Size Matters: E-Health Implementation Challenges Across Norwegian Municipalities

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Abstract— This study explores the size-dependent challenges and strategies in implementing e-health systems across Norwegian municipalities. Through a qualitative analysis of semi-structured interviews, the research identifies distinct barriers and approaches among small, medium, and large municipalities. Small municipalities face operational challenges and resource constraints, medium municipalities struggle with system integration and interoperability, and large municipalities are hindered by vendor lock-in and outdated technological frameworks. The study emphasizes the importance of context in e-health implementation, suggesting tailored strategies for municipalities based on size and capacity. This paper contributes to understanding the complexities of ehealth implementation, offering insights for policymakers and practitioners aiming to optimize healthcare delivery through technology.

Keywords- E-Health Implementation; Municipal Healthcare; System Interoperability.

I. INTRODUCTION

E-health systems, defined as the use of Information and Communication Technology (ICT) to improve health services and outcomes, have become integral to modern healthcare delivery. Globally, these systems address pressing challenges such as aging populations, escalating healthcare costs, and the need for more efficient care delivery [1]. In Norway, where municipalities manage primary healthcare services, effective e-health implementation is vital for equitable and sustainable healthcare delivery [2].

The implementation of e-health systems in municipalities is influenced by a complex interplay of technical, organizational, and human factors. One prominent challenge is the fragmentation of healthcare information systems, which often lack interoperability and hinder seamless data exchange across different service levels and institutions [3]. This fragmentation is exacerbated by the varying capacities of municipalities to implement and manage advanced technological solutions, with smaller municipalities often struggling with limited financial and human resources [4]. This fragmentation is further complicated by a historical lack of regional ana national coordination in municipal e-health initiatives. Additionally, the dependence on proprietary systems has created issues such as vendor lock-in, which constrains innovation and limits municipalities' ability to tailor solutions to local needs [5].

Recognizing these challenges, various initiatives have in recent years emerged to support the adoption and integration of e-health systems. In Norway, the 2020 "Akson" project sought to establish a unified electronic health record (EHR) system for almost all municipalities, aiming to address interoperability issues and enhance data sharing (Directorate of eHealth, 2020). Similarly, a national e-health coordination network ("KS e-komp") directed by the municipalities' interest organization provides a collaborative platform for municipalities to share knowledge, resources, and best practices in e-health implementation. While these initiatives represent important steps forward, the effectiveness of such programs often depends on their ability to account for the diverse contexts and needs of municipalities of varying sizes.

From an academic perspective, research on e-health implementation has emphasized the importance of contextual factors, such as organizational readiness, governance structures, and user acceptance, in determining success [6][7]. However, there remains a gap in understanding how these factors differ across municipalities of different sizes and capacities. Addressing this gap is crucial for developing targeted policies and strategies that can enhance e-health adoption and performance across all levels of municipal healthcare.

In Section 2, we present the methodological approach of the study, including the research design, data collection, and analysis procedures. Section 3 outlines the results, structured around key themes identified in small, medium, and large municipalities. In Section 4, we discuss these findings in relation to existing literature, focusing on system challenges, collaboration, and attitudes toward change. Section 5 highlights the implications for policy and practice and concludes the paper by summarizing key insights and suggesting directions for future research.

II. METHODS

This study adopts an interpretive research tradition to explore the size-dependent challenges and strategies associated with e-health implementation in Norwegian municipalities. The study employs a qualitative methodology, specifically using semi-structured interviews and thematic

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framework analysis, to gain an in-depth understanding of the phenomena under investigation.

The interpretive approach was chosen to investigate the nuanced and context-specific challenges faced by municipalities of varying sizes. This tradition allows for the exploration of participants' perspectives and experiences, emphasizing meaning-making processes in the context of e-health implementation. Interpretive research focuses on understanding phenomena within their specific contexts by engaging deeply with participants' lived experiences [8]. Such an approach is particularly well-suited for exploring the socio-technical dynamics of e-health, as it acknowledges the interplay between technology, organizational structures, and human behavior [9].

