

Experimenting with Case-Based Reasoning to Present Educative Health Information on the Internet: The Example of SeniorGezond

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Abstract

Background: Information about health prevention can contribute to the awareness and the knowledge of consumers and patients about their own health. Messages originating from other users (cases) can be perceived as more credible and hence more persuasive. With this in mind, we have developed an informative website called SeniorGezond, which includes a case-based tailoring component, in the domain area of fall incidences. **Objectives:** To investigate whether the use of cases is suitable for presenting and tailoring educative health information; and to gain insights in the user's opinion about the use of cases to provide tailored preventive information. **Methods:** We conducted a qualitative study using questionnaires, focus group discussions, interviews, and observations. Participants were elderly, family caregivers and healthcare professionals. **Results:** Users were able to find relevant cases for their problems, but had a mixed reaction on the usefulness and appreciation of the cases. **Conclusions:** There is a need for a delicate balance between a recognizable story with all the important health information and good readable and concise information. A good text structure is required to support this. While cases do have potential in health education, further research is needed in order to identify the necessary requirements which will make the cases successful.

Keywords:

Case-based reasoning; Internet; Public health informatics; Health education; Elderly; Accidental falls

1. Introduction

Falls are a major health problem among the elderly. Approximately 30% of the community-dwelling persons aged 65 and older fall at least once per year. The consequences of falling are dramatic both in personal health loss as well as in economic costs [1]. This stresses the importance of preventing the elderly from falling.

More and more the Internet is used for disseminating information about preventive health activities. The use of the technology to improve patient's knowledge and to involve them in their own health promotion can lead to better health outcomes [2].

Rimal and Adkins [3] have hypothesized that messages originating from other users would be perceived as more credible and hence more persuasive when similar to their own

situations. Case-based reasoning is an approach to problem solving and learning. It utilizes the specific knowledge of previous experienced, concrete problem situations [4]. Finding a similar case, which is reused in this new problem situation, solves the problem of a user.

There are many different health promotion websites using an information tailoring approach [5]. However, as far as we know, none of these websites uses cases to present health information. However, Kreuter et al. proposed the idea of using narrative stories to tailor information [6]. Case-based reasoning might be considered as a way of presenting tailored information.

We have been interested in exploring the use of cases within a health information system. For our purpose, this meant compiling a database with cases on falling problems. Because falling incidents are often 'caused' by multiple health problems together, cases reflect multiple health and environment problems in different combinations.

This article reports on a study with two objectives: (1) To investigate whether the use of cases is suitable for presenting and tailoring educative health information; (2) To gain insights in the user's opinion about the use of cases to provide tailored preventive information.

2. Methods

2.1. The instrument: The website SeniorGezond

The website SeniorGezond (SeniorHealth) contains information about falling and possible interventions. Target audience of the website are the elderly who are at risk from falling, family caregivers and healthcare professionals. We developed a prototype [7], which incorporates twenty cases, covering a limited part of the actual domain knowledge. We adapted an existing case-based reasoning system and prepared case titles on the basis of gender, age, main (health) problem, and solution. Our assumption was that the user could identify him/herself with one or more cases and learn from them.

Users could enter their query in natural language. We assumed that the use of natural language would provide good results, since no specific knowledge of query formulation is required [8]. After formulating their problem users received in order of relevance a list of cases matching their problem. A case contained a description of a similar problem that the user experiences, possible solutions, and options to search for further information such as facts about relevant topics and more information about actions a person can take.

2.2. Study design

We conducted a usability test, using questionnaires, focus group meetings, interviews, and observations. In total 28 people participated in the evaluation of the prototype. This included 18 elderly, aged 55 years or older (one however did not comply), 5 family caregivers and 5 healthcare professionals. The elderly were experienced with using the computer; a majority (n=13) was also familiar with the Internet. The elderly and two of five family caregivers tested the website in a laboratory situation, while three family caregivers and all the healthcare professionals (nurse, physician, and policy makers) used the website either at home or at work. The elderly and the family caregivers tested the website by carrying out four scenarios. Each scenario contained a problem regarding falling.

2.3. Data collection

Each participant filled in a questionnaire of 57 questions, about the interface, the content, and usability. The options were mainly multiple choice. Participants could also add comments and explanations if needed. The elderly and two family caregivers were observed while using the system. Observation was carried out using an "observation form" wherein points of attention could be recorded. Focus group sessions and interviews were used to gather additional information.

3. Results

3.1. Usefulness of cases

We were interested in finding out whether a suitable case could be found for a given scenario the participant had to work with. Eleven out of 16 seniors (69%) found a suitable case for their scenario. In the focus group discussions and the interviews the following question was discussed: "What do you think about the search facility to find relevant cases?". This question on the use of cases provoked a mixed reaction. Interestingly all healthcare professionals, some family caregivers and some seniors thought cases would be useful *for others but not for themselves*. Results are summarized in table 1.

Table 1 - The table summarizes the reactions of the participants on the use and relevance of the cases.

