

Emerging Triage Support Environment for Dementia Care with Camera System

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Abstract. This study proposes a new concept called a Triage Support Environment based on the authors' research at three care homes. We believe that this study will help develop information and communication technology (ICT) systems for caring for people with dementia (PWD). We installed a video monitoring system for caregivers in three homes and observed the positive and negative effects of applying the system to caregiving. In terms of positive effects, the video monitoring system enabled caregivers to optimize their work and helped them concentrate on their tasks at hand, reducing both mental and physical stresses. On the other hand, some caregivers expressed concerns over being watched by other caregivers through the monitor, especially when their activities were recorded. We discuss these issues and explain how the concept of a Triage Support Environment may lead to a solution for these problems.

Keywords: triage, group home, persons with dementia, camera system.

1 Introduction

A growing number of people are now entering the *elderly* age category in Japan; this category is defined as those over sixty-five years old. Consequently, the demand for qualified caregivers is increasing, but most care homes for the elderly are short-staffed and caregivers' workloads are increasing. This has resulted in numerous caregivers burning out from overwork. Japan is not the only country facing this challenge; many developed countries like Germany, Italy, and the Republic of Korea face the same problem. According to a report from the United Nations [1], many countries are expected to become super-aged societies around the year 2050, when more than twenty percent of the population will be over sixty-five years or older.

The growing number of elderly persons also raises the issue of dementia, because the probability of becoming cognitively impaired increases with age. Care for elderly people with dementia requires particular attention because they are vulnerable to environmental irregularities and become uncomfortable when they do not recognize their surroundings. Thus, caregivers must take many things into consideration to assure peaceful lives for those with dementia.

To keep things under control, caregivers need to know be aware of what is going on in a care home, including which residents are where, with whom, and for what. However, this creates a dilemma. The privacy of the residents is violated to some extent if a care house is designed to allow caregivers to observe every corner. The

residents' wellbeing, however, is put at risk if the house is designed like a normal house, because most corners are unobservable from a distance. There must be a tradeoff between privacy and safety. If we value privacy over safety, we can make the house cozy, but caregivers will have to run from corner to corner to prevent possible accidents. Accordingly, most care houses have one large common room in the center with bedrooms adjoining it, allowing caregivers to observe all residents from the common room.

We take another approach to adjusting the balance between privacy and safety. We place the highest value on residents' privacy and believe that a normal house is the best place for those with dementia to live their lives peacefully. However, converting a normal house into a care home inevitably increases the risk of some residents being harmed by accidents while they are unattended by caregivers. We resort to technological solutions to solve the problem of blind spots. That is, we install a video monitoring system into care homes.

It is not particularly innovative to introduce a camera and a monitor into a care home for persons with dementia. Several existing monitoring systems have been developed by researchers such as [2-9]. In this study, we emphasize the system's usage by and effects on caregivers to clarify how well such monitoring systems are utilized and to consider how to design a better system. Thus far, little attention has been paid to how ICT augments caregivers' ability to administer care; most efforts have focused solely on developing useful systems. In this study, we focus on caregivers instead of particular technologies or systems.

We believe that monitoring systems not only help caregivers care for people with dementia but also reduce the physical and mental stresses that come from caregiving. If we respect the concept of personhood [10-11] as advocated by the pioneer, we must consider both patient and caregiver equally; that is, it is not particularly fair to ask caregivers to sacrifice their lives for caregiving. The basic human rights of person with dementia must be observed.

We installed camera systems into three care homes for our field study and analyzed the systems' effects on caregivers by employing a qualitative method with the hope that our research would lead to useful systems for them [12-13]. We conducted a series of interviews with sixteen caregivers and three managers, in addition to a video observation of their caregiving. In the remainder of the document, we refer to care homes as *group homes* according to the custom in Japan.

2 Related Work

The ENABLE project, conducted across several countries in Europe, namely, the U.K., Norway, and Finland, investigated issues involved in monitoring and supporting people with dementia [7, 14-15]. They developed several useful devices for people with dementia, such as gas cooker monitors and automatic nightlights, and were instrumental in establishing guidelines for the use of assistive technologies based on the results of their field studies [14]. They also considered ethical issues related to the use of technology on people with dementia [15]. The project is regarded as a pioneering study in this area of research with respect to both the scale and depth of the investigations.

Several monitoring systems have been developed with the intent of ensuring the safety of people with dementia. Such systems focus on preventing residents from wandering without any specific purpose. For example, Masuda et al. developed a system to detect wandering in bedrooms using a step sensor [3]. A four-week clinical trial at a hospital showed that their system detected thirty cases of wandering. Miskelly developed two (independent) systems for tracking people with dementia, one of which consists of bracelet-type tags and a monitoring station [4], and the other uses a GPS-enabled mobile phone [5]. Other researchers have adopted GPS technology as well [8-9].

