough the interface is, but also the interface should be clear such that we can imagine the healthcare activity of the user enough to feel like encouraging him. Usually, the healthcare activities of the users are imagined from their achievement history (thus healthcare nurses are able to send proper advices in the typical systems). But note that there are the problem of privacy when users see the other user's daily achievement history, i.e., many people would not feel well when their achievement history is put open in public. Especially, the specific description of daily goals may not accepted by some people.

On this problem, our solution is to classify daily goals into several categories. Then, when we see another user's history, we are able to understand the sort of his each daily goal (without seeing the specific description of daily goals). This would include acceptable information for us to imagine his activities and come to feel like encouraging him. As the categories for the purpose above, we select the following 8 categories:

Food Amount (FA): Daily goals in this category try to reduce daily calories ingested to reduce weight, e.g., stop eating between meals, eat 2/3 of usual amount of rice, etc.

Nutrition (NT): This category tries to improve nutritious balance of daily foods, e.g., eat fruits 3 times a week, drink coffee without sugar, eat vegetable salad once daily, etc.

Light Exercise (LE): This category tries to perform light exercise, e.g., use stairs instead of elevator, perform stretching after taking a bath, etc.

Hard Exercise (HE): This category tries to perform hard exercise, e.g., walk 10,000 steps a day, jog outside everyday, perform physical training 5 times a week, etc.

Daily Measurements (DM): This category tries to measure

their body periodically, e.g., measure weights twice (morning and evening) a day, etc.

Prohibit Drinking (PD): This category tries to quit drinking alcohol, e.g., quit drinking twice a week, drink 1/2 of the usual amount of beer, etc.

Prohibit Smoking (PS): This category tries to quit smoking, e.g., quit smoking 3 days a week, reduce the number of cigarettes to 1/2 of usual, etc.

Others (OT): This category includes daily goals which are not included in the above 7 categories, e.g., get up early, chew foods sufficiently many times, etc.

3.3 Augmenting the Number of Encouragements

If the probability to occur chain encouragements is low, the number of encouragement reduces as time passes and cycles would disappear soon. For this problem, we propose two solutions. One is to enforce users to encourage other users when they input daily records. This method provides a constant number of encouragements everyday not to reduce cycles. An anxiety is that users feel the enforced encourage operation laborious or stress, resulting in stopping to use our system. This point should be confirmed in the evaluation.

Another solution is to create automated encouragements to augment the number of encouragements. This also provide encouragements everyday not to reduce cycles. The anxiety of this method is that users would be discouraged when they know that computers, but not real people, are generating encouragements, resulting in lose interests to use this system. In this work we selected the former solution and developed a prototype system based on it.

3.4 Connection among Users

To create sustainable cycles of encouragements, we regard it also important to create connection among users. The connection among users here means formation of some recognition against other users, i.e., feeling of friends or rivals who lead us to act with or compare us with those people. Through those connections we intend to make users interested in other individual users, by which we expect to augment users' motivation for their activities and the number of encouragements. Specifically, if the list of users who recently encouraged you is given, one would go to see the daily activity of the users, and then he would make encouragements for them with high probability as a reply for them. As another example, if a ranking of the number of encouragements is given, one would check users around the rank of you. Further, if one found users whose daily activities are similar to him/her, then he/she may wish to continuously watch them as his/her rival user.

We regard such kind of connections among users as quite essential when discussing the formation of sustainable cycles. Consequently, in our system design, we implement the following as shown afterwards:

- the list of users who recently encouraged you,
- the list of users you recently encouraged,
- the list of users you want to watch (watch list),
- and ranking of 1-week achievement score and the number of encouragements given.

Also as information by which one may be interested in others, we allow users to input their profile information and put it open to public.

Table 1: Software Used for the Server

Software	Version
CentOS	4.3
Apache	2.0.52
PostgreSQL	7.4.13
PHP	4.3.9
Postfix	2.2.2.10

4 SYSTEM IMPLEMENTATION

4.1 overview

We carefully designed the system with the peer-encouragement mechanism and the environmental mechanisms in order to make the circulation of encouragements work well. Overview of the system has been explained in Sec. 3.1 and Fig. 1. We implemented the server using the software shown in Table 1. Note that, since in this paper we evaluate the effect of peer-encouragement mechanisms, we illustrate the interfaces for general users only (i.e., the interface for healthcare nurses are not included in this paper.)

