

Understanding Elderly Care: A Field-Study for Designing Future Homes

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ABSTRACT

While the population is aging the role of information and communication technology (ICT) has grown in elderly care. This development has brought versatile ICT-related supportive systems to professionals and laymen working with aging people. The current study analyzed how professionals in elderly care perceived their workflow challenges before new ICT is developed and implemented to support their work. The results of this study are set to inform the design of a novel ICT system for a sheltered care home.

CCS CONCEPTS

• **Computer systems organization** → **Embedded systems**; *Redundancy*; Robotics • **Networks** → Network reliability

KEYWORDS

Elderly care, nursing, workflows, bottlenecks, automated monitoring

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1 INTRODUCTION

The purpose of this study was to analyse how caretakers working in elderly care perceive their work processes and challenges at work. The study was carried out in a elderly care center located in Finland. The motivation for the study was based on the fact that society is ageing at a fast pace with the population aged 60 and over, representing the fastest-growing group, with the majority needing supervision and assistance to perform daily activities [1]. Part of elderly social services' agenda is to move nursing home and healthcare center ward's patients to sheltered accommodations where Assistive Technology (AT) is being deployed to provide support and around the clock care [1]. By improving elderly well-being, health, functional capacity and independent living, one can significantly prevent sickness and allow for a healthier lifetime [2,3,4.] Elders' transition to a sheltered accommodation takes place when living independently at home is no longer possible. Matters like health deterioration, various morbidities, memory loss, cognitive decline, the loss of family members, daily routines degradation - such as routine food intake - overall hygiene and cleanliness, remembering to follow medication schedules, as well as a limited budget, make living independently a potential life threatening experience [5,6,7,8,9.] For the elderly, dementia is a common affliction, requiring around the clock care and constant attention. In certain countries, sheltered accommodations provides a care environment for more than 40,000 elderly afflicted with dementia [2,3]. For a residential fee, elders are provided with a private room or apartment, and often share the restrooms. In addition, a team of nurses is available and supervise around the clock, with catering and cleaning services included [4]. Unfortunately, not everyone is able to afford a sheltered accommodation. Unable to do so, elderly may feel as a source of frustration and a burden for the relatives [2,3]. In this study, we aimed to better understanding of elderly care workflows and identify bottlenecks in order to create an Internet of Things (IoT)

infrastructure (called CARE) following a User-Centered and Service Design approach. We focused on the nurses and caregivers' daily challenges, routines and concerns while at work and created models that inform us how to design CARE with a caregiver's mindset. The research question was answered with the help of interviews and observations, and both personnel and the elderly living in the premises were met several times during the study. The study was part of the CARE, heading to its ultimate goal to offer sheltered accommodation offerings to anyone by means of information and communication technology (ICT), IoT and context-awareness. By doing so, we can encourage elderly to live independently longer, ease relatives' concerns and ultimately increase elders' Quality of Life. In turn, CARE would alleviate the pressure in social services budget. The paper continues with introducing previous work related to the current research topic. After that, the field study is described in detail. The paper ends with discussing the findings in relation to existing knowledge and presenting conclusions based on the study

2 RELATED WORK

2.1 Sheltered accommodations

Sheltered accommodation is an intermediate between the residential and institutional care, which aims to ensure that long-term care is not arranged in conventional hospital environments, but in a nursing home or assisted living unit [10,11]. When transitioning to a sheltered accommodation, patient care relationships should be maintained, otherwise the quality and safety of the care service may suffer [6,11]. Sheltered accommodations aims to accommodate a home-like life: elders may bring their own home furniture and memories (e.g., objects, pictures) [12,13] and spend time in privacy [9] yet with a sense of security that there is someone always there [9,14,15,16,17,18]. Designing ICT for elderly care is challenging and requires a multidisciplinary perspective. Developing context-aware health care systems is in extreme demand [19,20]. As the 'Baby Boomer' generation is aging, the innovation focus is on effective solutions: easy to deploy, scale and maintain. Primarily, such technology would enable people to remain in their familiar home, by non-intrusive monitoring; and if in healthcare facilities, efficiency, flexibility and security are key requirements [21].

