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# Preparing for successful implementation of assistive living technology in primary elderly care services; what are the key contextual factors? A case study from Norway."

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**Objective:** To identify contextual factors at different organizational levels to guide the implementation of an assistive living technology intervention in Norwegian primary home care that would prevent inappropriate hospital admissions.

Design: A single embedded case study design was carried out in an urban municipality in Western Norway, to get an overview of key contextual factors from the municipality's perspective.

**Data collection and analysis:** The data collection was based on a triangulation of methods involving document analysis, semi-structured individual interviews, and focus group interviews to get a broad insight when preparing for an intervention. Data were collected on three levels of the healthcare system; 1) national policy documents and regulations (macro) 2) five individual interviews with senior managers and municipal strategy documents (meso) and 3) two focus group interviews with nurses and nurse managers in direct patient care (micro). The MUSIQ framework was used as a guide in the data analysis.

**Results:** The main contextual factors identified were external motivators and project sponsorship (macro level), leadership, workforce focus and maturity (meso level), and motivation to change and maturity (micro level).

**Conclusions:** The findings underpin the premise that people and technologies are linked in a dynamic health care system made up of multiple interacting stakeholders. Aligning interests across multiple stakeholders remains a challenge when planning for an assistive living technology intervention in primary care. Integration of technological solutions into health care services was more a vision than a reality because of a low level of organizational readiness in the municipality.

**Key words:** Health services research, qualitative research, health informatics

**Strengths and limitations of this study:**

- Applies a multilevel approach to acknowledge the organizational, social, political and policy context in which assisted living technologies are planned to be implemented.

- Provides rich, qualitative data from three levels of the healthcare system; 1) national policy documents and regulations (macro) 2) individual interviews with senior managers and municipal strategy documents (meso) and 3) focus group interviews with nurses and nurse managers in direct patient care (micro).
- The use of the MUSIQ framework in the data analysis provides empirical content, which can help operationalize factors in the framework.
- The intended user's perspective of a technological solution is not integrated in the study.
- Does not formulate a solution regarding implementation of assistive living technologies.

## INTRODUCTION

Remote monitoring for clinical biomarkers, alarms, sensors, and reminders [1] have been promoted to deliver improved primary health care services by addressing many of the challenges faced by an ageing society.[2-4] Older persons are substantial consumers of both hospital care and primary care services,[5 6] and continuous discussion questions if a proportion of the hospital admissions could have been prevented in primary treatment and care.[7 8] Some of the admissions are considered to be inappropriate,[9] and in this context, the use of assistive living technologies has been heralded as a solution[2-4].

Despite its promise to improve primary health care, the success rate for implementing assistive living technologies has been low.[10-13] There is a general interest in the role of context in understanding variaton of success in quality improvement (QI), but this focus is lacking in research regarding implementation of assistive living technolgies in primary care.[13-16] Little evidence exists for approaches to improve the implementation process of assistive technology, and studies to date have been limited in their design. [13 15 17 18] Few studies have used robust methodology to assess how contextual factors, such as external environment, organizational issues, technological infrastructure, and human actions, interact with each other to influence the implementation process.[16 19 20]

Exploration is needed of the wider context in which the technologies would operate, and how the technology could be integrated into a complex health care system.[4 20 21] In order to increase the likelihood of successful implementation, it is crucial to adress elements at the

micro level (human decisions and actions ), as well as the wider context in the meso level (the organization in which the humans interact), and at the macro level (national policy on assistive living technologies). Based on the notion that elements at the micro level can both influence and be influenced by elements at the meso level and macro level, more knowledge is needed for where to direct efforts and resources, in order for professionals and organizations to prepare a more optimized implementation of assistive living technologies in primary care.[20 22 23]

## CONCEPTUAL FRAMEWORK

In the literature, diverse QI frameworks (e.g., Model for Improvement[24], PARIHS[25], ARCHIE[4]) and implementation models (e.g., PRIME[26]) exist. In this study we apply the Model for Understanding Success in Quality (MUSIQ),[27] as it is in the forefront of incorporating contextual factors in QI processes. Kaplan *et al.* identified a need for a conceptual model that builds on existing implementation frameworks, and developed MUSIQ using a systematic review[16] and structured input from a diverse panel of QI experts.[27 28] The MUSIQ framework[27] as described in figure 1, is a comprehensive conceptual framework for approaching and studying an implementation process in health care. It offers an opportunity to formally evaluate the contextual factors involved in implementation of new measures within health care, and therefore is chosen as an appropriate and helpful framework to inform the planning phase of an assistive technology intervention to prevent inappropriate hospital admissions for older adults receiving home based care.

*Figure 1 about here MUSIQ* 

MUSIQ shows how context influences the success of individual QI projects and hypothesizes that the implementation of a system, the process changes, and the associated outcome improvements are influenced directly by microsystem and QI team factors, which are interdependent and mutually reinforcing. The identified contextual factors are organized based on the level of the healthcare system in which they are believed to operate, including the micro level, the organizational or meso level, and the external environmental or macro

level. Factors operating within the macro level are external incentives, such as new national policy documents or sponsored projects. At the organizational level, QI leadership (senior management) directly influences leadership at the micro level. For example, external motivators can put pressure on senior management in an organization to support a particular QI project. This could then lead to support and training for health care personnel involved in the particular QI project, which in turn will increase the likelihood of successful implementation of the QI project.

The aim of this study was to identify contextual factors at the macro, meso, and micro levels to guide the implementation of an assistive living technology intervention in Norwegian primary home care that would prevent inappropriate hospital admissions. To achieve this aim, specific objectives were to increase knowledge about:

1. Policy makers' view of the implementation of assistive living technology in primary care.
2. Primary care organizations' and management's perspectives regarding the implementation of assistive living technologies.
3. Health care personnel's perspective regarding the uptake and use of assistive living technologies.

## METHODS

### Setting

The study was carried out in an urban municipality in Western Norway, which included 1600 elderly recipients of home-based care. The municipality was in the process of integrating assistive living technologies in primary care during the next few years,[29] and was involved in the national programme for telehealth, together with 31 of Norway's 428 municipalities.

### Design

A single embedded case study design[30] was employed to get an overview of key contextual factors from the municipality's perspective, thus getting a better understanding of which factors could be targeted when planning an assistive living technology intervention in

primary care. The case was defined as the municipality. The embedded design included macro, (policy), meso, (organization) and micro (clinical team in homecare) levels in the data collection and analysis.

**Data collection**

The data collection was based on a triangulation of methods involving document analysis, semi-structured individual interviews, and focus group interviews to get a broad insight when preparing for an intervention.[31] Data were collected on three levels of the healthcare system; 1) national policy documents and regulations (macro) 2) individual interviews with senior managers and municipal strategy documents (meso) and 3) focus group interviews with nurses and nurse managers in direct patient care (micro). Informants were chosen based on purposeful sampling [32], seeking informants who were most able to inform us on the research question. An overview of data material is depicted in table 1.

Table 1: Data material:

| **System level** | **Data** | |
|---|---|---|
| Macro level | Documents : 6 (national policy documents) | ONR 2011:11[33], Report No. 9 (2012-2013) to the Storting;[34] Report No. 10 (2012-2013) to the Storting;[35] Report No. 29 (2012-2013) to the Storting,[36] Report No 11 (2014-2015) to the Storting.[37] Care Plan 2020[38] |
| Meso level | Interviews: 5 | Assistant director, project manager, adviser in municipal administration, head of |

| | | |
|---|---|---|
| | | health and welfare department, head of home-based care |
| | Documents: 2 | Municipal strategy plan for implementing assistive living technologies, Report on use of resources in municipal health- and care services |
| Micro level | Focus group interviews : 2 (*n=12*) | 6 informants in each group; nurses in direct patient care and nurse managers |

1) Macro-level data collection: Acquisition of documents

The data collection at the macro level involved acquisition of national policy documents (e.g., national care plan and whitepapers) developed by the Ministry of Health and Care Services.[33-38] These documents are referred to as "external environment" in the MUSIC framework.[28] All documents are publicly available on the Internet (https://www.regjeringen.no/en/find-document/id2000006/?ownerid=421).

2) Meso-level data collection: Semi-structured interviews and acquisition of documents

Five individual semi-structured interviews were conducted with senior managers in primary care. Individual interviews were employed to ensure a more in-depth understanding of the leaders' roles in the implementation of assistive living technologies in elderly primary care. Recruitment was initiated through the study's working group members, by asking them for a recommendation as to who could best explicate the aspects of interest. All of the informants asked to participate accepted. The interviews were conducted by the same person (MTG) for consistency. A semi - structured interview guide was developed based on MUSIQ, focusing on organizational structures and processes for managing quality, and the leader's role in QI

work. The interviews were audiotaped and transcribed verbatim. The municipality's strategic plan for implementing assistive living technologies,[29] and a report on the use of resources in municipal health and care services[39] were included to provide additional perspectives about key issues, and to serve as a supplementary source for understanding discrepancies among informants[40].

3) Micro-level data collection: Focus group interviews

Two focus group interviews were conducted (*n=12*) in 2014. Maximum variation sampling[32] was employed to identify a sample of health care professionals who represented different lines of work at the micro level. Informants were either nurses involved in direct patient care or nursing managers who administered care services for the elderly. Participants were recruited through administrative personnel in the municipality, who were otherwise not involved in this study. A thematic interview guide was developed for the purpose of exploring aspects related to implementation of assistive living technologies. Focus group interviews were employed so that participants could discuss perceptions, opinions and thoughts related to the abovementioned topics[41]. The interviews were led by a moderator (MTG) to ensure rich and relevant data[42]. A co-moderator made notes on observations and impressions during the interviews. Interviews were audiotaped and transcribed verbatim.

**Data Analysis**

The MUSIQ framework was used as a guide in the data analysis, by providing a priori themes in advance of the analysis process. This is described by Crabtree & Miller as a template organizing style.[31] Three data sources were analyzed ; at the macro level, national policy documents;[43] at the meso level, key documents from the municipality and transcripts from individual interviews; and at the micro level, transcripts from focus group interviews. We read meso– and micro-level transcripts repeatedly to gain familiarity, and then analyzed all data material, using the MUSIQ theoretical framework. The complete analysis process of organizing and connecting involved (i)Identification of segments in the interview, related to the contextual factors described in the MUSIQ framework; (ii) Sorting segments to get all similar text in one place; (iii) Reading the segments and making the connections by

"displaying" the template sorted text.[31] Table 2 illustrates the analytical process. To ensure trustworthiness in the analysis, analyst triangulation and member checks were applied.[32 44 45]

Table 2: Data analysis process:

| | **Data source** | | **Findings** | **Factors in MUSIQ** |
|---|---|---|---|---|
| Macro level | Care plan 2020 | «Main aim in the National program for development and implementation of assistive living technologies is that assistive living technologies are integrated in primary care services."[38] | Governmental expectations related to implementation of assistive living technologies, as an integrated part of municipal services | External motivator |
| Meso level | Head of health and social welfare departmen t | "I don't quite know how, and this is probably the big challenge; how will the municipal build a system concerning this?" | Organization is still immature | Maturity |
| Micro level | Nurse, focus group 2 | "I think that Skype could be a tool between accident and emergencies department, general practitioners and home-based care. One thing is to describe it over the phone, it's completely different to show how the situation really is; we could provide blood pressure, pulse, $O_2$ saturation and such…" | Healthcare professionals motivated to use assistive living technologies in daily care | Motivation to change |

**Ethical approval**

This project has been approved by the Norwegian Data Protection Authority (Approval ref# 21/2013).

**RESULTS**

The main contextual factors identified in this study were external motivators and project sponsorship (macro level), leadership, workforce focus and maturity (meso level), and motivation to change and maturity (micro level). The results are depicted in figure 2.

Figure 2: Results organized on different levels:

*Figure 2 about here*

**Macro level**

Document analysis of national policy documents showed that external motivators and project sponsorship were the main contextual factors at the macro level. Policy documents demonstrated wide-ranging governmental expectation at the macro level for integration of telehealth /telecare in the care services by 2020: [38]

> *"The National programme for development and implementation of assistive living technologies main objective is that assistive living technologies are integrated in primary care services."*

In this, it was demonstrated that the external environment, represented by several reports to the Parliament, was an incentive for leaders in the municipality to translate the national targets to local initiatives, by being an external motivator. Furthermore, the document analysis showed that the Directorate of Health (DoH) exercised a role as project sponsor, as it provided funding for assistive living technology projects led by the municipality. For example, the municipality had a project through the National programme, involving the transition of analogue personal alarm systems to digital solutions, which was funded by the DoH. Summed up, the identified factors – external motivator and project sponsorship at the macro level – represented expectations from outside entities that guided senior leaders in defining a local mission and vision for the municipality.

**Meso level**

QI leadership and maturity were the two main factors identified at the meso level. In the interview material, it became evident that the leaders in the municipality had to align the local QI work to address the national priorities and focus areas. Thus, the identified contextual factors at the macro level functioned as incentives for the municipality to focus on the uptake and use of assistive living technologies. One senior leader expressed that,

> *"We are part of the National programme, which focuses on safety alarms; therefore, we have two projects concerning safety. First and foremost we must prioritize this work. The national directions are clear about which activities the municipalities should prioritize."*
>
> Project manager

In terms of leadership, the senior leaders regarded it as their responsibility to be familiar with and committed to ongoing projects involving the use of assistive living technologies. Furthermore, leadership emerged also as a factor in the interview material by various expressions about how QI work was of great importance in the municipality. The assistant director made it clear that anchoring of projects was a necessity for ongoing projects, and that there was a system for QI work in the municipality:

> *"It's my responsibility to attain goals and measures which are defined in the strategy, and to follow up on all the ongoing projects. It must be anchored in the management – we know that for everything we do!"*
>
> Assistant director

> *"We've had focus on QI since we got re-organized, arranging semi-annual dialogue gatherings in a quality network, where the employees in the health and care districts can give input on how to succeed."*
>
> Assistant director

In fact, not only the leaders employed by the municipality, but also the local politicians showed a dedicated focus on assistive living technologies. This was exemplified by the

aforementioned municipal strategic plan for implementation of assistive technologies. The plan was politically approved, and laid out the municipality's goals for the use of such technologies[29]. Document analysis of the strategic plan identified a clear statement about integration of assistive living technologies through projects involving relevant technology. However, nothing explicit regarding leadership was identified through document analysis of the plan, but leadership was implicit when organizational issues were described.

Data infrastructure, resource availability and QI workforce focus were contextual factors that emerged in meso-level interviews. These factors were an expression for organizational readiness, and tell us something about an organization's maturity. Maturity – or the lack of maturity – emerged as a key contextual factor at the meso level. Findings from individual interviews addressed several concerns about whether the municipality was ready to actually implement assistive living technologies. One informant expressed such a concern:

> *"We have actively recruited participants in the project related to personal alarm systems, but that raises a lot of questions: Does the municipality want to take on more tasks? Who will provide service functions related to this? What will it cost…? There are ethical issues…I wish more of this was clarified before we started…"*
>
> Head of health and social welfare department

Maturity regarding municipal data infrastructure was also addressed in the interview material. It was still unclear if and how the municipality was prepared for the integration of assistive living technologies in the care services:

> *"I don't quite know how, and this is probably the big challenge; how will the municipality build a system concerning this? Today we have a system, and a dedicated QI-team, perhaps it will be IT… but I think it has to be part of our system."*
>
> Head of health and social welfare department

Document analysis of the municipal strategic plan identified challenges related to implementation and integration. The challenges were related directly to the lack of guidelines from national authorities regarding financial issues, standardization of technological platforms / infrastructure / cyber security, legal issues, organizational aspects and ethical considerations[29]:

*"…financing is still undetermined. Several prerequisites must be clarified in order for the municipality to use assistive living technologies. Issues concerning legislation, ethics, cyber security, technology requirements and safe operations need to be addressed."*

These challenges were also an expression for the lack of organizational maturity, thus maturity emerged as a key factor at the meso level regarding both organizational readiness, data infrastructure and challenges related to the lack of guidelines from national authorities.

