

# Artificial intelligence-assisted decision-making in long-term care: a qualitative study on opportunities and prerequisites for responsible innovation

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## Abstract

**Background:** While use of artificial intelligence (AI)-based technologies such as decision-support systems (AI-DSSs) could help sustaining and improving the quality and efficiency of care, their deployment also creates ethical and social challenges. In recent years, there has been a growing prevalence of high-level guidelines and frameworks to provide guidance on responsible AI innovation. However, few studies specify how AI-based technologies such as AI-DSSs can be responsibly embedded in specific contexts such as the nursing process in the long-term care (LTC) for older adults.

**Objective:** Opportunities and prerequisites for responsible AI-assisted decision-making in the nursing process were explored from the perspectives of nurses and other professional stakeholders in LTC.

**Methods:** Semi-structured interviews were conducted with 24 care professionals in Dutch LTC, including nurses, care coordinators, data specialists and care centralists. Two imaginary scenarios about the future use of AI-DSSs were developed beforehand and used to enable participants to articulate their expectations regarding the opportunities and risks of AI-assisted decision-making. After first openly discussing opportunities and possible risks associated with both scenarios, six high-level principles for responsible AI were used as probing themes to evoke further consideration on risks of using AI-DSSs in LTC. Further, participants were asked to brainstorm about possible strategies and actions in the design, implementation and use of AI-DSSs to address or mitigate the mentioned risks. A thematic analysis was carried out to identify opportunities and prerequisites for responsible innovation in this area.

**Results:** Professionals' stance towards the use of AI-DSSs is not a matter of purely positive or negative expectations, but rather a nuanced interplay of positive and negative elements that lead to a weighed perception of opportunities and prerequisites for responsible AI-assisted decision-making. Both opportunities and risks were identified in relation to early identification of care needs, guidance in devising care strategies, shared decision-making, and caregivers' workload and work experience. To optimally balance opportunities and risks of AI-assisted decision-making, seven categories of prerequisites for responsible AI-assisted decision-making in the nursing process were identified: (1) regular deliberation on data collection, (2) a balanced proactive nature of AI-DSSs, (3) incremental advancements aligned with trust and experience, (4) customization for all user groups including clients and caregivers, (5) measures to counteract bias and narrow perspectives, (6) human-centric learning loops, and (7) routinization of using AI-DSSs.

**Conclusions:** Opportunities of AI-assisted decision-making in the nursing process could turn into drawbacks, depending on the specific shaping of the design and the deployment of AI-DSSs. Therefore, we recommend viewing the responsible use of AI-

DSSs as a balancing act. Moreover, given the interrelatedness of the identified prerequisites, we call for various actors, including developers and users of AI-DSSs, to cohesively address different factors important to the responsible embedding of AI-DSSs in practice.

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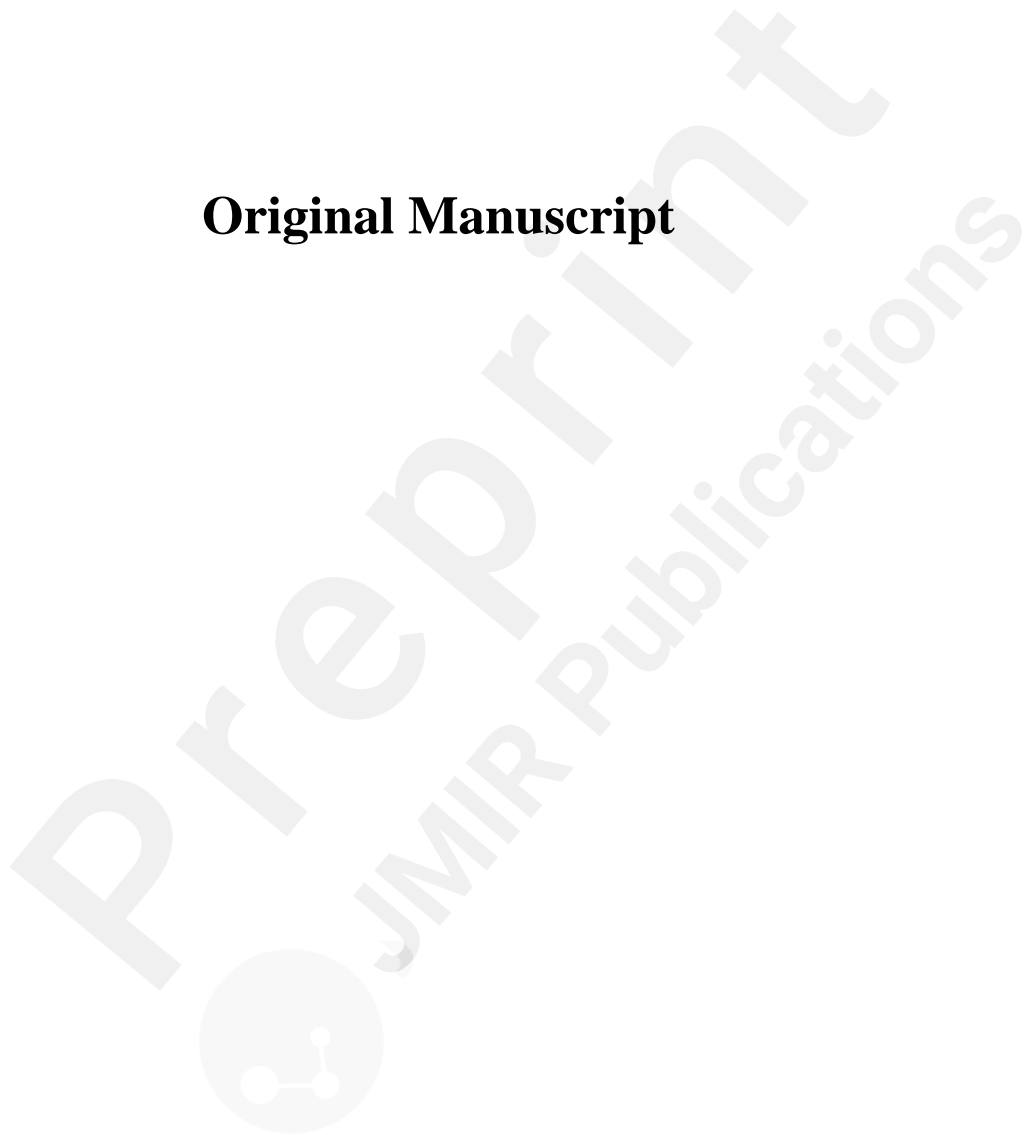
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**Original Manuscript**