Lin et al. integrated several technologies into a tracking system (radio frequency identification, a global positioning system, a global system for mobile communications, and a geographic information system) that did not interfere with the activities of people with dementia [2].

More generally, research on smart homes can be seen as an area that is closely related to ours. A smart home with a sensor network installed in it enables caregivers to monitor the whereabouts of residents. When a smart home is inhabited by people with dementia, the home can help caregivers sense the risks involved in residents' unusual behaviors, wandering, agitation, and so on [6, 16-17].

3 Research Design

3.1 Overview of the Camera System and System Installation

The installed monitoring systems were slightly different in the three group homes (Table 1). Hereafter, the three homes will be referred to as GH-A, -B, and -C. The system installed in GH-A allowed for video recording and its devices were wired. The systems installed in GH-B and GH-C used wireless devices and did not allow video recording. In this section, we focus on the system installed in GH-C.

We designed the system as simply as we could because the caregivers in GH-C were not familiar with computers. The system consisted of four wireless cameras, a portable monitor, and a laptop PC functioning as server. Visual data from the cameras were gathered on the server and were displayed on a Web browser. A down-scan converter was employed to turn the information displayed on the Web browser into TV signals, which were emitted to a portable monitor. Possible malfunctions due to mishandling by the caregivers or residents were reduced to the minimum because it was impossible for them to operate the system through the monitor. The cameras and the monitor were placed as shown in Figure 1.

Before the installation, a preliminary investigation was carried out to identify blind spots in the group home and to identify the system's requirements. The manager and the caregivers were concerned with invasion of privacy and were especially keen to avoid any unwanted effects that might be caused by video recording, so we paid the most attention to preserving residents' privacy. Thus, we decided to set the cameras in common spaces only, such as the entrance hall, entrance hall corridor, and living room (the positions noted as Z1 to Z5 in Figure 1). Furthermore, we decided not to include any video recording functionality in the system. In our discussion with the manager of GH-C, we discovered that spots Z1 to Z5 were often difficult to observe.

Table 1. Overview of the group homes and the study

	GH-A	GH-B	GH-C
Figuration	renovated		purpose-designed and newly established
Number of residents	9	6	9
Total of caregivers	9	5	8
Number of informants	6	5	5
Caregivers in daytime	2 or 3	2	2 or 3
Caregivers in nighttime	1	1	1
Residential areas	first and second floor	first floor	first floor
Start of operation	December 2006	January 2005	March 2008
Time of interview	before after	— June 2007	— November and December 2007 May 2008
Time of video observation	before after	— —	March 2008 December 2008

3.2 Interview

A series of semi-structured interviews were carried out after systems had been installed in GH-A and GH-B. As for GH-C, we carried out the interviews before and after the installation. We interviewed the caregivers, asking them what they thought of the system and which aspects they regarded as the most valuable in terms of dementia care. Specifically, we asked the caregivers the following questions:

- Q1. What is the burden of dementia care? (before)
- Q2. What is/are the most important factor(s) for dementia care? (before)
- Q3. How do you use the video monitoring system? (after)
- Q4. What do you think of the system? (after)
- Q5. How has the system affected your work stress? (after)

Table 2. Profiles of interviewees

Interviewees	Level of expertise	Qualification of nursing
a1	moderate	eligible
a2	moderate	
a3	high	
a4	low	
a5	moderate	
a6	low	
b1	moderate	
b2	low	
b3	moderate	
b4	low	
b5	low	
c1	high	eligible
c2	moderate	
c3	high	
c4	moderate	
c5	moderate	

Table 1 gives an overview of our field study. The group homes accommodated either six or nine residents at full capacity, and the number of caregivers present at the homes was as required by law. The profiles of the interviewees are illustrated in Table 2. We graded the caregivers of the three groups according to their work experience: the *low* group had less than three years experience; the *moderate* group had three to seven years experience; and the *high* group had more than seven years experience.

All the interviews were recorded with an IC recorder and were fully transcribed for ease of reference. The constant comparative method was used to analyze the transcriptions. The transcriptions were repeatedly read as many times as possible to identify any commonalities and differences among the data.

3.3 Video Observation and Analysis

We recorded and observed the behavior of caregivers and residents. The caregivers and the managers allowed us to record their activities with two extra video cameras that were not part of the video monitoring system. We carried out the data collection for two days before installation and another two days after installation. We analyzed their behaviors in the corridor (V1 in Figure 1) and in the living room (V2) to focus our investigation on the events that were closely related to daily activities such as assistance in the washroom.