**Micro level**

At the micro level, motivation to change and maturity were the two main contextual factors that emerged from the focus group interviews. Motivation to change was identified in both focus group interviews, where the informants talked about the potential benefits that could arise from using assistive living technologies:

*"We would like to have this (assistive living technologies)! (Laughter and talking) …we require equipment to do INR (International Normalized Ratio = blood test for regulating anticoagulation treatment), bladder scan, oxygen saturation…and CrP" (C-reactive Protein = blood test indicating infections (laughter from several).*

Several nurses, focus group 1

*"I think that Skype could be a tool between accident and emergencies department, general practitioners and home-based care. One thing is to describe it over the phone, it's completely different to show how the situation really is; we could provide blood pressure, pulse, $O_2$ saturation and such…"*

Nurse, focus group 2

Analysis of the interviews revealed that healthcare professionals were motivated to use assistive living technologies in daily care, provided there was a practical benefit for it. However, the informants did not address leadership as a focal point when asked what it would take to integrate assistive living technologies in the care services. Leadership did, however, emerge as a factor, but related to a lack of trust in the local leader's impact on decision-making, with respect to the uptake of assistive living technologies:

> *"I don't think the local leaders have a say in this. It is the municipality's administration who writes the budget. I believe that they decide which tools to use. If they decide we should have tablets, then that would be implemented in all districts."*
>
> Nurse, focus group 2

All in all, the results showed that issues concerning implementation and organizational factors related to the integration of assistive living technologies in home-based care were addressed only to a small degree. The main finding at the micro level was that the technological solutions had to function properly in the day-to-day work. They described experiences with the opposite, and that dysfunctional technology was discouraging and frustrating in their line of duty. Maturity was also a key finding at the micro level. For example, the lack of data infrastructure was regarded as a hindrance for successful integration:

> *"In the rest of Europe, they have a standard for everything, and they are able to integrate things much more easily. Here, each GP have their own computer system, and each municipality has their own computer system…"*
>
> Adviser

The municipality lacked a sophisticated enough data infrastructure to be ready for integration of assistive living technologies in the care services.

## DISCUSSION

Based on document analysis and interviews with both leaders and health care personnel, this study identified several of the contextual factors in the MUSIQ framework. More specifically, the study revealed explicit expectations from policy makers at the macro level regarding the implementation and uptake of assistive living technologies in Norwegian municipalities (meso level). These expectations were reflected in the findings at the meso level, where the senior leaders were well aware of the agenda set from above. Project sponsorship from a macro entity (i.e., DoH) led to the start-up of projects using assistive living technology in the municipality, which illustrated that an external environment was a driving force in this respect. However, many aspects still remained unclear in the macro-meso relationship, such as further financing of ongoing projects, and legal and technological

aspects, because there were no guidelines from the macro level addressing these issues. The leaders in the municipality had a dedicated focus on assistive living technology per se, but the integration of technological solutions into health care services was still more a vision than a reality because of a low level of organizational readiness in the municipality.

Previous studies in this field have used various theoretical frameworks to identify and explore factors that influence adoption, implementation and continued use of assistive living technologies. Sugarhood *et al*.[17] concluded that successful implementation of telecare very much depends on to what degree contextual factors are specified, understood and addressed. But their study focused more specifically on the material features (interviews with staff in industry), and functionality of telecare technologies (interviews with service providers who supported telecare-in-use). We did not focus on specific aspects of the implementation process because we wanted to use a multilevel approach, and tried to identify key contextual factors relevant for planning an assistive living implementation in elderly primary care. Greenhalgh *et al*.[13] have developed a study program called "SCALS" which focuses on assistive living technologies in their organizational, social, political and policy context, using a systems approach that includes interdependencies. There are no publications from the "SCALS" program to date (other than the referred study protocol), but the program seems to be based on the same notion as our study, namely that contextual factors play a pivotal role for the understanding of implementation and integration of a technological solution into a complex health care system.

The MUSIQ framework can help us understand how factors are interdependent, e.g. that external motivators at the macro level will be an incentive for leaders at the meso level to translate national QI priorities into local initiatives at the micro level. This hypothesis is partially supported by our findings. We found that the strategies developed in policy documents affected the upper management in the municipality, but health care personnel at the micro level were not so familiar with the strategies and emphasis on assistive living technologies.

In our study, health care personnel (micro-level focus group interviews) were motivated to change their daily practice by using technological solutions, but the lack of data infrastructure and resource availability hindered such a change. From previous research, we

know that lack of organizational readiness for change is an important factor in understanding why implementation efforts fail.[46]

**Strengths and weaknesses**

This case study does not formulate a solution for how to implement assistive living technologies but the insights from the study could be used in comparable settings. One premise in this paper is to acknowledge the organizational, social, political and policy context in which assisted living technologies are implemented. The findings underpin the premise that people and technologies are linked in a dynamic health care system made up of multiple interacting stakeholders. We have not focused on the ‘‘user system’’, that is, the intended user of a technological solution. This needs to be addressed for successful adoption. Still, the analyzed data were rich, and represented three levels (macro-meso-micro). Another limitation is the use of the MUSIQ framework in the data analysis; because of the a priori defined themes, we could have missed out on themes relevant for the planning of an assistive living intervention.

**Implications**

Through this study, we have generated empirical knowledge about contextual factors that can influence the implementation of assistive living technologies in primary home care. The study already positions assistive living technologies as an innovation whose success depends on the social and organizational context. Two key implications are evident from our study. First, we have shown that various contextual factors existing in a complex health care system (represented by a municipality) are present and need to be addressed in order to optimize the likelihood for successful implementation. Low levels of uptake and use may be explained in part by organizational immaturity and different focus of the various stakeholders; thus, aligning interests across multiple stakeholders remains a challenge when planning for an assistive living technology intervention in primary care. Second, our findings suggest that the challenge lies not solely in the implementation process, but also in the integration of assistive living technologies in municipal care service provision, beyond the initial adoption. For the municipality, there is uncertainty about guidelines from national entities, and concerted and ongoing efforts are required to integrate assistive living technologies as a routine and sustained part of primary care services.

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**Competing interests**

Grant funding for research but no other competing interest.

**Contributors**

MTG planned the study design, was responsible for the development of data collection tools, contributed to data analysis and drafted this manuscript. SW contributed to the study design, contributed to the development of data collection tools, data analysis, and contributed to drafting of the manuscript. IT contributed to data analysis and drafting of the manuscript. All authors have read and approved the manuscript.

**Data sharing statement**

This is a qualitative study and therefore the data generated is not suitable for sharing beyond that contained within the submitted manuscript. Further information can be obtained from the corresponding author.

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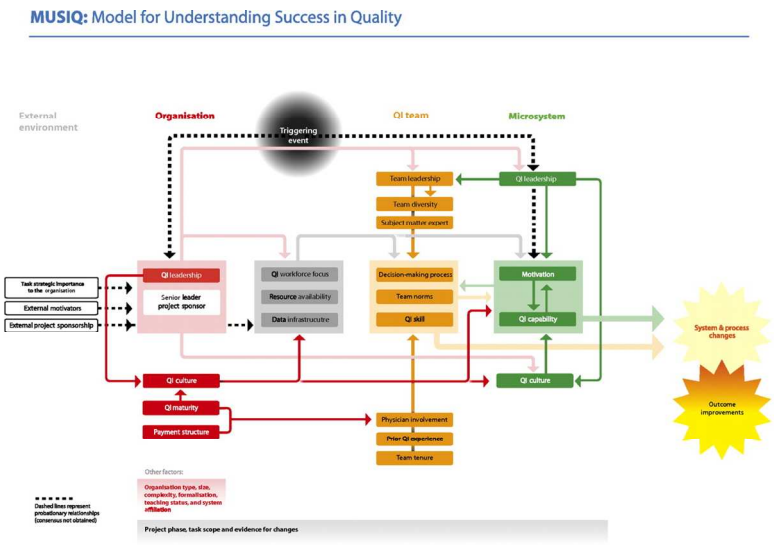
**Model for Understanding Success in Quality (MUSIQ).**




Heather C Kaplan et al. BMJ Qual Saf 2012;21:13-20

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Figure 1 in manuscript: the MUSIQ framework. Copyright © BMJ Publishing Group Ltd and the Health Foundation. All rights reserved. Reuse licence number 3785340881529.

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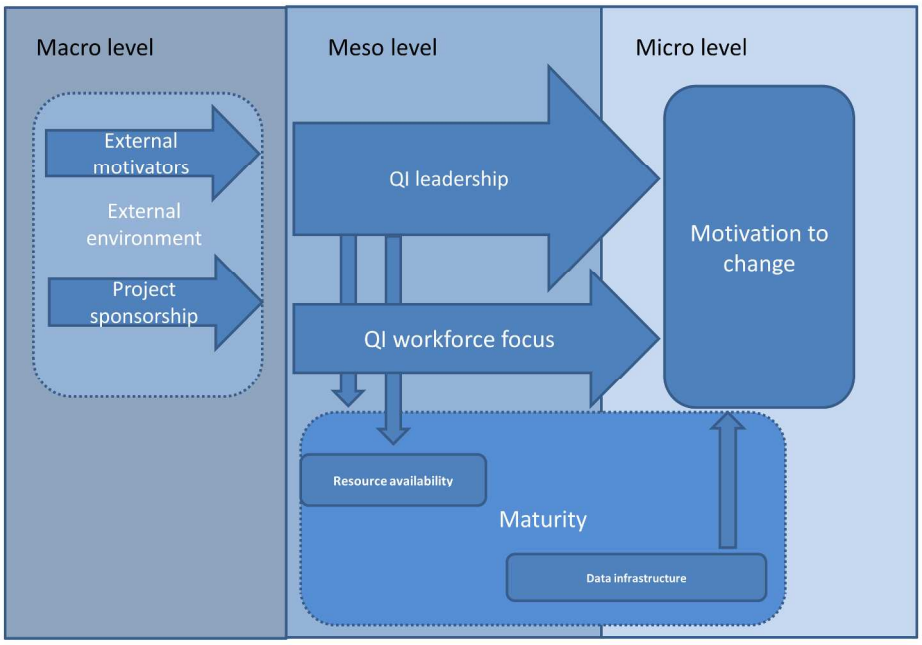


Figure 2 in manuscript: Presentation of results / main contextual factors.

254x190mm (300 x 300 DPI)

Tong et al., International Journal for Quality in Health Care; Volume 19, Number 6: pp. 349 –357
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## Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups (

1. Interviewer/facilitator Which author/s conducted the interview or focus group? ***P. 7***

2. Credentials What were the researcher's credentials? E.g. PhD, MD ***P. 1***

3. Occupation What was their occupation at the time of the study? N/A

4. Gender Was the researcher male or female? N/A

5. Experience and training What experience or training did the researcher have? N/A

6. Relationship established Was a relationship established prior to study commencement?

***P. 7-8***

7. Participant knowledge of the interviewer N/A

8. Interviewer characteristics What characteristics were reported about the interviewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic N/A

9. Methodological orientation and Theory What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis ***P. 8***

10. Sampling How were participants selected? e.g. purposive, convenience, consecutive, snowball ***P 7-8***

11. Method of approach How were participants approached? e.g. face-to-face, telephone, mail, email ***P 8***

12. Sample size How many participants were in the study? ***P 7-8***

13. Non-participation How many people refused to participate or dropped out? ***P 7***

14. Setting of data collection Where was the data collected? e.g. home, clinic, workplace N/A

15. Presence of non-participants Was anyone else present besides the participants and researchers? ***P 8***

16. Description of sample What are the important characteristics of the sample? e.g. demographic data, date ***P 7-8***

17. Interview guide Were questions, prompts, guides provided by the authors? Was it pilot tested? ***P 8***

18. Repeat interviews Were repeat interviews carried out? If yes, how many? N/A

19. Audio/visual recording Did the research use audio or visual recording to collect the data? ***P 7-8***

20. Field notes Were field notes made during and/or after the interview or focus group? ***P 8***

21. Duration What was the duration of the interviews or focus group? N/A

22. Data saturation Was data saturation discussed? N/A

23. Transcripts returned Were transcripts returned to participants for comment and/or correction? N/A

24. Number of data coders How many data coders coded the data? ***P 9***

25. Description of the coding tree Did authors provide a description of the coding tree? ***P 10***

26. Derivation of themes Were themes identified in advance or derived from the data? ***P 8***

27. Software What software, if applicable, was used to manage the data? N/A

28. Participant checking Did participants provide feedback on the findings? N/A

29. Quotations presented Were participant quotations presented to illustrate the themes / findings? Was each quotation identified? e.g. participant number ***P 11-15***

30. Data and findings consistent Was there consistency between the data presented and the findings?

31. Clarity of major themes Were major themes clearly presented in the findings?

32. Clarity of minor themes Is there a description of diverse cases or discussion of minor themes?

BMJ Open

# What are the key contextual factors when preparing for successful implementation of assistive living technology in primary elderly care? A case study from Norway.

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| | |

# What are the key contextual factors when preparing for successful implementation of assistive living technology in primary elderly care? A case study from Norway.

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Word count: 4856

**Objective:** To identify contextual factors at different organizational levels to guide the implementation of an assistive living technology intervention in Norwegian primary home care.

Design: A single embedded case study design was carried out in an urban municipality in Western Norway, to get an overview of key contextual factors from the municipality's perspective.

**Data collection and analysis:** The data collection was based on a triangulation of methods involving document analysis, semi-structured individual interviews, and focus group interviews to get a broad insight when preparing for an intervention. Data were collected on three levels of the healthcare system; 1) national policy documents and regulations (macro) 2) five individual interviews with senior managers and municipal strategy documents (meso) and 3) two focus group interviews with nurses and nurse managers in direct patient care (micro). The MUSIQ framework was used as a guide in the data analysis.

**Results:** The main contextual factors identified were external motivators and project sponsorship (macro level), leadership, workforce focus and maturity (meso level), and motivation to change and maturity (micro level).

**Conclusions:** The findings underpin the premise that people and technologies are linked in a dynamic health care system made up of multiple interacting stakeholders. Strategies developed in policy documents affected upper management in the municipality, but health care personnel at the micro level were not so familiar with strategies and emphasis on assistive living technologies. Health care personnel in our study were motivated to use technological solutions, but lack of data infrastructure and resource availability hindered this. Uncovering these factors has important implications in how to increase the likelihood of successful implementation of assistive living technologies. Integration of technological solutions into health care services was more a vision than a reality because of a low level of organizational readiness in the municipality.

**Key words:** Health services research, qualitative research, health informatics,

**Strengths and limitations of this study:**

- Applies a multilevel approach to acknowledge the organizational, social, political and policy context in which assisted living technologies are planned to be implemented.
- Provides rich, qualitative data from three levels of the healthcare system; 1) national policy documents and regulations (macro) 2) individual interviews with senior managers and municipal strategy documents (meso) and 3) focus group interviews with nurses and nurse managers in direct patient care (micro).
- The use of the MUSIQ framework in the data analysis provides empirical content, which can help operationalize factors in the framework.
- The intended user's perspective of a technological solution is not integrated in the study.
- Sample size is small; other municipalities, countries and settings may illustrate different opportunities and challenges.