## Original paper

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### Abstract

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**Keywords:** responsible innovation, ethics, stakeholder perspectives, decision-support systems, long-term care

## Introduction

In the long-term care (LTC) for older adults, technologies based on artificial intelligence (AI) are increasingly being developed and deployed to support the nursing process, from the assessment and diagnosis of care needs to the planning, implementation and evaluation of care strategies addressing these needs [1–9]. For instance, AI-based decision-support systems (AI-DSSs) could support specific aspects of the nursing process such as monitoring clients' behavior and vital signs with the aim to identify frailty, to assess dementia-related problems and suitable interventions, and to triage health deteriorations before eventually transferring clients to an emergency department or institutional care setting [1,10–13]. Throughout the nursing process, nurses, care coordinators and other care professionals generally need to navigate through a complex web of diagnostic and therapeutic uncertainties, client preferences and values, and cost considerations [14,15]. Against the backdrop of the growing gap between the number of qualified caregivers and the number of people in need of care, AI-supported decision-making by caregivers could help sustaining and improving the quality and efficiency of care.

AI-based technologies can, for a given set of human-defined objectives, make predictions, recommendations, or decisions influencing real or virtual environments, thereby using machine or human-based data and input [16]. The term AI-DSSs refers to information systems that acquire relevant data about care needs or processes, present the relevant data to users such as nurses, and possibly translate raw data into actionable information, such as alerts, risk assessments or recommendations about care strategies [15,17–19]. Like AI in general, AI-DSSs combine *pre-programmed, rule-based* algorithms and *data-driven, self-learning* algorithms rooted in machine learning. While initially being rule-focused, these systems now increasingly incorporate machine learning. This enables them to extract patterns and new insights from datasets that may be challenging for humans to analyze, and to improve their performance (eg, recommendations) based on new data [3,15,19–21]. Anticipated progress in AI-DSSs, therefore, suggests a growing role in *proactively* supporting nurses and other stakeholders in decision-making about person-centered care strategies by harnessing relevant data.

Notwithstanding the potential of AI-DSSs and other AI-based technologies to support caregivers and other stakeholders in LTC, their deployment also creates ethical and social challenges. The long-term data gathering of data about individuals' health and well-being, along with algorithms playing a pivotal role in interpreting these data to arrive at care-related decisions, raises concerns. These

concerns encompass the potential erosion of individuals' privacy, autonomy, and self-determination, depersonalization of the caregiver-client relationship, and discrimination, problematization and stigmatization of old age [5,19,22–24]. Due to the impact that the use of AI-based technologies may have on older adults' lives and caregivers' work and the potential resistance that might emerge during implementation, implications need to be assessed and addressed at an early stage of their development.

In recent years, there has been a growing prevalence of guidelines and frameworks to provide guidance on responsible AI innovation for diverse stakeholders such as researchers, legislators, technology developers, and technology users. Studies that have compared responsible AI frameworks emphasize a general consensus around high-level principles, such as transparency, justice, fairness, and nonmaleficence [25–27]. However, current guidelines are generally highly abstract and leave much room for interpretation as to how these principles can be practically applied and contextualized to specific technologies like AI-DSSs and in specific contexts such as LTC [27,28]. While scholars recognize the importance of a more context-specific conceptualization of these principles, multiple literature reviews have shown that only few studies specify practical approaches to responsible AI innovation for specific application domains, and this is especially true for applications of AI in LTC [6,8,29,30].