Sensors are already commonplace to monitor a patient's condition, especially in hospitals, health-care centers, ambulances and at home care. Sensors can monitor the physiological and physical health by means of electronic, thermal, optical, chemical and genetic signals, including vital measurements such as from the cardiogram, pulse, body temperature, blood pressure, oxygen saturation, and daily activity [22]. With historical sensor data, differences in one's functional ability over time can be identified [23]. Novel applications and use of sensors are necessary for assessing a patient's health and wellbeing, to reach a diagnosis, and to decide whether further treatment or care plan is necessary [24]. A review on intelligent assistive technology application reveals that majority of the research foci has been on physical disabilities among the younger population, with a minor focus on supporting

the aging population [25]. Tackle the challenge of a reduced nursing workforce, researchers have been evaluating the use of robots with an utilitarian and companionship function. In two independent reviews on the applicability of assistive robots in elderly care [26,27], authors found the effects of improving mood are short lived as the novelty effect vanishes. Research is scarce in evaluating the impact of utilising robots for as nursing agents on a longitudinal evaluation, so it remains unclear whether robots are a viable solution. Consequently, we argue that we must focus on helping the existing workforce and better understand how we can use technology to help the nursing/caregiving staff in daily activities, instead of replacing them. However, simply applying technological solutions to healthcare is insufficient. There are four factors significantly related to abandonment of ICT in healthcare [28]: users' non-involvement in the selection of the technology; ease of use; device performance; and evolving user needs or priorities. In other words, technology-driven interventions must involve the end-users and their long-term needs. Researchers [47] have noted in the study that video technology, text-based communication, and remote control have been used to track elderly care. Earlier studies have studied the benefits of video technology when used with older people using network technology. Network technology can be used to communicate with the elderly and their relatives. Nursing personnel benefit from network technology and they experience that it eases work and communication between professionals and clients. With mobile technology, healthcare professionals can communicate better with each other. Patient safety, customer orientation, efficiency, timeliness and balance are important in healthcare. Mobile-based applications, which are directly linked to health care information systems, are added to support the achievement of goals of nursing care. [49]. Mobile healthcare applications are in direct contact with information systems. Real-time data transfer improves the patient's quality of care, reduces bottlenecks in nursing and reduces errors when recording is done directly into the information system without intermediate steps [49]. The care management plan will help to maintain elderly care implementation, monitoring, evaluation and development of nursing. The problem areas and risk factors of working in elderly care are shown in Figure 1 [30]. It is likely that workflow systems will become a core component in future sheltered accommodation [31]. The sheltered accommodation workflows are defined by medical protocol. It consists of a patient care plan with several tasks.

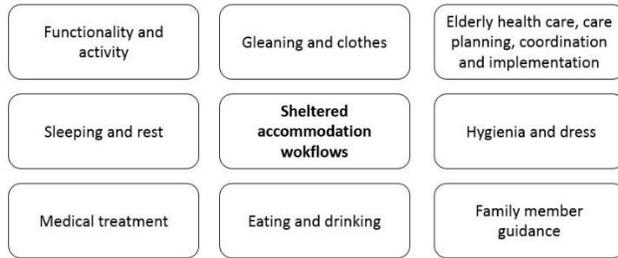


Figure 1: Tasks related to workflows.

In The care management plan will bring out the customer's need for care and rehabilitation resources, needs, services, and care and treatment, as well as the possibilities of preventive work [29]. Monitoring the health and well-being of the elderly, it is essential how the elderly work, behave and perform their daily lives [32]. In order to assist the elderly in daily work it is important to identify the limitations of the ability of the elderly to function. Nurses' views are an important part of ensuring the quality of care. The ability to perform daily routines is used as measurement of elderly people functional capacity. Family member guidance is one of the nurse's tasks. The role of the family in service systems is important. Active participation of the care of the elderly is an asset for elderly people and brings content, continuity and relevance to elderly's life. Usually the relative is a spouse, child or someone else close to elderly. Research shows that it is important to encourage and support the relatives to interact with elderly [50] Patients' rooms and common spaces should be designed to be large enough and despite of limitations elderly should be able to move around the premises freely. Activity of patients can be followed with new technology and it increases freedom of movement and safety. Such technologies are movement and alert systems [33,34]. The explosive growth of elderly care takes place rapidly and health care system is mainly developed for taking care of illness not for increasing needs for elderly care. The study found that the new technology can be used to prepare to meet the need for care and assistance due to the decline in performance, as well as elderly relatives is good to prepare for the fact that the elderly will deteriorate in the last years of life [33,34].