## INTRODUCTION

In times of demographic changes, the use of assistive living technologies is suggested to help monitor and treat degenerative and chronic diseases which follows an ageing society,[1-4] through the use of sensors, alarms and reminders.[5] One context in which the use of assistive living technologies has been heralded as a solution, is prevention of hospitalizations.[6 7]

Older persons are substantial consumers of both hospital care and primary care services,[8-9] and a continuous discussion questions if a proportion of hospital admissions could have been prevented in primary treatment and care.[10 11] Although assistive living technologies have been positively evaluated, more studies are needed regarding the outcome and effectiveness of these technologies, [12-14] but there is a potential to prevent hospitalizations by providing early warnings of exacerbation events or deterioration. This is a significant issue in regard to both quality and cost.[1]

Despite its promise to improve primary health care, the success rate for implementing assistive living technologies has been low.[15-18] This could be explained by previous research failing to consider critical issues in the use of these technologies. In particular, there is a

need to consider the wider social framework within which the new technologies would operate, and how the technology could be integrated into a complex health care system.[4 19]

There is a general interest in the role of context in understanding variaton of success in quality improvement (QI), but this focus is lacking in research regarding implementation of assistive living technolgies in primary care.[18-22] Little evidence exists for approaches to improve the implementation process of assistive technology, and studies to date have been limited in their design. [18 21 23 24] Few studies have used robust methodology to assess how contextual factors, such as external environment, organizational issues, technological infrastructure, and human actions, interact with each other to influence the implementation process.[22 25 26]

In order to increase the likelihood of successful implementation, it is crucial to adress elements at the micro level (human decisions and actions ), as well as the wider context in the meso level (the organization in which the humans interact), and at the macro level (national policy on assistive living technologies). Based on the notion that elements at the micro level can both influence and be influenced by elements at the meso level and macro level, more knowledge is needed for where to direct efforts and resources, in order for professionals and organizations to prepare a more optimized implementation of assistive living technologies in primary care.[26-28]

**CONCEPTUAL FRAMEWORK**

In the literature, diverse QI frameworks (e.g., Model for Improvement[29], PARIHS[30], ARCHIE[4]) and implementation models (e.g., PRIME[31]) exist. In this study we apply the Model for Understanding Success in Quality (MUSIQ),[32] as it is in the forefront of incorporating contextual factors in QI processes. Kaplan *et al.* identified a need for a conceptual model that builds on existing implementation frameworks, and developed MUSIQ using a systematic review[22] and structured input from a diverse panel of QI experts.[32 33] The MUSIQ framework[32] as described in figure 1, is a comprehensive conceptual framework for approaching and studying an implementation process in health care. It offers an opportunity to formally evaluate the contextual factors involved in implementation of new measures within health care, and therefore is chosen as an appropriate and helpful framework to

inform the planning phase of an assistive technology intervention to prevent inappropriate hospital admissions for older adults receiving home based care.

*Figure 1 about here MUSIQ* 

MUSIQ shows how context influences the success of individual QI projects and hypothesizes that the implementation of a system, the process changes, and the associated outcome improvements are influenced directly by microsystem and QI team factors, which are interdependent and mutually reinforcing. The identified contextual factors are organized based on the level of the healthcare system in which they are believed to operate, including the micro level, the organizational or meso level, and the external environmental or macro level. Factors operating within the macro level are external incentives, such as new national policy documents or sponsored projects. At the organizational level, QI leadership (senior management) directly influences leadership at the micro level. For example, external motivators can put pressure on senior management in an organization to support a particular QI project. This could then lead to support and training for health care personnel involved in the particular QI project, which in turn will increase the likelihood of successful implementation of the QI project.

The aim of this study was to identify contextual factors at the macro, meso, and micro levels to guide the implementation of an assistive living technology intervention in Norwegian primary home care that would prevent inappropriate hospital admissions. To achieve this aim, specific objectives were to increase knowledge about:

1. Policy makers' view of the implementation of assistive living technology in primary care.
2. Primary care organizations' and management's perspectives regarding the implementation of assistive living technologies.
3. Health care personnel's perspective regarding the uptake and use of assistive living technologies.

## METHODS

### Setting

The study was carried out in an urban municipality in Western Norway. Healthcare service delivery in this municipality was divided into four geographically organized units, and comprised 1600 elderly recipients of home-based care. This study involved two of these units, with 800 elderly receiving home-based care. The municipality was in the process of integrating assistive living technologies in primary care during the next few years,[34] and was involved in the national programme for telehealth, together with 31 of Norway's 428 municipalities.

### Design

A single embedded case study design[35] was employed to get an overview of key contextual factors from the municipality's perspective, thus getting a better understanding of which factors could be targeted when planning an assistive living technology intervention in primary care. The case was defined as the municipality. The embedded design included macro, (policy), meso, (organization) and micro (clinical team in homecare) levels in the data collection and analysis.

### Data collection

The data collection was based on a triangulation of methods involving document analysis, semi-structured individual interviews, and focus group interviews to get a broad insight when preparing for an intervention.[36] Data were collected on three levels of the healthcare system; 1) national policy documents and regulations (macro) 2) individual interviews with senior managers and municipal strategy documents (meso) and 3) focus group interviews with nurses and nurse managers in direct patient care (micro). Informants for the individual interviews were chosen based on purposeful sampling [37], seeking informants who were most able to inform us on the research question. Senior managers were selected because they held major roles in the municipality's work with implementing assistive living technologies in primary care, and were in the best position to validate and provide relevant information for the study.

An overview of data material is depicted in table 1.

Table 1: Data material:

| System level | Data | |
|---|---|---|
| Macro level | Documents : 6 (national policy documents) | ONR 2011:11[33], Report No. 9 (2012-2013) to the Storting;[34] Report No. 10 (2012-2013) to the Storting;[35] Report No. 29 (2012-2013) to the Storting,[36] Report No 11 (2014-2015) to the Storting.[37] Care Plan 2020[38] |
| Meso level | Interviews: 5 | Assistant director, project manager, adviser in municipal administration, head of health and welfare department, head of home-based care |
| | Documents: 2 | Municipal strategy plan for implementing assistive living technologies, Report on use of resources in municipal health- and care services |
| Micro level | Focus group interviews : 2 (*n=12*) | 6 informants in each group; nurses in direct patient care and nurse |

managers

1) Macro-level data collection: Acquisition of documents

The data collection at the macro level involved acquisition of national policy documents (e.g., national care plan and whitepapers) developed by the Ministry of Health and Care Services.[38-42] These documents are referred to as "external environment" in the MUSIC framework.[33] All documents are publicly available on the Internet (https://www.regjeringen.no/en/find-document/id2000006/?ownerid=421).

2) Meso-level data collection: Semi-structured interviews and acquisition of documents

Five individual semi-structured interviews were conducted with senior managers in primary care. These managers were all having a key strategic position within the municipality with important oversight of the decision-making processes related to assistive living technologies. Individual interviews were employed to ensure a more in-depth understanding of the leaders' roles in the implementation of assistive living technologies in elderly primary care. Recruitment was initiated through the study's working group members, by asking them for a recommendation as to who could best explicate the aspects of interest. All of the informants asked to participate accepted. The interviews were conducted by the same person (MTG) for consistency. A semi - structured interview guide was developed based on MUSIQ, focusing on organizational structures and processes for managing quality, and the leader's role in QI work. The interviews were audiotaped and transcribed verbatim. The municipality's strategic plan for implementing assistive living technologies,[34] and a report on the use of resources in municipal health and care services[43] were included to provide additional perspectives about key issues, and to serve as a supplementary source for understanding discrepancies among informants[44].

3) Micro-level data collection: Focus group interviews

Two focus group interviews were conducted (*n=12*) in 2014. Maximum variation sampling[37] was employed to identify a sample of health care professionals who represented different lines of work at the micro level. Administrative personnel in the municipality, who otherwise were not involved in this study recruited informants; 12 health care professionals who

worked either in direct patient care or administered care services for the elderly were invited to participate in the interviews, all agreed. 11 women and 1 man in the age between 30-55 years, who had worked in primary care for more than five years, participated. None of the informants were directly engaged in the work with assistive living technologies. A thematic interview guide was developed for the purpose of exploring aspects related to implementation of assistive living technologies. Focus group interviews were employed so that participants could discuss perceptions, opinions and thoughts related to the abovementioned topics[45]. The interviews were led by a moderator (MTG) to ensure rich and relevant data[46]. A co-moderator made notes on observations and impressions during the interviews. Both interviews lasted approximately 90 minutes. Interviews were audiotaped and transcribed verbatim.

**Data Analysis**

The MUSIQ framework was used as a guide in the data analysis, by providing a priori themes in advance of the analysis process. This is described by Crabtree & Miller as a template organizing style.[36] With the template (theory-based) analysis style the text is organized according to preexisting theoretical or logical categories, to provide new descriptions of previously known phenomena.[47] Three data sources were analyzed ; at the macro level, we analyzed [48] national policy documents to map the stated governmental expectations related to implementation of assistive living technologies in Norwegian municipalities. The role of the macro-level data is to link the governmental expectations concerning the use of assistive living technologies in municipal elderly health care, and how these are addressed by the municipal at meso and micro level. At the meso level, we analyzed key documents from the municipality and transcripts from individual interviews; and at the micro level, the units of analysis were transcripts from focus group interviews.

We read meso– and micro-level transcripts repeatedly to gain familiarity, and then discussed the emerging findings as a team whose backgrounds spanned health and social science (MTG nurse/PhD candidate; IT nurse/Postdoctor; SW social scientist/Professor). Data material was analyzed thematically[36], using the MUSIQ theoretical framework. Data was analyzed iteratively until no new themes emerged. Table 2 illustrates the analytical process. To ensure trustworthiness in the analysis, analyst triangulation and member checks were applied.[37 49 50]

Table 2: Data analysis process:

| | Data source | | Findings | Factors in MUSIQ |
|---|---|---|---|---|
| Macro level | Care plan 2020 | «Main aim in the National program for development and implementation of assistive living technologies is that assistive living technologies are integrated in primary care services."[43] | Governmental expectations related to implementation of assistive living technologies, as an integrated part of municipal services | External motivator |
| Meso level | Head of health and social welfare departmen t | "I don't quite know how, and this is probably the big challenge; how will the municipal build a system concerning this?" | Organization is still immature | Maturity |
| Micro level | Nurse, focus group 2 | "I think that Skype could be a tool between accident and emergencies department, general practitioners and home-based care. One thing is to describe it over the phone, it's completely different to show how the situation really is; we could provide blood pressure, pulse, $O_2$ saturation and such…" | Healthcare professionals motivated to use assistive living technologies in daily care | Motivation to change |

## Ethical approval

This project has been approved by the Norwegian Data Protection Authority (Approval ref# 21/2013).

## RESULTS

The main contextual factors identified in this study were external motivators and project sponsorship (macro level), leadership, workforce focus and maturity (meso level), and motivation to change and maturity (micro level). The results are depicted in figure 2.

Figure 2: Results organized on different levels:

*Figure 2 about here*

### Macro level

Document analysis of national policy documents showed that external motivators and project sponsorship were the main contextual factors at the macro level. Five white papers [38-42]state in various ways that telehealth/telecare should be integrated in the health care services. The Norwegian government established a national programme for development and implementation of assistive living technologies, which main objective is that assistive living technologies are integrated in primary care services by 2020.[42]:p.28. Expectations are stated in a direction of more user-oriented health care services[40]:p.40, and that the uptake and use of assisted living technologies are part of an innovative and provident health care system[40]:p.55.

In this, it was demonstrated that the external environment, represented by several reports to the Parliament, was an incentive for leaders in the municipality to translate the national targets to local initiatives, by being an external motivator. Furthermore, the document analysis showed that the Directorate of Health (DoH) exercised a role as project sponsor, as it provided funding for assistive living technology projects led by the municipality. For example, the municipality had a project as part of the National programme, involving the transition of analogue personal alarm systems to digital solutions, which was funded by the DoH.

**Meso level**

QI leadership and maturity were the two main factors identified at the meso level. In the interview material, it became evident that the leaders in the municipality had to align the local QI work with the national priorities and focus areas, as defined in macro level policy documents.

> *"We are part of the National programme, which focuses on safety alarms; therefore, we have two projects concerning safety. First and foremost we must prioritize this work. The national directions are clear about which activities the municipalities should prioritize."*
>
> Project manager

In terms of leadership, the senior leaders regarded it as their responsibility to be familiar with and committed to ongoing projects involving the use of assistive living technologies. Furthermore, leadership emerged also as a factor in the interview material by various expressions about how QI work was of great importance in the municipality. The assistant director made it clear that anchoring of projects was a necessity for ongoing projects, and that there was a system for QI work in the municipality:

> *"It's my responsibility to attain goals and measures which are defined in the strategy, and to follow up on all the ongoing projects. It must be anchored in the management – we know that for everything we do!"*
>
> Assistant director

> *"We've had focus on QI since we got re-organized, arranging semi-annual dialogue gatherings in a quality network, where the employees in the health and care districts can give input on how to succeed."*
>
> Assistant director

Nothing explicit regarding leadership was identified through document analysis of the municipality's strategic plan [34], but leadership was implicit when organizational issues were described. Data infrastructure, resource availability and QI workforce focus were contextual

factors that emerged in meso-level interviews. These factors were an expression for organizational readiness, and tell us something about an organization's maturity. Maturity – or the lack of maturity – emerged as a key contextual factor at the meso level. Findings from individual interviews addressed several concerns about whether the municipality was ready to actually implement assistive living technologies. One informant expressed such a concern:

> *"We have actively recruited participants in the project related to personal alarm systems, but that raises a lot of questions: Does the municipality want to take on more tasks? Who will provide service functions related to this? What will it cost…? There are ethical issues…I wish more of this was clarified before we started…"*
>
> Head of health and social welfare department

Maturity regarding municipal data infrastructure was also addressed in the interview material. It was still unclear if and how the municipality was prepared for the integration of assistive living technologies in the care services:

> *"I don't quite know how, and this is probably the big challenge; how will the municipality build a system concerning this? Today we have a system, and a dedicated QI-team, perhaps it will be IT… but I think it has to be part of our system."*
>
> Head of health and social welfare department

Document analysis of the municipal strategic plan [34] identified challenges related to implementation and integration. The challenges were related directly to the lack of guidelines from national authorities regarding financial issues, standardization of technological platforms / infrastructure / cyber security, legal issues, organizational aspects and ethical considerations:

> *"…financing is still undetermined. Several prerequisites must be clarified in order for the municipality to use assistive living technologies. Issues concerning legislation, ethics, cyber security, technology requirements and safe operations need to be addressed."*

These challenges were also an expression for the lack of organizational maturity, thus maturity emerged as a key factor at the meso level regarding both organizational readiness, data infrastructure and challenges related to the lack of guidelines from national authorities.

**Micro level**

At the micro level, motivation to change and maturity were the two main contextual factors that emerged from the focus group interviews. Motivation to change was identified in both focus group interviews, where the informants talked about the potential benefits that could arise from using assistive living technologies:

> *"We would like to have this (assistive living technologies)! (Laughter and talking) …we require equipment to do INR (International Normalized Ratio = blood test for regulating anticoagulation treatment), bladder scan, oxygen saturation…and CrP" (C-reactive Protein = blood test indicating infections (laughter from several).*
>
> Several nurses, focus group 1

> *"I think that Skype could be a tool between accident and emergencies department, general practitioners and home-based care. One thing is to describe it over the phone, it's completely different to show how the situation really is; we could provide blood pressure, pulse, $O_2$ saturation and such…"*
>
> Nurse, focus group 2

Analysis of the interviews revealed that healthcare professionals were motivated to use assistive living technologies in daily care, if there was a practical benefit for it. However, the informants did not address leadership as a focal point when asked what it would take to integrate assistive living technologies in the care services. Leadership did, however, emerge as a factor, but related to a lack of trust in the local leader's impact on decision-making, with respect to the uptake of assistive living technologies:

> *"I don't think the local leaders have a say in this. It is the municipality's administration who writes the budget. I believe that they decide which tools to use. If they decide we should have tablets, then that would be implemented in all districts."*
>
> Nurse, focus group 2

All in all, the results showed that issues concerning implementation and organizational factors related to the integration of assistive living technologies in home-based care were addressed only to a small degree. The main finding at the micro level was that the technological solutions had to function properly in the day-to-day work. They described experiences with the opposite, and that dysfunctional technology was discouraging and frustrating in their line of duty. This implies that maturity was also a key finding at the micro level. For example, the lack of data infrastructure was regarded as a hindrance for successful integration:

> *"In the rest of Europe, they have a standard for everything, and they are able to integrate things much more easily. Here, each GP have their own computer system, and each municipality has their own computer system…"*
>
> Adviser

The municipality lacked a sophisticated enough data infrastructure to be ready for integration of assistive living technologies in the care services.