This study aims to contribute to filling this knowledge gap by presenting the results from an interview study on opportunities and prerequisites for responsible AI-assisted decision-making in the nursing process, with a specific focus on the LTC domain. In-depth interviews were performed with a variety of professional stakeholders in LTC, including nurses who have a pivotal role in implementation. The results could lead to recommendations for responsibly embedding these future technologies into nursing practices.

## Methods

Semi-structured interviews were conducted to explore the perspectives of nurses and other professional stakeholders in LTC on opportunities and prerequisites for responsible AI-assisted decision-making in the nursing process. The interviews were conducted as part of the HAAL (HeAlthy Ageing eco-system for peopLe with dementia) project<sup>1</sup>, which is part of the European Active and Assisted Living (AAL) programme. In HAAL, an international consortium<sup>2</sup> collaborates on the co-design, development, testing and commercialization of an AI-DSS that is intended to provide actionable information to formal caregivers of frail older adults, in particular people with dementia, with the aim of reducing their workload and increasing the quality of care. The consortium acknowledges that innovators need to anticipate on, reflect on and respond to the ethical and social implications of increasingly advanced AI-DSSs at an early stage of innovation. Therefore, in parallel to the iterative co-design, development and field testing of a low-complex AI-DSS, the empirical research presented in this paper was conducted to explore opportunities and prerequisites for responsible innovation in AI-DSSs.

As input for the interviews, two distinct imaginary scenarios were developed, outlining different roles for AI within AI-DSSs. The scenarios were inspired by the AI-DSS developed in the HAAL project, and leveraged on the distinction between descriptive, predictive and prescriptive data analytics algorithms [31,32]. The AI-DSSs in the first scenario included only descriptive analytical functions, while the second scenario involved a more advanced AI-DSSs including descriptive, predictive and prescriptive functions. Through these scenarios, abstract notions like AI and AI-DSSs

<sup>1</sup> AAL Europe, 2021, Project number: AAL-2020-7-229-CP

<sup>2</sup> The HAAL consortium consists of care organizations, research institutes and commercial firms from the Netherlands, Italy, Taiwan and Denmark.



have been rendered more tangible, enabling interview participants to articulate their expectations and considerations regarding the opportunities and risks of AI-assisted decision-making more effectively [33–35]. In addition, six principles for responsible AI from *the WHO guidance on Ethics & Governance of Artificial Intelligence for Health* [36], were used as probing themes to evoke further consideration on risks of using AI-DSSs in LTC and strategies to address these.

## Participants

In total, 24 participants took part in this study. Recruitment took place through e-mail inquiries to care organizations involved in the HAAL project, and to other LTC facilities within the Netherlands. The researchers' goal was to achieve a varied composition of participants with different roles in the LTC for older adults and with varying degrees of experience with technology, data and AI.

Participants can broadly be categorized into four groups: nurses ( $N=13$ ), care coordinators ( $N=6$ ), data specialists ( $N=3$ ) and care centralists ( $N=2$ ). The group of nurses comprised nurses with varying levels of education and in various roles, from more executive district nurses to quality nurses with greater responsibilities in coordinating the care of different clients. The group of care coordinators comprised case managers dementia ( $N=2$ ), geriatric care coordinators ( $N=2$ ), and specialists geriatric care ( $N=2$ ), who all primarily coordinate and oversee various aspects of the care for frail older adults, including medical, social and support services, and act as central point of contact to clients and their formal and informal care network. While the former two roles focus on coordinating home-based care, specialists geriatric care treat clients with complex care problems in both nursing homes and at home. The data specialists play a central role within their care organization in managing and utilizing data to provide actionable insights to care teams, for instance through dashboards, and develop AI-based applications to support decision-making and improve the quality of care. Finally, nursing care centralists are positioned within care centers in the Netherlands that respond to alarms (for example from active and passive alarming instruments) and care-related questions. For instance, they remotely provide advice to clients or call in a caregiver on site when needed. Thus, these participants already had a role in decision-making about care strategies based on data.

Of the 24 participants, 16 participants held a formal role in advancing digitization within their care organization. This might imply that these participants had on beforehand already made or could relatively easily make explicit representations about opportunities and prerequisites for responsible AI-assisted decision-making in LTC. More specifically, these were 9 (of 13) nurses, 2 (of 6) care coordinators, 3 (of 3) data specialists and 2 (of 2) care centralist. Further, 18 of the 24 participants were female and 6 were male. The mean age of participants was 41 years old (Min=21; Max=61) and on average, the participants had 16 years of occupational experience in healthcare (Min=3; Max=40).

## Procedure and Materials

All interviews were conducted digitally through a video call. During the calls, the option was used to share the screen to provide additional visual support for the interview questions. The interviews were conducted between May 2022 and February 2023 and their mean duration was 79 minutes (Min=58; Max=119). In total 24 interviews were conducted (by DL, NS and SA). 17 of these interviews were conducted by pairs of researchers and 7 interviews were conducted by a single researcher. With a multidisciplinary group of researchers (DL, NS, SA, HHN, WB and AP), an interview protocol was developed. Minor adaptations were made to the protocol after pilot testing with the first two participants.

