

Pilot Design of a Survey Instrument for Assessment of Assistive ICT Initiatives

Judith Molka-Danielsen¹ and Carl Erik Moe²

¹ Molde University College, Molde, Norway

² University of Agder, Kristiansand, Norway

¹j.molka-danielsen@himolde.no

²Carl.E.Moe@uia.no

Abstract. In most parts of the Western world, we are seeing a growing population of elderly. Health factors can pose barriers to independent living for this population. Several municipality based projects are seeking ways to address the needs of this diverse citizen segment. Use of ICT in the home may allow for longer independent living for elderly. In prior research we proposed a framework for assessment of projects targeting the use of ICT for independent living for elderly. Additionally we recommended assessment criteria to account for environmental contextual factors and for Quality of Life factors among the elderly [1]. We briefly present this framework in this paper and extend this work by designing a survey instrument. We describe a pilot project and discuss how our survey instrument may be applied as part of the assessment of the project.

Keywords: assistive living, ICT, Quality of Life, wellness and safety technologies

1 Introduction

In light of a growing population of elderly, municipalities in the Nordic countries and in many other countries across the Western world are seeking ways of addressing the diverse needs of the segment. Many communities are funding programs that design and develop a variety of information communication technologies (ICT) intended to improve the Quality of Life (QoL) of these elderly citizens. The stakeholders in such programs are diverse and include the target elderly citizen population, their relatives, health and care workers, political entities and technology vendors. The latter group is often the most proactive in pointing out possible advantages of adoption of their ICT technology solutions. In the interest of avoiding an imbalanced assessment of such technologies, due to possible stakeholder bias, we suggested in [1] that present and future initiatives could benefit by the application of an evaluation framework that accounts for QoL factors as well as project specific contextual factors. This paper extends the former work by designing a survey

instrument for assessment of a pilot project for independent living for the elderly. Secondly we propose a strategy for the administration of the survey instrument.

2 Background Literature and Theory

The adoption of ICT technologies in the home, such as computers and Internet access, have achieved high rate of acceptance among the elderly in the Western world, including the Norwegian society. Over the last 6 years the proportion of people in Norway in the age group 65-74 that has used a PC and Internet on an almost daily basis, has more than doubled, in this age group 45% use a PC and 39% use Internet daily or nearly every day [2]. We expect this group will continue to be PC and Internet users as time goes by and they get older, hence we expect a high increase in net users among the elderly. Mobile devices with new and easy to use interfaces have also successfully penetrated the market of senior citizens [3]. Hence we can expect that senior citizens will be ready to adopt technology for assisted living to an increasing degree.

2.1 Challenges of elderly and choices of Assistive Technology

What are the challenges faced by elderly and what are the current choices? The challenges vary considerably [4], although a public report for the Norwegian Health ministry [5] suggests focusing on three issues; fall prevention and detection, communication technology and wander management systems (using geographic positioning systems or GPS technology). There are also other challenges that senior citizens living at home may face such as lack of nutrition, difficulties in managing opening doors, heating, communication with medical staff and family etc.

A SINTEF (the largest independent research organization in Scandinavia), project on assistive technologies for houses and apartments [6] reports a number of possibilities. These include smart homes with sensors for temperature, lights, opening doors, sensors monitoring movement and falls, systems for monitoring and advising on issues related to health and diseases (e.g. diabetes and malnutrition) and GPS's for people with cognitive dissonance (dementia). Both this report and the NOU 2011:11 base their division on the Center for Aging Services Technologies' work [7], see Table 1 for an overview.

One of the challenges is to select a portfolio of equipment that elderly can get access to as the need for assistive technology occurs and possibly gradually increases [8]. There are several challenges related to this including issues concerning financing, standardization and integration, implementation in a health care setting and keeping track of technologies and their application. There is very little prior research on effects of assistive technology for elderly in need of care, while living alone, however we will briefly refer to some work in this area.

A thorough literature review of 89 trials including 97,894 people found that complex interventions can help elderly people to continue living at home, largely through prevention of the need for nursing-home care, and can help to reduce the rate

of falls [4]. Their results indicate substantial variation in needs, the format of care, involvement of health-care professionals, and site of care provision and intensity.

A study of 18 elders with ambient intelligent system installed in their dwellings in Holland, found that the new technologies contributed to a greater sense of safety and security at home, feelings that were shared by the relatives [9]. However the study does not take into account many of the Quality of Life domains [10] such as emotional wellbeing, personal development, self-determination and social inclusion.