Every ninety minutes from four o'clock in the afternoon to half past five in the early morning (16:00 to 5:30), we counted how often each resident performed an action and how the caregiver responded to it. We studied the behaviors observed in the evening and at night because we assumed that the effects of the system could be best evaluated during that period. The number of caregivers was limited to one at night, and the camera system was expected to be most effective then. Previous studies also suggest that caregivers receive the most benefit from monitoring systems at night [12-13].

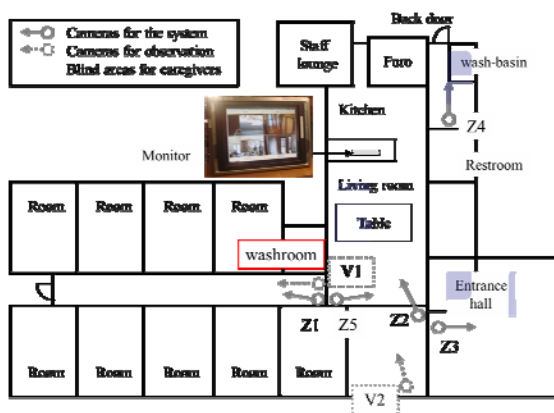


Fig. 1. Camera arrangement at the group home and its outlooks

3.4 Ethical Considerations

In this study, we strictly observed informed consent guidelines in asking individual caregivers and managers of the group homes for data collection. Likewise, a letter of consent was obtained from the residents' families.

Video cameras were never set in private residential areas such as inside a resident's room, the washroom, *furo* (Japanese-styled bathroom), etc., to maintain privacy.

The ethics committee of the Japan Advanced Institute of Science and Technology approved the data collection method used in our study.

4 Results

4.1 Results of Interview: Alleviating Caregivers' Stress

The series of interviews revealed that the system reduced caregivers' physical and mental stress, as previously reported (the details were reported in [12-13]). Caregivers reported that some areas became blind spots at night because fewer caregivers are available to work overnight. The video monitoring system was most effective during nighttime, in particular, the time from midnight to early morning. Caregivers who worked during the night were very anxious about blind spots. They were afraid that some residents might be seriously injured, for example, suffer from bone fracture, if they fell down. Such accidents are always a possibility, but they must be avoided because being injured and confined to a bed may further cognitively impair the person. Caregivers were so worried of accidents that they would get anxious in the evenings.

After the video monitoring system was installed, they felt that the system alleviated their stress and improved their work styles significantly because it enabled them to focus on the tasks at hand, such as writing residents' daily records, washing dishes, or cooking, without experiencing excessive strain.

As previously reported [12-13], video cameras raise concerns about the violation of privacy, which becomes a source of stress for caregivers. However, our research and a separate investigation on technology acceptance [18] indicate that caregivers can accept ICT after they acknowledge the benefits of the devices; however, ICT usually gave rise to feelings of rejection during the initial phase of operation.

4.2 Results of Interview: Release from Restrictions

During both the daytime and nighttime shifts, caregivers reported that the camera system helped them make decisions. For instance, when a resident appears from his/her room and walks toward the washroom (depicted in the center of Figure 1) at night, caregivers in the kitchen may not be aware of the event. If they notice that a resident is heading toward the washroom, they leave their work and take any necessary action.

Even if two or three caregivers are working during the daytime, blind spots are an unavoidable issue in group homes. In addition to the limitations that caregivers have regarding resources for observing residents, caregivers also have an obligation to ensure residents' safety. To maintain PWD's physical safety, caregivers often

disturbed residents' activities before system operation. A veteran caregiver (a3) noted that she always asked residents about where he/she wanted to go when they stood up and/or showed signs of heading in some direction. She felt apologetic for this behavior and felt that it became a source of stress. Another caregiver (a6) related how she used the system to take preemptive actions. When she noticed a resident going out to take a walk, she rushed to the back door and walked toward the resident to greet them from the front. In the case of GH-C, two caregivers (c4 and c5) and a manager said that it was easy for them to observe residents entering or exiting the washroom during both the day and night.

Before the introduction of the monitoring system, residents' activities were limited in order to secure their physical safety. On the other hand, both PWDs and caregivers were under fewer restrictions while the system was in place. A veteran caregiver (c3) reported that the elderly residents' peace of mind improved in response to the increased level of caregiver attention.

4.3 Results of Video Observation: Changing Work Style

Figure 2 shows the behaviors of two caregivers. This figure indicates that the caregivers' responses to the residents' behaviors were optimized. Despite the fact that the total number of responsive actions is slightly different, the proportion of actions changed: caregivers could adequately judge whether they needed to take action and assist residents. In fact, the system helped the caregivers adjust their efforts to the residents' demands and allowed caregivers to wait until residents truly needed help.