The interview protocol (see Multimedia Appendix 1) was structured as follows: In the first part of the

interviews, participants were invited to reflect on the two developed imaginary scenarios that outline different roles for AI within the HAAL-DSS, in order to explore their perspectives on the opportunities and implications of using AI-DSSs in LTC. First, a general explanation was given about the AI-DSS developed in the HAAL project. The AI-DSS in the HAAL project concerns a dashboard that acquires, presents and utilizes the data generated by various digital care and well-being technologies that can be deployed in older adult's home. When used, the technologies collect data about older adults' physical activity, eating and sleeping patterns, cognitive functioning, mood, social contact or medication intake. All technologies were explained and shown to participants using a visual illustration. Then, questions were asked about the perceived relevance of, and the participant's familiarity with the various technologies and data.

In the second part, a description and visual illustration was provided of, and questions were asked related to two imaginary scenarios about the future use of the HAAL-DSS. The first scenario describes a situation in which nurses and other professional stakeholders in LTC use a descriptive dashboard that provides an overview of data that is collected over time via a tailored selection of digital care- and well-being technologies. The primary goal of this dashboard is to make the data generated by various technologies available to caregivers in one place, to prevent that they need to look into separate overviews and apps. In addition, different colors are used to signify varying levels of risk or urgency associated with specific collected data. In doing so, the dashboard distinguishes between situations that are potentially risky and require immediate attention due to a rapid change in the data trend or data indicating an emergency situation such as a fall (red), situations that may require timely attention such as increased toilet use or a disturbed day-night rhythm (orange), and situations that are stable and do not seem to require timely action (green). Apart from application of this coloring scheme, no interpretation of the data is made by algorithms. The dashboard from the first scenario is strongly inspired by the actual dashboard developed in HAAL, though the scenario and the existing dashboard do not exactly correspond.

The second scenario takes a more speculative turn and describes a situation in which nurses and other professional stakeholders in LTC use a more advanced AI-DSS with descriptive, predictive and prescriptive functions. In this scenario, the data generated by the selected care technologies is not only integrated in one system and marked by a color (red, orange, green) to signify risk levels, but also automatically translated into actionable insights by algorithms. The actionable insights could for instance entail risk scores about possible future emergency situations such as a fall, and recommendations about possible follow-up actions, such as to stimulate a client's physical activity if the data indicates a relatively inactive period.

The aim of the two scenarios was to portray potential future situations of AI-assisted decision making in LTC and prompt reflection on positive and negative short- and long-term impacts of AI-DSSs in LTC. Both scenarios leave room for the interview participants to indicate if, and for which types of caregivers and other stakeholders in LTC the respective dashboard might be relevant, and why. After questions about the expected added value of both types of AI-DSSs, participants were also asked which of the two dashboards they would prefer and why. In addition, a short explanation was given about the term 'AI', including everyday examples, whereafter participants were asked what role they hope AI will play in the future of LTC.

In the third part, participants were asked about risks related to the use of AI-DSSs in LTC, along with possible strategies and actions to address or mitigate these risks. First, participants were invited to openly discuss any risks or concerns linked to both scenarios, and to consider whether they perceived any explicit differences in the risks associated with more advanced AI-DSSs as compared to low-complex AI-DSSs. Participants were also asked to brainstorm about possible strategies and actions to

address or mitigate the mentioned risks in the design, implementation and use of AI-DSSs. Subsequently, targeted questions were asked about risks related to AI-assisted decision-making by employing specific probing themes. These probing themes were derived from six key ethical principles for the use of AI for health as proposed in the *WHO guidance on Ethics & Governance of Artificial Intelligence for Health*: (1) protecting human autonomy, (2) promoting human well-being and safety and the public interest, (3) ensuring transparency, explainability and intelligibility, (4) fostering responsibility and accountability, (5) ensuring inclusiveness and equity, and (6) promoting AI that is responsive and sustainable [36]. After briefly explaining each principle to participants based on the explanation provided in the WHO guidance, participants were asked about their views about these principles in the context of AI-assisted decision-making in LTC. Again, participants were asked to brainstorm about possible strategies and actions to address or mitigate the mentioned risks. Finally, participants were asked if they had any other suggestions or topics they wanted to discuss in relation to the implications of using AI-DSSs in LTC.

Prior to the interviews, general information was given about the goal and procedure, and participants were asked to read and sign an informed consent form. The recorded interviews were transcribed verbatim by a professional transcription service. The transcripts were then coded for confidentiality and identifying information was removed. The interviews were conducted in Dutch.