Table 1. Overview of categories of aging services technologies.

Category	Technology type
Safety technologies	<ul style="list-style-type: none"> - Wander management systems (Targeted for dementia that may forget their way back home) - Mobility aids - Fall detection and prevention technologies - Stove user detectors - Smoke and temperature monitor - Door locks
Health and wellness technologies	<ul style="list-style-type: none"> - Wellness monitoring technologies (Sensor based technologies, designed mainly for self-managed fitness/wellness applications) - Telemedicine and telehealth - Medication compliance technologies (Monitoring, reminding and dispensing patients of their medication) - Cognitions technologies (for stimulation and entertainment, assessment and reminding)
Social connectedness technologies	<ul style="list-style-type: none"> - Phones, cell-phones and video-phones - Internet-connections with easy-to-use interface with e-mail etc.

In a systematic review of studies of interventions to enhance the Quality of Life of older people in residential long-term care, 35 articles are assessed on issues such as study design, quality of the studies, measures of QoL and effects on QoL [11]. The study finds that most of the papers are low on methodological quality, and the instruments used to measure QoL were diverse. The interventions were often rather limited, whereas QoL is a multidimensional concept, which may explain the lack of a systematic effect on QoL across the studies.

2.2 Defining Quality of Life

Quality of Life (QoL) is an umbrella conceptualization that refers to wellbeing across multiple domains. QoL conceptualization in principle has both subjective and objective components, is based on individual needs and is composed of multidimensional constructs influenced by relationship and environmental factors [10]. While an in depth review of QoL domain cannot be presented in this paper, former research has informed our framework. Briefly, no consensus exists on how

QoL should be defined. Within each of the identified domains, there can be a number of factors that contribute to the evaluation. One example is the domain of emotional wellbeing. It may include a number of contextual factors, among these safety, independence, self-mastery, freedom from stress and satisfaction [12][13][14][10][15].

A part of our QoL framework is presented in Table 2 [1] (Moe & Molka-Danielsen, 2012). We have not included macro-level factors from our framework in this paper and refer readers to the aforementioned study. The macro-level factors are of broader environmental scope (such as community level) and as such are usually outside the control of the project management, and so are not addressed in the proposed survey instrument.

The analysis framework was based on the core domains of Schallock and Alonso [10]. According to Agee and Freedman [12, p. 1781]; “QoL measures can be objective measures of goal attainment or subjective perceptions of users.” Researchers who examine the use of assistive technologies have predominantly used subjective measures in defining the success of assistive devices [10]. We have included both subjective measures in our QoL framework.

Table 2. QoL Assessment Framework for Assistive Technologies for Independent Living.

QoL Domains	Micro-level individual factors	Meso-level (program and ICT support) contextual factors
Emotional Wellbeing	Contentment, satisfaction, mental-stress, self-concept, happiness, trust	Safety support integrated, freedom from self-monitoring
Interpersonal Relations	Friendships	Interactions, social support
Material Wellbeing	Standard of living (alone, assisted at home, care center), income, possessions	Housing standard (old, new), existing ICT supports
Personal Development	Living skills, personal competence	Rehabilitation program, self-mastery, augmentative technology
Physical Wellbeing	Health status, nutrition status, mobility	Sensors to monitor home environment, personal movement, and nutrition levels
Self Determination	Autonomy, self-direction, personal control, preferences, choice	Personal controls, planning controls for the home environment
Social Inclusion	Access and participation in communities of friends, family, supporters	ICT supports for community access and participation, status checks,

		integration of ICT within home
Rights	Privacy, personal freedom, sense of dignity	ICT supports self-control, responsibility, protection of individual rights

Note. This table is based on Table 4 in Moe & Molka-Danielsen, [1].

The stakeholder groups are described in the next Section 3 along with a description of the pilot project.

3 Lister Region: Independent Living Projects

Most of the Lister region has been running projects on assistive technology since 2011. The Lister region is a network of 6 collaborating municipalities on the south-west coast of Norway. These are in many ways typical Norwegian communities, the biggest municipalities having a population of close to 9 000. The municipalities have a thriving collaboration on several issues, including health services for patients that are sent home after hospitalization.

The project “Longer in own life” runs from 2011 to 2015 and has the overall goal of assisting in independent living through use of smart homes or technology in individual homes. This project has served as a demonstrator of assistive technology and two demonstrator apartments are up and running. One is a new apartment tailored to the need of elderly, whereas the other is an existing apartment that has been in use for years. The new apartment opened for more flexibility as it could be wired using different technologies; the older one is based on wireless technology.

