The Proposal of the Remote Consultation Service System Using the Outline Function for Consultation

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Abstract. Remote welfare services for caregivers have recently been offered in response to the recent increase in demand for care that has accompanied the aging of society. However, due to the often extended periods of caregiving involved, care consultations can sometimes lack cohesion unless information about the early stages of care are available. In order to address this issue, the whole history of communication between care experts and family members should be structured and visualized when remote welfare services are provided. We propose a form of remote consultation where care experts can offer coherent and efficient consultations using all available information, such as up-to-date information from "lifelogs" and past processes of care consultations obtained from the use of all historically available information.

Keywords: remote consultation, care, computer-mediated communication, care assistance.

1 Introduction

With the aging of the Japan's population in recent years, the number of elderly people requiring care (hereinafter, care recipients) is increasing. With that, the number of care-related consultations from care recipients or family members providing care at home (hereafter caregiver) is fast increasing. The condition of the care recipient, being particular to each person, requires a detailed response after the individual circumstances have been ascertained. Although care workers or care professionals provide a portion of the care based on the care plan created by the care manager, the reality is that the main portion is left to the caregiver. As Japan's care system [6] itself has yet to reach a high level of sophistication, caregivers face the problem that in dealing with the care recipient's daily changing condition, they cannot obtain expert care advice when it is needed [1] from care workers or care professionals who are present at only specific times. Remote consultations with care experts by telephone, for example, therefore occur often. Such consultations, however, have the following issues.

1. Because caregivers are often novices in the field of care, they find it difficult to explain the condition they are faced with in a systematic manner. Therefore several

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issues often emerge mixed up with one another during consultation without having been arranged in an orderly manner. This then makes it difficult for the expert to distinguish between high- and low-priority issues.

2. Care often stretches over many years. Generally, consultations about care with experts therefore take place many times. It is inefficient for the expert to retrace and inquire after the care recipient's history during the consultation. From the caregiver's viewpoint the consultation will not proceed smoothly if the expert is not aware of the care recipient's progress and treatment. Also, there might arise situations in which the effectiveness of the advice is not understood because the caregiver does not understand the fundamental ideas and the numerical reasoning provided by experts from their professional points of view.

We have proposed and tested a system that enables effective consultation by enabling experts to deal with multiple caregivers simultaneously in remote consultations [4], but have yet to address the issues described above. Moreover, although there are handover mechanisms such as providing handwritten notes on site about the care recipient's condition as assessed by care workers or care professionals, because the time spent on site by care workers or care professionals is short they cannot form an accurate understanding of the care recipient's overall condition. Also, because the structures for collaboration are insufficient, there is no framework for the effective use of information. Meanwhile, development of sensor technology and systems technology has begun for monitoring care recipients' daily living conditions based on information such as biological and positional information, imaging information and environmental information [3, 5, 8, 13], but these technologies are not yet being sufficiently utilized.

To deal with the issues outlined above, in this report we propose a care consultation system that enables smooth and effective care consultation, where experts systemize and visualize the consultation process and share it with caregivers, and where experts in their consultations show the caregivers, together with past consultation processes which have been accumulated chronologically, the lifelogs [14, 2] containing the general living conditions of the care recipient.

This system's characteristic feature is to enable the expert to engage in deeper consultation with the caregiver through providing a function for systemizing and visualizing the consultation process, as well as a function for displaying consultation points that are mutually agreed upon between the expert and the caregiver, past consultation processes and daily living conditions (lifelogs). We evaluated the characteristics of remote consultation in care consultation using this system, and we found that the use of this system increased users' level of satisfaction with the consultation content.

2 Conventional Remote Consultation Technologies and Their Issues

Remote consultation is a format whereby a caregiver can consult with a care expert at a remote location. The scope of remote consultation has broadened in recent years to

include, for instance, technical support for PC users, consultation on financial products, and consultation on clinical issues [9, 11]. At the same time tools have been introduced for this consultation format that use video communication or that support asynchronous consultation via bulletin board system [7].

In conventional remote consultation, the expert often, upon clarifying the caregiver's issues, proceeds with the consultation following a standard procedure (e.g. formats where flowcharts or templates are filled out), which then results in an answer to the issue under consultation. This is done to raise experts' time efficiency [12] by standardizing the consultation process, as experts often spend unnecessarily long times on consultations due to the inexperience of the average user with the consultation process.

In the field of care [10], however, the following issues arise with the conventional remote consultation methods.

