From episodes to continuity of care: A study of a call center for supporting independent living

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From episodes to continuity of care: A study of a call center for supporting independent living

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Abstract

Call centers are a central coordination hub for remote health services and telemedicine. Recently, also telecare providers use call centers to support the remote care of seniors living independently. Although we know that the quality of the interaction between caregiver and senior care recipient is important, there is a gap in our knowledge as to how ICT solutions can support this interaction through a call center model. In this paper, we describe a case study of a modern call center designed to provide services for independent living, primarily for seniors. The case study gives us new insight into how service providers envision ICT support for independent living in the future. We discuss our findings from interviews, observations and design workshops in light of relevant literature about independent living. We conclude with a set of directions for future ICT for call centers to support independent living of seniors. These tools should: 1) support continuity of care instead of episodes of care, 2) support caregiving activities in addition to medical triage activities, 3) support "technical caregiving" i.e. remote use, testing and maintenance of technology at home, and 4) support call center operators in leading ad hoc and emergent coordination in distributed teams.

Author Keywords

Call center, independent living, aging in place, assistive technology, quality of client provider interaction, personalization, caregiving, emergent coordination in distributed teams, remote technology maintenance.

1. Introduction

Many visionaries of independent living describe scenarios where seniors[1], supported by technology, are in full charge of their own lives. Ample empirical evidence, however, shows that the success of telecare and telemedicine initiatives is to a large degree dependent on the quality of the communication between the care recipient and the caregivers who remotely provide the care (van den Berg et al. 2012; Lindberg et al. 2013). The importance of this communication is evident from the growing number of initiatives that adapt the model of "health call center" (Kastens 1998) to the new needs emerging from independent living in form of telecare—See for instance the recent CSCW journal article by Procter et al. (2016). In a recent study commissioned by the Norwegian health authorities, 19 cases of telecare from USA, UK, Denmark, Sweden and Norway were presented and compared (P A Consulting Group 2014). All these telecare cases used call centers as the main coordination hub and client front end. What is common among the cases is: 1) the emerging need to support independent living in addition to traditional health-related services, and 2) the introduction of home care technologies such as PERS (personal emergency response systems), sensor-based monitoring of medical conditions, audiovisual communication, alarms etc. that essentially turn call centers into high-tech control rooms for care. Call centers are regarded as a major part of the national architecture for telecare in Norway (Norwegian Department of Healthcare 2015).

Although we know that remote caregiver-caretaker communication is important, it is not studied properly in the research literature (Koch 2006). The role of the call center is often mentioned as a minor detail, while much more attention is paid to the technology at home—which is often used to monitor and collect data. There is a potential tension between the mere idea of call centers as "*the new factories*" (Martin et al. 2007) and the very personal and delicate conduct of care, especially care for seniors (Halldorsdottir 2008). Telecare systems introduce a paradox in that they "*introduce scale and a new form of distance into home care work, whilst simultaneously making care appear more immediate*" (Roberts and Mort 2009). Inappropriate ICT tools can damage this immediacy of telecare. This paper, along with a few others, is a step towards illuminating what happens when we use modern ICT-enabled call centers to provide remote care. We provide some recommendations for future ICT tools in order to better support telecare, in particular the independent living of seniors. Our assumption is that the practices and the technology needed for call centers for telecare and independent living are different from the conventional health call centers. We acknowledge that healthcare is an important aspect of the lives of seniors.

[1] In this article we use the term *senior* to denote older adults who are the recipients of the services provided by the studied call center. This is a term used by the seniors themselves, e.g. in the titles of local senior associations such as "SeniorNett" and "SeniorIKT". We use the term *elderly care* to denote the type of services provided by the studied call center.

Seniors visit hospitals more often than younger people do. At the same time, independent living brings to the table a host of new needs that have to do with the activities of daily life, with feeling of safety, dignity, independence, participation and identity (Bowes and McColgan 2012; Rowe and Kahn 1997). Seniors, confronted by fast-paced clinical situations such as those represented by many health call centers, might feel worthless, without control, and excluded from decisions about their own health (Bridges, Flatley, and Meyer 2010). With the increasing prevalence of call centers as a hub for independent living there is a risk that the long term co-production of elderly care (Procter et al. 2014a) might be neglected. It is important that we study and learn from the conduct of call centers in providing services to seniors. Our research goes beyond describing the practices of the call centers operators. We suggest specific directions for how the ICT supporting tools should be designed in the future.

In this paper, we describe the case of a modern call center currently being set up in the city of Trondheim, Norway. The new call center brings together two existing organizations, a conventional health call center and a telecare call center. Our research question is "how do operators in a telecare call center use ICT tools to deliver care to users?" This case is relevant because it sheds light on how service providers perceive such remote care services of the future. The case is also unique because it emphasized the differences and similarities between the two types of call centers, and the new needs emerging from services to support independent living. We conducted this case study as part of our involvement in facilitating the co-design of the new ICT tools that the call center personnel will use. We have used interviews, observations, and data from a number of co-design workshops. The process of data collection took place during 2013-2014. This study focuses on the conduct of the operators in the call center. This means that we do not here touch upon the needs of the recipients of the call center services, such as seniors living independently at their homes. We do however acknowledge the importance of complementing our study with future studies demonstrating the conduct and the needs of these service recipients.

In the rest of this paper, we first provide an overview of relevant research. We continue by describing the case, and the rationale for the creation of the new call center in Trondheim. We then describe the method of interpretative case study we have used, and the processes of data collection and analysis. We present our findings from the data, including a description of the ICT tool concepts. The participating call center operators developed these concepts through a co-design process facilitated by us. The concepts provide insight into the perceived needs of these operators. Finally, we discuss our findings in relation to bordering CSCW research, and implications for the design of independent living call centers.

2. Background

Telemedicine and telecare are gaining increasing relevance in many western countries due to demographic changes and changes in the nature of the health and care needs of the population. People live longer. Many live with chronic diseases, many have co-morbidity and frailty, or cognitive disabilities. Telemedicine and telecare services are implemented to help seniors and others live independently, by e.g. helping them manage their medical conditions (van den Berg et al. 2012), increasing their feeling of safety using technologies such as personal emergency response systems (PERS) (Hessels, Le Prell, and Mann 2011), or helping them stay independent and cope with everyday activities at home and in the community (Procter et al. 2016). An underlying assumption for these services is that society saves resources by keeping people away from the hospital, and that the quality of the seniors' lives improves if they can manage their own life and stay independent (Bowes and McColgan 2012).

An important piece of the independent living puzzle is the caregiver support. Service providers increasingly use dedicated call centers to provide parts of this support. In this section, we will provide an overview of earlier research in two related areas. We will first discuss the concept of call center from a CSCW perspective. We will then look at how service providers use call centers in healthcare and elderly care. In summary, the literature on call centers is centered on a tension between a top-down management mindset of efficiency, and a bottom-up need for flexibility and the strong need for local knowledge among the operators. We also note that call centers for health and care emphasize support for "episodes" of care, which is in contrast to the need for continuity in care.

2.1 Call centers and the practice of the operators

The abundance of telecommunication and commodity ICT has resulted in call centers becoming a major organizational model. So-called "inbound" call centers[1], i.e. call centers that process incoming requests, are where most modern organizations provide information to and assist existing and prospective customers. These centers use ICT-based communication channels such as telephone lines, self-service web portals, and increasingly social media (Malthouse et al. 2013), to communicate with customers. For a number of organizations, such as airlines, credit card companies, and internet shops, call centers are the main means of communicating with customers (Gans, Koole, and Mandelbaum 2003). Much of the research on call centers is about operational aspects including load forecasting, capacity planning, queueing, personnel scheduling, and human resources management (Aksin, Armony, and Mehrotra 2007). The number of personnel working in one or another form of call center is estimated to be close to ten million worldwide, with five million in USA alone (Witsil 2014).

The main underlying management philosophy apparent in call center literature is that of efficiency and automation of routine work. ICT systems, such as call classification and triage tools, help operators—also called agents—categorize incoming requests using standardized forms and procedures: "*[T]he standardization processes [...] were almost always classification processes – operators [...] were expected to see their encounters with customers not only in terms of a standardized procedure but also as 'types' of encounter, generated by schema embedded in machinery*" (Martin et al. 2007). Operations managers assume that, by doing this kind of categorization, a single operator can handle an increased number of requests, and ICT tools can automate much of the interaction. This is important since the main cost of running a call center is the personnel cost (Aksin, Armony, and Mehrotra 2007). The vision of a fully automated call center is evident in this citation from a major call center resource web site: "*Speaking to, or interacting with a dedicated person for service will still exist but it will be a niche activity that companies will charge for*" (Millard et al. 2010).