The technologies installed are mostly fairly basic and include a system for controlling lights, heating and oven so that the inhabitant can make sure that everything is switched off by pressing one switch when leaving the apartment (or while in bed). They also include items like an alarm on the refrigerator so that medical staff or relatives can see if the inhabitant has used the refrigerator and remembered to eat. Medical dispensers to help control the intake of medicine are displayed, and there are Internet connections with easy to use interface for communication.

During fall 2012 assistive technology is implemented in 7 rooms with technology which is tailored to the individual patients in one nursing home. Implementations in two other nursing homes are planned for spring. The municipalities adopted a menu based system where they select the appropriate services for each patient from options including fall detection, wandering, fire alarm, light management and two way communications between patients and staff. One of the implementations will be in a rehabilitation department with 9 patients, whereas in the other will be a department with 30 regular patients. Our survey instrument will be tested in these 2 projects.

4 Methodology for Survey Design and Administration

Our literature review provides background and informs our survey design. The literature search in the prior sections was conducted in Google Scholar and Science Direct, using the keywords quality of life assessment and assistive living / independent living. The survey design is based on the previously developed QoL framework and is informed by its categories (presented in table 2 of this paper), that adopts a multi- part design focusing on micro- and meso- level factors.

The survey questions make reference to the WHO (1996) survey instrument [16]. The objective of the survey is that a micro-level inquiry of elderly users (recipients of assistive ICT) will reveal the elderly recipients' individual attitudes of their wellbeing. The second part of the survey will inquire among a larger group of stakeholders to include elderly living alone, relatives and care workers. Questions chosen should be based on the contextual factors of systems and technology of the project. The basic structure of the questions is described in Section 5. The questions will be modified for each project context. We propose the project leader can later look for a correlation between individual assessment and contextual.

The methodology for the selection of the basic “types” of questions is as based on the following rationale.

- Questions from the WHO-questionnaire that were selected to address the QoL domains as listed in Table 2. The WHO questions that were selected are highlighted in “grey” in the Table in the Appendix. Other questions were left out of our survey design because we feel they address a broader assessment of QoL that goes beyond the expected impact of the ICT projects. For example, question 12 in the Appendix “have you enough money to meet your needs?” is a question about financial resources in the environmental domain. This would not be a relevant question for assessment of the ICT projects where resources are already given out freely for the project.
- The WHO-questions were categorized into the framework categories on the basis of how well they were a match for the QoL category. For example, QoL category “emotional wellbeing” has the factors of “contentment, satisfaction, mental-stress, self-concept, happiness, and trust.” We found the WHO questions G1 (how do you rate your quality of life?) and 5 (how much do you enjoy life?) and 6 (to what extent do you feel your life to be meaningful?) under the psychological domain also addressed the issues of contentment, satisfaction, and happiness.
- However, the WHO-questions did not address all of the factors within our QoL framework. Again, looking at the example in the prior bullet point, the questions did not address issues of mental-stress, self-concept, and trust. We then developed additional questions to address individual factors and contextual factors that were not addressed by the WHO survey.
- We found the WHO survey in particular only addressed some of the individual factors, and did not address contextual factors. Therefore, most of our additional questions fall under the category of contextual factors.
- One limitation of our methodology of developing a new survey instrument is that the validated calculation instructions on the WHO survey could (if adopted) have been used to get validated results. However, as we explained

above, the WHO survey does not cover all of the individual factors and covers none of the contextually specific factors. Also, we discuss the administration of the survey through interview in later sections. It follows; we suggest a qualitative analysis of the descriptive narrative will give more meaningful evaluation.

The next Section 5 presents the QoL survey instrument design and recommendations for administration. We suggest a two part survey is needed. Part one should address the micro-level factors of Table 2. Part two should address the meso-level factors of Table 2. The authors claim that the macro-level factors are largely outside the control of such projects, and are not addressed in the proposed survey instrument.