1. Because various individual factors in a care recipient's condition, including medical history and past interventions, are often intricately entwined, it is difficult to proceed with a consultation following a standard procedure. Caregivers also find it difficult to explain these factors separately. The factors therefore often come up in a mixed up manner during a consultation, without past conditions or overlapping issues having been arranged in order. It is for this reason also difficult for the expert to distinguish between the high- and low-priority issues.
2. Because of this characteristic, experts are forced to deal with the caregiver's multiple issues on a case-by-case basis. At that point, the caregiver often loses the ability to understand the relationships between the proposed measures. In other words, forming an overall image of the eventual measures to be taken is difficult. As a result, caregivers are often left without having gained a clear understanding sufficient to dispel any anxiety regarding the condition of concern or an unknown condition, and left wondering as to whether all issues really have been resolved.

3 Proposed Method

3.1 Concept

In this study, we constructed a consultation outline system, thus enabling the visualization of the overall consultation content and confirmation by the expert of past consultations, in order to deal with and increase caregivers' levels of satisfaction with the results of consultation using computer-mediated communication, while dealing with the issues outlined above. At the same time we propose a system that, by providing a means for the expert to further monitor the care recipient's condition since past consultations via a lifelog, enables the expert to conduct a deeper consultation upon forming a more detailed understanding of the changes in the care recipients' situation.

3.2 Consultation Outline

The purpose of the consultation outline is to systematically and chronologically visualize the communication process of current and past consultations, and, with the expert sharing information with the caregiver, to conduct a deeper consultation regarding the care recipient's condition. In the consultation outline, the entire consultation is systemized. We propose the following features and techniques in order to achieve the goal outlined above (Fig. 1).

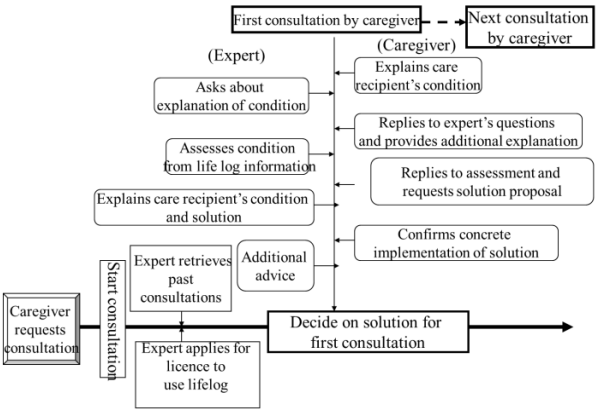

Fig. 1. Visualization structure of consultation process

1. *Visualization of the consultation process.* The conversation between the caregiver and the expert regarding a specific issue raised by the caregiver is displayed as a tree diagram. At that time, the expert creates a tree diagram with the issue raised by the caregiver as the top-level event. The tree diagram displays the caregiver's questions and remarks as well as the expert's opinions about them, following the conversational flow. As the conversational flow can be expressed chronologically in this tree diagram, discrepancies between the perceptions of the caregiver and the expert disappear. In this conversation, the expert expresses his views based on the lifelog [8], and conveys the care recipient's condition based on quantitative criteria to the caregiver. When a solution has been decided, the expert adds a relevant keyword to the top-level event thus making it searchable at a later date.
2. *Systemization of the consultation process.* Because caregivers are unfamiliar with the consultation process, their questions and opinions sometimes shift to other issues. On occasion there is such a plethora of issues to consult on that it is difficult to discuss them. In that case the expert itemizes them and proceeds with the consultation on the particular issues. In other words, when the caregiver's conversation moves from the current topic to a different topic, the expert creates a new top-level event for this different issue, generates a different tree diagram to the one for the conversation up to that point, and engages in a consultation for which the overall structure has been made clear.
3. *Searching similar consultations in the past.* Using the keywords attached to the top-level events in past cause and effect diagrams, the expert can search past consultation histories (top-level events and the associated tree diagrams) for consultations similar to the one currently engaged in. Any applicable items are displayed

and the conversation is facilitated by the caregiver and the expert sharing information relating to solutions for the current issue, using the consultation histories as a reference.

4. *Displaying consultation results.* When the expert's solutions consented to by the caregiver have been decided as a result of the consultation between caregiver and expert on an issue raised by the caregiver, a description of these solutions is given at the end of the corresponding tree diagram, ending the consultation on that issue. This enables the caregiver to clearly confirm the solutions for individual issues. In this way, the issues raised by the caregiver and the expert's eventual solutions for each of them are settled in the order that they have been discussed, and the overall care consultation is displayed as a cause and effect diagram. This article takes as its premise that the caregivers are ordinary family members, who are familiar with using a PC.

3.3 Building a Consultation System Using Consultation Outlines

The system's basic configuration using consultation outlines is shown in Fig. 2. While listening to the caregiver's issues, the expert ascertains the care recipient's daily condition through the lifelog information accumulated through, for example, sensors, and at the same time pulls up outlines for similar past consultations using related keywords and thus forms a deeper understanding of the care recipient's condition. On the basis of this understanding, the expert responds to the caregiver, adds the individual conversations to the "current condition outline" and, by sharing this outline with the caregiver, continues the consultation with both parties in agreement.