## Analyses

In order to gain insight into participants' perspectives on opportunities and prerequisites for responsible AI-assisted decision-making, a thematic analysis following Braun and Clarke (2012) and using MAXQDA 2022 analysis software was independently carried out by four researchers. One researcher (DL) analyzed all 24 transcripts and three researchers (NS, SA or BH) each analyzed 8 transcripts.<sup>3</sup> The transcripts were analyzed by a stepwise construction of codes. Based on our research question, three initial main codes were pre-established: 1) potential supportive roles of AI-DSSs in the nursing process, which represent opportunities for innovation, 2) risks of using AI-DSSs, which provide first indications about factors that need to be addressed for responsible embedding of these technologies in practice, and 3) corresponding opportunities and prerequisites for responsible design, implementation and use of AI-DSSs. Further main codes and subcodes were derived inductively from the data. During the coding process and after the initial coding, occasional differences in the identified codes were discussed and resolved through three consultation sessions involving all four researchers. Some of the results have been presented by means of illustrative quotes, which were translated from Dutch to English and carefully selected to represent the arguments presented in the interviews and do justice to the variety of perspectives shown within the interviews. In the selection, we have also considered whether the quotes could be understood without the context in which they were originally uttered.

## Results

This section present participants' viewpoints on opportunities and prerequisites for responsible AI-assisted decision-making in the nursing process. In doing so, we firstly discuss anticipated opportunities and risks of using AI-DSSs in nursing processes, and secondly identified prerequisites for responsible innovation in this context.

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<sup>3</sup> While distributing tasks, the goal was to give each researcher the broadest possible view of the dataset. Therefore, NS and SA, who were involved in conducting some of the interviews, analyzed transcripts of interviews in which they had not been involved themselves.

## Opportunities and risks of AI-assisted decision-making in nursing practice

When reflecting on the utility of increasingly advanced AI-DSSs, participants envisioned various supportive roles of AI-DSSs in the nursing process. Based on their substantial experience and domain knowledge in LTC, all participants were able to make explicit representations of potential supportive roles of AI-DSSs in the nursing process. Participants discussed a diverse array of risks of using AI-DSSs in nursing practice, even though multiple participants also shared that they lacked experience in contemplating about the risks and downsides of AI-DSSs, and AI more broadly. Comments about risks were frequently raised spontaneously when participants were prompted to reflect on the two imaginary scenarios outlining differing types of AI-DSSs, though in most cases these comments were shared as a response to either open or targeted (principle-based) interview questions about risks. Opportunities and risks identified are related to various (interrelated) themes, such as early identification of care needs, guidance in devising care strategies, shared decision-making, and caregivers' workload and work experience, and which we discuss below.

### Early Identification of Care Needs

Most participants anticipated that AI-DSSs could support caregivers in remote and early anticipation of care needs, thereby enabling them to proactively intervene and initiate appropriate interventions. As multiple participants discussed, a wide variety of existing care technologies enable caregivers to remotely monitor clients' health, well-being and behavior. The data generated by such technologies can provide insight into changing care needs of specific clients. Such data might be remotely accessed and evaluated by caregivers, but could also be automatically processed - through AI - into actionable insights such as signals and alarms about increased risks that are reported to caregivers. Given that more and more data are being collected via various care technologies, multiple participants explicitly expressed optimism that AI could enable and optimize the utilization of these increasing amounts of data, thereby enhancing already implemented and more stand-alone forms of remote monitoring. Furthermore, some participants reported that they perceived that insights gained through continuous technology-based monitoring might contribute to more adequate and complete information about care needs, because, for instance, clients may not always (be able to) share all relevant information, caregivers' observations when visiting clients generally provide only a limited view of the whole situation, and caregivers might inconsistently report on the same situations. A nurse (participant 14) shared, *"If you think there is a specific care need but you are not sure what is actually happening in the client's room or house, we now often still ask about the nurse's gut feeling, which is often correct, of course, but now [with a AI-DSS] we can check with data what is really the case."* In this line, some participants anticipated AI's potential in not just aiding caregivers in targeted risk assessments or attempts to gain insight into unexplained behavior of clients, but also swiftly uncovering overlooked areas of attention or emerging trends related to a client's health, well-being or behavior.

Notwithstanding these opportunities, participants also shared multiple concerns in relation to the identification of care needs based on personal data. For instance, multiple participants argued that a false sense of security may be created when caregivers excessively depend or trust on the outputs from AI-DSSs, assuming that these outputs encompass all relevant insights about clients' health, well-being and care needs. Also, some participants argued that numerous issues or concerns related to older adults' data could be flagged as potentially problematic. As suggested, this might result in caregivers taking care interventions, whether or not under pressure from other stakeholders such as clients' families. However, those interventions might be perceived as unnecessary or even undesirable by stakeholders such as clients themselves. Therefore, the use of AI-DSS might lead to

over-problematization of old age and stigmatizing stereotypes, impacting both the quality of life of older adults and the workload of caregivers. One care coordinator (participant 22) argued, *“The system may ignore the norms and values of a particular client. [...] Sometimes things that may seem very problematic may actually not be that problematic to a client.”*