5 Proposal for the Survey Instrument

The World Health Organization has developed a QoL assessment instrument that focuses on the individual wellbeing beyond simple aspects of health care to provide more holistic feedback of health and health care. They define QoL as:

Quality of life is defined as individuals' perceptions of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns. [16, p. 5]

The WHO assessment instrument denotes four domains: 1. Physical health, 2. Psychological, 3. Social relationships, and 4. Environment. Two questions are general questions of wellbeing (Q1 & Q2), questions 3-26 produce a scoring within domains. The 26 questions are provided in Appendix 1 with assignments of the domain of the question. The questions numbers are denoted in parenthesis in the second column of Table 3. The WHO QoL assessment instrument (1996) has helped to inform the formation of our survey instrument. Our questions for Part 1 and Part 2 of our survey are listed in columns 2 and 3 in Table 3.

Table 3. QoL Survey Instrument: Individual and Contextual Factors.

QoL Domains	Survey Part 1 Individual factors	Survey Part 2 Contextual factors
Emotional Wellbeing	Contentment, satisfaction, mental-stress, self-concept, happiness, trust	Safety support integrated, freedom from self-monitoring
	<ul style="list-style-type: none"> • WHO (5, 6) • Do you feel afraid when alone? • WHO (G1) 	<ul style="list-style-type: none"> • Do you trust that you can call for help and be heard when needed? • Does use of monitoring technology in your home help you enjoy life? • Does use of technology in your home make life more meaningful?

Interpersonal Relations	Friendships <ul style="list-style-type: none"> • WHO (20) • WHO (22) with family, with support staff? 	Interactions, social support <ul style="list-style-type: none"> • Do you have daily individual communication through technology with your friends, family, support staff? • Does communication technology help you in your personal relations
Material Wellbeing	Standard of living (alone, assisted at home, care center), income, possessions <ul style="list-style-type: none"> • WHO (23, 24) 	Housing standard (old, new), existing ICT supports <ul style="list-style-type: none"> • How satisfied are you with your access to health services through ICT?
Personal Development	Living skills, personal competence <ul style="list-style-type: none"> • WHO (13, 14) 	Rehabilitation program, self-mastery, augmentative technology <ul style="list-style-type: none"> • How available is technology for access to your day-to-day information technology needs? • Does ICT give you more opportunity for leisure activity?
Physical Wellbeing	Health status, nutrition status, mobility <ul style="list-style-type: none"> • WHO(G2, 3, 4) 	Sensors to monitor home environment, personal movement, and nutrition levels <ul style="list-style-type: none"> • Do monitors in the patient's home help you to determine if the patient is eating well? • Does technology help you avoid disturbances or worries in your sleep?
Self Determination	Autonomy, self-direction, personal control, preferences, choice <ul style="list-style-type: none"> • WHO(3, 15, 17) 	Personal controls, planning controls for the home environment <ul style="list-style-type: none"> • Does welfare technology help you to get around in your home? • Does welfare technology help you to perform your daily living activities (cooking, cleaning, personal hygiene)?

Social Inclusion	Access and participation in communities of friends, family, supporters	ICT supports for community access and participation, status checks, integration of ICT within home
	<ul style="list-style-type: none"> • (WHO: 20, 22) • How satisfied are you with your access to your network of friends, family, support staff? 	<ul style="list-style-type: none"> • Do you use Internet based social media tools (such as e-mail, Facebook or Skype) to have access to your network of friends and family and support staff? • If so, how often do you use social media tools? • Does it help?
Rights	Privacy, personal freedom, sense of dignity	ICT supports self-control, responsibility, protection of individual rights
	<ul style="list-style-type: none"> • (WHO: 8, 13) 	<ul style="list-style-type: none"> • Does welfare technology help you to get information on your rights? • Do you feel welfare technology is invasion of your privacy • Does welfare technology improve your sense of personal dignity? Or does it harm it?

5.2 Administration of the Survey Instrument

This section suggests the usage method for the survey instrument. We propose administration of the survey design based on non-probability sampling techniques as the population of elderly in the pilot project is a specific cluster or group of persons living in a nursing home. This group may not be representative of a broader elderly population. Secondly, some persons within the pilot project may not be available as respondents due to health related reasons. Lastly, time and resources for collection of the samples will limit the number of persons that can be asked to participate [17]. A limitation of non-probability sampling is that there is an assumption that there is an even distribution of characteristics within the population, but one cannot verify that a general population is represented.

The sample will be collected through purposive sampling technique through expert choice of those who will administer and run the survey instrument. In purposive sampling judgment is used by the experts, who will select respondents they believe possess the necessary attributes of the target segment. In this study our expert is the local project manager who will select respondents from three stakeholder groups including: elderly persons living in the experimental units, relatives of persons living in experimental units, and professional staff working in the nursing homes. The

purpose of our sampling will be to provide descriptive information on the attitudes of the stakeholder groups.