The interfaces for general users consist of 7 views: top view, daily goals settings, achievement history view, peer-encouragement view, ranking view, profile edit view, and settings. We omit the transition diagram since users can move among those views using the menu bar seen in the upper part of each view.

4.2 Top View

Fig. 3 shows the top view of the system, to which users first come after the authentication. Three fields ① ② and ③ are shown, which is to be explained below. The left button of field ① brings users to the pop-up window in which users input their daily achievements for daily goals. In our system, users can input the achievement of each daily goal, body weight, and a short comment of the day. After the input of those daily records, users are brought to the peer-encouragement view to enforce them to make encouragement for other users. The right button in field ① brings users to the peer-encouragement view directly. The detail of the peer-encouragement view is seen in Sec.4.5.

The field ② of Fig. 3 shows the 1-week daily achievement history of an user. In this figure, three goals are shown by categories LE(Light Exercise), NT(Nutrition) and FA(Food Amount). Each goal's 1-week achievement history is seen in a row. Each row consists of two sub-rows. The upper sub-row

Figure 3: Top View

shows the daily achievement of the daily goal in four levels, i.e., double O, O, triangle and X. If the goal is weekly goal (i.e., the goal to achieve the fixed number in a week, e.g., twice a week), different character meaning "excuse" may be used, which means the goal is not achieved but is allowed. The lower sub-row shows the number of encouragements received from other users in each day. This count is done for each kind of encouragements "encouragement" and "admiration" represented by different color of stars. In the second rightmost column, the statics values including the number of days continuing to input achievement are shown. In the rightmost column, the rankings of achievement score in the past 1-week in each goal category are shown. The second lowest row shows the daily comments of the user. In the lowest row body weights are seen if they are input by the user.

The field ③ of Fig. 3 shows the three *user lists*; *the watch list* is the list of users you want to watch continuously, *the encourage user list* is the list of users you encouraged recently, and *the encouraged user list* is the list of users who encouraged you recently. To add users into one's watch list, the user can go to the peer-encouragement view (see Sec. 4.5) or the ranking view (see Sec. 4.6) and click the link to add people into his/her watch list. Other two lists are updated automatically according to the history of encouragements about each user. In each user list, users are displayed with the list of categories of his/her daily goals and his/her newest comment. By clicking each user, we can go to the top view of the user. The design of the top view of other users consists of only the field ② and the function that you make encouragements for the user is added, i.e., the two encouragement buttons are added.

4.3 Daily Goals Setting View

Fig. 4 shows the daily goals setting view, in which at most 10 daily goals are set. There are seven fields to explain. Field

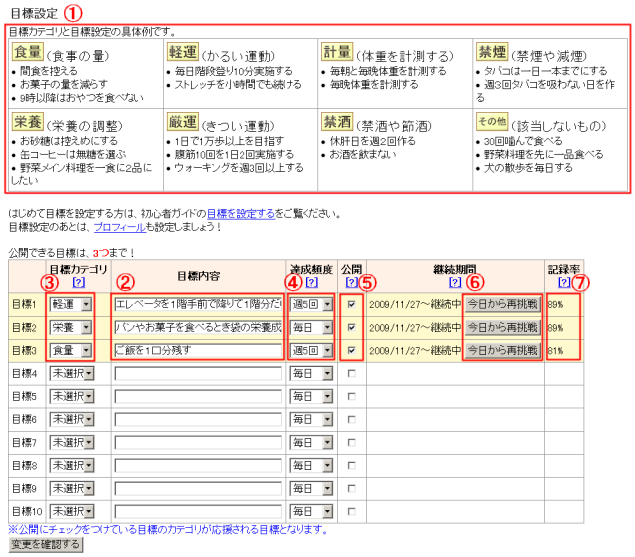

Figure 4: Daily Goals Setting View

① shows the examples of goals for reference. To guide users the correspondence between text-form daily goals and the categories, this field is necessary. The other six fields are the part of the web form to set daily goals. In the second leftmost column (field ②) we fill the text representation of daily goals. Then, in the leftmost column (field ③) we select the corresponding category among 8 candidates shown in Sec. 3.2. In the column ④, we select the type of the goal, i.e., daily goal or weekly goal (if we select weekly goal, we can select the number of expected achievements in a week.) In the column ⑤ users select whether the goal is open in public or not; users can select at most 3 goals to be open, to which other users make encouragements. In the column ⑥ we see the period of time that we are trying to achieve that daily goal, and users can reset the starting day and restart for this goal by pressing the button (i.e., the achievement history is cleared). In the column ⑦ we see the ratio of days that the user inputs the achievements so far.