In addition, multiple participants commented that the potential misuse or unauthorized access to personal data could jeopardize older adults' individual privacy and ability to make their own decisions (ie, autonomy), and consequently their trust in their care network. Also, some participants suggested that the potential opacity of AI algorithms may complicate both clients' and caregivers' understanding about certain aspects of health and care and potentially diminish their trust and confidence in the collection and utilization of personal data. Furthermore, some participants commented that shifts towards data- and AI-assisted remote care might not be widely accepted. Two participants argued that this raises questions regarding to what extent it can be justified to enforce the implementation of these changes to clients or caregivers who are hesitant or unwilling to adopt these new approaches. As one nurse (participant 20) put it: *“It [using AI-CDSSs] becomes part of the foundation of your profession [...] It becomes an important part of determining your actions. But if someone does not want that, then you suddenly need your old-fashioned skills again, which requires a different way of caregiving that may no longer fit in with regular work processes or the zeitgeist. [...] And then it could also be that the health insurer says: 'We will no longer pay for that, because there is a better alternative.'”*

### **Guidance in Devising Care Strategies**

Multiple participants anticipated that, by pointing caregivers to possible care needs and providing inspiration or substantiation about suitable care strategies, AI-DSSs might increasingly guide or direct caregivers in decision-making about person-centered care strategies. As some participants commented, AI-DSSs might thereby act as a kind of personal 'coach', 'mentor' or 'advisor' with three apparent, related functions. First, multiple participants argued that AI-DSSs might offer inspiration or evidence about tailored, person-centered interventions aimed at improving an individual client's health and well-being, thereby helping caregivers to devise care strategies to address specific issues. Second, multiple participants envisioned that AI-DSSs could facilitate the substantiation and validation of caregivers' initial ideas about care strategies by utilizing objective data to reinforce why these strategies should be implemented or explored further. Third, some participants anticipated that AI-DSSs might increasingly support caregivers in evaluating whether certain person-centered interventions were in retrospect suitable and whether adjustments should be made. AI-DSSs were thus anticipated to enable iterative data-informed deliberation on person-centered care strategies. Some participants argued that AI-DSSs may be particularly useful for relatively inexperienced caregivers who may overlook certain matters or possible care strategies due to a lack of experience, or for temporary substitute workers who are less familiar with a client's behavior, daily rhythm and personal needs or preferences. Some others argued that more experienced caregivers might also find value in such AI assistance because of their potentially deeply rooted approaches to understanding care needs and implementing care strategies that could be challenged by AI-DSSs' output.

Despite these potential benefits, most participants also shared concerns that AI-DSSs' guidance of caregivers in devising care strategies could lead to excessive reliance. In this line, multiple participants argued that caregivers' excessive reliance on AI-DSSs may gradually diminish their capacities for independent decision-making and critical thinking about person-centered care. One nurse (participant 21) said, *“What I find a bit scary when a system is many times more intelligent*

*than you, is that it does not always necessarily make you smarter. [...] The more you are facilitated with knowledge and interpretations and so on, the less you have to think for yourself."* In addition, some participants suggested that caregivers who excessively rely on AI-DSSs may insufficiently consider broader contextual factors or crucial nuances in individual clients' characteristics and needs. Consequently, as some participants argued, excessive reliance on AI-DSSs might result into misguidance towards unsuitable care strategies, and into negative impacts on the overall quality of care due to reduced adaptability of caregivers – and the care system as a whole – to unforeseen circumstances or erroneous or suboptimal recommendations by AI-DSSs. One nurse (participant 11) explained, *"For instance, a male client who is very autistic may often retreat to his room and feel good about that. I can imagine that the system would then say: 'This client rarely leaves his room, there is a risk of loneliness'. Then you may think that is a good conclusion, while it is actually good for this man that he often withdraws himself. Otherwise, he would be seriously overstimulated."*

### **Shared Decision-making**

Many participants anticipated that AI-DSSs could support shared decision-making by older adults and their (in)formal caregivers. Multiple participants argued that AI-DSSs could support caregivers in conversations with clients and their care network, including informal and other formal caregivers, by helping to clarify care needs, identifying unaddressed care needs, and revealing and substantiating necessary adjustments in the care plan. Similar to the broader spectrum of data and technology, AI-DSSs are perceived to potentially act as conversational tools, fostering a more collective approach to decision-making in the nursing process. In this line, it was also mentioned by a few participants that the use of AI-DSSs could support the shared responsibility of different caregivers for providing good care. One nurse (participant 3) suggested, *"A psychological side effect of sharing information amongst all care professionals is that care coordinators no longer feel solely responsible for difficult decisions such as scaling down care. It is increasingly becoming a shared responsibility. By sharing information and anchoring it in the process, there is much more support for difficult measures."*

At the same time, it emerges from some participants' comments that, instead of using data and AI-DSSs' outcomes as input for shared decision-making, people might also – intentionally or unintentionally – use these outcomes against one another. As some participants argued, in contexts where AI-DSSs collect, store, and utilize sensitive personal data, multiple interests could be intertwined and potentially be conflicting, such as the client's interest to protect their dignity and personal boundaries, professional caregivers' interest to anticipate and understand care needs, informal caregivers' interest to monitor (the quality of) formal care provided, and health insurers' interest to exercise control over the care to be provided. Ultimately, such conflicts of interests could result into mistrust.