A. Data Collection

Data were collected through semi-structured interviews conducted between April and June 2021. The interviews were designed to elicit detailed accounts of the challenges and strategies related to e-health systems in small, medium, and large municipalities.

B. Sampling strategy

The study employed a purposive sampling strategy to recruit at least two informants from each municipality size category. The sample of six municipalities was chosen to capture variation across size categories, not to achieve representativeness. Purposive sampling ensured relevant informants, and two cases per category allowed for meaningful comparisons within the study's qualitative scope. While the sample is limited, it was sufficient to identify key themes and size-related differences. Classification followed the Statistics Norway (SSB) guidelines: municipalities with fewer than 5,000 inhabitants were categorized as "small," those with 5,000 to 19,999 as "medium," and those with over 20,000 as "large" [10]. A convenience list of four municipalities in the "small", and five in the "medium" categories, and two in the large category were created. Invitations to participate were sent to the "IT Director" or a similar role for municipalities that listed such contact information on their website. If no IT contact was listed, the invitation was directed to the "Director of Health Services" or equivalent. For municipalities without any specific contact details listed, invitations were sent to the official email address of the municipality. Of the eleven invitations sent, six municipalities accepted, one declined, and four did not respond. The six respondents were evenly distributed across the three municipality size categories.

C. Interview Process

Interviews were conducted using video conferencing systems, ensuring flexibility and accessibility for participants across various municipalities. Each interview lasted between 45 and 90 minutes and was audio-recorded with the participants' consent. The recordings were subsequently transcribed verbatim to ensure an accurate representation of the data.

D. Data Analysis

Thematic framework analysis was employed to identify patterns and themes within the data. This method provides a systematic approach to organizing and interpreting qualitative data while maintaining flexibility to accommodate emergent themes [11]. The analytical process consisted of several iterative steps to ensure depth and rigor in the interpretation of findings.

The analysis began with familiarization, during which the researchers reviewed the transcripts multiple times to immerse themselves in the data. Preliminary observations and reflections were recorded to capture initial impressions and identify potential areas of interest. Following this, coding was conducted inductively, with codes generated directly from the data rather than predefined categories. This inductive approach aligns with recommendations for thematic analysis, allowing the data to guide the development of key concepts [12]. For example, statements such as "Switching systems seems like a daunting process due to extensive re-training requirements" were coded as "Resistance to System Changes," while remarks like "We developed a platform to consolidate data from various systems during COVID" were coded as "Efforts Toward Unified Data Systems."

Once initial codes were generated, they were organized into thematic categories (Table 1), forming the basis of the analytical framework. This step involved grouping codes by their conceptual similarity and relevance to the research questions.

TABLE I. THEMATIC CATEGORIES	
Category	Description
E-health system challenges	Captures mentions of specific challenges within electronic health systems, including issues with integrations, user-friendliness, and system maintenance.
System implementation experiences	Relates to experiences and perspectives on implementing e-health systems, including the transition processes, user adoption, and training needs.
Stakeholder perspectives on system needs	Captures the expressed needs and requirements from various stakeholders like healthcare providers, system administrators, and local government officials regarding e-health systems.
Comparisons of system functionalities	Used for parts of the transcript where comparisons are made between different systems or where the functionality of existing systems is evaluated against potential new systems.
Innovations and improvements discussed	Any discussion related to innovations in e-health systems, potential improvements, or emerging technologies being considered for implementation.
Interactions with vendors and suppliers	Includes any mentions of interactions with technology vendors and suppliers, including negotiations, challenges, and the dynamics of vendor relationships.
Impact of e-health on clinical practices	References to how e-health systems impact clinical practices, decision-making, and patient management.
Policy and regulatory references	Any mention of policy, regulations, or national guidelines that influence the decision-making and operations of e-health systems.
Cross-municipal collaboration and challenges	Discussions related to the collaboration across different municipalities or regions, including shared challenges and collaborative projects.