On the other hand, a number of studies, especially in the CSCW community, show the complexity of the call center "call handling," even in apparently simple and straightforward cases. Ackerman and Halvorson (1998) have discussed the knowledge intensiveness of call center processes. Despite the seemingly simple nature of a telephone call, they show in details how the processing of that call involves layers of knowledge distributed among the operators and the various artifacts they use: "*Memories were complexly distributed, interwoven, and occasionally overlaid. They were sometimes the province of the individual...or the group... [We have tried to show that] there is no such thing as an organizational memory, as the metaphor attempts to invoke.*" Normark and Randal (2005), in a study of an emergency call center, have similar conclusions. They discuss the concept of "local expertise", i.e. the type of knowledge that has local relevance but is invisible in the global organization: "*The tricky problem for knowledge management in this context is that a range of different knowledges need to be encapsulated in such a way that accurate results can be delivered quickly and reliably to those who need to use it, precisely because the system is both time- and safety- critical*" (Normark and Randall 2005, 351).

Complexity of call handling procedures is further treated by Martin et al. (2007), who refer to call centers as "*the new factories*". They argue that even though call center management philosophy is to streamline and classify customers and requests, the real work requires continuous *in situ* decisions and work-arounds by the operators. Operators are, among other things, mediators between the "context-free" classification systems, and the situated nature of the ongoing synchronous collaboration with the caller. This kind of mediation is crucial in order to create a sense of "*continuity of care*". Proper handling of a call is possible only when "*historic information*" supports "*this interaction, now"*. Through this kind of translation and contextualization work, operators are important agents for "saving the face of the company": "*It is one thing to acknowledge that organizational categorization schemes are pragmatic 'forcing devices' that must be used by operators (but may be improved). It is another to allow these shortcomings to become public*" (Martin et al. 2007). The same study also shows how operators used the comment fields in the classification tools to create a sense of continuity in the provided service: "*The written commentaries in associated fields in fact often provided a clearer memory of the work undertaken than the classification scheme itself, offering the possibility to facilitate continuity of service through an audit trail of customer–organization interaction*" (Martin et al. 2007).

In summary, the literature on call centers shows a tension between two views. A top-down managerial view promotes a rational model based on call classification. This view stands in stark contrast to the day-to-day work of the operators characterized by localized and shared expertise and workarounds in order to deliver a good service to the customer.

2.2 Call centers in healthcare and independent living

We can roughly divide the application of call centers in healthcare and independent living into three areas: 1) medical triage and health call centers, 2) telephone nursing services, and 3) remote care or telecare for independent living.

Health call centers and medical triage. Most hospitals and healthcare providers have some form of call center to handle unplanned or emergency health-related requests. These call centers are often either outsourced (Johnson 2014) or exist as part of emergency departments. This type of call center has been used for decades as healthcare service front ends, as main contact point for clients, and as hubs for integrated healthcare service provision (Moss 2014; Kastens 1998). At the heart of health call centers is the medical triage process. Medical triage is the medical counterpart of the call classification process discussed above. Triage tools are decision-making tools that were originally developed for use in war situations, designed to handle large and unpredictable amounts of injured with limited medical resources. The principles from 1792 proposed by Baron Larrey, Surgeon in Chief to Napoleon's Imperial Guard, still underlie most of today's triage systems: "*First, treating the sickest first, second evacuating them to the most appropriate care facility in priority order, third maximising the use of our available resources for maximum patient benefit, and aiming for minimum time to definitive treatment*" (Robertson-Steel 2006). The main difference from that time is the large number of possible treatment choices that are available in today's triage tools. Additionally, triage work today can be done face-to-face or remotely by phone and other networked tools. Telephone triage needs a different set of skills than face-to-face triage. The personnel in a telephone triage setting need to

know how to utilize verbal-only dialog as source of data for decision-making. Specialized interview techniques are needed in order to perform the remote triage task (Rutenberg 2000).

Central to the discussion of medical triage is the deviations and exceptions that occur in practice, also called *triage drift*. Bjørn and Rødje (2008) have discussed the concept of triage drift in their case of an emergency department in a Canadian hospital. They define triage drift as "*the seemingly unstructured and heterogeneous aspects implicit in triage work when performed by experienced triage nurses acting on their experience and intuition* " (Bjørn and Rødje 2008). There is disagreement in the literature about how to address triage drift. However, Bjørn and Rødje state that: "*The conflict between standardization and triage drift cannot be fully resolved, but rather needs to be acknowledged in order to find a balance between allowing for flexibility and complexity while maintaining a coherent structure*" (ibid). Some medical literature also considers triage drift as a positive rather than negative phenomenon: "*It is a widely held belief that the use of protocols eliminates ambiguity in decision making and standardizes the approach to a problem. However, inflexible protocols that limit nursing judgment should be avoided. In fact, the extent to which use of even flexible protocols might limit nursing judgment, possibly adversely affecting the patient outcome, is unknown*" (Rutenberg 2000). For better or worse, triage systems are at the heart of health call centers, and are gradually becoming a central part of telephone nursing and call centers for independent living.

Telephone nursing. Telephone nursing is "*all nursing services delivered over the telephone [including] telephone triage, nurse advice, and care management.*" (Greenberg 2009). Although there is an overlap between health call centers and telephone nursing, here we are concerned with the advice-giving aspects of telephone nursing. In this sense, telephone nursing does not involve the emergency and diagnosis aspects that are inherent in a health call center. The role of the nurses here is that of providing "*health advice, emotional support, consultation, resource identification, and counseling...health coaches for health promotion and coordination of care...and provide education to families and other caregivers*" (Moss 2014). In this sense, telephone nursing also overlaps with support for independent living, but is of a more episodic nature similar to that of health call centers. With the explosion of the fitness market, and the focus on health promotion and preventive care, the telephone nursing market is foreseen to increase considerably. Triage systems and decision support software are used extensively in telephone nursing (Moss 2014; Holmström 2007; Greenberg 2009).

Telephone nursing constellations seem to focus on episodic triage services. Attempts to provide more complicated care and advice have shown to be difficult. For instance, Stacey et al. (2005) found that nurses in a Canadian call center faced a number of barriers when attempting to provide "value sensitive" advices—advice that can have both positive and negative impact, for instance related to pregnancy. Some of these barriers include the lack of support in available triage tools, unclear directions, and organizational pressure to minimize call length (Stacey et al. 2005).

Call centers for telecare and independent living. Telecare and independent living literature is expansive. However, there are only few studies of how call center operators conduct their work. One is that of Roberts, Mort et al. (Roberts and Mort 2009; Roberts, Mort, and Milligan 2012). According to their observations, one part of the operators' work is similar to what we have discussed above for the other types of call centers, i.e. handling calls using social knowledge and local expertise: "*...teleoperators have to work with uncertainty and indeterminacy. The information they receive in any one call or alarm event is very limited (the person may be unable to communicate clearly; an alarm may mean many different things)... [relevant] information may not be 'on the database' but exists in a shared social memory or emerges in conversations held in the monitoring centre*" (Roberts, Mort, and Milligan 2012). Other parts of the job are quite different from what an emergency call center operator might be doing: "*teleoperators do a kind of 'repair work' in which they attempt to refashion forms of social relationships for older people who are living in relative isolation.... Although often reported as personally rewarding, this work has significant psychological costs for teleoperators: costs that should be acknowledged and accounted for in evaluations of telecare services*" (ibid). E.g. one of their tasks is to determine whether a call is "real or false", triggered based on a "real need" on simply because a caretaker feels lonely and wants to talk to someone. Other activities include "*attempts to 'talk people into' doing something*", such as getting them out of the bed and sending them to bathroom. Operators in the reported studied were also involved in coordinating a network of caregivers, formal and informal, as they had realized the limitations of the care they could provide over a telephone line: "*telecare depends on 'old-fashioned' social networks of potentially co-present carers that can be mobilized in instances of uncertainty*" (ibid). In short, the operators studied by Roberts and Mort had a number of duties that are quite different than those of a typical emergency call center:

> *"The teleoperators we observed undertake multiple, complex tasks in their attempts to repair or reshape social relationships through the telephone and computer technologies available to them: they provide essential social contact for those who 'have nobody'; they provide preliminary verbal care in situations where the need does not justify calling on a different carer; they take care of people in crisis until help arrives; and they mediate between kinds of carers involved in any particular person's life"* (Roberts, Mort, and Milligan 2012).