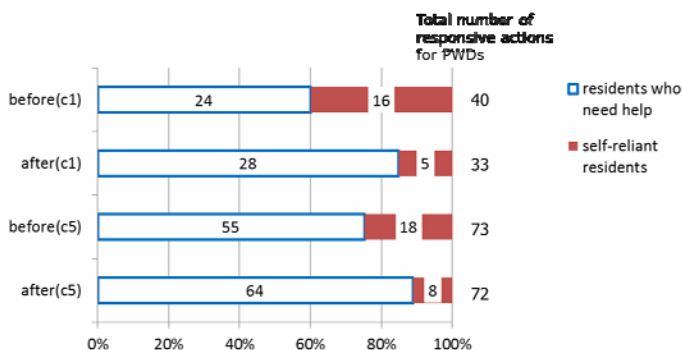


Fig. 2. Change in responsive action for PWDs

5 Discussion

Figure 3 is a summary of the results, and it illustrates the proposed concept of a *triage support environment*. The group homes we investigated were strained due to a lack of resources and fatigue. Caregivers always had to observe residents to maintain their safety. Whenever they detected certain behaviors, especially when residents attempted to go outside, caregivers had to ask the resident to confirm where he/she wants to go

and what they want to do; in order to do so, the caregiver had to suspend their task at hand, such as cooking, cleaning, or toiletry assistance. They did not have enough time to evaluate a resident's actions. If caregivers were late in noticing a resident's action, they stopped their task immediately and headed to the scene. It is quite difficult to take the right decision under stressful conditions. Furthermore, the lack of redundant force to response residents' accidental actions was ascribed as a cause of stress.

However, caregivers were more at peace and were able to effectively respond to residents' needs while the system was in use. These benefits were the result of increased time for waiting, judging, and preparing that came from the system. The time that caregivers need to determine who needs help and to prioritize their actions is an important factor in their job performance.

Triage refers to the prioritization of the allocation of resources for medical treatment according to the severity of a patient's condition. The term is used in computer science to categorize vast information [19], documents [20], and e-mail [21].

When using the camera system, caregivers could observe residents and take action according to the urgency of their need. In other words, the camera system helped create a triage support environment. It should be noted, however, that the most important aspect of the triage support environment in this study is the time it allows caregivers to *wait* until action is necessary, which enhances the independence of PWDs, as opposed to the original meaning of triage, which is to treat aggressively based on severity.

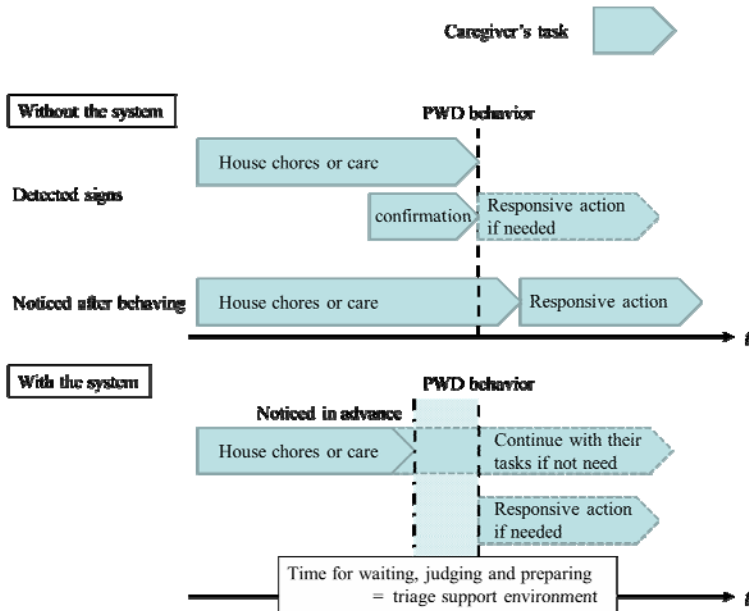


Fig. 3. Emerging triage support environment

6 Conclusion

We analyzed how the camera system affected caregivers in terms of how the system could contribute to the field of caregiving. The results of interviews showed that the stress caregivers felt was decreased. The reason for this stress reduction is most likely the increased control they had over observing the residents' behaviors with the camera system. Ironically, the camera system liberated both PWDs and caregivers from oppressive surveillance. The video observation allowed caregivers to efficiently respond to PWD activity. Finally, we established the concept of a "trriage support environment," which can augment dementia care.

Because we only carried out our experiments, further data collection is required to verify our findings. We also need to improve the camera system by investigating the caregivers' needs with additional field studies.

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