4.4 Achievement History View

In the achievement history view, users can see the daily achievement history of themselves. The items that users can see is all the input data they input so far, the record of encouragements received from other users so far, and some related statistic values. We omit the explanation of this view since there is no specific feature in this view.

4.5 Peer-encouragement View

In the peer-encouragement view we can encourage other users with one-click "encouragement" or "admiration" operation. To augment the number of encouragements, we make users encourage other users at least once a day, as mentioned in Sec.3.3. So, after inputting the daily achievement, users are forced to come to this view and to make encouragements. Also, users can visit this view at their will after that.

Fig. 5 shows the view to encourage other users, where 5 users are selected and shown in 5 rows. Field ① of Fig. 5

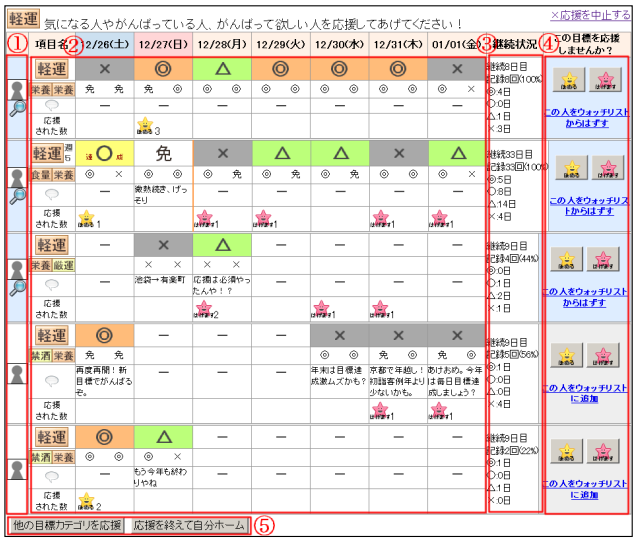

Figure 5: Peer-encouragement View

Figure 6: Ranking View

shows the 5 users whose nickname is hidden. Those users are selected basically at random, but we embed a mechanism that the users of less received encouragement is more likely to be selected. Field ② shows the achievement history of users as a reference data to decide whether you encourage them or not. In this field, the information seen is mostly the same as the field ② of top view (Fig. 3), i.e., the 1-week achievement history of three daily goals, the daily comments, and the 1-week history of received encouragements for each user. In the field ③ we see some statistic variables which is the same as the field ② of Fig. 3, i.e., the length of time in days since the users start trying their achievement, the number of input in days, and the number of each level of achievements (i.e., double O, O, triangle, and X). You can encourage those 5 users according to the information described above; the encouragement is done by two buttons shown in field ④ in Fig. 5. Each of two buttons corresponds to two sorts of encouragements, i.e., "encouragement" and "admiration." Also, by clicking the hyper link below the two buttons, we can add the user into our watch lists. Note that you are not necessary to encourage all those 5 people. However, at least one encouragement is required to finish this view. When you finish encouraging, you can continue to encourage other users or return to your top view, using the buttons seen in field ⑤.

4.6 Ranking View

In the ranking view we can see the weekly ranking of achievement scores and the number of encouragements obtained (for each of "encourage" and "admiration"). The ranking is created for each category of daily goals; each ranking consists of users who have at least one daily goal which belong to that category. Fig. 6 shows the ranking view. In field ① we can select the ranking to look: the upper tabs correspond to 8 categories and "all categories" added at the leftmost tab. Specifically, from its left side, the categories All, FA, NT, LE, HE, DM, PD, PS, OT described in Sec. 3.2 are shown. If we click one, the ranking shown in fields ③ ④ ⑤ changes to the corresponding ranking table. The three buttons in field ① allows us to select the sort of ranking, i.e., from the left side, achievement score, the number of "admiration" obtained, and that of "encouragement" are placed. The field ② shows your rank in the ranking table selected in the operation of field ①. In fields ③ ④ ⑤ the ranking table is shown. The leftmost column shows the user nicknames and their rank, The second leftmost column shows the users' three goal categories and the 1-week achievement history. The next three columns show the achievement score, the number of "admiration," and that of "encouragement," respectively. The achievement score is simply calculated as the weighted sum of daily achievement levels of a user. Specifically in this system, double O is 4 points, O is 3 points, triangle is 2 points, and X is 1 point. The newest daily comments of each user are also seen in those fields. Note that fields ③ ④ and ⑤ are dyed with different colors: in the ranking you can easily recognize yourself by orange color ④, do the users in your watch list by blue color ③, and other users are not colored (white) like field ⑤. When we click the users seen, then we move to their top view where we can make encouragements for them, and can add him/her into our watch lists.