Another set of studies done by Procter, Greenhalgh et al. (Procter et al. 2014b; Wherton et al. 2015; Procter et al. 2016) sheds light on similar and new types of activities, and how technology can be designed to support them. Similar to Roberts and Mort, they observe the importance of the social network of the caretakers, and argue that interaction with the social settings of the caretaker should be part of the job description of the service providers: "*...services should be designed to facilitate informal and interpersonal interaction as a component of routine practice. Additionally, technical subsystems might even be designed to prompt and encourage interpersonal interaction in order to develop a positive personal relationship with the service when desired*" (Wherton et al. 2015). Another topic is the role of service providers and operators in appropriating the technology for telecare: "*care professionals' accounts of installing ALTs [Assisted Living Technologies] in users' homes illustrated that this task requires considerable hands-on, practical reasoning to fit the technology around the individual contexts, material constraints and the particular ends that are to be achieved*" (ibid). This last topic is part of a larger "co-production" need addressed in depth in (Procter et al. 2014b) where caregiving is seen as the collaborative task of continuous appropriation of settings, routines and technologies. Awareness of the status of the care network is therefore crucial in order to answer a call from a caretaker: "*details of the care recipient, their habits and routines, and the members of their support network are usually displayed on the call centre worker's screen when a call is received... in principle, the call taker is in a position to 'join up' what otherwise are often fragmented services*" (ibid). However, they show that in practice this "joining up" is complicated because of the limitations in the supporting ICT tools—for instance, the lack of integration among the various technical devices and infrastructures. In order to support the caregiving activity of the call center operators, they envision a "*Facebook for ageing in place*", a dashboard that can collect all the necessary information about the care network in one place.

3. The case

In this section, we present the background and the context for our case study. We first describe how the care system for seniors living independently is organized in Trondheim, Norway, and what health institutions are involved in taking care of this user group. We then discuss the background for the decision to merge two of these institutions, emergency clinics and safety patrols, into one large unit.

3.1 The organizational and political context

Figure 1 shows the main municipal primary care institutions in Trondheim mentioned in this study. These are emergency clinics (EC, Norwegian "Legevakt"), safety patrols (SP, Norwegian "Trygghetspatruljen") and home care (HC, Norwegian "Hjemmetjenesten"). In addition, ambulance services are—as hospitals—part of the specialist care services available to seniors and other citizens. In everyday situations, seniors are mostly in touch with SP and HC. Those seniors with medical conditions are also in touch with EC and are frequent visitors to the hospital. We focus on SP and EC in our case study. We studied an ongoing merge between these two institutions that will result in a new call and alarm center called *Helsevakta*

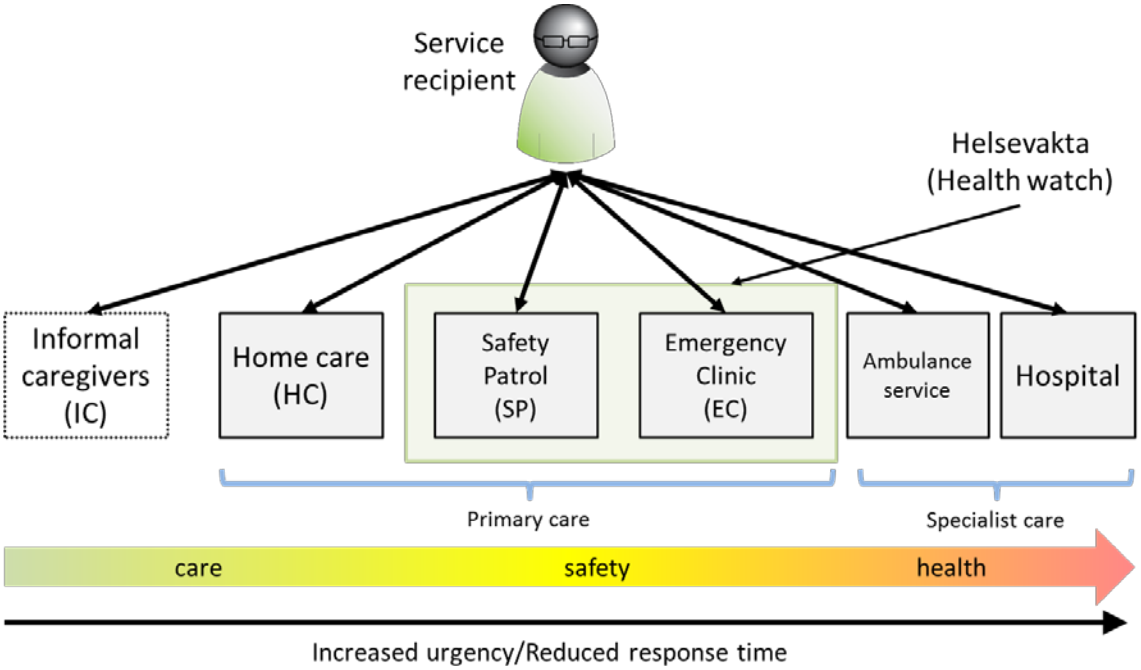


Figure 1: Various institutions involved in the support of seniors living independently in Trondheim, Norway.

(Health Watch, HW). Before we discuss the merge and HW we give a short background on EC and SP.

EC is the current 24/7, out of office primary health care service for unplanned incidents and urgent health requests. EC has a health call center, an emergency department with 2-3 physicians available 24/7, and one car with an ambulatory physician. The call center receives phone calls from the public and other institutions (such as elderly care centers and the police). When the call is received, call center operators need to determine the urgency level of the call. A telephone triage process is carried out to determine whether the incident can be solved by a) medical advice for self-care, b) a visit to the EC emergency department, c) a visit to the patient at home, or d) if it is a life-threatening medical emergency, forwarding the patient to ambulance services and the emergency department at the hospital. Statistics for the EC from 2014 shows 55033 consultations with physicians, 49606 with nurses, and 42465 incoming calls (County administration 2015).

In contrast to EC—whose services are available to the entire population in the region—Safety Patrol (SP) serves only those individuals who are entitled to a Personal Emergency Response System (PERS). These individuals are normally seniors and other people with special needs living independently in the community. SP has a pool of cars and health care personnel – mainly nurses –and a call and alarm center. Alarms are generated by users pushing alarm buttons on their PERS pendants – e.g. following a fall at home –or by automatic alarms such as fire and door alarms. When a call or alarm is received, call center operators get instant access to information about the person whom the alarm system belongs to. SP employs around 80 people (50 full time positions), mainly nurses. There are approx. 3700 users of PERS service, mainly seniors. SP call center receives around 12 000 alarms each month, approx. 10% of which result in a dispatch or home visit (Brørs 2013).

Like many western countries, the Norwegian healthcare system is undergoing structural changes. A major healthcare reform –called "collaboration reform" –was announced in 2009 (The Norwegian Ministry of Health and Care 2009). The reform resulted in primary care assuming a number of tasks that were until then the responsibility of the hospitals: "*a basic assumption for the collaboration reform is that the answer to many of the increasing number of healthcare challenges is to be found in municipalities and in primary care*." (ibid pp.15, our translation). As part of this shift in responsibilities, municipalities are now in charge of a number of challenging patient groups, including frail senior patients with co-morbidity and patients with chronic diseases. Discharge from hospitals happen earlier than before. Municipalities are penalized for failing to receive discharged patients. Follow-up happens at home and in community-based institutional care centers. One recent study shows that municipalities tend to become more specialized and focus on short-term rehabilitation of discharged patients at the cost of long-term preventive care (Abelsen et al. 2014).

3.2 The Health Watch and the merge process

The collaboration reform was initiated because of a number of systemic challenges; integrated and continuous care was not good enough, preventive care was often missing in provided services, and the healthcare system was not prepared for the coming demographic changes. In order to address these challenges, Trondheim municipality has decided to build a modern center to serve all urgent, unplanned and out of office visits, calls and alarms. The purpose of the new center is 1) to handle all urgent requests regarding unplanned healthcare and safety needs of the citizens in one place, 2) to provide short-term medical care in an in-house ward in order to avoid re-hospitalization, and 3) to integrate telecare with assistive technologies in near future. The new center, called *Helsevakta* (Health watch, HW), will be finished by 2018. The main institutions that will be included in the new HW are EC and SP. EC and SP had each their own separate premises at the time of our study. Currently both groups reside in an existing building at the SP premises. Both groups will move into the new building in 2018.

HW will combine the services currently offered by EC and SP. Access points for users will include telephone, web and modern telemedicine and telecare—e.g. PERS, automatic fall alarms, tracking of dementia patients, monitoring of chronic condition. The need for HW was outlined in two strategy documents developed by Trondheim Municipality, "Strategy for welfare technology" (Trondheim Municipality 2011b) and "The senior plan" (Trondheim Municipality 2011a). Seniors and people with special needs are one of the main envisioned user groups for HW.

The merge process consists of two parallel processes. First, the municipality acquired a lot in 2013 in order to construct the HW building. Second, the municipality started a procurement process to acquire new ICT tools for HW. The idea was that the two groups, EC and SP, would use the same tools. We focus our study on this second process. It was acknowledged from the start that off-the-shelf ICT tools were not an option. Our research team got involved in developing the requirements for the ICT tools. We structured the process in form of a number of interviews, observations and co-design workshops, resulting in a number of paper prototypes that were then documented in a report. The municipality used this report as part of the commercial procurement process that followed.

The process of developing the tools for the future HW is important because it brought together two types of participants: 1) call center operators from EC, representing a group who already worked in a quite conventional health call center, and used standardized triage tools and 2) the group of operators from SP, who delivered a care service to seniors living in the

community. These two groups had to cooperate in order to design the ICT tools that both of them would use in their future workplace.