3 RESULTS AND DISCUSSION

3.1 Workflows and Bottlenecks

The field study was performed with in a local elderly care centre housing pensioners with both mental and physical disabilities. At the time of the study, the care centre housed 10 to 15 elderly people. We observed and interacted with both employees and patients for a total of 2 days, ensuring that we were present at critical moments in the care process. In our observations we focused on the identification of work processes and related bottlenecks.

The data was collected using individual theme interviews with the nursing staff [37], providing a semi-structured interview with

the possibility to further discuss important topics that potentially arise. The interviews focused on the following themes: daily care tasks and requirements, decision making, evaluation of patient needs, vision on sheltered accommodation care, and the background of the inhabitants.

The interviewees were chosen based on availability, yet provide a well-balanced sample of staff positions at the care institution. The interviews were carried out computer-assisted, as one of the interviewers wrote immediately the answers to the laptop computer. The field study was conducted by the interviewees in their own working environment, and the interviewers were able to observe and perceive the environment at the same time. This procedure was in line with one of the methods of qualitative research [35.]

The interviews were collected in two service sections with the nursing staff in two parts and carried out by three researchers at the University of Oulu. The researchers first determined the nurses' level of education and work. The interviews allocated 45 minutes for each interviewee. In the interviews, daily work routines related to workflows were inquired and monitored. Tasks related to patients, information about their visits to rooms and what kind of bottlenecks they detect. Special tags are added to show the most problems such as when starting the night shift no report is written and in the first meeting the personnel is gathering for the most loaded shift (morning).

During the interviews, the nurses stressed their current approach in carrying out their nursing duties. A strong emphasis is placed on the difference between care services offered in sheltered accommodation versus care in a health care center. Nurses aimed to construct an environment in which the participant feels at home, and are therefore reluctant to implement practices or technologies that are common in the hospital environment.

In addition, the interviews highlighted several shortcomings in information availability that severely hampered their day-to-day work activity. We provide several examples

This was however not recorded and thus hampers the quality of care provided to the patients. A similar concern was noted on the shower schedule of the patients. As a result of the patients' mental state (including memory loss), nurses cannot simply rely on information they provide. Nurses are required by law to keep a record of patients' healthcare problems and plans. These records are used to assess and monitor the quality of care, yet require constant data recording by the nurses. We observed nurses writing this information down on paper in events such as changes in medication, reports of bi-weekly doctor visits, or other reasons for concern. These papers were then collected in a central place, after which the information was transferred to a digital system roughly.

Once a week by one of the nurses. In the interviews, nurses stated that the computer system is sluggish and disconnected from the care centre (located in a different part of the building).

It appeared that one critical element in the nurses work is the handover meeting. The handover meeting is repeated every day around the same time (during overlap of two shifts, see Fig. 2), in which all nursing staff is present. During this meeting, the nurses

discuss the events that had occurred during their shifts, problems encountered with the patients, and any changes with regards to their medical condition.

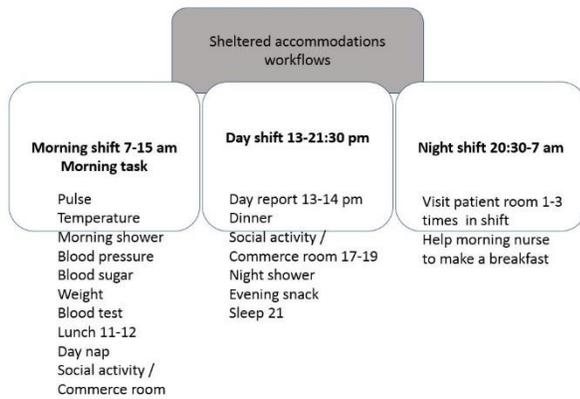


Figure 2: Identified sheltered accommodation workflows

Figure 2 illustrates the identified workflows and bottleneck that cause challenges for the information sharing. Special tags are added to show the most problems such as when starting the night shift no report is written and in the first meeting the personnel is gathering for the most loaded shift (morning).