	Questionnaires	Focus groups / interviews	Observations
Seniors	11 out of 16 positive (2 not responded)	Do not need cases Patronizing, unnecessary, a total failure and not realistic Like the recognition	Some experienced difficulties searching for a suitable case
Family caregivers	4 out of 5 positive	Useful and reassuring Cases contain useful tips	-
Healthcare professionals	1 out of 5 positive (4 not responded)	Important facility Good for elderly	-

3.2. Structure of cases

Fourteen out of 16 seniors (88%) found the cases well structured (question A in table 2) and 12 out of 16 seniors (75%) found the information well readable (question B in table 2). In the focus group discussions and the interviews the following question was discussed: "What do you think about the website's lay out?". Participants were critical about the structure. They wanted to have smaller pages or more structure within one page using for instance bold accents. Important aspects were that the case titles did not reflect the whole content of the cases and that the cases were too specific. Stories contained too many details and were too long-winded. There is a great discrepancy between the user's overall opinion given in the questionnaire and the comments made during the focus groups and the interviews. It is likely that during the focus groups negative critics were given, with less attention being given to positive comments. Table 2 shows the results about the content structure.

Table 2 - The table summarizes the reactions of the participants on the content structure.

	Questionnaires		Focus groups / interviews	Observations
	Question A (structure)	Question B (readable)		
Seniors	14 out of 16 positive (2 not responded)	12 out of 16 positive (2 not responded)	Title does not reflect the case content Cases need to be more general Cases need to be less specific, so more users can recognize themselves Cases are too long-winded The text need to be more to the point (some did not agree) Text is too long, more telegram style is needed Comforting such descriptive stories	Critics on the amount of text
Family caregivers	3 out of 5 positive	4 out of 5 positive	Stories are too long More accentuation of keywords within the text	Due to the amount of text user sometimes does not see everything on one page
Healthcare professionals	3 out of 5 positive (2 not responded)	4 out of 5 positive (1 not responded)	No good match between the questions asked and the answer in the case	-

3.3. Finding the cases

Users were asked about their preferred ways of searching (multiple answers could be given). Three out of 18 seniors (17%) preferred searching by entering a sentence in natural language, while, whereas 13 out of 18 (72%) preferred to search by keyword (not in table). Indeed, some participants reported their difficulty in formulating their request in natural language and it often took them a long time to enter a query (as also observed in the sessions). As a result, some participants tended to use keywords instead of queries in natural language. Users also had trouble interpreting case titles and therefore had difficulties determining the most relevant case in the list. Table 3 shows more detailed information about user's search preferences.

Table 3 - The table summarizes the reactions of the participants on case search.

	Questionnaires	Focus groups / interviews	Observations
Seniors	3 out of 17 positive (1 not responded)	Difficult to formulate a question It might be good for people who fall Not clear you could choose from the case list Formulating query took a lot of time	It was very clear that some users found it difficult to enter questions in natural language. They were instead entering keywords During the sessions, participants commented on how much it would cost if they had to do this at home, because it took them such a long time
Family caregivers	1 out of 5 positive	Nice to formulate a question like this Difficult to formulate and think what words to enter Takes a lot of time Useful for others Often only a small part of the case applicable to oneself	-
Healthcare professionals	2 out of 5 positive	Good for family members and seniors themselves Nice to formulate a question	-

4. Discussion

In order to propose relevant cases to the user, the website first needs to be able to accurately identify the user's problems. In our context, the participants had problems entering whole queries in natural language, and spent a lot of time trying to do so. It is thus not surprising that they did not favour searching via natural language input and rather opted for a keyword search. However, we found no literature regarding users having problems using natural language on the Internet.

Cases often turned out to be too specific for the users. Too many details in the problem description made cases less recognizable for the user, and not all the information matched the user's profile. As a result, users had some trouble identifying themselves with the persons portrayed in the cases. It is indeed acknowledged that user's identification with information is important. For example, the fall prevention project at Queen Mary's School of Medicine and Dentistry [9] used images of rooms to illustrate risk for falling. However, the user's concentration weakened if a room looked significantly different from their own room. This study indicates that if users have trouble in identifying themselves with the cases this might influence the case's persuasiveness for behavioural change.

Some comments were made about too much text being presented in single pages. Less information within one page might be more suitable and helps the users identify better with the case. In addition, when there is less information within the case the information can be better reflected in the case title. However, it needs to be stressed that cases have a descriptive nature and larger text pages are often inevitable. Altering this, might counter balance the essence of case stories.

We found that collecting realistic cases for SeniorGezond was not easy. Often cases were too medical for a website about fall prevention targeted at lay people. In addition, it appeared difficult to cover the whole problem domain of fall incidents in cases.

5. Conclusions

The participants in our study (especially the elderly users) often did not prefer using natural language to formulate their problems and find relevant cases. The target audience must thus be carefully considered when designing search facilities within a website. There needs to be a delicate balance between a recognizable story with all the important health information and good readable and concise information. A good text structure is required to support this. Furthermore, the content must not be too specific in order to help the user identify with the case and to compose case titles that fit the content. While cases do have potential in health education, further research is needed in order to identify the necessary requirements which will make cases more successful.

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