Table shows thematic categories developed from the initial codes

The category "E-health System Challenges" included codes such as "Integration Difficulties," "User-friendliness Issues," and "System Maintenance Challenges." In parallel, the category "System Implementation Experiences" encompassed codes like "Transition Processes," "User Adoption," and "Training Needs." This process of categorization was iterative, with the researchers continually revisiting and refining the groupings as new insights and patterns emerged from the data. As the analysis progressed, the framework was systematically applied across all transcripts to ensure consistency in identifying and interpreting the recurring themes. In total, we identified nine thematic categories that comprehensively captured the nuanced experiences and varying strategies employed by municipalities of different sizes in managing and innovating their e-health systems. These categories provided a robust framework for analyzing the diverse challenges and innovative solutions in e-health system implementation across municipal contexts.

The final step involved interpreting the themes in relation to the size of municipalities, emphasizing contextual differences and their implications for e-health implementation. This phase required synthesizing the themes to construct a coherent narrative that reflected the complexities of the data.

E. Ethical Considerations

According to §2 and §4 of the Norwegian Act on Medical and Health Research, this study did not require approval from the Regional Ethics Committee (REK). The data handling procedures were approved by the Data Protection Officer at the University Hospital of North Norway. Participants provided informed consent prior to their involvement, including consent for audio recording and transcription. Confidentiality was ensured by anonymizing participant data and securely storing all research materials.

F. Limitations

While the interpretive approach provides rich, contextual insights, the study's reliance on purposive sampling may limit the generalizability of its findings. For instance, larger municipalities typically have designated IT directors, whereas in smaller municipalities, these responsibilities often overlap with other roles and are not the primary focus. Consequently, there is a higher level of confidence in having identified the most suitable informants in larger municipalities. Additionally, the necessity of conducting interviews remotely due to pandemic restrictions during the study period may have impacted the depth of interaction with participants. The methodological approach allowed for an exploration of ehealth implementation practices across municipalities, offering a basis for analyzing and understanding the challenges and strategies related to their sizes.

III. RESULTS

This section presents findings from the comparative analysis of e-health challenges and strategies across small, medium, and large municipalities in Norway. The results are structured around three primary themes: system challenges, collaboration and knowledge sharing, and attitudes toward change. Differences related to municipality size are highlighted, providing a nuanced understanding of the factors influencing e-health implementation.

A. System Challenges

1) Small Municipalities

Participants from small municipalities consistently highlighted the complexity and outdated nature of their ehealth systems. These systems impose significant usability challenges on healthcare staff, many of whom lack the technical expertise required to navigate them effectively. Limited technical resources and staffing capacity further exacerbate these issues, necessitating reliance on external support for system management. For example, one respondent stated, "Gerica (their ehr system) is a bit outdated...a significant program that lacks intuitive design and requires substantial training." Another participant emphasized the burden of retraining, noting, "Switching systems seems like a daunting process due to extensive re-training requirements.".

2) Medium Municipalities

In medium municipalities, integration and interoperability emerged as primary concerns. Participants reported difficulties in achieving seamless document sharing and aligning patient medication lists across systems. The persistence of fragmented systems was attributed to specialist groups favoring tailored software solutions, resulting in operational inefficiencies. The diversity of systems within these municipalities was noted as a complicating factor, hindering efforts to establish consistent workflows across healthcare services.

3) Large Municipalities

Respondents from large municipalities identified vendor lock-in as a major challenge, emphasizing the constraints it imposes on data access and innovation. Large municipalities often depend on proprietary systems that limit their ability to integrate new functionalities or collaborate with external stakeholders. While smaller municipalities also faced challenges with proprietary applications, the more complex system requirements in large municipalities made this challenge more pressing in comparison. For instance, one respondent remarked, "We face significant vendor lock-in that prevents us from accessing our own data and innovating freely." Current platforms were described as technologically outdated and tightly coupled, making updates and modifications both slow and complex. Despite these challenges, respondents demonstrated an advanced awareness of data governance issues and expressed a strong desire to modernize system architectures.