Table 1: Timeline of events relevant to the case study.

Time period	Event
2008-9	The announcement and initiation of the health reform "cooperation reform".
2010	Trondheim Municipality receives funding to start working with a joint call center.
2011	The city council approves the “Strategy for welfare technology” and “Senior Plan”.
2012	Due to the complexity in the system, the municipality seeks cooperation with “National program for vendor development”, aiming to have an improved dialogue with potential suppliers.
2013 January	The municipality holds a dialogue conference with potential vendors. Our research team is first involved in the process, conducting interviews and field observations.
2013 September	Following a period of much planning, the municipality wants to start the design work, and invited our research team to assist in the design of the ICT tools.
2014 July	Procurement process closes, and commercial vendors start the development process.
2014 September	Evaluation of proof-of-concept ICT tools.

4. Method and approach

4.1 Research strategy.

Our study follows closely the interpretative case study research strategy (Yin 2014; Walsham 1995). The research question is "how do operators in a modern telecare call center use ICT tools to deliver care to users?" Initially we did not have any propositions and used an inductive and grounded approach to our data. Gradually we developed a direction for our study, influenced by the concept of episodic versus continuous care discussed later. Our unit of analysis is HW as a technology-supported organization. HW illustrates a modern telecare call center in the process of being developed. The phenomenon we have attempted to shed light on is call center operators' conduct of their day-to-day work, and the implications this might have for ICT support. We collected data from a variety of sources, and used thematic analysis (Braun and Clarke 2006) to move from data to a set of high-level themes that we present later. We have used the framework and the principles of Klein and Myer (1999) in this process.

Figure 2 shows the overall process that has led to the research results we present in this article. Initially, our research group started a collaboration with the municipality because of some very practical reasons. A procurement process for ICT tools for HW was planned for the beginning of 2014. HW project managers wished to involve the employees in the process of defining the requirements for the tools. Our group was assigned the task of planning and facilitating the co-design process, involving participants from EC and SP. Initially, we used a grounded approach where the goal was to use co-design and co-creation processes to develop requirements that were true to the needs of the employees (Portigal 2013; Ries 2011). This process (shown to the left in Figure 2) started by our team meeting with the management to set the expectations, and

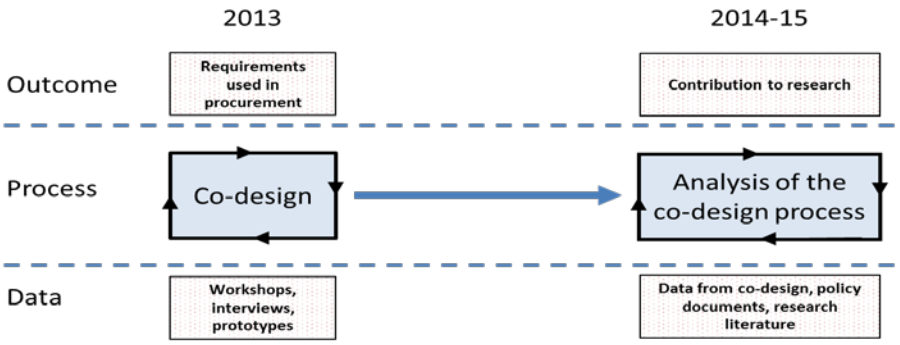


Figure 2: The overall research process.

conducting short observations at EC and SP premises. Afterwards, a series of co-design and usability evaluation workshops were organized (see Table 2 for an overview). Later, we conducted an interpretative analysis of the co-design process (shown in the right side of Figure 2).

4.2 Data collection

We documented the co-design process in form of meeting minutes, field notes, and workshop minutes. We created summary reports from each workshop, and presented these reports to the participants. We created a final report and delivered it to the municipality as a requirement specification for the commercial procurement process. All the ICT concepts, mock-ups and prototypes were registered and documented. Table 2 shows an overview of the collected data.

Table 2: Overview of data collected during the co-design process.

Data generation method	**Informants**
Four informal semi-structured interview (duration one hour each) focusing on the goals for the co-design process. Documentation: hand-written notes of 10-11 pages.	Leaders for EC (male, background: doctor), SP (female, background: nurse), and two project managers for the new HW (both female and nursing background).
Observations. Two half-day observations, one at EC and one at TP. Documentation: About ten pages of field notes.	At the premises of EC and SP. The observations focused on how the operators in each site worked with each other during call handling.
Co-design workshop 1, duration about 4 hours. We used several creative sticky-note sessions to create concepts. Documentation: Hand-written notes, photos, and minutes.	Five participations from EC, including two managers (three female operators, one female manager, one male manager). All nursing background except EC manager who is a doctor. Four participants from SP including two managers (three female [one manager], one male [manager]). All with nursing background Two from HW project management (both female, nursing background).
Co-design workshop 2, duration about 4 hours. Reviewing and updating of mock-ups created using the prototyping tool Balsamiq. Documentation: 6-7 pages of notes, and updates to the initial mock-ups.	The same as co-design workshop 1.
Co-design workshop 3, duration about 4 hours. Same focus as workshop 2. Documentation: Summative report from the workshops.	The same as co-design workshop 1.
Preparation meeting for usability evaluation, duration about 2 hours, focus on what to evaluate. Documentation: meeting minutes of about 5 pages.	Two participants. One participant from EC (female) and one participant from TP (male). Both nursing background.
Usability evaluation workshop, duration about 4 hours. Focus on testing of the web-based low-fidelity prototype. Documentation: Summary of the evaluation, about four pages.	Five participants. Two participants from TP, three from EC. All nursing background.
Software concepts, mock-ups and prototypes. Documentation: photos, Balsamiq mock-ups, web-based low-fidelity prototype.	None.

4.3 Data analysis

Part two of this study (the right side of Figure 2) started after we had finalized the co-design process. We wanted to learn from the process we had just facilitated. A number of other Norwegian municipalities were in the process of investing in call centers for telecare. We wanted to document the insight from our process, and possibly generalize some of our findings. An additional motivation was that the researchers working as facilitators had observed some tensions during the workshops that

merited closer analysis. At this point, we adopted an interpretative approach to the data from the co-design process (Walsham 2006; Klein and Myers 1999). We discovered that the co-design process and the produced prototypes provided data that we could interpret in the larger context of the HW project, the emergence of telecare call centers in Norway, and the role that call center operators played in providing telecare services. The framework of Klein and Myers was applicable to this end: "*The process of interpretation moves from a pre-cursory understanding of the parts to the whole and from a global understanding of the whole context back to an improved understanding of each part, i.e., the meanings of the words*" (1999, 71).

We did not have the privilege of going back and collecting more data from HW at that point because the unit engaged heavily in the commercial procurement process for months after we had finalized our co-design process. Instead, we collected and analyzed data from other sources (such as strategic municipality documents) in addition to the first-order data we had from the co-design process. We wanted to better understand the context in which HW existed by bringing in new perspectives, following Klein and Myer's principle of multiple interpretations: "*The principle of multiple interpretations requires the researcher to examine the influences that the social context has upon the actions under study by seeking out and documenting multiple viewpoints along with the reasons for them. The analysis of reasons may include seeking to understand conflicts related to power, economics, or values*" (1999, 77). As Walsham argues, although case studies can include different types of data sources such as documents and observations, interview data are: "*still an important data source, since they enable researchers to step back and examine the interpretations of their fellow participants in some detail*" (1995, 78). We therefore base our findings heavily on what the participants said and did during the co-design process (documented in our meeting and workshop notes). Additionally, we believe both documents and research literature have provided us with a deeper understanding and data to support our findings (Glaser and Strauss 1967; Prior 2003).

Our analysis started in an inductive way. Two of the authors (BF and TV) read the written scripts from the interviews, and the minutes and summaries from the workshops. The two authors did each a first independent round of thematic analysis (Braun and Clarke 2006) resulting in a number of initial codes or topics. We created a refined working set of topics during a number of meetings among all the three authors. Some examples of these early topics are "limitations of technical solutions", "decision support", "need for classification", and "new factories". This set of topics guided our collection of documents, and we identified relevant research literature. Through further iterations, where we compared emerging topics to literature, we identified the following set of four top-level themes (discussed in details in the next section):

1) *Supporting independent living: episodes vs. continuity*- Whereas the focus for EC has been urgency and rapid response, our data shows that SP operators are engaged in day-to-day non-urgent caretaking tasks supported by a personalized history of interaction with each client.
2) *Co-constructing care: protocols vs. workarounds*- Protocols play a central role in decision-making and communication among the operators. At the same time, protocols act merely as maps. Operators are engaged in continuous knowledge-based *ad hoc* coordination where they themselves play a key leadership role.
3) *Playing it safe: Politics and audit trails*- The conduct of the alarm and call center is subject to strong political and legal frameworks. These frameworks affect the conduct of the operators, sometimes resulting in inefficient operation such as lack of access to needed data.
4) *Future call center operator: a high tech profession*- The addition of telemedicine and telecare technologies to the homes of seniors has resulted in a demand for high-level technical competences. The fact that these technologies evolve all the time adds to the complexity.