**DISCUSSION**

Based on document analysis and interviews with both leaders and health care personnel, this study identified several of the contextual factors in the MUSIQ framework. More specifically, the study revealed that external motivators and project sponsorship at the macro level represented expectations from outside entities that guided senior leaders in defining a local mission and vision related to use of assistive living technologies for the municipality. These expectations were reflected in the findings at the meso level, where the senior leaders were well aware of the agenda set from above. However, many aspects still remained unclear in the macro-meso relationship, such as further financing of ongoing projects, and legal and technological aspects, because there were no guidelines from the macro level addressing these issues. Micro level findings revealed that health care professionals were not very conscious about other factors than the practical use of assistive living technologies.

Previous studies in this field have used various theoretical frameworks to identify and explore factors that influence adoption, implementation and continued use of assistive living

technologies. Sugarhood *et al*.[23] concluded that successful implementation of telecare very much depends on to what degree contextual factors are specified, understood and addressed. Greenhalgh *et al*.[18] have developed a study program called "SCALS" which focuses on assistive living technologies in their organizational, social, political and policy context, using a systems approach that includes interdependencies. There are no publications from the "SCALS" program to date (other than the referred study protocol), but the program seems to be based on the same notion as our study, namely that contextual factors play a pivotal role for the understanding of implementation and integration of a technological solution into a complex health care system.

The framework applied in our study (MUSIQ) can help us understand how factors are interdependent, e.g., that external motivators at the macro level will be an incentive for leaders at the meso level to translate national QI priorities into local initiatives at the micro level. This hypothesis is partially supported by our findings. We found that the strategies developed in policy documents affected the upper management in the municipality, but health care personnel at the micro level were not so familiar with strategies and emphasis on assistive living technologies. The lack of such alignment between levels could represent a challenge when preparing for successful implementation of assistive living technologies in primary elderly care. A report from report The King's Fund [51] summarizes relevant evidence regarding integration of care, from a multi-level perspective. In relation to interdependent factors, they underline that initiatives at the macro system must be linked to initiatives at the meso level for particular care groups and populations, and at the micro level for individual service users and carers. Organizational maturity and readiness to implementation is of vital importance, but the actual use of the technology takes place on micro level – in the provision of care for the elderly. Thus, it is necessary to address this implementation gap, in order to deliver the expected outcomes related to the uptake and use of assistive living technologies.

Despite of this implementation gap, the health care personnel (micro-level focus group interviews) in our study were motivated to change their daily practice, by using technological solutions, but the lack of data infrastructure and resource availability hindered such a change. From previous research, we know that lack of organizational readiness for change is an important factor in understanding why implementation efforts fail.[52]

Uncovering these factors has important implications in how to increase the likelihood of successful implementation of assistive living technologies, which in turn potentially could reduce unnecessary cost and burden on overstretched health services.

**Strengths and weaknesses**

This case study does not formulate a solution for how to implement assistive living technologies but the insights from the study could be used in comparable settings. One premise in this paper is to acknowledge the organizational, social, political and policy context in which assisted living technologies are implemented. The findings underpin the premise that people and technologies are linked in a dynamic health care system made up of multiple interacting stakeholders. We have not focused on the ‘‘user system’’, that is, the intended user of a technological solution. This needs to be addressed for successful adoption. The implementation process should be informed by all stakeholders – individual users, service providers and technology suppliers, to ensure a person-centered, holistic and ethically based approach. Such co-production should be addressed in future research.

The findings from this case study pertain to the particular organization and context prevailing in the included Norwegian municipality; other municipalities, countries and settings may illustrate different opportunities and challenges. It could be argued that our sample of informants including 17 primary care managers and health care professionals should have been larger. However, the involved informants represents senior managers at the meso level with the key competence need to be mapped in our study, such as strategic knowledge on plans, decision-making, funding, and vulnerability in infrastructure. The sample of 12 health care professionals have daily patient contact and represents future users of the assistive living technology with similar competence and experience with such technology. Hence, their perspectives may be transferable to other similar contextual settings as described here. Still, the analyzed data were rich, and represented three levels (macro-meso-micro).

Another limitation is the use of the MUSIQ framework in the data analysis; because of the a priori defined themes, we could have missed out on themes relevant for the planning of an assistive living intervention.

**Implications**

Through this study, we have generated empirical knowledge about contextual factors that can influence the implementation of assistive living technologies in primary home care. The study already positions assistive living technologies as an innovation whose success depends on the social and organizational context. Two key implications are evident from our study. First, we have shown that various contextual factors existing in a complex health care system (represented by a municipality) are present and need to be addressed in order to optimize the likelihood for successful implementation. Low levels of uptake and use may be explained in part by organizational immaturity and different focus of the various stakeholders; thus, aligning interests across multiple stakeholders remains a challenge when planning for an assistive living technology intervention in primary care. Second, our findings suggest that the challenge lies not solely in the implementation process, but also in the integration of assistive living technologies in municipal care service provision, beyond the initial adoption. For the municipality, there is uncertainty about guidelines from national entities, and concerted and ongoing efforts are required to integrate assistive living technologies as a routine and sustained part of primary care services. In a Norwegian context, it will be of vital importance to develop a clear framework and action plan within primary care, in order to address the different focus of the various stakeholders involved in the implementation process. This includes clearly defined roles and responsibilities. Moreover, is it important to incorporate specific assessment for assistive living technologies into service provision; the guidelines from national authorities must be clear and unambiguous.

**Acknowledgements**

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**Competing interests**

Grant funding for research but no other competing interest.

**Contributors**

MTG planned the study design, was responsible for the development of data collection tools, contributed to data analysis and drafted this manuscript. SW contributed to the study design, contributed to the development of data collection tools, data analysis, and contributed to drafting of the manuscript. IT contributed to data analysis and drafting of the manuscript. All authors have read and approved the manuscript.

**Data sharing statement**

This is a qualitative study and therefore the data generated is not suitable for sharing beyond that contained within the submitted manuscript. Further information can be obtained from the corresponding author.

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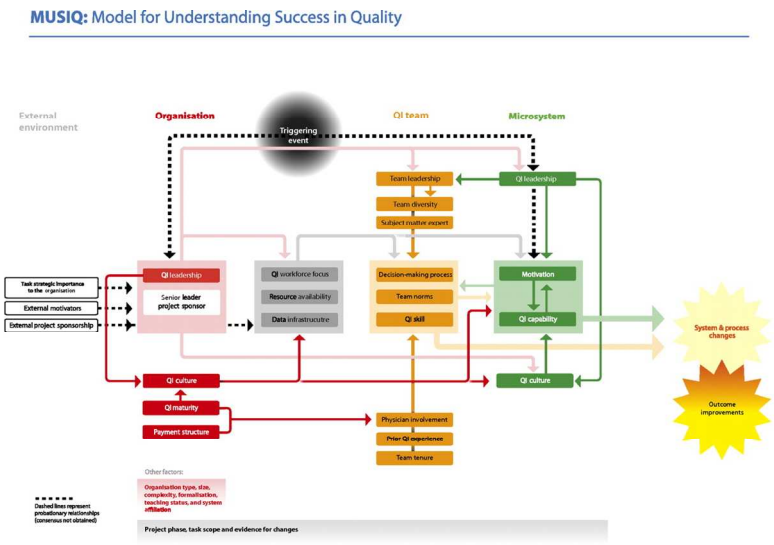
**Model for Understanding Success in Quality (MUSIQ).**




Heather C Kaplan et al. BMJ Qual Saf 2012;21:13-20

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Figure 1 in manuscript: the MUSIQ framework. Copyright © BMJ Publishing Group Ltd and the Health Foundation. All rights reserved. Reuse licence number 3785340881529.

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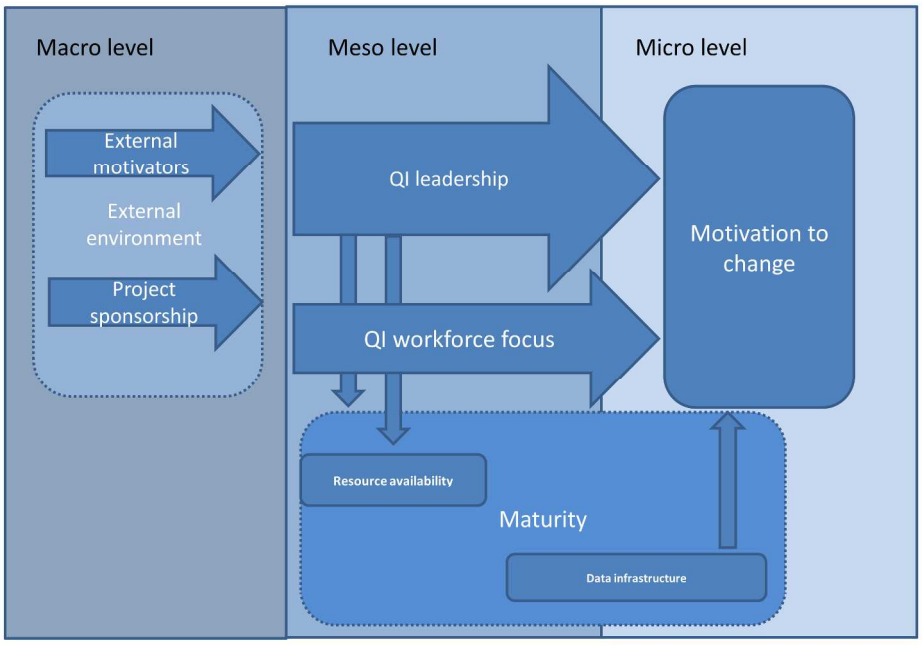


Figure 2 in manuscript: Presentation of results / main contextual factors.

254x190mm (300 x 300 DPI)

Tong et al., International Journal for Quality in Health Care; Volume 19, Number 6: pp. 349 –357
10.1093/intqhc/mzm042 Advance Access Publication: 14 September 2007:

## Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups (

1. Interviewer/facilitator Which author/s conducted the interview or focus group? ***P. 8***

2. Credentials What were the researcher's credentials? E.g. PhD, MD ***P. 1***

3. Occupation What was their occupation at the time of the study? ***P. 10***

4. Gender Was the researcher male or female? ***P. 1***

5. Experience and training What experience or training did the researcher have? ***P. 10***

6. Relationship established Was a relationship established prior to study commencement?

***P.8***

7. Participant knowledge of the interviewer ***P. 9***

8. Interviewer characteristics What characteristics were reported about the interviewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic

***P. 9***

9. Methodological orientation and Theory What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis ***P. 9***

10. Sampling How were participants selected? e.g. purposive, convenience, consecutive, snowball ***P 8-9***

11. Method of approach How were participants approached? e.g. face-to-face, telephone, mail, email ***P 8***

12. Sample size How many participants were in the study? ***P 8-9***

13. Non-participation How many people refused to participate or dropped out? ***P 8***

14. Setting of data collection Where was the data collected? e.g. home, clinic, workplace N/A

15. Presence of non-participants Was anyone else present besides the participants and researchers? ***P 8***

16. Description of sample What are the important characteristics of the sample? e.g. demographic data, date ***P 8-9***

17. Interview guide Were questions, prompts, guides provided by the authors? Was it pilot tested? ***P 8***

18. Repeat interviews Were repeat interviews carried out? If yes, how many? ***P 6***

19. Audio/visual recording Did the research use audio or visual recording to collect the data? ***P 9-10***

20. Field notes Were field notes made during and/or after the interview or focus group? ***P 9***

21. Duration What was the duration of the interviews or focus group? ***P 10***

22. Data saturation Was data saturation discussed? ***P 10***

23. Transcripts returned Were transcripts returned to participants for comment and/or correction? N/A

24. Number of data coders How many data coders coded the data? ***P 10***

25. Description of the coding tree Did authors provide a description of the coding tree? ***P 11***

26. Derivation of themes Were themes identified in advance or derived from the data? ***P 9***

27. Software What software, if applicable, was used to manage the data? N/A

28. Participant checking Did participants provide feedback on the findings? N/A

29. Quotations presented Were participant quotations presented to illustrate the themes / findings? Was each quotation identified? e.g. participant number ***P 11-16***

30. Data and findings consistent Was there consistency between the data presented and the findings? ***P 11-16***

31. Clarity of major themes Were major themes clearly presented in the findings? ***P 11-16***

32. Clarity of minor themes Is there a description of diverse cases or discussion of minor themes? ***P 11-16***

BMJ Open

# What are the key contextual factors when preparing for successful implementation of assistive living technology in primary elderly care? A case study from Norway.

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| | |

# What are the key contextual factors when preparing for successful implementation of assistive living technology in primary elderly care? A case study from Norway.

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Word count: 4664

**Objective:** To identify contextual factors at different organizational levels to guide the implementation of an assistive living technology intervention in Norwegian primary home care.

**Design:** A single embedded case study design was carried out in an urban municipality in Western Norway, to get an overview of key contextual factors from the municipality's perspective.

**Data collection and analysis:** The data collection was based on a triangulation of methods involving document analysis, semi-structured individual interviews, and focus group interviews to get a broad insight when preparing for an intervention. Data were collected on three levels of the healthcare system; 1) national policy documents and regulations (macro) 2) five individual interviews with senior managers and municipal strategy documents (meso) and 3) two focus group interviews with nurses and nurse managers in direct patient care (micro). The MUSIQ framework was used as a guide in the data analysis.

**Results:** The main contextual factors identified were external motivators and project sponsorship (macro level), leadership, workforce focus and maturity (meso level), and motivation to change and maturity (micro level). Strategies developed in policy documents affected upper management in the municipality, but health care personnel at the micro level were not so familiar with strategies and emphasis on assistive living technologies. Health care personnel in our study were motivated to use technological solutions, but lack of data infrastructure and resource availability hindered this.

**Conclusions:** Aligning interests across multiple stakeholders remain a challenge when planning for an assistive living technology intervention in primary care. In the studied municipality, integration of technological solutions into health care services was more a vision than a reality because of a low level of organizational readiness.

**Key words:** Health services research, qualitative research, health informatics

**Strengths and limitations of this study:**

- Applies a multilevel approach to acknowledge the organizational, social, political and policy context in which assisted living technologies are planned to be implemented.
- Provides rich, qualitative data from three levels of the healthcare system; 1) national policy documents and regulations (macro) 2) individual interviews with senior managers and municipal strategy documents (meso) and 3) focus group interviews with nurses and nurse managers in direct patient care (micro).
- The use of the MUSIQ framework in the data analysis provides empirical content, which can help operationalize factors in the framework.
- The intended user's perspective of a technological solution is not integrated in the study.
- Sample size is small; other municipalities, countries and settings may illustrate different opportunities and challenges.