B. Collaboration and Knowledge Sharing

1) Small Municipalities

Collaboration among small municipalities was primarily operational in nature, focusing on resource pooling to address capacity limitations. Shared servers, joint training initiatives, and regional cooperation were identified as essential strategies for managing e-health systems efficiently. Respondents highlighted the importance of these collaborative efforts in overcoming resource constraints and ensuring the continuity of system operations.

One participant shared, "We began with shared servers and system responsibilities among several municipalities." Another added, "Training and courses are shared among the municipalities to reduce resource strain.".

2) Medium Municipalities

Medium municipalities leveraged knowledge-sharing networks such as KS e-komp to align strategies and share best practices. These networks facilitated greater engagement with national initiatives, enabling municipalities to address system integration challenges more effectively. Collaboration in this context was more structured than in small municipalities, reflecting the increased complexity of e-health operations. One respondent described the benefits of such networks: "We work closely with other municipalities through KS e-komp to share knowledge and approaches." Another highlighted broader opportunities, noting, "Being part of national initiatives provides opportunities to align with broader goals."

3) Large Municipalities

Collaboration in large municipalities extended beyond operational and strategic alignment to include policy-level engagement. Respondents highlighted their involvement in shaping e-health policies and engaging with national and international stakeholders. The COVID-19 pandemic served as a catalyst for innovation, with several large municipalities developing platforms to consolidate data from fragmented systems. These initiatives demonstrated the potential of collaboration to address systemic challenges effectively.

One participant explained, "We developed a platform to consolidate data from various systems during COVID, which has been well-received."

C. Attitudes Toward Change

1) Small Municipalities

Respondents from small municipalities expressed significant resistance to change, driven by concerns over resource limitations and the perceived burden of system adaptation. Fear of disruptions to established workflows and the high cost of training further contributed to this resistance. Change was often viewed as a risk rather than an opportunity. For example, one participant noted, "Switching systems seems like a daunting process due to extensive re-training requirements." Another stated, "Basic knowledge is not enough to handle the system effectively; it feels like one needs an IT background."

2) Medium Municipalities

In medium municipalities, change was generally perceived as necessary but was hindered by fragmentation and conflicting preferences among specialist groups and departments. The lack of a unified approach to system adoption posed additional challenges, complicating efforts to implement large-scale changes effectively. One respondent commented, "Fragmentation persists as specialist groups favor their specific software solutions." Another highlighted, "The lack of integration makes large-scale changes very challenging."

3) Large Municipalities

Respondents from large municipalities exhibited a proactive attitude toward transformative change, driven by the need to address data governance and improve interoperability. However, external factors such as vendor dependencies and systemic bottlenecks at the national level constrained their ability to implement these changes. Despite these limitations, large municipalities demonstrated a strong commitment to innovation and modernization. One respondent emphasized, "We are constrained by vendor dependencies, but we remain committed to driving innovation and modernization." Another explained, "Transformative changes require national-level coordination, which can be slow."

IV. DISCUSSION

The findings from this study highlight the size-dependent challenges faced by municipalities in implementing e-health systems. By examining these challenges and the corresponding strategies, this discussion contextualizes the contingencies of municipality size in shaping e-health capabilities and outcomes.

A. System Challenges Across Municipalities

The analysis underscores how municipality size shapes the scope and nature of e-health challenges. Small municipalities face fundamental operational difficulties, such as outdated systems and limited technical capacity. These findings align with prior research suggesting that rural and smaller local governments often lack the infrastructure and human resources needed for technological innovation [4]. This reliance on external support and resistance to system changes, driven by resource constraints, underscores the importance of designing low-complexity, user-friendly e-health systems. For example, as one respondent stated, "Switching systems seems like a daunting process due to extensive re-training requirements." Such insights align with findings by Venkatesh et al. [6], who emphasize the critical role of perceived ease of use in technology adoption.

In contrast, medium municipalities encounter challenges primarily related to integration and interoperability. The coexistence of multiple, fragmented systems tailored to specific functions hinders seamless data sharing and workflow consistency. These findings resonate with studies highlighting the complexities of integrating heterogeneous systems in midsized organizations [13]. Addressing this issue requires technical solutions, such as standardized data exchange protocols, and governance mechanisms to align diverse stakeholders [14].