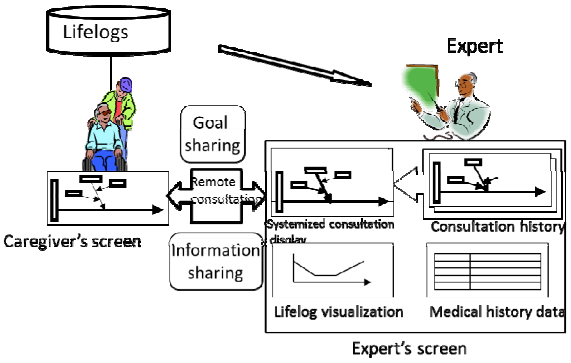

Fig. 2. Overall system configuration for remote care consultation

3.4 Advantages of Consultation Outlines

Advantages for the Expert. The expert can obtain, before the start of the consultation, information on the care recipient's condition through the caregiver's past outlines and through the lifelogs, and can embark on the consultation after having formed a sufficient understanding of aspects such as the caregiver's ideas, preferences and

characteristics. By displaying the aim of the current consultation and the conversation content on a screen shared with the caregiver during the consultation, information sharing with the caregiver can be planned. The entered consultation content is saved as the current consultation outline, and can be used as reference information for consultation at a later date. In other words, the expert can extract relevant past consultation outlines as needed and can ensure smooth communication by presenting them to the caregiver. When caregiver's remarks are inconsistent with past remarks, past consultation records can be shown and changes in the care environment or the caregiver's true intention can be checked. Moreover, by having a shared aim with the caregiver, if a conversation veers off topic, this can be made clear and, with the caregiver's assent, the consultation can proceed under the expert's guidance.

Advantages for the Caregiver. For the caregiver, consultations with an expert that extend over a number of days become simpler, and also when unfamiliar with the consultation process consultations that extend over long periods of time become possible. As consultation outlines moreover clarify the expert's advice and views, a more profound understanding can be gained of the consultation content, providing the caregiver with a sense of security and trust in the consultation. At the same time, the mutual trust between caregiver and expert grows through the sharing in the consultation, enabling a more profound consultation. The caregiver can also achieve a sense of security because it is possible to check the consultation histories, which are saved, once the consultation has finished. By starting the next consultation after having checked the previous consultation outline in advance, the caregiver can facilitate a smooth conversation.

4 Consultation Procedure

4.1 Consultation Overview

For this study, we engaged in remote consultation about care using computer-mediated communication (in this case Skype). We performed the consultation while monitoring, using consultation outlines, consultations performed in the past, the flow of the current consultation and the care environment.

4.2 Consultation Procedure

The consultation was performed through the following procedure.

1. Start the consultation.
2. Display one consultation issue.
3. Share content regarding one consultation issue (questions by the expert and answers by the caregiver).

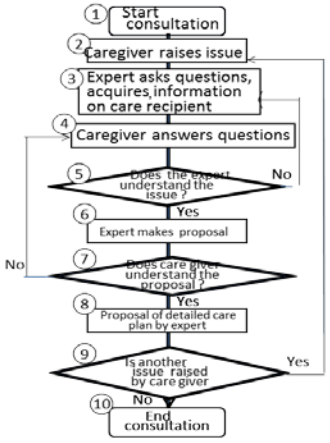

Fig. 3. Procedure for outline building

4. Has the expert understood the issue? If not, return to step 3.
5. Expert obtains care recipient's lifelogs and past related outlines.
6. Expert indicates direction for a solution.
7. Caregiver can ask about the expert's proposed solution.
8. Expert provides concrete explanation of the proposal.
9. Does the caregiver agree with the proposed solution? If not, caregiver provides reasons; return to step 6.
10. Expert gives detailed presentation and explanation of the care plan.
11. If the consultation has finished, go to step 12; if there is another consultation issue, go to step 2.
12. Input the date and the names of the expert and caregiver. Expert attaches keywords to the individual top-level events.
13. End consultation.

Through these steps an outline is created and shared between the expert and the caregiver.

4.3 Important Aspects of the Consultation Procedure

Clarifying the Aim of the Consultation. The caregiver conveys the current issue to the expert. If the consultation is about many issues at the same time, the expert divides them into individual issues, and engages in a consultation on each separate issue. If the caregiver has sought consultation about similar kinds of issues in the past, the expert will communicate while referring to related parts in past consultation outlines. At that time, the expert enters the current consultation content in the allocated box. The caregiver proceeds with the consultation while checking the consultation exchanges displayed on a PC screen.