## INTRODUCTION

In times of demographic changes, the use of assistive living technologies is suggested to help monitor and treat degenerative and chronic diseases which follows an ageing society,[1-4] through the use of sensors, alarms and reminders.[5] One context in which the use of assistive living technologies has been heralded as a solution, is prevention of hospitalizations.[6 7]

Older persons are substantial consumers of both hospital care and primary care services,[8-9] and a continuous discussion questions if a proportion of hospital admissions could have been prevented in primary treatment and care.[10 11] Previous research stresses that more studies are needed to assess outcome and effectiveness related to the use of assistive living technologies, [12-14] but there is a potential to prevent hospitalizations by providing early warnings of exacerbation events or deterioration. This is a significant issue in regard to both quality and cost.[1]

Despite its promise to improve primary health care, the success rate for implementing assistive living technologies has been low.[15-18] This could be explained by previous research failing to consider critical issues in the use of these technologies. In particular, there is a

need to consider the wider social framework within which the new technologies would operate, and how the technology could be integrated into a complex health care system.[4 19]

There is a general interest in the role of context in understanding variaton of success in quality improvement (QI), but this focus is lacking in research regarding implementation of assistive living technolgies in primary care.[18-22] Little evidence exists for approaches to improve the implementation process of assistive technology, and studies to date have been limited in their design. [18 21 23 24] A systematic review found that studies in this field were heterogenic and applied multiple measures of a given contextual factor and tested the associations between these measures and multiple measures of QI success.[22] Other studies argue that the use of traditional controlled trial efficacy research design provides limited information about the mechanisms that produced the outcomes, and why an intervention varies by setting.[25 26] This implies that few studies have been designed to assess how different contextual factors, such as external environment, organizational issues, technological infrastructure, and human actions, interact with each other to influence the implementation process.[22 25 26]

In order to increase the likelihood of successful implementation, it is crucial to address elements at the micro level (human decisions and actions ), as well as the wider context in the meso level (the organization in which the humans interact), and at the macro level (national policy on assistive living technologies). Based on the notion that elements at the micro level can both influence and be influenced by elements at the meso level and macro level, more knowledge is needed for where to direct efforts and resources, in order for professionals and organizations to prepare a more optimized implementation of assistive living technologies in primary care.[26-28]

## CONCEPTUAL FRAMEWORK

In the literature, diverse QI frameworks (e.g., Model for Improvement[29], PARIHS[30], ARCHIE[4]) and implementation models (e.g., PRIME[31]) exist. In this study we apply the Model for Understanding Success in Quality (MUSIQ),[32] as it is in the forefront of incorporating contextual factors in QI processes. Kaplan *et al.* identified a need for a conceptual model that builds on existing implementation frameworks, and developed MUSIQ using a systematic review[22] and structured input from a diverse panel of QI experts.[32 33] The MUSIQ

framework[32] as described in figure 1, is a comprehensive conceptual framework for approaching and studying an implementation process in health care. It offers an opportunity to formally evaluate the contextual factors involved in implementation of new measures within health care, and therefore is chosen as an appropriate and helpful framework to inform the planning phase of an assistive technology intervention to prevent inappropriate hospital admissions for older adults receiving home based care.

*Figure 1 about here MUSIQ* 

MUSIQ shows how context influences the success of individual QI projects and hypothesizes that the implementation of a system, the process changes, and the associated outcome improvements are influenced directly by microsystem and QI team factors, which are interdependent and mutually reinforcing. The identified contextual factors are organized based on the level of the healthcare system in which they are believed to operate, including the micro level, the organizational or meso level, and the external environmental or macro level. Factors operating within the macro level are external incentives, such as new national policy documents or sponsored projects. At the organizational level, QI leadership (senior management) directly influences leadership at the micro level. For example, external motivators can put pressure on senior management in an organization to support a particular QI project. This could then lead to support and training for health care personnel involved in the particular QI project, which in turn will increase the likelihood of successful implementation of the QI project.

The aim of this study was to identify contextual factors at the macro, meso, and micro levels to guide the implementation of an assistive living technology intervention in Norwegian primary home care that would prevent inappropriate hospital admissions. To achieve this aim, specific objectives were to increase knowledge about:

1. Policy makers' view of the implementation of assistive living technology in primary care.

2. Primary care organizations' and management's perspectives regarding the implementation of assistive living technologies.
3. Health care personnel's perspective regarding the uptake and use of assistive living technologies.

## METHODS

### Setting

The study was carried out in an urban municipality in Western Norway. Healthcare service delivery in this municipality was divided into four geographically organized units, and comprised 1600 elderly recipients of home-based care. This study involved two of these units, with 800 elderly receiving home-based care. The municipality was in the process of integrating assistive living technologies in primary care during the next few years,[34] and was involved in the national programme for telehealth, together with 31 of Norway's 428 municipalities.

### Design

A single embedded case study design[35] was employed to get an overview of key contextual factors from the municipality's perspective, thus getting a better understanding of which factors could be targeted when planning an assistive living technology intervention in primary care. The case was defined as the municipality. The embedded design included macro, (policy), meso, (organization) and micro (clinical team in homecare) levels in the data collection and analysis.

### Data collection

The data collection was based on a triangulation of methods involving document analysis, semi-structured individual interviews, and focus group interviews to get a broad insight when preparing for an intervention.[36] Data were collected on three levels of the healthcare system; 1) national policy documents and regulations (macro) 2) individual interviews with senior managers and municipal strategy documents (meso) and 3) focus group interviews with nurses and nurse managers in direct patient care (micro). Informants for the individual

interviews were chosen based on purposeful sampling [37], seeking informants who were most able to inform us on the research question. Senior managers were selected because they held major roles in the municipality's work with implementing assistive living technologies in primary care, and were in the best position to validate and provide relevant information for the study.

An overview of data material is depicted in table 1.

Table 1: Data material:

| **System level** | **Data** | |
|---|---|---|
| Macro level | Documents : 6 (national policy documents) | ONR 2011:11;[2] Report No. 9 (2012-2013) to the Storting;[38] Report No. 10 (2012-2013) to the Storting;[39] Report No. 29 (2012-2013) to the Storting,[40] Report No. 11 (2014-2015) to the Storting;[41] Care Plan 2020[42] |
| Meso level | Interviews: 5 | Assistant director, project manager, adviser in municipal administration, head of health and welfare department, head of home-based care |
| | Documents: 2 | Municipal strategy plan for implementing assistive living technologies, Report on use of resources in |

| | | |
|---|---|---|
| | | municipal health- and care services |
| Micro level | Focus group interviews : 2 (*n=12*) | 6 informants in each group; nurses in direct patient care and nurse managers |

1) Macro-level data collection: Acquisition of documents

The data collection at the macro level involved acquisition of relevant national policy documents (e.g., national care plan and whitepapers) developed by the Ministry of Health and Care Services.[2 38-42] These documents were included because they provide information about macro level entities' vision and ideas concerning the use of assistive living technologies in health care. Macro level data are referred to as "external environment" in the MUSIC framework.[33] All documents are publicly available on the Internet and downloaded from: https://www.regjeringen.no/en/find-document/id2000006/?ownerid=421.

2) Meso-level data collection: Semi-structured interviews and acquisition of documents

Five individual semi-structured interviews were conducted with senior managers in primary care. These managers were all having a key strategic position within the municipality with important oversight of the decision-making processes related to assistive living technologies. Individual interviews were employed to ensure a more in-depth understanding of the leaders' roles in the implementation of assistive living technologies in elderly primary care. Recruitment was initiated through the study's working group members, by asking them for a recommendation as to who could best explicate the aspects of interest. All of the informants asked to participate accepted. The interviews were conducted by the same person (MTG) for consistency. A semi - structured interview guide was developed based on MUSIQ, focusing on organizational structures and processes for managing quality, and the leader's role in QI work. The interviews were audiotaped and transcribed verbatim. The municipality's strategic plan for implementing assistive living technologies,[34] and a report on the use of resources in municipal health and care services[43] were included to provide additional perspectives about

key issues, and to serve as a supplementary source for understanding discrepancies among informants[44].

3) Micro-level data collection: Focus group interviews

Two focus group interviews were conducted (*n=12*) in 2014. Maximum variation sampling[37] was employed to identify a sample of health care professionals who represented different lines of work at the micro level. Administrative personnel in the municipality, who otherwise were not involved in this study recruited informants; 12 health care professionals who worked either in direct patient care or administered care services for the elderly were invited to participate in the interviews, all agreed. 11 women and 1 man in the age between 30-55 years, who had worked in primary care for more than five years, participated. None of the informants were directly engaged in the work with assistive living technologies. A thematic interview guide was developed for the purpose of exploring aspects related to implementation of assistive living technologies. Focus group interviews were employed so that participants could discuss perceptions, opinions and thoughts related to the abovementioned topics[45]. The interviews were led by a moderator (MTG) to ensure rich and relevant data[46]. A co-moderator made notes on observations and impressions during the interviews. Both interviews lasted approximately 90 minutes. Interviews were audiotaped and transcribed verbatim.

**Data Analysis**

The MUSIQ framework was used as a guide in the data analysis, by providing a priori themes in advance of the analysis process. This is described by Crabtree & Miller as a template organizing style.[36] With the template (theory-based) analysis style the text is organized according to preexisting theoretical or logical categories, to provide new descriptions of previously known phenomena.[47] Three data sources were analyzed ; at the macro level, we analyzed [48] national policy documents to map the stated governmental expectations related to implementation of assistive living technologies in Norwegian municipalities. The role of the macro-level data is to link the governmental expectations concerning the use of assistive living technologies in municipal elderly health care, and how these are addressed by the municipal at meso and micro level. At the meso level, we analyzed key documents from the

municipality and transcripts from individual interviews; and at the micro level, the units of analysis were transcripts from focus group interviews.

We read meso– and micro-level transcripts repeatedly to gain familiarity, and then discussed the emerging findings as a team whose backgrounds spanned health and social science (MTG nurse/PhD candidate; IT nurse/Postdoctor; SW social scientist/Professor). Data material was analyzed thematically[36], using the MUSIQ theoretical framework. Data was analyzed iteratively until no new themes emerged. Table 2 illustrates the analytical process. To ensure trustworthiness in the analysis, analyst triangulation and member checks were applied.[37 49 50]

Table 2: Data analysis process:

| | Data source | | Findings | Factors in MUSIQ |
|---|---|---|---|---|
| Macro level | Care plan 2020 | «Main aim in the National program for development and implementation of assistive living technologies is that assistive living technologies are integrated in primary care services."[43] | Governmental expectations related to implementation of assistive living technologies, as an integrated part of municipal services | External motivator |
| Meso level | Head of health and social welfare departmen t | "I don't quite know how, and this is probably the big challenge; how will the municipal build a system concerning this?" | Organization is still immature | Maturity |
| Micro level | Nurse, focus group 2 | "I think that Skype could be a tool between accident and emergencies department, general practitioners and home-based care. One thing is to describe it over the phone, it's completely different to show how the situation really is; we could provide blood pressure, pulse, $O_2$ saturation and such…" | Healthcare professionals motivated to use assistive living technologies in daily care | Motivation to change |

## Ethical approval

This project has been approved by the Norwegian Data Protection Authority (Approval ref# 21/2013).

## RESULTS

The main contextual factors identified in this study were external motivators and project sponsorship (macro level), leadership, workforce focus and maturity (meso level), and motivation to change and maturity (micro level). The results are depicted in figure 2.

Figure 2: Results organized on different levels:

*Figure 2 about here*

### Macro level

Document analysis of national policy documents showed that external motivators and project sponsorship were the main contextual factors at the macro level. Six white papers [2] [38-42]state in various ways that telehealth/telecare should be integrated in the health care services. The Norwegian government established a national programme for development and implementation of assistive living technologies, which main objective is that assistive living technologies are integrated in primary care services by 2020.[42]:p.28. Expectations are stated in a direction of more user-oriented health care services[40]:p.40, and that the uptake and use of assisted living technologies are part of an innovative and provident health care system[40]:p.55.

In this, it was demonstrated that the external environment, represented by several reports to the Parliament, was an incentive for leaders in the municipality to translate the national targets to local initiatives, by being an external motivator. Furthermore, the document analysis showed that the Directorate of Health (DoH) exercised a role as project sponsor, as it provided funding for assistive living technology projects led by the municipality. For example, the municipality had a project as part of the National programme, involving the transition of analogue personal alarm systems to digital solutions, which was funded by the DoH.

**Meso level**

QI leadership and maturity were the two main factors identified at the meso level. In the interview material, it became evident that the leaders in the municipality had to align the local QI work with the national priorities and focus areas, as defined in macro level policy documents.

> *"We are part of the National programme, which focuses on safety alarms; therefore, we have two projects concerning safety. First and foremost we must prioritize this work. The national directions are clear about which activities the municipalities should prioritize."*
>
> Project manager

In terms of leadership, the senior leaders regarded it as their responsibility to be familiar with and committed to ongoing projects involving the use of assistive living technologies. Furthermore, leadership emerged also as a factor in the interview material by various expressions about how QI work was of great importance in the municipality. The assistant director made it clear that anchoring of projects was a necessity for ongoing projects, and that there was a system for QI work in the municipality:

> *"It's my responsibility to attain goals and measures which are defined in the strategy, and to follow up on all the ongoing projects. It must be anchored in the management – we know that for everything we do!"*
>
> Assistant director

> *"We've had focus on QI since we got re-organized, arranging semi-annual dialogue gatherings in a quality network, where the employees in the health and care districts can give input on how to succeed."*
>
> Assistant director

Nothing explicit regarding leadership was identified through document analysis of the municipality's strategic plan [34], but leadership was implicit when organizational issues were described. Data infrastructure, resource availability and QI workforce focus were contextual

factors that emerged in meso-level interviews. These factors were an expression for organizational readiness, and tell us something about an organization's maturity. Maturity – or the lack of maturity – emerged as a key contextual factor at the meso level. Findings from individual interviews addressed several concerns about whether the municipality was ready to actually implement assistive living technologies. One informant expressed such a concern:

> *"We have actively recruited participants in the project related to personal alarm systems, but that raises a lot of questions: Does the municipality want to take on more tasks? Who will provide service functions related to this? What will it cost…? There are ethical issues…I wish more of this was clarified before we started…"*
>
> Head of health and social welfare department

Maturity regarding municipal data infrastructure was also addressed in the interview material. It was still unclear if and how the municipality was prepared for the integration of assistive living technologies in the care services:

> *"I don't quite know how, and this is probably the big challenge; how will the municipality build a system concerning this? Today we have a system, and a dedicated QI-team, perhaps it will be IT… but I think it has to be part of our system."*
>
> Head of health and social welfare department

Document analysis of the municipal strategic plan [34] identified challenges related to implementation and integration. The challenges were related directly to the lack of guidelines from national authorities regarding financial issues, standardization of technological platforms / infrastructure / cyber security, legal issues, organizational aspects and ethical considerations:

> *"…financing is still undetermined. Several prerequisites must be clarified in order for the municipality to use assistive living technologies. Issues concerning legislation, ethics, cyber security, technology requirements and safe operations need to be addressed."*

These challenges were also an expression for the lack of organizational maturity, thus maturity emerged as a key factor at the meso level regarding both organizational readiness, data infrastructure and challenges related to the lack of guidelines from national authorities.

**Micro level**

At the micro level, motivation to change and maturity were the two main contextual factors that emerged from the focus group interviews. Motivation to change was identified in both focus group interviews, where the informants talked about the potential benefits that could arise from using assistive living technologies:

> *"We would like to have this (assistive living technologies)! (Laughter and talking) …we require equipment to do INR (International Normalized Ratio = blood test for regulating anticoagulation treatment), bladder scan, oxygen saturation…and CrP" (C-reactive Protein = blood test indicating infections (laughter from several).*
>
> Several nurses, focus group 1

> *"I think that Skype could be a tool between accident and emergencies department, general practitioners and home-based care. One thing is to describe it over the phone, it's completely different to show how the situation really is; we could provide blood pressure, pulse, $O_2$ saturation and such…"*
>
> Nurse, focus group 2

Analysis of the interviews revealed that healthcare professionals were motivated to use assistive living technologies in daily care, if there was a practical benefit for it. However, the informants did not address leadership as a focal point when asked what it would take to integrate assistive living technologies in the care services. Leadership did, however, emerge as a factor, but related to a lack of trust in the local leader's impact on decision-making, with respect to the uptake of assistive living technologies:

> *"I don't think the local leaders have a say in this. It is the municipality's administration who writes the budget. I believe that they decide which tools to use. If they decide we should have tablets, then that would be implemented in all districts."*
>
> Nurse, focus group 2

All in all, the results showed that issues concerning implementation and organizational factors related to the integration of assistive living technologies in home-based care were addressed only to a small degree. The main finding at the micro level was that the technological solutions had to function properly in the day-to-day work. They described experiences with the opposite, and that dysfunctional technology was discouraging and frustrating in their line of duty. This implies that maturity was also a key finding at the micro level. For example, the lack of data infrastructure was regarded as a hindrance for successful integration:

> *"In the rest of Europe, they have a standard for everything, and they are able to integrate things much more easily. Here, each GP have their own computer system, and each municipality has their own computer system…"*
>
> Adviser

The municipality lacked a sophisticated enough data infrastructure to be ready for integration of assistive living technologies in the care services.