It is also relevant to write shortly about the role and the background of the authors. All three authors have a background in ICT. One of the authors (BF) was not involved in the initial co-design process. Another author (TV) was involved in the development and evaluation of the web-based prototype that resulted from the co-design workshops, but was not involved in the interviews and observations. The third author (MM) was one of the original workshop facilitators, participated in the observations, and in this way had deep knowledge of the entire co-design process. This combination gave us the possibility to critically analyze the data, and at the same time have access to enough background knowledge about the case.

5. Findings

In this section, we first provide some findings from our analysis of the co-design process. We then describe the resulting ICT tool concepts developed by the participants.

5.1 Supporting independent living: episodes vs. continuity

The two groups have different approaches towards the clients. While EC is more concerned with identifying life-threatening situations no matter who the callers are—but important where they are—for SP the identity of the caller plays a central role.

This distinction was clear when discussing the caller registration functionality in the ICT tool. Participants from EC wanted quick caller identification and access to medical journal:

> ***EC operator:*** *"We should be able to write NN and move on. We cannot stop the treatment because we don't have the name."*

> ***EC operator:*** *"We need to be able to connect the phone number to the medical journal system."*

EC provides urgent and episodic health services, and the operators are concerned with urgency. Moreover, EC provides services to all the population of the region (approx. 200 000), which makes it difficult to have any kind of relationship to the callers. The situation is different for SP. All the clients of SP (around 3700) are registered users of the service. Many of these are repeat callers. This means that SP personnel normally know who they are interacting with when a situation develops. Knowing the individual clients and their needs affects the service:

> ***SP Operator:*** *"It helps to know the patient. Often when a new nurse talks to her she is not willing to reveal much information about her situation."*

> ***SP Operator:*** *"Patients who have anxiety... it helps that they know you...that you have visited them earlier. You know how to calm them down."*

There are situations where SP involves other institutions (HC, EC or ambulance) because of the need for medical or care assistance. In these situations SP's background knowledge about the client is valuable for uncovering urgent situations and assisting HC, EC and ambulance personnel in their work. Some example of such assistance:

- In one observed incident of a fall at home, the fact that the client was known to be an obese person allowed SP to inform the ambulance personnel to take along a lift.
- In one case the daughter of a client called SP because the father was unconscious. An ambulance was dispatched immediately. After having read the logs from earlier incidents the SP personnel discovered that the daughter had a history of "dramatizing" the situation. The operator called the ambulance to inform about this.
- From interview with SP operators: "*we often notify HC that the client has not taken her medicine.*"

We also observed that SP operators in some aspects knew the client better than HC (home care) personnel do. This is despite the fact that HC personnel visit them on a daily basis to perform routine maintenance tasks:

> ***SP Operator:*** *"I feel like we uncover much more than what HC manages to."*

SP operators told us that in some cases they detect important changes in the client's behavior via phone conversations. Some of these changes—e.g. signs of cognitive decline—have led to medical tests and updates to the services the clients receive:

> ***SP Operator:*** *"I noticed change in her behavior... seems to be code 311. I wrote down notes in Gerica [the journal system] that goes to HC and to welfare office [in charge of screening clients who are candidate for new services]."*

Some of the tools that are used—e.g. the journal system Gerica—offer free text notes fields that are useful in building up an informal "profile" for each client. Both HC and SP are good at documenting such information. The information that was there was considered useful and was consulted in every situation by SP and EC operators when a call or alarm arrived.

Our data illustrates how SP operators assist their clients in everyday care situations. Up to 90% of calls to SP are resolved during the call, without any need for further action. A large part of these calls are related to normal daily activities, such as a client who needs to take a shower or visit the bathroom, a client who wonder when HC will be there, or who feels unsafe and needs someone to talk to. In many cases, SP operators cooperate with HC personnel to address such requests. In other cases, SP seems to be the main care provider or coordinator of care. For instance, in one case a client calls because she wants to take a shower:

> ***SP Operator:*** *"She calls...wants to take a shower. I call HC and they tell me they have been there already but she was in bed and didn't want to take a shower then. She has to wait."*

Sometimes SP must take further action—in addition to telephone advice— to help with everyday care tasks. It is quite common for them to send out a car to help a client with a visit to the bathroom, or just to comfort them:

> ***SP Operator:*** *"There are some recurring alarms from clients who have to go to the bathroom or just feel lonely. We need to visit them in between HC visits."*

> ***SP Operator:*** *"We have many alarms from people who go to bathroom and are not able to get up."*

In some cases it is the HC personnel who help out SP. This was common for clients who had HC service—all SP clients have the PERS service but not all of them have HC service with home visits. For instance, HC could be used to check for an alarm:

SP Operator: *"We don't need to send a car if we know that HC is on the way. We just coordinate with them."*

The majority of SP clients are community-dwelling seniors, some of them living with or close to caregiving family members. The relation between SP operators and clients' family caregivers was ambivalent. On the negative side, some operators told us that they hesitated to contact family caregivers because they had had problems with them earlier. They felt being judged by family caregivers for the quality of the service they provided. Some family members did not wish to be contacted, or were not able to help—themselves having health-related or other problems. On the other hand, some family caregivers had requested to be informed about emergencies—although they were only a few and often did not have time to help when asked. Some of them used the alarm service as a security and peace of mind for themselves. Enrolling a senior as client was often regarded as positive for his/her family caregivers because they would have more time to take care of themselves. In summary, it seemed the SP operators did not have access to and did not use the informal care network of the clients in any extended way. This finding is different from those of other researchers discussed earlier, where the informal network played a much larger role.

5.2 Co-constructing care: protocols vs. workarounds

Decision-making tools were perceived to be important for all the participants. EC uses a standardized triage tool called Norwegian Medical Index, NMI (Norwewgian medical association 2009). NMI is a triage tool that guides the operator through a set of questions and suggests an action to be taken, such as giving a telephone advice, or dispatching the EC car, or calling for an ambulance. NMI is available in book form, but EC operators use a web-based version adapted for telephone triage called *Telefonråd* (telephone advice). The participants reported that they do not use the tool in the sense of visiting the web page for each incident. However, they told us that they have very good knowledge of the content of the tool and often use it in a flexible way:

EC Operator: *"We use NMI questions when we are unsure. You don't go to the web page and check the questions. But you need to know and be able to answer those questions."*

EC Operator: *"We first sort the calls roughly. Then if we know the call is not a red alert [emergency] we might go into NMI. "*

During the paper prototyping, NMI was considered to be an important part of the future ICT tools. It is in fact available as the default page after the registration of a call (see the section on ICT tools later):

EC Operator: *"NMI should be the first thing that EC personnel see."*

EC Operator: *"We should have the same [high quality] NMI system as the ambulance service."*

SP operators have check lists instead of triage tools. These check lists are mostly related to the technical infrastructure at home. For instance, there is a tool that allows them to see whether alarms have full battery, whether the base station is connected to the network etc. The tool uses color coding for different alarms—e.g. purple for fire alarms.

For both EC and SP we observed cases where the operators were engaged in fast paced *ad hoc* coordination with other institutions and in particular with ambulatory personnel. This coordination is handled using telephone—and through limited access to shared information. It demands a high level of local knowledge and experience from the operators. For instance, in one observed emergency, EC had information about a senior at a residential care facility who should be admitted to the hospital. The EC operator:

1- Calls the care facility to verify the patient's address.
2- Calls to book an ambulance.
3- Calls back the facility to get hold of someone who can open the door to the patient's apartment.
4- Calls ambulance to give background information about the patient.
5- Closes the case by doing the paper work locally.

The same kind of complex coordination was also observed by SP operators. For instance, in a case of a fall incident at home the SP operator:

1- Tries to find an available car by setting up a three-part telephone conference with two drivers. They decide which car will go there.
2- Provides background information such as address, who called, what is the situation, the client is obese, should take along a lift.

3- Follows the development and provides guidance during the operation. Inform ambulatory personnel about which floor in the building the patient lives in.
4- Discusses with the ambulatory personnel who should document what in which system.
5- They decide that the accident is a "fall with injury" and needs to be documented in two different systems.

The characteristic aspect of these situations is that the operators have a leading role and act as coordination hubs for all the involved parties. Another aspect is the kind of improvisation that happens, which is heavily dependent on the local knowledge and experience of the operators.