4.7 Profile Edit View

In this system users can input their personal profiles into the system and open them in public. The data items which are possible to input are: living area, sex, birthday, blood type, hobby, profession, and introduction texts. The profile is intended to be the information to connect users, i.e., an user is possibly interested in other users from the information. This information can be seen in their top view, and also we can search users using those items from the search form of the system.

4.8 Setting View

In the setting, users can modify the settings of remainder mails, which is sent everyday at the determined time not to forget inputting daily achievements. Users can select whether

they use this function, and can set the e-mail address and the time to receive the e-mail. In this e-mail, information of receiving encouragements are seen so that they can get to know someone has encouraged them.

5 EVALUATION

5.1 Methods

We evaluated the one-click peer-encouragement mechanism using the system implementation introduced in the previous section. We operate the system about one month with 29 people and obtain event logs and answers of questionnaire. As for the questionnaire, the selected questions and the answers are shown in Table 2. Here, we adopt 5-level rating for all the questions, where 5 is the most positive and 1 is the most negative evaluation. In this experiment, we mainly try to evaluate how effectively the peer-encouragements are circulating in advance of practical use in the scene of healthcare instructions.

Several conditions, however, should be properly prepared to obtain reliable results from the experiments. Especially, whether the daily goals are adequately determined or not affects significantly on the evaluation results, so we conduct that each participant consults a healthcare nurse to determine their adequate daily goals. Although many of participants are not even candidates of metabolic syndrome, they all have room to improve their lifestyle, so that they all set daily goals with their will to improve their lifestyle and promote their health.

5.2 Results

First we present the results on circulation of encouragements observed. Fig. 7 shows the number of encouragements observed, presented as accumulated numbers in time course. Here, the “enforced” encouragements mean the encouragements which are made when users first come to the peer-encouragement view without their will as described in Sec.4.5., while the “active” encouragements mean those which are made when users come to the peer-encouragement view or other users’ top view at their will.

From this graph, the number of the active encouragements are far larger than enforced encouragements (about 86% of all the encouragements were the active one). Note that we see the rapid change of the curve around 2010/1/5, which would be the effect of new-year days. Fig. 8 shows the specification of the active encouragements classified by sources from which users made encouragements from. Here, “user lists” means the three user lists (the watch list, list of the users who encouraged you, and the list of users you encouraged) described in Sec.4.2, i.e., they are the encouragements that users click other users in those user lists and encourage them in their top view. The “encouragement view” means the encouragements from peer-encouragement view described in Sec.4.5. The “ranking view” means the encouragements from ranking view described in Sec.4.6, i.e., users click other users in the ranking view and made encouragements at their top view. The “user’s top” means the encouragements made at users’

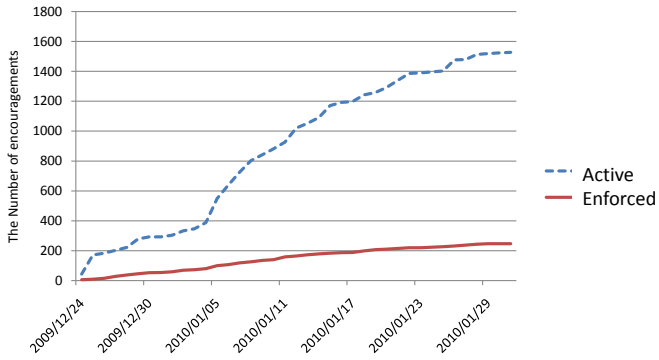

Figure 7: Number of Active/Enforced Encouragements

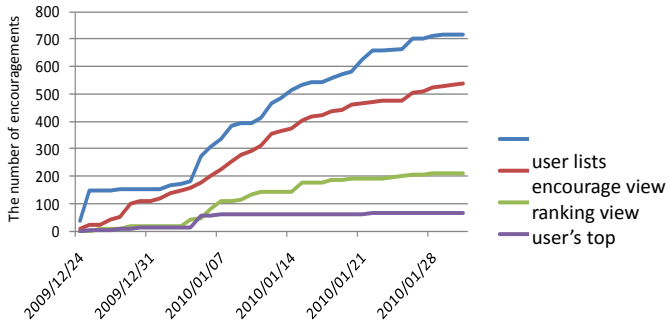

Figure 8: Source of Active Encouragements

top view to which users come using keyword search form of the system.