## DISCUSSION

Based on document analysis and interviews with both leaders and health care personnel, this study identified several of the contextual factors in the MUSIQ framework. More specifically, the study revealed that external motivators and project sponsorship at the macro level represented expectations from outside entities that guided senior leaders in defining a local mission and vision related to use of assistive living technologies for the municipality. These expectations were reflected in the findings at the meso level, where the senior leaders were well aware of the agenda set from above. However, many aspects still remained unclear in the macro-meso relationship, such as further financing of ongoing projects, and legal and technological aspects, because there were no guidelines from the macro level addressing these issues. Micro level findings revealed that health care professionals were not very conscious about other factors than the practical use of assistive living technologies.

Previous studies in this field have used various theoretical frameworks to identify and explore factors that influence adoption, implementation and continued use of assistive living

technologies. Sugarhood *et al*.[23] concluded that successful implementation of telecare very much depends on to what degree contextual factors are specified, understood and addressed. Greenhalgh *et al*.[18] have developed a study program called "SCALS" which focuses on assistive living technologies in their organizational, social, political and policy context, using a systems approach that includes interdependencies. There are no publications from the "SCALS" program to date (other than the referred study protocol), but the program seems to be based on the same notion as our study, namely that contextual factors play a pivotal role for the understanding of implementation and integration of a technological solution into a complex health care system.

The framework applied in our study (MUSIQ) can help us understand how factors are interdependent, e.g., that external motivators at the macro level will be an incentive for leaders at the meso level to translate national QI priorities into local initiatives at the micro level. This hypothesis is partially supported by our findings. We found that the strategies developed in policy documents affected the upper management in the municipality, but health care personnel at the micro level were not so familiar with strategies and emphasis on assistive living technologies. The lack of such alignment between levels could represent a challenge when preparing for successful implementation of assistive living technologies in primary elderly care. A report from report The King's Fund [51] summarizes relevant evidence regarding integration of care, from a multi-level perspective. In relation to interdependent factors, they underline that initiatives at the macro system must be linked to initiatives at the meso level for particular care groups and populations, and at the micro level for individual service users and carers. Organizational maturity and readiness to implementation is of vital importance, but the actual use of the technology takes place on micro level – in the provision of care for the elderly. Thus, it is necessary to address this implementation gap, in order to deliver the expected outcomes related to the uptake and use of assistive living technologies.

Despite of this implementation gap, the health care personnel (micro-level focus group interviews) in our study were motivated to change their daily practice, by using technological solutions, but the lack of data infrastructure and resource availability hindered such a change. From previous research, we know that lack of organizational readiness for change is an important factor in understanding why implementation efforts fail.[52]

Uncovering these factors has important implications in how to increase the likelihood of successful implementation of assistive living technologies, which in turn potentially could reduce unnecessary cost and burden on overstretched health services.

**Strengths and weaknesses**

This case study does not formulate a solution for how to implement assistive living technologies but the insights from the study could be used in comparable settings. One premise in this paper is to acknowledge the organizational, social, political and policy context in which assisted living technologies are implemented. The findings underpin the premise that people and technologies are linked in a dynamic health care system made up of multiple interacting stakeholders. We have not focused on the ‘‘user system’’, that is, the intended user of a technological solution. This needs to be addressed for successful adoption. The implementation process should be informed by all stakeholders – individual users, service providers and technology suppliers, to ensure a person-centered, holistic and ethically based approach. Such co-production should be addressed in future research.

The findings from this case study pertain to the particular organization and context prevailing in the included Norwegian municipality; other municipalities, countries and settings may illustrate different opportunities and challenges. Data collection at the macro level was not standardized, and only comprises documents and not interviews. The identified documents are all valid for Norwegian municipalities working with assistive living technologies in health care. Moreover, the documents reflect directions and expectations that municipalities must comply with, and therefore provide information paramount to understand the external environment in the study. It could be argued that our sample of informants including 17 primary care managers and health care professionals should have been larger. However, the involved informants represents senior managers at the meso level with the key competence need to be mapped in our study, such as strategic knowledge on plans, decision-making, funding, and vulnerability in infrastructure. The sample of 12 health care professionals have daily patient contact and represents future users of the assistive living technology with similar competence and experience with such technology. Hence, their perspectives may be transferable to other similar contextual settings as described here. Still, the analyzed data were rich, and represented three levels (macro-meso-micro).

Another limitation is the use of the MUSIQ framework in the data analysis; because of the a priori defined themes, we could have missed out on themes relevant for the planning of an assistive living intervention.

**Implications**

Through this study, we have generated empirical knowledge about contextual factors that can influence the implementation of assistive living technologies in primary home care. The study already positions assistive living technologies as an innovation whose success depends on the social and organizational context. Two key implications are evident from our study. First, we have shown that various contextual factors existing in a complex health care system (represented by a municipality) are present and need to be addressed in order to optimize the likelihood for successful implementation. Low levels of uptake and use may be explained in part by organizational immaturity and different focus of the various stakeholders; thus, aligning interests across multiple stakeholders remains a challenge when planning for an assistive living technology intervention in primary care. Second, our findings suggest that the challenge lies not solely in the implementation process, but also in the integration of assistive living technologies in municipal care service provision, beyond the initial adoption. For the municipality, there is uncertainty about guidelines from national entities, and concerted and ongoing efforts are required to integrate assistive living technologies as a routine and sustained part of primary care services. Evidence-based implementation strategies (e.g., PRIME[31], CFIR[53]) support the notion that context affects organizational change, dissemination, innovation, implementation, and knowledge translation. In a Norwegian context, it will be of vital importance to develop a clear framework and action plan within primary care, in order to address the different focus of the various stakeholders involved in the implementation process. This includes clearly defined roles and responsibilities. Moreover, is it important to incorporate specific assessment for assistive living technologies into service provision; the guidelines from national authorities must be clear and unambiguous. Future studies are advised to take these aspects into consideration when planning for an assistive technology intervention in community care.

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**Competing interests**

Grant funding for research but no other competing interest.

**Contributors**

MTG planned the study design, was responsible for the development of data collection tools, contributed to data analysis and drafted and revised this manuscript. SW contributed to the study design, contributed to the development of data collection tools, data analysis, and contributed to drafting and revision of the manuscript. IT contributed to data analysis and drafting and revision of the manuscript. All authors have read and approved the final version of the manuscript.

**Data sharing statement**

This is a qualitative study and therefore the data generated is not suitable for sharing beyond that contained within the submitted manuscript. Further information can be obtained from the corresponding author.

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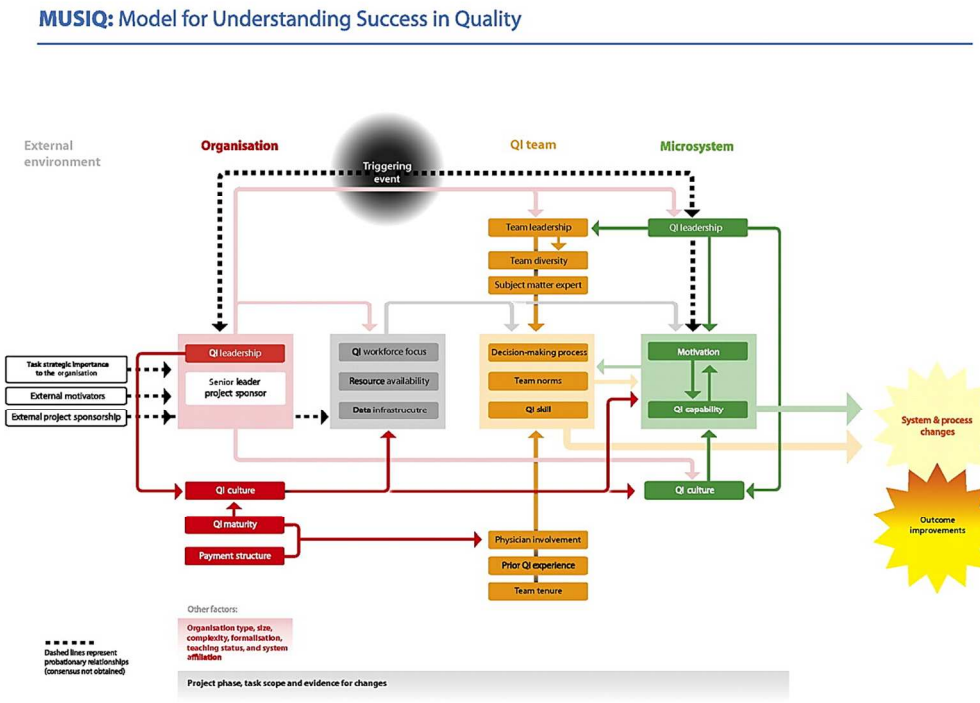


The MUSIQ framework as described in figure 1, is a comprehensive conceptual framework for approaching and studying an implementation process in health care.

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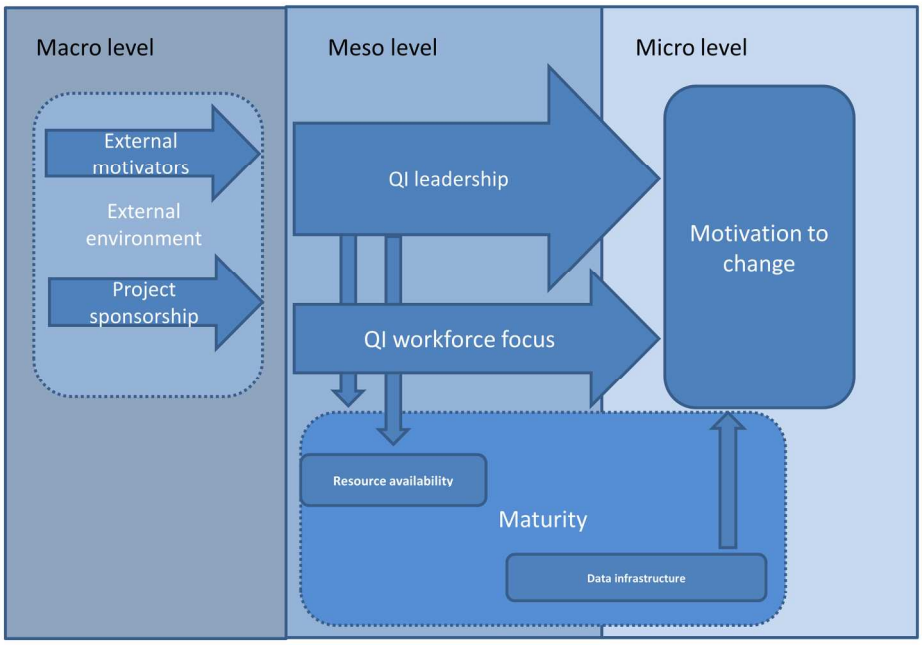


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190x142mm (300 x 300 DPI)

Tong et al., International Journal for Quality in Health Care; Volume 19, Number 6: pp. 349 –357
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## Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups (

1. Interviewer/facilitator Which author/s conducted the interview or focus group? ***P. 8***

2. Credentials What were the researcher's credentials? E.g. PhD, MD ***P. 1***

3. Occupation What was their occupation at the time of the study? ***P. 10***

4. Gender Was the researcher male or female? ***P. 1***

5. Experience and training What experience or training did the researcher have? ***P. 10***

6. Relationship established Was a relationship established prior to study commencement?

***P.8***

7. Participant knowledge of the interviewer ***P. 9***

8. Interviewer characteristics What characteristics were reported about the interviewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic

***P. 9***

9. Methodological orientation and Theory What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis ***P. 9***

10. Sampling How were participants selected? e.g. purposive, convenience, consecutive, snowball ***P 8-9***

11. Method of approach How were participants approached? e.g. face-to-face, telephone, mail, email ***P 8***

12. Sample size How many participants were in the study? ***P 8-9***

13. Non-participation How many people refused to participate or dropped out? ***P 8***

14. Setting of data collection Where was the data collected? e.g. home, clinic, workplace N/A

15. Presence of non-participants Was anyone else present besides the participants and researchers? ***P 8***

16. Description of sample What are the important characteristics of the sample? e.g. demographic data, date ***P 8-9***

17. Interview guide Were questions, prompts, guides provided by the authors? Was it pilot tested? ***P 8***

18. Repeat interviews Were repeat interviews carried out? If yes, how many? ***P 6***

19. Audio/visual recording Did the research use audio or visual recording to collect the data? ***P 9-10***

20. Field notes Were field notes made during and/or after the interview or focus group? ***P 9***

21. Duration What was the duration of the interviews or focus group? ***P 10***

22. Data saturation Was data saturation discussed? ***P 10***

23. Transcripts returned Were transcripts returned to participants for comment and/or correction? N/A

24. Number of data coders How many data coders coded the data? ***P 10***

25. Description of the coding tree Did authors provide a description of the coding tree? ***P 11***

26. Derivation of themes Were themes identified in advance or derived from the data? ***P 9***

27. Software What software, if applicable, was used to manage the data? N/A

28. Participant checking Did participants provide feedback on the findings? N/A

29. Quotations presented Were participant quotations presented to illustrate the themes / findings? Was each quotation identified? e.g. participant number ***P 11-16***

30. Data and findings consistent Was there consistency between the data presented and the findings? ***P 11-16***

31. Clarity of major themes Were major themes clearly presented in the findings? ***P 11-16***

32. Clarity of minor themes Is there a description of diverse cases or discussion of minor themes? ***P 11-16***

BMJ Open

# What are the key contextual factors when preparing for successful implementation of assistive living technology in primary elderly care? A case study from Norway.



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| | |

# What are the key contextual factors when preparing for successful implementation of assistive living technology in primary elderly care? A case study from Norway.

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Word count: ~~4664~~ 4738

**Objective:** To identify contextual factors at different organizational levels to guide the implementation of an assistive living technology intervention in Norwegian primary home care.

**Design:** A single embedded case study design was carried out in an urban municipality in Western Norway, to get an overview of key contextual factors from the municipality's perspective.

**Data collection and analysis:** The data collection was based on a triangulation of methods involving document analysis, semi-structured individual interviews, and focus group interviews to get a broad insight when preparing for an intervention. Data were collected on three levels of the healthcare system; 1) national policy documents and regulations (macro) 2) five individual interviews with senior managers and municipal strategy documents (meso) and 3) two focus group interviews with nurses and nurse managers in direct patient care (micro). The MUSIQ framework was used as a guide in the data analysis.

**Results:** The main contextual factors identified were external motivators and project sponsorship (macro level), leadership, workforce focus and maturity (meso level), and motivation to change and maturity (micro level). Strategies developed in policy documents affected upper management in the municipality, but health care personnel at the micro level were not so familiar with strategies and emphasis on assistive living technologies. Health care personnel in our study were motivated to use technological solutions, but lack of data infrastructure and resource availability hindered this.

**Conclusions:** Aligning interests across multiple stakeholders remain a challenge when planning for an assistive living technology intervention in primary care. In the studied municipality, integration of technological solutions into health care services was more a vision than a reality because of a low level of organizational readiness.

**Key words:** Health services research, qualitative research, health informatics

**Strengths and limitations of this study:**

- Applies a multilevel approach to acknowledge the organizational, social, political and policy context in which assisted living technologies are planned to be implemented.
- Provides rich, qualitative data from three levels of the healthcare system; 1) national policy documents and regulations (macro) 2) individual interviews with senior managers and municipal strategy documents (meso) and 3) focus group interviews with nurses and nurse managers in direct patient care (micro).
- The use of the MUSIQ framework in the data analysis provides empirical content, which can help operationalize factors in the framework.
- The intended user's perspective of a technological solution is not integrated in the study.
- Sample size is small; other municipalities, countries and settings may illustrate different opportunities and challenges.