### **Workload and Work Experience**

On the one hand, most participants suggested that the use of AI-DSSs might alleviate caregivers' cognitive load and improve work experience. Most participants envisioned that AI-DSSs could relieve caregivers from, or even make possible the processing of large amounts of pertinent data gathered in the care context. Some participants perceived it to be increasingly unrealistic to expect caregivers to invest time in tasks involving the analysis of substantial amounts of data, given the high workload, the increasing amount of data gathered in the care context, and the often lacking analytical skills to interpret these data. In this line, multiple participants suggested that AI-DSSs could relieve caregivers' workload by automating routine tasks such as monitoring the clients' daily rhythm or medication intake. In addition, some participants argued that by AI-DSSs taking on data-intensive and repetitive tasks, caregivers might experience substantial decrease in mental strain and a more

sustainable work environment. Also, a few participants mentioned that a decrease in cognitive load resulting from the use of AI-DSSs may potentially allow caregivers to dedicate more time and attention to empathetic aspects of caregiving and nuanced decision-making about person-centered care, rooted in thorough research into the specific clients' care needs.

On the other hand, multiple participants argued that the use of AI-DSSs may also lead to an increased workload and deteriorating work experience of caregivers. Some participants anticipated that caregivers using AI-DSSs might be unable to oversee (some of) the systems' outcomes or feel overwhelmed by the number of AI-generated insights, alarms and recommendations to follow up on. Some participants also stated that caregivers may feel pressured to follow up on AI-DSSs' outcomes. As one nurse (participant 20) commented, *"I see the risk that if you as a care professional decide to ignore a system, like 'I'll let this one go' or 'I don't recognize this [problem] at all', that it could become a difficult story. [...] To what extent will you, as a care professional, still have the right to say: 'I will not do this, or I see it differently'?"* Furthermore, multiple participants argued that if caregivers rely too much on AI-DSSs, it might diminish their active role and autonomy in investigating care needs and devising person-centered care strategies. As some participants suggested, job satisfaction and the sense of professional fulfillment or purpose that caregivers could derive through person-centered and empathetic aspects of caregiving may thereby be reduced.

## **Prerequisites for the Responsible Embedding of AI-DSSs in Nursing Practice**

Participants discussed a broad array of factors that should be taken into account in order to responsibly embed AI-DSSs in nursing practices, and optimally balance opportunities and risks of AI-assisted decision-making. These factors can roughly be categorized into seven interrelated categories of prerequisites for the responsible embedding of AI-DSSs in nursing practice.

### **1) Regular Deliberation on Data Collection**

Stakeholders in data practices, including clients themselves, should regularly deliberate on the data required as input for AI-DSSs. Despite the potential of AI-DSSs to propose better insights as AI-DSSs acquire more (eg, more diverse or more long-term) data, most participants stressed that only essential data should be acquired in order to, for instance, limit privacy infringements, counteract over-problematization of old age, and prevent cognitive overload of caregivers. One nurse (participant 21) stressed, *"What I personally find troubling is that we want to keep an eye on people all day long. [...] I would rather like us to look more closely at specific points about which we say: we might want some extra attention on that. So, for example you might want to know more about - I'll name it - the medication moment around ten o'clock. What happens around that moment that makes that the client may or may not do something with it? Or a fall incident, what happens before that makes the person fall every time?"* In this line, multiple participants argued that the collection of data should always relate to specific objectives (ie, care needs or life goals) agreed upon by clients and caregivers. Some participants also proposed regular deliberation by stakeholders, including clients, on the necessity and implications of data collection, since care needs, stakeholders' personal values and technological possibilities change over time.

### **2) A Balanced Proactive Nature of AI-DSSs**

AI-DSSs should have a balanced proactive nature, meaning that these systems should proactively support the nursing process, while avoiding decision automation. On the one hand, multiple participants stressed that AI-DSSs should ease data-intensive analytical tasks by processing data into

actionable insights that encourage to implement certain care strategies or delve deeper into identified concerns. Some participants argued that in the meantime, it is crucial to avoid overwhelming caregivers with too many insights that, from a practical point of view (eg, due to limited time and resources), cannot be acted upon, or are not necessarily problematic.

On the other hand, there was broad consensus among participants that human agency in decision-making should not be overshadowed and that ample space should be created for caregivers to devise person-centered care strategies by themselves. Multiple participants suggested that the need for users to think critically for themselves should be explicitly communicated to users during implementation. Some proposed that users could also be informed about this via the user interface of AI-DSSs. Furthermore, multiple participants noted that it could be meaningful if AI-DSSs point caregivers to specific areas of concern, but that it should largely remain caregivers' responsibility to come up with person-centered approaches to address specific issues. One nurse (participant 7) argued, *"If you see that a client has been less mobile the entire week, I think you should look at it like: 'okay, what have we observed ourselves in recent weeks?' [...] And what actions you take in response, I think, always depends on the client [...] Let caregivers think for themselves about the interventions that are appropriate, because of course you do not always have to implement the same interventions in a certain situation."*