The operators lack tool support for this kind of coordination. Almost everything happens on the phone. Situation awareness and sharing of information—especially with ambulatory personnel—is a challenge:

> ***SP Operator:*** *"Once we sent two cars to the same house, and were at the same time booking the third car to go there!"*

> ***SP Operator:*** *"There is no way of sharing information with the car. They have to use the GPS in the car to find the house."*

> ***EC Operator:*** *"We need big wall screens with information about what is happening."*

Lack of information sharing tools encourages informal communication. Informal handovers and verbal exchange of crucial information are common. Operators orally double-check own decisions with other operators.

5.3 Playing it safe: Politics and audit trails

In addition to being a professionally demanding work environment, the operators also work in an environment that is heavily shaped by outside political, organizational, legal and safety frameworks and demands. The operators spent a considerable amount of time discussing these issues during the workshops.

Many of the underlying motivations, and thereby the criteria for the assessment of HW, are of strategic and political importance for the municipality. The local media follow the developments carefully and document problematic cases—many of which end up in the front page. One example of a widely discussed and politically hot topic is waiting times and response delays in healthcare services. This topic was discussed among the operators in the context of how the new system should expose delays in processing calls and alarms. This was a sober discussion. On one hand the operators acknowledge that information about delays can be useful:

> ***EC Operator:*** *"A new way of working...a good idea. There are no secrets here. We should be able to see all delays. Today we cannot see it all the time... we have to go to a page and make a report"*

On the other hand the operators were interested in testing out solutions before committing to one:

> ***SP Operator:*** *"It can be disturbing if such information is always in your face. We don't want a witch hunt while we are working."*

> ***EC Operator:*** *"The solution should be flexible. You can start off with a low priority task and then comes a high priority...what do you do? You end up breaking the rule. The system should handle this in a proper way."*

The result was the proposal to have features in the future ICT tool in order to show urgency of calls and alarms, and be able to see own and other operators' assigned tasks and their delays.

Audit trails and access to medical data was another such issue. The majority of the ICT systems used by the operators have automatic auditing functionality that logs information about who is accessing which data. In addition, these systems and the surrounding routines—e.g. the triage system and the patient journal—require that data is entered manually by the operators when they access information or when they do some tasks. From our observations we noticed that the operators might be hesitant to access data before they have a good reason—and this might be regarded as problematic:

> ***EC Operator:*** *"All the path to information is logged... even things you click on by mistake. It is important that the new system allows us to summarize the reasons [for access], and that this summary is shown first."*

On the other hand, audit data (especially the manually entered data) was regarded as useful for the operators in their day-to-day tasks. They considered technologies that facilitate logging of data to be useful—e.g. audio logs with automatic transcription.

5.4 Future call center operator: a high tech profession

Operators at EC do not deal with technology at homes. The situation is very different for SP operators. In order to provide their services, the SP operators need to make sure the technological infrastructure at the clients' homes is functional. The number of home devices connected to the alarm system can be quite large in some cases, including door alarms, smoke and

gas alarms, refrigerator door alarms, and medicine dispensers—and the list is growing. Although installation is done by technical staff—with nursing background— day-to-day maintenance, monitoring and testing are done by the operators in the call center. Some of the operators—called super users—have gradually gained a great amount of practical technical knowledge about these systems:

> ***SP Operator:*** *"Old houses are not good because they might unexpectedly lose electricity. It will knock out the alarm system."*
>
> ***SP Operator:*** *"Houses with many floors have bad coverage. We get a lot of silent alarms [alarms where the operators cannot get in contact with the clients] from these houses."*
>
> ***SP Operator:*** *"You need an old-fashioned phone line to the house. Broadband does not work with the alarm system."*
>
> ***SP Operator:*** *"GSM cellular based systems are not good. They don't support voice communication."*

The operators have also developed routines where they test the equipment together with the clients. For instance, the operators encourage the clients to test the alarms by regularly pushing the pendant button, despite the fact that these systems also have a self-test function (testing the system every 72 hours).

This technical knowledge is mainly the result of on-the-job learning since SP operators all have nursing background. Due to the evolving and innovative nature of the technology—e.g. smart house technology being considered as a future extension—the operators are also involved in co-design activities like this project, and participate in procurement processes at the municipality.

5.5 The resulting artifacts

In this section, we provide an overview of the ICT tool concepts that were developed during the co-design process. The tool concepts are interesting not because they represent any novelty from an ICT perspective—there is a number of commercial call center tools available in the market. They are interesting because they materialize the requirements of the operators that participated in the co-design workshops. The concepts were developed from vague ideas based on the operators' own needs and their knowledge of other tools they had used earlier. These ideas were then structured and gradually transferred into paper prototypes. Our research group assisted in the process by using standard paper prototyping techniques and tools.

Table 3 in the next page shows the main ICT artifact, the information dashboard. This tool is designed to be used as the main information tool on the desktop of each operator, providing an overview of incoming requests and assisting in processing individual requests. The table shows how the dashboard concept developed from paper-based ideas written on yellow notes, to a mock-up developed in a computerized prototyping tool, and further into a low-fidelity web-based prototype. In addition to this dashboard two other concepts were developed: 1) a tool for fleet management (a large shared screen showing a map and associated information), and 2) mobile app concepts to be used in the cars and during visits to homes.

The information dashboard can be regarded as a workflow tool that follows the process of handling an incoming request—i.e. a call or an alarm—from the left side of the screen to the right (see the figure in Table 3 row B). As incoming requests arrive, available operators pick them up and use the tool to handle them in the correct way. The specific steps in the process are the following (see the numbered labels in Table 3 row B):

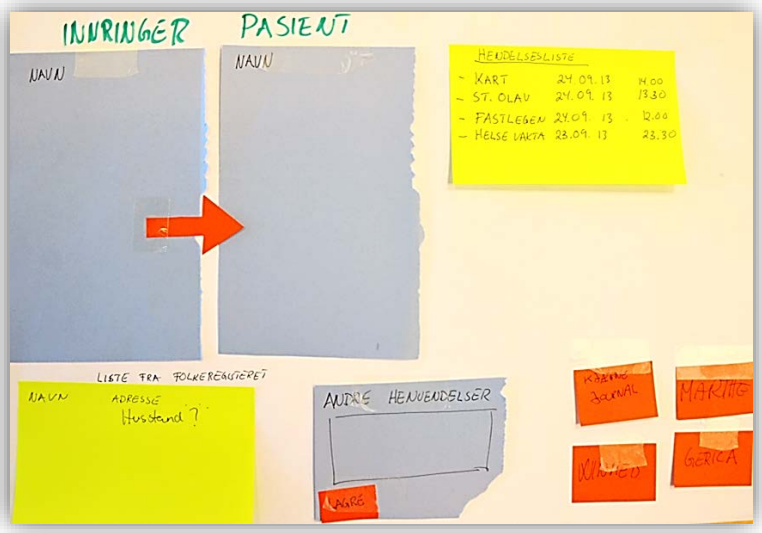
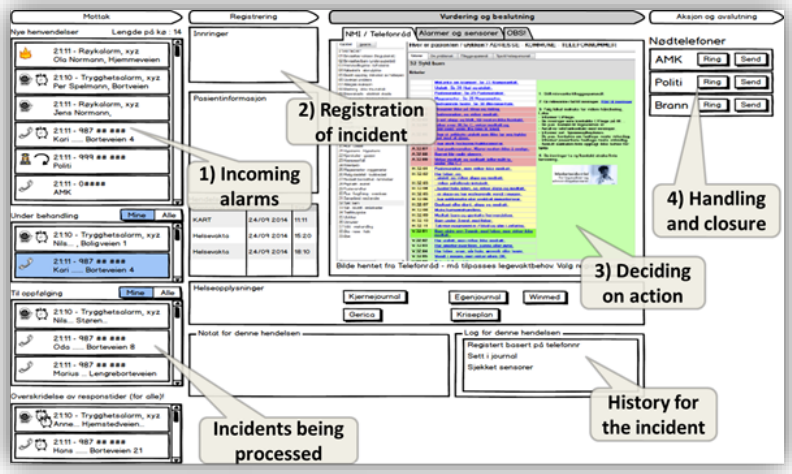
1) The request from a client shows up in the list of open requests (labeled "incoming alarms"). A request can be a call, or an alarm that is triggered automatically—e.g. a fall alarm. The system automatically adds some contextual information to each request as it arrives—e.g. the name of the caller if available, the type of the request, and its perceived urgency.
2) Once an operator chooses to handle a request, he selects the request icon and the system assigns the request to that operator. The operator should then add relevant information during the "registration of the incident". The operator obtains this information mainly by talking to the caller on the phone.
3) A number of tools are available for the operator in order to assist him/her in deciding follow-up actions (see "deciding on action" in the figure). These tools include a telephone triage tool, and various tools providing context information from e.g. sensors and other databases. The operator can for instance see an overview of all the assistive technologies installed at the caller's home, and whether they function properly or need maintenance—e.g. their battery level is low or they are disconnected. The operator can also look up in other databases, such as the electronic patient record.
4) Using the above decision-making tools, the operator makes a decision and initiates a follow up action—e.g. calling the ambulance service or ordering a home visit by SP (see "handling and closure" in the figure).