The survey instrument in the form of semi-structured questionnaires should be administered as face-to-face interviews in the native language of the elderly patient. The patients, relatives and health care workers need to be informed on the motivation for survey, terms and on some of the applications of the technology. More specifically, the interview participants will need to be informed during the interview on the meaning of certain terminology. For example, what is “ICT”, “monitoring technology”, and “welfare technology”. These words will be made clear with examples and by pointing to the technology in the homes in the case study at the beginning of the interview session. In the survey questions in Table 3, these terminologies are just “markers” to be filled in with context specific meanings. So the actual “list of questions” will be refined for each project.

These project specific terminology needs to be explained, to help participants reflect on what they know and use. Caution is recommended in the interview process as there is a risk of imposing a bias towards technology determinism on the respondents, they might feel they are expected to tell a story of assistive technology improving their quality of life. In summary, the questionnaires need to cover the same issues or domains, but we will need to tailor them to the stakeholder groups, patients, relatives and support staff.

Finally, this paper does not assess an administration of the survey instrument in an actual project. This is suggested as a next step in our research. The University of Agder is associated with the prior mentioned Lister region project as an evaluator of the project. The authors therefore intend to pilot the survey instrument in the autumn 2013.

6 Concluding Remarks

This article has presented the design of a survey instrument for assessment of a project using assistive living technology for independent living. An important approach to the design of the instrument is consideration of the stakeholders. We see three stakeholder groups as contributing to the assessment; patients, relatives and health and care workers. The questions were informed by the WHO survey instrument. Our survey instrument consists of two parts; one part for individual factors and the second part to address contextual factors such as the use of ICT and welfare technology. In application of the survey, we expect will shed light on the extent that contextual factors affect the individual factors and the overall assessment by the elderly participants. We have suggested that the survey instrument is administered through interviews and should be grounded in the setting with each patient and with other stakeholders. The next step will include the need to develop three basic versions of questionnaires to be tailored to each of the primary stakeholder groups that is: patients, relatives and support staff. In administration of pilot interviews, we will hope to gain feedback from the project leaders of the Lister project based on their experience with health service provision on the appropriateness of the questions to each target group. Specifically, we aim to pilot the survey

instrument with 1-2 recipients from each of the primary stakeholder groups within 2013.

The goal the survey instrument is to contribute to a better understanding of benefits that assistive technologies can bring to the elderly and of the elderly own assessment of how introduced technologies have impact on their Quality of Life. The design of an appropriate survey instrument to capture this information is an important first step in the evaluation process

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Appendix: World Health Organization (WHO) Quality of Life (QoL) Assessment Questions 1996

WHO* Domain	Question
G1	1. How would you rate your quality of life?
G2	2. How satisfied are you with your health?
1	3. To what extent do you feel that physical pain prevents you from doing what you need to do?
1	4. How much do you need any medical treatment to function in your daily life?
2	5. How much do you enjoy life?
2	6. To what extent do you feel your life to be meaningful?
2	7. How well are you able to concentrate?
4	8. How safe do you feel in your daily life?
4	9. How healthy is your physical environment?
1	10. Do you have enough energy for everyday life?
2	11. Are you able to accept your bodily appearance?
4	12. Have you enough money to meet your needs?
4	13. How available to you is the information that you need in your day-to-day life?
4	14. To what extent do you have the opportunity for leisure activities?
1	15. How well are you able to get around?
1	16. How satisfied are you with your sleep?
1	17. How satisfied are you with your ability to perform your daily living activities?
1	18. How satisfied are you with your capacity for work?
2	19. How satisfied are you with yourself?
3	20. How satisfied are you with your personal relationships?
3	21. How satisfied are you with your sex life?
3	22. How satisfied are you with the support you get from your friends?
4	23. How satisfied are you with the conditions of your living place?
4	24. How satisfied are you with your access to health services?
4	25. How satisfied are you with your transport?
2	26. How often do you have negative feelings such as blue mood, despair, anxiety, depression?

*WHO domains are: 1. Physical Health – pain, discomfort, sleep and rest, dependence on medical aids; -mobility; 2. Psychological – thinking, concentration; positive vs. negative feelings, self-esteem; 3. Social Relationships – personal; - social inclusion; 4. Environment – financial resources; opportunities for new skills; participation in opportunities. [16]