All six nurses described nursing work in the same way. Nurses work in three shifts and one nurse is responsible for the department during the turn. The morning shifts is hardest and there are more staff working the shift. In the morning, nurses help the patients in their morning activities and assist them in dining. Elderly people are dating, watching television or playing games in the living room with other people in the house. The care plan helps nurses to implement workflows, as they bring the client's need for care and rehabilitation needs [29]. Nurses change the shift at one o'clock and keep a report of their workload. The researchers found that reporters did not use any notes at all, and treatment measures were not recorded. Nurses spend most of their time in the living room and are not aware of what is happening in the elderly's rooms. The rooms are located near the living rooms, but the cry of the elder does not come through the door. Figure 3 illustrates one section of the environment with the bedrooms and their location in the home.

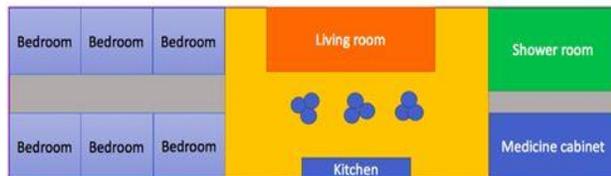


Figure 3. Plan drawing of the home.

As seen in Figure 3, the bedrooms are near each other but e.g. when a nurse is assisting an elderly to take shower, the distance to

people being in their bedrooms is so long, that cry for help might not be heard by the nurse. This is a concern and requires automated monitoring. In addition, as the nurses spend most of their working hours elsewhere but in the bedrooms, they revealed challenges to notice if an elderly is aiming to the toilet or trying to get out of bed for any other reason. As a detail, the observations revealed that the nurses shouted for assistance into the bedroom in case of need in lifting

The purpose of the study was to identify potential challenges in the workflows in a sheltered care come before new solutions offered by new ICT were designed and implemented. As a result, Figure 2 revealed several bottlenecks to be further analyzed and influenced. A treatment /care plan is composed of tasks executed by the care professionals (e.g., nurses, physicians, doctors). In elderly care, the tasks are the integral units of the nursing workflow. A workflow is a step-by-step execution plan for accomplishing a task. Without workflows, care quality degrades [3].

Poor facilities with archaic technology is usually a delimiting factor for nursing efficiency. The care plan is not solely for the patient. It also defines the workflow needs of the nursing staff: how often and how long should tasks occur. It aids to measure and maintain elderly care implementation, monitoring, evaluation and inform the future development of nursing. Traditionally, such care plans are depicted in physical paper. When doubt arises, nursing staff needs to retrieve it, which can sometimes be time consuming. In our field-study, we aimed at identifying workflow breakdowns (i.e., instances of workflow's steps which can be automated or fulfilled digitally or eliminated) in order to minimize nursing workload. The goal of learning nursing workflows can be to safeguard information that directs the work performance, that is, professional problem-solving skills. The development of work affects the whole organization through productivity, efficiency and innovation. Sensor technology is able to respond to fast data security, which guides work and work situations and is able to address bottlenecks in work. At the same time, it is an investment in employees' knowledge and completeness

By providing sensor technology to support elderly care, we can improve the quality criteria for nursing, affecting the structure, operation, or outcome of workflows and have a major impact on the outcome of nursing. With sensor technology we can also reduce bottlenecks in healthcare.

4 CONCLUSIONS

Earlier studies point out that workflows in sheltered accommodations can be supported by sensor technology. Nurses are released from recording to nursing care when the elderly physical, psychological and social changes can be detected in a timely manner. Nurses can provide quality support to elderly closed ones and closed ones can be brought closer to elderly care. In the future health care services are changing to digital services and technology is developing along all the time. Technology can ease everyday chores of sheltered accommodations and the care can be more rapid. By the aid of advanced technology information about their closed ones can be provided very quickly, even in real time.

The technology helps medical personnel to treat patients with higher quality and nurses have more time to take care of patients. The study interviewed medical personnel of sheltered accommodation, and even the interviewee target group was rather small, bottlenecks could be point out from workflows. Analysis and results of the collected data in study confirms previous research on the subject. The medical staff initially opposed the assistive technology, but brought out in interviews that they need technology at work almost on a weekly basis. Every interviewed nurse stated that the sheltered accommodation is home-like, and that's why nurses use only little bit of time to record patient care. However, nurses recognized that the law requires that the patient's health information is recorded to information system.

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