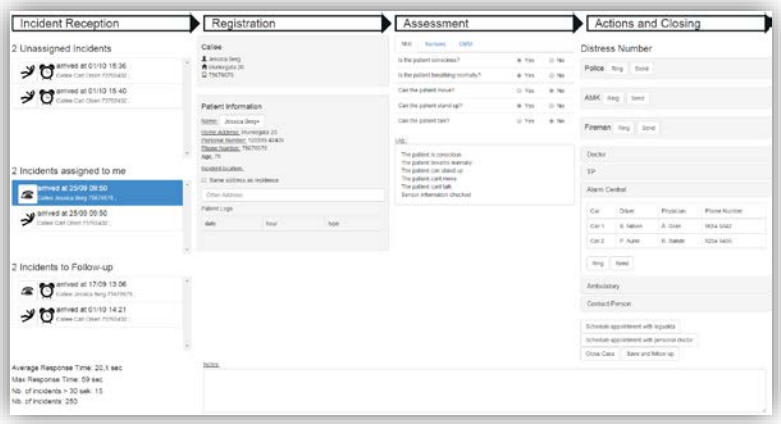
At any time during the processing of the request, the operator can view and update a history file related to the specific client (see the bottom-right part of the figure in row B). In addition, the tool provides each operator with an overview of what the other operators do at any time, and which calls are not currently being handled (bottom-left part in the figure in row B).

The resulting prototypes try to address some of the shortcomings of existing tools. For instance, they attempt to increase situation awareness by providing an overview of all the arriving requests, who is handling which request, and the status of delayed requests. In this way each operator is made aware of what the other operators are doing. In addition, the large wall-mounted map prototype allows the operators in the call center be aware of the location of each car and other contextual awareness information such as the traffic condition in the city.

In addition to awareness of others' activities, the dashboard also provides awareness of the status of the current request that the operator is engaged with. The tools allow the operator to have full overview of the process, instead of guiding the operator through a process. So the tool can be seen as a map rather than a script (Schmidt and Simone 2000). It also allows the operator to inspect the status of the technical infrastructure at home, e.g. check connectivity and battery level of assistive technologies.

Table 3: The development of the information dashboard for the call center, from paper-based concepts to a low-fidelity prototype.

A) Results from the first workshop. Participants used paper prototyping techniques to create the user interface of the information dashboard for the call center. In addition, user interfaces for fleet management and for mobile clients were prototyped during this workshop.	
B) Results from the second and third workshops. Participants evaluated mock-ups developed based on the paper prototypes from the first workshop. The mock-ups were partly developed during the first workshop, and partly offline by our research team based on the paper prototypes developed during the first workshop. The mock-ups were interactive, and resembled a real user interface. The dashboard mock-up shown here illustrates the workflow for handling incoming requests.	

C) A web-based implementation of the information dashboard. This tool was evaluated for its usability by the participants. However, the implementation was of little interest for them since the mock-ups were already being used by a commercial vendor to develop the real dashboard.	

6. Discussion

> "- Researcher*: What would you say was the fundamental difference between caring and uncaring?*
> - Former patient*: I'm not sure how to put it other than 'personal relationship'; the sense is somehow that your and my spirits have met in the experience, and the whole idea that there is somebody in that hospital who is with me, rather than working on me*" (Halldorsdottir 2008).
>
> "*...in the call centre we observed a notice board next to the operators' station with a 'thank you' note from one of the older people. This had been sent following a visit from one of the older people who came to visit the centre because she wanted to see the operators who cared for her and where they worked*" (McLoughlin et al. 2013).

In this paper, we have discussed the call center concept as an organizational tool to provide services for independent living of seniors. It is not to deny that the call center idea is to promote efficiency and economy of scale. It is also not to deny that demographic changes confront care institutions with challenges that are difficult to handle without thinking in terms of organizational efficiency and reengineering of services. Our knowledge of how call centers function, and what impact they have on services, is mainly based on health call centers and telephone nursing services. Our study is one of only a few to provide insights into how call centers affect remote elderly care. Our findings show that there are some fundamental differences between the traditional health call centers, and call centers for telecare and independent living. We believe these differences have profound impact on how ICT tools should be built.

In the following, we will first discuss our findings and their implications for future ICT tools. We will then return to a discussion of the dashboard tool that the co-design participants developed, and discuss the similarities and the differences between this tool and what we found from our analysis of the process that led to it.

6.1 Support for continuity instead of episodes of care

The main topic that emerges from our data is the tension between the *episodic* nature of existing call centers and the *continuous* nature of elderly care. EC operators were concerned with exceptional episodes that typically occur when an otherwise healthy person becomes ill and needs assistance. The SP operators we observed, similar to telecare operators from other studies, have an ongoing relationship with the senior person, and use this relationship as an important asset to provide efficient services. Operators in our study used their relationship with the senior person not only to personalize the provided services, but also to coordinate the care work in a network of caregivers, as also observed in (Roberts, Mort, and Milligan 2012). Their in-depth tacit knowledge of the person they cared for allowed them to take a leadership role in these networks.

Current call center tools and systems are not built to support these continuous care processes. Existing triage and classification systems are built around clinical episodes. Assessment and evaluation of healthcare service outcomes are also based on episodes that can be quantified[2]. We need tools that can support operators in building a trajectory of care, in order to support continuity and provide a feeling of safety for the clients. We also need new ways of measuring quality in telecare call centers.

It is at the same time not clear how a continuous long-term care process can be documented properly without service providers entering into ethically challenging situations. We have experienced in other studies that nurses are reluctant to

document interactions that are considered private. Excessively documenting what happens at home can lead to "extitutionalization"—as opposed to institutionalization—i.e. transforming home into a place that is no longer private, as observed by Milligan et al.: "*This, then, raises critical questions about whether telecare is able to make the home a better place to live than alternative options, or whether the spaces and functions of the home—and the power relationships within it—change such that they may no longer be recognisable or desirable places to live*" (Milligan, Roberts, and Mort 2011).

Moreover, it is not clear what information is relevant "downstream". This challenge is also raised by Zhou et al. (2012) in their study of care teams in hospitals: "*If there is no clear anticipated downstream use, or there may be uncertainties with regard to how the information will be used later, clinicians are inclined not to document the information into patient records*" (Zhou et al. 2012). Thus, there is a "*tension in everyday practice between short-term, specialized use and long-term use*". The way SP operators use the system, i.e. building a long-term profile of each user, is similar to the way primary care clinicians used the "patient problem list" (PL) in Zhou et al.'s study. Research in personalization and customer relationship management often takes for granted the availability of a large amount of "profile data" about the customer or user (Gauch et al. 2007; Nguyen and Mutum 2012). This can be challenging for long-term care processes involving sensitive data and large care networks—see the section on "playing it safe" and the need-to-know principle of data access. Developing a "continuous care triage tool" for independent living, without thinking about how we should document and evaluate care processes, is unrealistic. Fostering the personal relationship between the caregiver and the care recipient, and taking advantage of the caregiver's tacit knowledge, can be efficient methods to avoid this kind of extitutionalization. But more research needs to be done in developing proper ICT support.

6.2 Support for caregiving tasks

Another difference we observed studying the two types of operators from EC and SP were the nature of the activities in which they were involved, and the knowledge and the skills that each group of operators needed. Although there is an overlap between the users who call EC and SP, EC operators are called upon only when there are medical reasons. SP operators, on the other hand, are involved in all the three types of care activities identified by e.g. Roberts and Mort (2009)—*monitoring*, *physical care*, and *social-emotional care*. According to Roberts and Mort, the act of monitoring has gradually become synonymous with automated forms of collecting data from the home environment, and has lost "*its human connotation which survives in terms such as 'watching' or 'checking'*." We observed in our study that the operators and the seniors were involved in a dialog of "watching" and "checking" through the technology. The operators asked the seniors to test their alarm system frequently by manually activating it. This led to the operators calling the seniors to check that everything was ok, which in turn led to a continuous dialog. One can argue that this dialog of "watching and checking" also provided social-emotional care to the seniors. Current call center technology—including the dashboard prototype developed by the participants—has no support for this form of informal dialog. In fact, the way health institutions evaluate call centers might result in this kind of social contact between the operator and the seniors disappear totally unless the value of maintaining such contact is documented and support for it is implemented in future tools[3]. As an example, the type of alarms mentioned above are often considered as "false alarms", to be avoided due to their perceived unnecessary costs.