Large municipalities contend with advanced challenges, such as vendor lock-in, which restricts access to data and limits innovation. These municipalities operate on outdated platforms that are tightly coupled, making changes both slow and resource-intensive. For instance, that significant vendor lock-in prevented access to their own data, challenging innovation. The persistence of vendor lock-in reflects broader issues in e-health system procurement, where proprietary solutions often dominate. These findings suggest that large municipalities would benefit from national-level interventions to promote open data standards and reduce dependency on proprietary systems [15]. Municipalities may benefit from exploring open standards and open-source solutions like openEHR, which can support data portability and reduce dependency on single vendors. Joint procurement initiatives could also offer greater leverage in negotiations. Additionally, national policies that encourage interoperability and vendorneutral approaches might help create more flexible and sustainable systems over time.

B. Collaboration and Knowledge Sharing

Collaboration emerges as a critical strategy across municipalities, but its nature and purpose vary with size. Small municipalities rely on collaboration to pool resources and share operational responsibilities. Shared training and infrastructure initiatives allow them to overcome capacity constraints. This observation aligns with studies highlighting the efficacy of intermunicipal cooperation in addressing resource disparities [16].

Medium municipalities utilize collaborative networks such as KS e-komp to align strategies and share best practices. These networks enable municipalities to collectively address integration challenges and benefit from national-level guidance. "We work closely with other municipalities through KS e-komp to share knowledge and approaches," explained one respondent. The role of such networks emphasizes the importance of collaborative innovation in public sector reforms.

In large municipalities, collaboration extends beyond operational needs to policy-driven initiatives and innovation. Their involvement in shaping e-health policies at national and international levels underscores their strategic importance. For instance, during the COVID-19 pandemic, several large municipalities developed platforms to consolidate fragmented data systems. This innovation exemplifies the transformative potential of policy-aligned collaboration.

C. Perspectives on Change

The willingness and ability to innovate are influenced by municipality size. Small municipalities exhibit cautious attitudes toward change, driven by resource limitations and concerns over workflow disruptions. This risk aversion aligns with studies suggesting that smaller organizations are slower to adopt new technologies due to financial and technical constraints [4].

Medium municipalities display moderate openness to change but encounter internal challenges related to fragmentation and stakeholder misalignment. Effective governance structures are crucial for fostering coordinated efforts toward e-health improvements.

Large municipalities adopt a proactive approach to innovation, motivated by the need to address advanced challenges like data governance and interoperability. However, progress is constrained by external factors, including vendor dependencies and national policy bottlenecks. Aligning local efforts with broader systemic reforms is essential to overcoming these barriers [17].

D. Implications for Policy and Practice

The insights from this study underscore the importance of context-sensitive strategies in e-health implementation. Policies must be tailored to the unique challenges and capacities of municipalities of varying sizes. For small municipalities, low-complexity and cost-effective systems are essential to enhance usability and minimize resource strain. Medium municipalities require interoperable solutions and governance mechanisms to address system fragmentation. Large municipalities need systemic support to overcome vendor lock-in and implement open data standards, enabling innovation and modernization.

Strengthening regional and national collaboration frameworks can further support municipalities in addressing shared challenges. Initiatives that align strategies and facilitate knowledge sharing are instrumental in fostering innovation and improving e-health outcomes. Capacity-building programs targeted at smaller municipalities can mitigate resistance to change and enhance digital competency, as evidenced by successful training initiatives in public sector organizations [18].

V. CONCLUSION

This study highlights the size-dependent challenges and strategies associated with e-health implementation in Norwegian municipalities. Small municipalities struggle with limited resources and outdated systems, medium municipalities face issues of integration and interoperability, and large municipalities grapple with vendor lock-in and data governance challenges. By examining these differences, this study underscores the importance of tailoring e-health policies and initiatives to the specific needs of municipalities based on their size and capacity. These findings provide valuable insights for policymakers and practitioners, emphasizing the need for inclusive and context-sensitive strategies to ensure equitable and effective e-health adoption.

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