## INTRODUCTION

In times of demographic changes, the use of assistive living technologies is suggested to help monitor and treat degenerative and chronic diseases which follows an ageing society,[1-4] through the use of sensors, alarms and reminders.[5] One context in which the use of assistive living technologies has been heralded as a solution, is prevention of hospitalizations.[6 7]

Older persons are substantial consumers of both hospital care and primary care services,[8-9] and a continuous discussion questions if a proportion of hospital admissions could have been prevented in primary treatment and care.[10 11] Previous research stresses that more studies are needed to assess outcome and effectiveness related to the use of assistive living technologies, [12-14] but there is a potential to prevent hospitalizations by providing early warnings of exacerbation events or deterioration. This is a significant issue in regard to both quality and cost.[1]

Despite its promise to improve primary health care, the success rate for implementing assistive living technologies has been low.[15-18] This could be explained by previous research failing to consider critical issues in the use of these technologies. In particular, there is a

need to consider the wider social framework within which the new technologies would operate, and how the technology could be integrated into a complex health care system.[4 19]

There is a general interest in the role of context in understanding variaton of success in quality improvement (QI), but this focus is lacking in research regarding implementation of assistive living technolgies in primary care.[18-22] Little evidence exists for approaches to improve the implementation process of assistive technology, and studies to date have been limited in their design. [18 21 23 24] A systematic review found that studies in this field were heterogenic and applied multiple measures of a given contextual factor and tested the associations between these measures and multiple measures of QI success.[22] Other studies argue that the use of traditional controlled trial efficacy research design provides limited information about the mechanisms that produced the outcomes, and why an intervention varies by setting.[25 26] This implies that few studies have been designed to assess how different contextual factors, such as external environment, organizational issues, technological infrastructure, and human actions, interact with each other to influence the implementation process.[22 25 26]

In order to increase the likelihood of successful implementation, it is crucial to address elements at the micro level (human decisions and actions ), as well as the wider context in the meso level (the organization in which the humans interact), and at the macro level (national policy on assistive living technologies). Based on the notion that elements at the micro level can both influence and be influenced by elements at the meso level and macro level, more knowledge is needed for where to direct efforts and resources, in order for professionals and organizations to prepare a more optimized implementation of assistive living technologies in primary care.[26-28]

## CONCEPTUAL FRAMEWORK

In the literature, diverse QI frameworks (e.g., Model for Improvement[29], PARIHS[30], ARCHIE[4]) and implementation models (e.g., PRIME[31]) exist. In this study we apply the Model for Understanding Success in Quality (MUSIQ),[32] as it is in the forefront of incorporating contextual factors in QI processes. Kaplan *et al.* identified a need for a conceptual model that builds on existing implementation frameworks, and developed MUSIQ using a systematic review[22] and structured input from a diverse panel of QI experts.[32 33] The MUSIQ

framework[32] as described in figure 1, is a comprehensive conceptual framework for approaching and studying an implementation process in health care. It offers an opportunity to formally evaluate the contextual factors involved in implementation of new measures within health care, and therefore is chosen as an appropriate and helpful framework to inform the planning phase of an assistive technology intervention to prevent inappropriate hospital admissions for older adults receiving home based care.

*Figure 1 about here MUSIQ* 

MUSIQ shows how context influences the success of individual QI projects and hypothesizes that the implementation of a system, the process changes, and the associated outcome improvements are influenced directly by microsystem and QI team factors, which are interdependent and mutually reinforcing. The identified contextual factors are organized based on the level of the healthcare system in which they are believed to operate, including the micro level, the organizational or meso level, and the external environmental or macro level. Factors operating within the macro level are external incentives, such as new national policy documents or sponsored projects. At the organizational level, QI leadership (senior management) directly influences leadership at the micro level. For example, external motivators can put pressure on senior management in an organization to support a particular QI project. This could then lead to support and training for health care personnel involved in the particular QI project, which in turn will increase the likelihood of successful implementation of the QI project.

The aim of this study was to identify contextual factors at the macro, meso, and micro levels to guide the implementation of an assistive living technology intervention in Norwegian primary home care that would prevent inappropriate hospital admissions. To achieve this aim, specific objectives were to increase knowledge about:

1. Policy makers' view of the implementation of assistive living technology in primary care.

2. Primary care organizations' and management's perspectives regarding the implementation of assistive living technologies.
3. Health care personnel's perspective regarding the uptake and use of assistive living technologies.

## METHODS

### Setting

The study was carried out in an urban municipality in Western Norway. Healthcare service delivery in this municipality was divided into four geographically organized units, and comprised 1600 elderly recipients of home-based care. This study involved two of these units, with 800 elderly receiving home-based care. The municipality was in the process of integrating assistive living technologies in primary care during the next few years,[34] and was involved in the national programme for telehealth, together with 31 of Norway's 428 municipalities.

### Design

A single embedded case study design[35] was employed to get an overview of key contextual factors from the municipality's perspective, thus getting a better understanding of which factors could be targeted when planning an assistive living technology intervention in primary care. The case was defined as the municipality. The embedded design included macro, (policy), meso, (organization) and micro (clinical team in homecare) levels in the data collection and analysis.

### Data collection

The data collection was based on a triangulation of methods involving document analysis, semi-structured individual interviews, and focus group interviews to get a broad insight when preparing for an intervention.[36] Data were collected on three levels of the healthcare system; 1) national policy documents and regulations (macro) 2) individual interviews with senior managers and municipal strategy documents (meso) and 3) focus group interviews with nurses and nurse managers in direct patient care (micro). Informants for the individual

interviews were chosen based on purposeful sampling [37], seeking informants who were most able to inform us on the research question. Senior managers were selected because they held major roles in the municipality's work with implementing assistive living technologies in primary care, and were in the best position to validate and provide relevant information for the study.

An overview of data material is depicted in table 1.

Table 1: Data material:

| **System level** | **Data** | |
|---|---|---|
| Macro level | Documents : 6 (national policy documents) | ONR 2011:11;[2] Report No. 9 (2012-2013) to the Storting;[38] Report No. 10 (2012-2013) to the Storting;[39] Report No. 29 (2012-2013) to the Storting,[40] Report No. 11 (2014-2015) to the Storting;[41] Care Plan 2020[42] |
| Meso level | Interviews: 5 | Assistant director, project manager, adviser in municipal administration, head of health and welfare department, head of home-based care |
| | Documents: 2 | Municipal strategy plan for implementing assistive living technologies, Report on use of resources in |

| | | |
|---|---|---|
| | | municipal health- and care services |
| Micro level | Focus group interviews : 2 (*n=12*) | 6 informants in each group; nurses in direct patient care and nurse managers |

1) Macro-level data collection: Acquisition of documents

The data collection at the macro level involved acquisition of relevant national policy documents (e.g., national care plan and whitepapers) developed by the Ministry of Health and Care Services.[2 38-42] These documents were included because they provide information about macro level entities' vision and ideas concerning the use of assistive living technologies in health care. Macro level data are referred to as "external environment" in the MUSIC framework.[33] All documents are publicly available on the Internet and downloaded from: https://www.regjeringen.no/en/find-document/id2000006/?ownerid=421.

2) Meso-level data collection: Semi-structured interviews and acquisition of documents

Five individual semi-structured interviews were conducted with senior managers in primary care. These managers were all having a key strategic position within the municipality with important oversight of the decision-making processes related to assistive living technologies. Individual interviews were employed to ensure a more in-depth understanding of the leaders' roles in the implementation of assistive living technologies in elderly primary care. Recruitment was initiated through the study's working group members, by asking them for a recommendation as to who could best explicate the aspects of interest. MTG asked potential informants face-to-face about participation, all accepted. There was no relationship between informants and interviewer prior to study commencement. The interviews were conducted by the same person (MTG) for consistency, took place at the respective informants' office, with only the informant and interviewer present, and lasted approximately 60 minutes. A semi - structured interview guide was developed based on MUSIQ, focusing on organizational structures and processes for managing quality, and the leader's role in QI work. The interviews were audiotaped and transcribed verbatim. The municipality's strategic

plan for implementing assistive living technologies,[34] and a report on the use of resources in municipal health and care services[43] were included to provide additional perspectives about key issues, and to serve as a supplementary source for understanding discrepancies among informants[44].

3) Micro-level data collection: Focus group interviews

Two focus group interviews were conducted (*n=12*) in 2014. Maximum variation sampling[37] was employed to identify a sample of health care professionals who represented different lines of work at the micro level. Administrative personnel in the municipality, who otherwise were not involved in this study recruited informants; 12 health care professionals who worked either in direct patient care or administered care services for the elderly were invited by mail to participate in the interviews, all agreed. 11 women and 1 man in the age between 30-55 years, who had worked in primary care for more than five years, participated. None of the informants were directly engaged in the work with assistive living technologies. A thematic interview guide was developed for the purpose of exploring aspects related to implementation of assistive living technologies. Focus group interviews were employed so that participants could discuss perceptions, opinions and thoughts related to the abovementioned topics[45]. The interviews were led by a moderator (MTG) to ensure rich and relevant data[46], there was no relationship between informants and interviewer prior to the interviews. A co-moderator made notes on observations and impressions during the interviews. Both interviews took place at the informants' work place, and lasted approximately 90 minutes. Interviews were audiotaped and transcribed verbatim.

**Data Analysis**

The MUSIQ framework was used as a guide in the data analysis, by providing a priori themes in advance of the analysis process. This is described by Crabtree & Miller as a template organizing style.[36] With the template (theory-based) analysis style the text is organized according to preexisting theoretical or logical categories, to provide new descriptions of previously known phenomena.[47] Three data sources were analyzed ; at the macro level, we analyzed [48] national policy documents to map the stated governmental expectations related to implementation of assistive living technologies in Norwegian municipalities. The role of the macro-level data is to link the governmental expectations concerning the use of assistive

living technologies in municipal elderly health care, and how these are addressed by the municipal at meso and micro level. At the meso level, we analyzed key documents from the municipality and transcripts from individual interviews; and at the micro level, the units of analysis were transcripts from focus group interviews.

We read meso– and micro-level transcripts repeatedly to gain familiarity, and then discussed the emerging findings as a team whose backgrounds spanned health and social science (MTG nurse/PhD candidate; IT nurse/Postdoctor; SW social scientist/Professor, all female). Data material was analyzed thematically[36], using the MUSIQ theoretical framework. Data was analyzed iteratively within our research team until no new themes emerged. Table 2 illustrates the analytical process. Study participants were not involved either in the analysis process or provided direct feedback on the findings, but to ensure trustworthiness in the analysis, analyst triangulation and member checks were applied.[37 49 50]

Table 2: Data analysis process:

| | Data source | | Findings | Factors in MUSIQ |
|---|---|---|---|---|
| Macro level | Care plan 2020 | «Main aim in the National program for development and implementation of assistive living technologies is that assistive living technologies are integrated in primary care services."[43] | Governmental expectations related to implementation of assistive living technologies, as an integrated part of municipal services | External motivator |
| Meso level | Head of health and social welfare departmen t | "I don't quite know how, and this is probably the big challenge; how will the municipal build a system concerning this?" | Organization is still immature | Maturity |
| Micro level | Nurse, focus group 2 | "I think that Skype could be a tool between accident and emergencies department, general practitioners and home-based care. One thing is to describe it over the phone, it's completely different to show how the situation really is; we could provide blood pressure, pulse, $O_2$ saturation and such…" | Healthcare professionals motivated to use assistive living technologies in daily care | Motivation to change |

## Ethical approval

This project has been approved by the Norwegian Data Protection Authority (Approval ref# 21/2013).

## RESULTS

The main contextual factors identified in this study were external motivators and project sponsorship (macro level), leadership, workforce focus and maturity (meso level), and motivation to change and maturity (micro level). The results are depicted in figure 2.

Figure 2: Results organized on different levels:

*Figure 2 about here*

### Macro level

Document analysis of national policy documents showed that external motivators and project sponsorship were the main contextual factors at the macro level. Six white papers [2] [38-42]state in various ways that telehealth/telecare should be integrated in the health care services. The Norwegian government established a national programme for development and implementation of assistive living technologies, which main objective is that assistive living technologies are integrated in primary care services by 2020.[42]:p.28. Expectations are stated in a direction of more user-oriented health care services[40]:p.40, and that the uptake and use of assisted living technologies are part of an innovative and provident health care system[40]:p.55.

In this, it was demonstrated that the external environment, represented by several reports to the Parliament, was an incentive for leaders in the municipality to translate the national targets to local initiatives, by being an external motivator. Furthermore, the document analysis showed that the Directorate of Health (DoH) exercised a role as project sponsor, as it provided funding for assistive living technology projects led by the municipality. For example, the municipality had a project as part of the National programme, involving the transition of analogue personal alarm systems to digital solutions, which was funded by the DoH.

**Meso level**

QI leadership and maturity were the two main factors identified at the meso level. In the interview material, it became evident that the leaders in the municipality had to align the local QI work with the national priorities and focus areas, as defined in macro level policy documents.

> *"We are part of the National programme, which focuses on safety alarms; therefore, we have two projects concerning safety. First and foremost we must prioritize this work. The national directions are clear about which activities the municipalities should prioritize."*
>
> Project manager

In terms of leadership, the senior leaders regarded it as their responsibility to be familiar with and committed to ongoing projects involving the use of assistive living technologies. Furthermore, leadership emerged also as a factor in the interview material by various expressions about how QI work was of great importance in the municipality. The assistant director made it clear that anchoring of projects was a necessity for ongoing projects, and that there was a system for QI work in the municipality:

> *"It's my responsibility to attain goals and measures which are defined in the strategy, and to follow up on all the ongoing projects. It must be anchored in the management – we know that for everything we do!"*
>
> Assistant director

> *"We've had focus on QI since we got re-organized, arranging semi-annual dialogue gatherings in a quality network, where the employees in the health and care districts can give input on how to succeed."*
>
> Assistant director

Nothing explicit regarding leadership was identified through document analysis of the municipality's strategic plan [34], but leadership was implicit when organizational issues were described. Data infrastructure, resource availability and QI workforce focus were contextual

factors that emerged in meso-level interviews. These factors were an expression for organizational readiness, and tell us something about an organization's maturity. Maturity – or the lack of maturity – emerged as a key contextual factor at the meso level. Findings from individual interviews addressed several concerns about whether the municipality was ready to actually implement assistive living technologies. One informant expressed such a concern:

> *"We have actively recruited participants in the project related to personal alarm systems, but that raises a lot of questions: Does the municipality want to take on more tasks? Who will provide service functions related to this? What will it cost…? There are ethical issues…I wish more of this was clarified before we started…"*
>
> Head of health and social welfare department

Maturity regarding municipal data infrastructure was also addressed in the interview material. It was still unclear if and how the municipality was prepared for the integration of assistive living technologies in the care services:

> *"I don't quite know how, and this is probably the big challenge; how will the municipality build a system concerning this? Today we have a system, and a dedicated QI-team, perhaps it will be IT… but I think it has to be part of our system."*
>
> Head of health and social welfare department

Document analysis of the municipal strategic plan [34] identified challenges related to implementation and integration. The challenges were related directly to the lack of guidelines from national authorities regarding financial issues, standardization of technological platforms / infrastructure / cyber security, legal issues, organizational aspects and ethical considerations:

> *"…financing is still undetermined. Several prerequisites must be clarified in order for the municipality to use assistive living technologies. Issues concerning legislation, ethics, cyber security, technology requirements and safe operations need to be addressed."*

These challenges were also an expression for the lack of organizational maturity, thus maturity emerged as a key factor at the meso level regarding both organizational readiness, data infrastructure and challenges related to the lack of guidelines from national authorities.