The same argument applies to physical care –e.g. hygiene-related tasks. SP operators in our study had to pay frequent home visits due to the need for various kinds of physical care raised by the seniors. In addition, they mediated some of these needs to the homecare personnel visiting the seniors on a daily basis. The very nature of telecare makes it easy to dismiss physical care as something "out of scope" that has to do with bricks and mortar, and nothing to do with digital systems and services. This is also evident from our study. Even though their practice includes strong elements of physical care, it is interesting to see that the operators did not think physical care needed any representation in the support tools. This might be because SP operators do not perceive physical care as their responsibility. However, according to Roberts and Mort, physical care has a big impact on the perceived quality of care: "*physical care...is always emotional labour and has a profound impact on the ways in which the older person experiences their own home as intimate space.*" A care service that ignores physical care as out of scope might potentially lead to social isolation and neglected users. We believe rich representation of physical care in support tools—e.g. history of home visits and who visited the person, when the person took a shower, whether the person has taken his/her medicine—can provide great value to call center operators, and can help improve the continuity of care and the coordination of resources. However, ethical guidelines need to be developed in order to clarify the collection and use of such information.

6.3 Support for "technical caregiving"

As an extension of physical care, and as another type of care activity, we have seen that SP operators, as part of their daily activities, are continuously integrating the testing and maintenance of technological infrastructures at home. This is a new type of care activity, which requires a new type of skill. These technical activities are closely related to the daily operation of the technical infrastructure, it is the operators who have continuous overview of the health of these systems, and it is the operators who are first made aware of any technical problems. It is therefore natural that call center operators will continue to play a part in such testing and maintenance activities. Well-functioning technology, the availability of technical support, and

clearly defined maintenance roles are major success factor for telecare (May et al. 2011; Broens et al. 2007). Additionally, not observed in our study but in the study done by (Procter et al. 2014a), assistive technologies also necessitate support for a bricolage where off-the-shelf devices are altered and composed into personalized infrastructures. It is unclear how these technical activities will evolve in the future, and who will be responsible for them. We see however a central—coordinating—role for the call center operators in the future. The developed dashboard tool had some support for this type of technical maintenance tasks—e.g. access to sensor information at home—but the operators did not see this as a priority apparently because they consider this type of maintenance as exceptions and not part of their job.

6.4 Support for leading care networks

The patterns of coordination among the operators in our study are similar to those reported earlier in co-located teams, e.g. in (Faraj and Xiao 2006; Lee et al. 2012). The EC and SP operators are engaged in *expertise coordination practices* through the use of formalized tools and routines—e.g. triage, check lists and audit trails—while at the same time do a lot of *dialogic coordination* involving protocol breaking, workarounds, improvisation and joint sense making (Faraj and Xiao 2006). Operators possess high amounts of tacit and local knowledge. Interesting to note is also the leading role of the operators in emergency episodes involving multiple agencies. Taking on such leading coordinator roles is not reported in other studies of call center operators but surfaces as an important aspect of the coordination as observed in our study. Dialogic coordination is complicated due to the distributed nature of the team and the lack of ICT support. Future tools for call centers could make use of well-established CSCW concepts such as shared workspace awareness (Dourish and Bellotti 1992; Gross 2013) and common information spaces (Bannon and Bødker 1997) to support such coordination in a flexible way. However, we observe that there are already big challenges with respect to technical integration among the various tools that are used. When adding new features, a prime consideration should be integration with existing tools.

6.5 The resulting ICT tools

We based the discussion in the previous sections on our post-mortem analysis of what the participants said and did during the co-design process, compared to existing theory and related research. This analysis resulted in some implications for the design of ICT tools. So how do these implications compare to what the participants themselves actually designed? In this section we provide our reflection regarding the dashboard tool, which is the main tool to be used by both of the operator groups.

It is not difficult to recognize episodes as the main overarching theme in the dashboard tool. Episodes of care are the "main narrative" (Star 1999). Episodes occur as alarms or phone calls come in, and episodes are the work unit of the operators until they reach a decision on closure. The tool also supports some continuity. For instance, there is an informal comment field that the operators can use to write down incidents and things to remember across episodes. There is also a much more extensive and automated process –compare to earlier tools –for identifying the caller. The tool also implements some elements of context, such as access to sensors and assistive technology at home. However, the overall workflow, i.e. prioritizing an alarm to process, deciding on action to take, and closing the alarm, is organized around episodes. There are several possible explanations for this. One explanation is call center operators' familiarity with and history of using triage tools. Many examples of ICT-based triage tools exist in the market. The participants in our study knew about these tools. They wanted their tool to be "exactly like those".

We can find another explanation by looking into the existing incentives and expectations. The default way of measuring efficiency in a call center is counting the calls –and alarms –that operators close. It is also important to reduce waiting times. Continuous care, despite it being a highly desirable outcome for all forms of care, is difficult to measure and quantify. The political justification for all major healthcare reforms, including that of building a new and modern HW, is efficiency. Operators in our study were aware of such political issues.

Beside this main narrative of episodes, there is another aspect of the developed dashboard tool that is worth discussing. The dashboard tool, as the participants designed it, has limited support for the day-to-day caregiving tasks. This is particularly true for physical caregiving tasks. The tool supports access to sensors at home, which will potentially provide access to a richer physical context in the future. However, the operators cannot see the latest activities of the homecare personnel. They still need to call the homecare personnel –outside the tool –in order to coordinate activities. Access to homecare service is available in the tool as a "closure button" –at the same level as access to an ambulance. This is despite the fact that, as we have seen, SP operators continuously rely on homecare personnel in their caregiving tasks. A possible explanation for this can be found in the earlier discussions of "invisible work" in the CSCW literature (Star and Strauss 1999). Homecare tasks can be considered as a form of invisible work, work that is done by those who live at home and that is ideally invisible to those outside the home. Homecare tasks, when they are outsourced, are done by workers with low formal education. However, leaving out homecare tasks in the support tool might create a major obstacle to provide continuous care. As pointed out by Star: "*Where the object of systems design is to support all work, leaving out what are locally perceived as 'nonpeople' can mean a nonworking system*" (Star 1999).

We can find another explanation for leaving out homecare in the political justification for the HW. Originally, HW was devised to support so-called "unplanned" activities. All planned activities, such as regular home visits by homecare personnel, were not to be part of the HW. It has however existed a continuous discussion among HW leaders whether it is possible to make a distinction between these two types of activities. Currently a national set of guidelines are under development with the aim of defining and distinguishing unplanned activities. However, our view is that such divisions will be artificial and will further hamper the provision of continuous care. Seen from a client's perspective it is difficult to justify why one should distinguish between planned and unplanned care tasks.

6.5 The values and viewpoints held by the seniors

A limitation of our study is that it does not address the views of the senior clients of the studied call center. This is due to the initial co-design setting that we were involved in, and consequently the scope of the study that became limited to the conduct of the call center operators. Seniors hold different values that need to set the tone for successful implementation of call center services. In our earlier studies of assistive services in Trondheim we have uncovered noticeable value differences among caregivers and caretakers regarding personal emergency response systems (Dahl et al. 2015). For instance, while safety of the senior person was of prime importance to the care personnel, seniors themselves did not seem to agree that they were at any risk. Instead, issues such as form factor and aesthetics of the body-worn censors seemed to be of greater importance for them (important to mention that the study was done in residential care homes where health care personnel are always available). As another example, we know from other studies in Trondheim that senior clients appreciate having a single point-of-contact (preferably the same person) and a phone number to call at any time (Farshchian and Dahl 2016). This contrasts the view of the service providers who want to reduce the frequency and the length of phone calls. Some of these perspectives might have implications for our study and our conclusions. We also need to complement our study with other studies illustrating seniors' views on e.g. privacy, information transparency, and acceptance of technology at home.

7. Conclusions

Call centers are being implemented worldwide to provide elderly care. It is tempting to use available models and expertise from health call centers in this new domain. However, the needs of seniors living at home are different from those of people in need of immediate medical help. For instance, the very basic assumption that a senior will call a call center might be wrong. Seniors in general don't ask for help because they think they will inconvenience the health personnel (Bowes and McColgan 2012).

Our study shows that there are some fundamental differences—with respect to existing models—that need to be taken into account when designing new telecare services and technologies. While existing triage tools focus on acute diagnosis of otherwise healthy people, seniors living at home might have co-morbidity and chronic diseases, or have other needs than medical assistance. In general, aging at home is a rich collaborative and social activity that is currently not sufficiently captured in the communication between a call center and the person living at home. Political and administrative priorities, due to high pressure on healthcare systems, favor emergencies over preventive care (Abelsen et al. 2014). Long-term primary care has a different trajectory than clinical care. More research is needed on organizational models and ICT tools. Our study is a step in this direction. Our contribution is a case study that specifically illustrates the differences between conventional health call centers and the new telecare call centers, and some directions for the design of future ICT tools to support call center operators.

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9. Endnotes

[1] The other mode of operation is "outbound", used mainly to market and sell products to new customers, but also as a means to pro-actively maintaining an existing customer relationship.

[2] Typically in terms of calls per day, length of call, customer satisfaction barometers.

[3] In their study of day-to-day co-creation of care, Procter et al. (Procter et al. 2014a) propose a "Facebook for elderly care" as one technological approach.

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