Information Acquisition on the Care Recipient. Depending on the circumstances, before the consultation the expert acquires the information necessary to the current consultation from the caregiver database, for example, the caregiver's knowledge level and the care recipient's state of health. The information included in the database includes past consultation outlines, lifelogs, and information on personal relationships.

Generating Outlines. The expert systemizes, visualizes and puts in chronological order the consultation purpose, consultation content and the information acquired by the expert. The expert shows the generated consultation outline to the caregiver. The caregiver checks the consultation outline and proceeds with the consultation while deciding whether the consultation content matches the consultation purpose.

5 Experiment

Objective. We took consultation on the creation of a care plan as the subject of the experiment. Through trials with and without the consultation outline, we examined

the expert's level of understanding toward the caregiver, the caregiver's level of understanding and satisfaction with regard to the consultation content, and changes in the burden on the expert.

Conditions
Condition 1: For examining the efficacy of the consultation outline, the consultation was performed more than twice. For the consultations following the second one, the previously performed consultation content is confirmed in advance.
Condition 2: Experts and participants are experienced PC users.
Condition 3: Caregivers engage in the consultation in a role play form which follows a scenario.

Participants. The experiment was carried out with one expert and six caregivers. The expert in the experiment was a student with knowledge of care. The caregivers were novices in care, but were students in their 20s who studied care beforehand.

Experimental Environment. We used a PC running Skype, a conversation-sharing system, and PowerPoint.

Experimental Procedure. We carried out the experiment according to the following procedure.

1. The first consultation was performed without using a consultation outline.
2. After the first consultation finished, a consultation outline and a care plan were drawn up and handed to the caregiver.
3. After a period of time, a second consultation was conducted, in one scenario with a consultation outline and in the other with only notes.

Experimental Results. We evaluated results after the experiment had finished through a questionnaire administered to caregivers. The questionnaire asked about the following eight points: level of satisfaction with the overall consultation, level of understanding of the consultation process and content, reliability of the consultation, smoothness of the consultation, level of concentration during the consultation, atmosphere of the consultation process, operability of the consultation processing and readability of the consultation screen. The questionnaire results are shown in Table 1. Ratings were given on a scale of 1 to 5, with 5 representing the highest rating.

The experiment results show that by adding past consultation outlines to the current one and by incorporating lifelogs, good ratings were given for the level of satisfaction with the consultation, and the levels of the understanding, smoothness and reliability of the consultation.

An analysis of variance between conditions showed a clear difference in the level of satisfaction (significance level 10%, F value 3.4). The caregiver's level of understanding of the consultation process was also significantly improved (significance level 10%, F value 2.9). The reliability of the consultation was also improved (significance level 10%, F value 3.5). Through the visual consultation process display, the smoothness of the consultation was also better (significance level 10%, F value 2.8).

5.1 Discussion

In concrete terms, we saw the following benefits and were able to solve the following problems on the caregiver's side.

1. Levels of satisfaction can be taken to have increased based on the following: caregivers and experts were able to have a discussion while confirming, during the consultation, the purpose and the content of the consultation, and caregivers were able to conclude the consultation after having formed a sufficient understanding, which was also based on the consultation history. In concrete terms, we improved the quality of remote consultation from the former level of "dissatisfied" to a level of "mostly satisfied".
2. It becomes possible for caregivers to check, by using the consultation outlines, the sequence through which the care plan has been reached, and thus their level of understanding increases.

Table 1. Questionnaire result (1-5 evaluates five steps altogether)

Item	Without outline	With outline
Degree of conversation partners' satisfaction	2.8	4.1
Degree of conversation partners' understanding	2.8	4.5
Reliability	3.0	4.2
Degree of conversation smoothness	3.0	4.0
Easiness of operation	3.3	3.3
Conspicuousness	2.6	4.0
Relaxed grade of conversation	3.2	3.3
Degree of conversation partners' concentration	3.2	3.8

6 Conclusion

In this paper we introduced consultation outline when engaging in care consultation using computer-mediated communication. We proposed a support system that uses consultation outlines to ensure consistently high level of satisfaction with respect to consultations which extend over long periods of time. We also verified the system's usefulness in an experiment. We can conclude from the experimental results that through remote consultation using consultation outlines caregivers and experts are well supported. Specifically, we can conclude from the experimental results that because the high-priority issues of the care under discussion came to the fore through remote consultation using consultation outlines, both caregivers and expert are provided satisfactory support. We have used a cause and effect diagram as the format for the consultation outline here, but plan to investigate display methods that match the respective characteristics of experts and caregivers. Further research is needed to investigate additional functions for use of the system in actual care environments.

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