The graph shows that the encouragements from the user lists and encouragement view count large number. Consequently, users are not only interested in encouragement view where users are randomly seen, but also encourage others using some kind of “connections” among users described in Sec.3.4. Fig. 9 shows further specification of “user lists” of Fig. 8. From the graph, the watch list does not work as a source of encouragements after 10 days past, while encouragements from other two user lists continuously increase in the whole period. This result implies that users tend to make encouragements based on the past encouragements of themselves or other users, e.g., they tend to make encouragements as a reply for other users, or tend to re-check the users they have encouraged before.

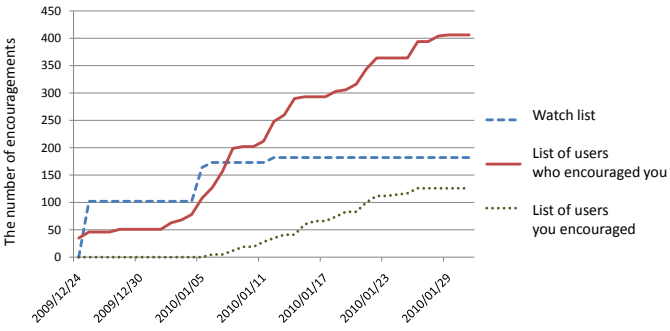

Figure 9: Source of Active Encouragements made from User Lists

Table 2: Questions and the Results (Selected from the questionnaire)

No.	Questions	Evaluation (# of answers)					
		average	5	4	3	2	1
A-1	How much did you motivated to continue your activities from the received encouragements?	3.5	1	14	3	0	3
B-5	Did you feel laborious to make encouragements?	3.5	5	6	3	5	1
F-1	Did you keep your motivation to continue your activities throughout the experiment?	4.0	3	16	1	0	1
F-2	Do you think that this system will work in the practical healthcare scenes?	3.8	3	13	3	2	0

Note that, from the result of the question B-5 seen in Table 2, users feel everyday's enforced encouragements somewhat laborious and time consuming. However, on the other side, they still continue to make encouragements at their will not only to the users from whom they received encouragements, but also to the other users from peer-encouragement view. This implies that the labor for enforced encouragements would be at allowable level and the motivation to continue which comes from receiving encouragements would be larger in total.

As seen above, in this experiment new encouragements are constantly generated by enforced encouragements mechanisms, and the encouragements actually chain via peer-encouragement view or via the mechanisms to keep "connections" such as user lists. As a result, encouragements are continuously supplied by users in the whole period of the experiment. Consequently, it is concluded that our mechanisms actually circulate encouragements among users.

Next we will see the effects of encouragements on users' motivation to continue their activity. From the result of question A-1 (see Table 2), high ratio of users answer that receiving encouragements from other users raise their motivation to continue their activities. Note that, as for 3 users who give the rating 1 for question A-1, we found that they also give low rating (1 or 2) for B-5, i.e., it infers that they are not motivated since they feel too much labor or stress in the operation of making encouragements. On the other side, from the event log, the number of daily records and that of received encouragements have very high correlation coefficient 0.85. Also the number of created encouragements and that of received ones have also high correlation coefficient 0.65. Consequently, users are typically motivated by receiving encouragements (except for few exceptions seen in the result of A-1), and in fact the number of users' daily records has deep relation with encouragements. Those results clearly show that the encouragements have motivated users to continue their activities.

Finally we see the total impression of users for our system. Question F-1 (in Table 2) shows that most of the users could keep their motivation throughout the period of the experiment. Also, F-2 shows that many users answer that they have good impressions and possible to have active impression in putting our system into practice. Although they are not professional in this area, but this result shows that at least many people feel well from the user's point of view.

6 CONCLUSIONS

In this paper we proposed a peer-encouragement mechanisms to improve users motivation to continue their healthcare activity while the amount of healthcare nurses' labor does not increase. We present our concept of peer-encouragement mechanisms in the healthcare scenes, and show the system design of a healthcare supporting systems to work in practice. Through one-month experiment, we confirmed that the proposed peer-encouragement mechanisms work effectively to create circulation of encouragements among users, and consequently the users are continually motivated to continue their healthcare activity without increasing healthcare nurse's work.

For the future, evaluation in the practical scene is necessary to try the mechanism to be put in practice. We would like to improve our system in consideration of the results obtained from this experiment, and try to conduct experiments in practical scenes.

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