**Micro level**

At the micro level, motivation to change and maturity were the two main contextual factors that emerged from the focus group interviews. Motivation to change was identified in both focus group interviews, where the informants talked about the potential benefits that could arise from using assistive living technologies:

> *"We would like to have this (assistive living technologies)! (Laughter and talking) …we require equipment to do INR (International Normalized Ratio = blood test for regulating anticoagulation treatment), bladder scan, oxygen saturation…and CrP" (C-reactive Protein = blood test indicating infections (laughter from several).*
>
> Several nurses, focus group 1

> *"I think that Skype could be a tool between accident and emergencies department, general practitioners and home-based care. One thing is to describe it over the phone, it's completely different to show how the situation really is; we could provide blood pressure, pulse, $O_2$ saturation and such…"*
>
> Nurse, focus group 2

Analysis of the interviews revealed that healthcare professionals were motivated to use assistive living technologies in daily care, if there was a practical benefit for it. However, the informants did not address leadership as a focal point when asked what it would take to integrate assistive living technologies in the care services. Leadership did, however, emerge as a factor, but related to a lack of trust in the local leader's impact on decision-making, with respect to the uptake of assistive living technologies:

> *"I don't think the local leaders have a say in this. It is the municipality's administration who writes the budget. I believe that they decide which tools to use. If they decide we should have tablets, then that would be implemented in all districts."*
>
> Nurse, focus group 2

All in all, the results showed that issues concerning implementation and organizational factors related to the integration of assistive living technologies in home-based care were addressed only to a small degree. The main finding at the micro level was that the technological solutions had to function properly in the day-to-day work. They described experiences with the opposite, and that dysfunctional technology was discouraging and frustrating in their line of duty. This implies that maturity was also a key finding at the micro level. For example, the lack of data infrastructure was regarded as a hindrance for successful integration:

> *"In the rest of Europe, they have a standard for everything, and they are able to integrate things much more easily. Here, each GP have their own computer system, and each municipality has their own computer system…"*
>
> Adviser

The municipality lacked a sophisticated enough data infrastructure to be ready for integration of assistive living technologies in the care services.

## DISCUSSION

Based on document analysis and interviews with both leaders and health care personnel, this study identified several of the contextual factors in the MUSIQ framework. More specifically, the study revealed that external motivators and project sponsorship at the macro level represented expectations from outside entities that guided senior leaders in defining a local mission and vision related to use of assistive living technologies for the municipality. These expectations were reflected in the findings at the meso level, where the senior leaders were well aware of the agenda set from above. However, many aspects still remained unclear in the macro-meso relationship, such as further financing of ongoing projects, and legal and technological aspects, because there were no guidelines from the macro level addressing these issues. Micro level findings revealed that health care professionals were not very conscious about other factors than the practical use of assistive living technologies.

Previous studies in this field have used various theoretical frameworks to identify and explore factors that influence adoption, implementation and continued use of assistive living

technologies. Sugarhood *et al*.[23] concluded that successful implementation of telecare very much depends on to what degree contextual factors are specified, understood and addressed. Greenhalgh *et al*.[18] have developed a study program called "SCALS" which focuses on assistive living technologies in their organizational, social, political and policy context, using a systems approach that includes interdependencies. There are no publications from the "SCALS" program to date (other than the referred study protocol), but the program seems to be based on the same notion as our study, namely that contextual factors play a pivotal role for the understanding of implementation and integration of a technological solution into a complex health care system.

The framework applied in our study (MUSIQ) can help us understand how factors are interdependent, e.g., that external motivators at the macro level will be an incentive for leaders at the meso level to translate national QI priorities into local initiatives at the micro level. This hypothesis is partially supported by our findings. We found that the strategies developed in policy documents affected the upper management in the municipality, but health care personnel at the micro level were not so familiar with strategies and emphasis on assistive living technologies. The lack of such alignment between levels could represent a challenge when preparing for successful implementation of assistive living technologies in primary elderly care. A report from report The King's Fund [51] summarizes relevant evidence regarding integration of care, from a multi-level perspective. In relation to interdependent factors, they underline that initiatives at the macro system must be linked to initiatives at the meso level for particular care groups and populations, and at the micro level for individual service users and carers. Organizational maturity and readiness to implementation is of vital importance, but the actual use of the technology takes place on micro level – in the provision of care for the elderly. Thus, it is necessary to address this implementation gap, in order to deliver the expected outcomes related to the uptake and use of assistive living technologies.

Despite of this implementation gap, the health care personnel (micro-level focus group interviews) in our study were motivated to change their daily practice, by using technological solutions, but the lack of data infrastructure and resource availability hindered such a change. From previous research, we know that lack of organizational readiness for change is an important factor in understanding why implementation efforts fail.[52]

Uncovering these factors has important implications in how to increase the likelihood of successful implementation of assistive living technologies, which in turn potentially could reduce unnecessary cost and burden on overstretched health services.

**Strengths and weaknesses**

This case study does not formulate a solution for how to implement assistive living technologies but the insights from the study could be used in comparable settings. One premise in this paper is to acknowledge the organizational, social, political and policy context in which assisted living technologies are implemented. The findings underpin the premise that people and technologies are linked in a dynamic health care system made up of multiple interacting stakeholders. We have not focused on the ‘‘user system’’, that is, the intended user of a technological solution. This needs to be addressed for successful adoption. The implementation process should be informed by all stakeholders – individual users, service providers and technology suppliers, to ensure a person-centered, holistic and ethically based approach. Such co-production should be addressed in future research.

The findings from this case study pertain to the particular organization and context prevailing in the included Norwegian municipality; other municipalities, countries and settings may illustrate different opportunities and challenges. Data collection at the macro level was not standardized, and only comprises documents and not interviews. The identified documents are all valid for Norwegian municipalities working with assistive living technologies in health care. Moreover, the documents reflect directions and expectations that municipalities must comply with, and therefore provide information paramount to understand the external environment in the study. It could be argued that our sample of informants including 17 primary care managers and health care professionals should have been larger. However, the involved informants represents senior managers at the meso level with the key competence need to be mapped in our study, such as strategic knowledge on plans, decision-making, funding, and vulnerability in infrastructure. The sample of 12 health care professionals have daily patient contact and represents future users of the assistive living technology with similar competence and experience with such technology. Hence, their perspectives may be transferable to other similar contextual settings as described here. Still, the analyzed data were rich, and represented three levels (macro-meso-micro).

Another limitation is the use of the MUSIQ framework in the data analysis; because of the a priori defined themes, we could have missed out on themes relevant for the planning of an assistive living intervention.

**Implications**

Through this study, we have generated empirical knowledge about contextual factors that can influence the implementation of assistive living technologies in primary home care. The study already positions assistive living technologies as an innovation whose success depends on the social and organizational context. Two key implications are evident from our study. First, we have shown that various contextual factors existing in a complex health care system (represented by a municipality) are present and need to be addressed in order to optimize the likelihood for successful implementation. Low levels of uptake and use may be explained in part by organizational immaturity and different focus of the various stakeholders; thus, aligning interests across multiple stakeholders remains a challenge when planning for an assistive living technology intervention in primary care. Second, our findings suggest that the challenge lies not solely in the implementation process, but also in the integration of assistive living technologies in municipal care service provision, beyond the initial adoption. For the municipality, there is uncertainty about guidelines from national entities, and concerted and ongoing efforts are required to integrate assistive living technologies as a routine and sustained part of primary care services. Evidence-based implementation strategies (e.g., PRIME[31], CFIR[53]) support the notion that context affects organizational change, dissemination, innovation, implementation, and knowledge translation. In a Norwegian context, it will be of vital importance to develop a clear framework and action plan within primary care, in order to address the different focus of the various stakeholders involved in the implementation process. This includes clearly defined roles and responsibilities. Moreover, is it important to incorporate specific assessment for assistive living technologies into service provision; the guidelines from national authorities must be clear and unambiguous. Future studies are advised to take these aspects into consideration when planning for an assistive technology intervention in community care.

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**Competing interests**

Grant funding for research but no other competing interest.

**Contributors**

MTG planned the study design, was responsible for the development of data collection tools, contributed to data analysis and drafted and revised this manuscript. SW contributed to the study design, contributed to the development of data collection tools, data analysis, and contributed to drafting and revision of the manuscript. IT contributed to data analysis and drafting and revision of the manuscript. All authors have read and approved the final version of the manuscript.

**Data sharing statement**

This is a qualitative study and therefore the data generated is not suitable for sharing beyond that contained within the submitted manuscript. Further information can be obtained from the corresponding author.

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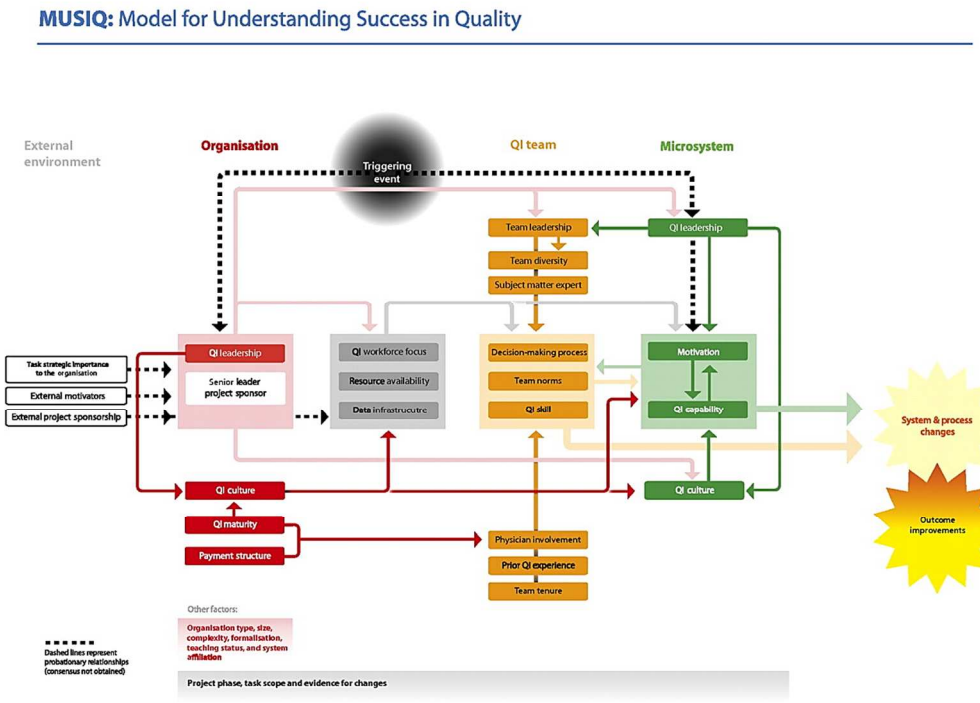


The MUSIQ framework as described in figure 1, is a comprehensive conceptual framework for approaching and studying an implementation process in health care.

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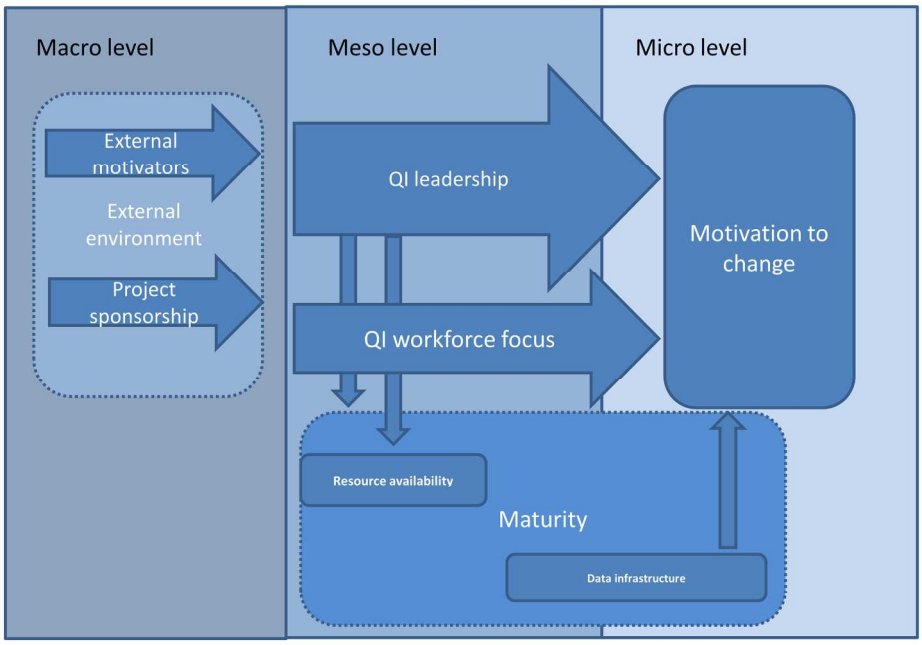


The main contextual factors identified in this study were external motivators and project sponsorship (macro level), leadership, workforce focus and maturity (meso level), and motivation to change and maturity (micro level). The results are depicted in figure 2.

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Tong et al., International Journal for Quality in Health Care; Volume 19, Number 6: pp. 349 –357
10.1093/intqhc/mzm042 Advance Access Publication: 14 September 2007:

## Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups (

1. Interviewer/facilitator Which author/s conducted the interview or focus group? ***P. 8 + 9***

2. Credentials What were the researcher's credentials? E.g. PhD, MD ***P. 1***

3. Occupation What was their occupation at the time of the study? ***P. 10***

4. Gender Was the researcher male or female? ***P. ~~1~~ 10***

5. Experience and training What experience or training did the researcher have? ***P. 10***

6. Relationship established Was a relationship established prior to study commencement?

***P.8 + 9***

7. Participant knowledge of the interviewer ***P.8 + 9***

8. Interviewer characteristics What characteristics were reported about the interviewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic

***P. ~~9~~ 18 + 19***

9. Methodological orientation and Theory What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis ***P. 9***

10. Sampling How were participants selected? e.g. purposive, convenience, consecutive, snowball ***P. 7 ~~8~~ + 9***

11. Method of approach How were participants approached? e.g. face-to-face, telephone, mail, email ***P. 8 + 9***

12. Sample size How many participants were in the study? ***P. 7 + 8~~9~~ (table 1)***

13. Non-participation How many people refused to participate or dropped out? ***P. 8 + 9***

14. Setting of data collection Where was the data collected? e.g. home, clinic, workplace ~~N/A~~ ***P. 8 + 9***

15. Presence of non-participants Was anyone else present besides the participants and researchers? ***P. 8 + 9***

16. Description of sample What are the important characteristics of the sample? e.g. demographic data, date ***P. 8 + ~~9~~***

17. Interview guide Were questions, prompts, guides provided by the authors? Was it pilot tested? ***P. 8 + 9***

18. Repeat interviews Were repeat interviews carried out? If yes, how many? ***P 6***

19. Audio/visual recording Did the research use audio or visual recording to collect the data? ***P. 8 + 9 ~~10~~***

20. Field notes Were field notes made during and/or after the interview or focus group? ***P 9***

21. Duration What was the duration of the interviews or focus group? ***P 8 + 9 ~~10~~***

22. Data saturation Was data saturation discussed? ***P. 10***

23. Transcripts returned Were transcripts returned to participants for comment and/or correction? ***P. 10*** ~~N/A~~

24. Number of data coders How many data coders coded the data? ***P. 10***

25. Description of the coding tree Did authors provide a description of the coding tree? ***P. 11***

26. Derivation of themes Were themes identified in advance or derived from the data? ***P. 9***

27. Software What software, if applicable, was used to manage the data? N/A

28. Participant checking Did participants provide feedback on the findings? ***P. 10*** ~~N/A~~

29. Quotations presented Were participant quotations presented to illustrate the themes / findings? Was each quotation identified? e.g. participant number ***P. 11-16***

30. Data and findings consistent Was there consistency between the data presented and the findings? ***P. 11-16***

31. Clarity of major themes Were major themes clearly presented in the findings? ***P. 11-16***

32. Clarity of minor themes Is there a description of diverse cases or discussion of minor themes? ***P. 11-16***