### **3) Incremental Advancements Aligned With Trust and Experience**

Advancements in AI-DSSs should involve incremental steps that align with users' and other stakeholders' evolving trust in, and experience with these systems. Despite the perceived need for proactive AI-DSSs that transform potentially unmanageable datasets into actionable insights, multiple participants stressed that their operation and use should provisionally not entail too much complexity and opacity. Caregivers, clients and other stakeholders should be enabled to gradually build trust as AI-DSSs prove their value during use. Multiple participants envisioned that, as trust in, and experience with AI-DSSs deepens, gradual advancements in these systems could be implemented. For instance, it may be useful to introduce more advanced predictive and prescriptive analytical functionalities, provided that users can interact with the system without their autonomy and abilities for critical thinking being diminished. Also, some participants argued that, before broader deployment, significant adjustments to algorithms and underlying logics within AI-DSSs may first need to be extensively tested in a secure setting and evaluated by an independent body. One data specialist (participant 12) argued, *"I think we need a quality mark to establish that trust and that we as sector must agree that if such a system does not have such a quality mark and it is still under development, we will not use it."*

### **4) Customization For All User Groups**

The design and implementation of AI-DSSs should involve customization for all user groups including clients and caregivers, entailing that users' interactions with AI-DSSs are tailored to their personal needs. Some participants argued that there is no one-size-fits-all approach for clients when deploying care technologies and collecting data in relation to their health, well-being and care needs. Differences between clients regarding their views on what is important in life and contributes to quality of care (eg, the best possible curative care, safety, freedom and privacy, etc.) may need to translate into variations regarding the choice of care technologies to be deployed, the data collected as input for AI-assisted decision-making, and who can access the resulting insights. In a similar vein, multiple participants argued that some degree of customization should also apply to caregivers. How AI-DSSs interact with specific caregivers – for instance what kind of insights are



provided and to what extent the systems' recommendations have already been concretized – and how caregivers are trained to optimally use AI-DSSs may need be tailored to caregivers' specific role, level of education and problem-solving capacities and ability for critical reflection. One care coordinator (participant 1) argued, *"I think it depends on the resolving power of the person viewing it. [...] Non-medical caregivers level two can often care for people very kindly and can help with washing, dressing and providing pills. But you cannot expect that when a client is ill, they will understand what needs to be changed with those medicines. So then maybe there must be a signal [by an AI-DSS] saying 'maybe you should discuss with the nurse or doctor what should be done with the medication'. But if you make that suggestion to a higher educated nurse, she will say 'yes, duh, I know that. That is my profession'. It might quickly cause irritation if things go like that."*

### **5) Measures to Counteract Bias and Narrow Perspectives**

During both the design of AI-DSSs and their practical deployment, measures should be taken to actively counteract bias and narrow perspectives. Multiple participants suggested that designers should provide transparency about the underlying functioning of AI-DSSs to ensure that caregivers can properly understand how AI-based insights are generated, and can assess the applicability and relevance of these insights in the context of individual clients. Simultaneously, some participants argued that although a certain level of transparency is essential, it should not entirely hinder the advantages offered by advanced AI analytics. They advocated a middle ground between fully explainable AI and black box AI. Multiple participants suggested that transparency about AI-based outcomes could be fostered through explanations via AI-DSSs' user interface about underlying trends in the data that led to a specific outcome, or about the types of data and client characteristics taken into account to achieve certain outcomes. In addition, multiple participants argued that the output of AI-DSSs should be framed as advice and not as compelling information to prevent users from following AI-based outcomes without critical reflection. Also, some participants suggested that, in cases where AI-DSSs provide caregivers with recommendations about interventions to address specific care needs, multiple possible strategies could be presented in order to prevent caregivers from fixating on one specific solution. Furthermore, some participants advocated incorporating contextual information about client's characteristics such as cultural and socio-economic background, as well as caregivers' own observations or interpretations. As suggested, such information could provide a broader perspective on the relevance of specific AI-generated insights, and might be crucial for caregivers to develop a nuanced understanding of a client's situation and care needs. Moreover, multiple participants suggested that it might be relevant if AI-DSSs not only provide insight into areas of attention in clients' health and care, but also highlight positive trends that indicate that a certain care intervention has been successful, for instance.

In addition to measures in AI-DSSs' design, many participants stressed that caregivers need training in the responsible use of these systems. For instance, multiple participants proposed training to critically evaluate the relevance of AI-generated insights and resist a potential tendency to accept supposedly 'evidence-based' outputs from AI-DSSs as the truth. Also, some participants stressed that training should counteract that caregivers overly concentrate on specific facets of health and well-being or particular care interventions to which AI-DSSs have guided their attention. One nurse (participant 17) stated, *"I think it is important to indicate very clearly in the training, for example, that options are presented for what you can do, but that you are supposed to think for yourself about what fits. Are you going to adjust the action slightly, are you going to take a completely different action, or aren't you going to anything at all?"*

## 6) Human-centric Learning Loops

AI-assisted decision-making should involve human-centric learning loops, entailing that caregivers ought to be involved during both the design of AI-DSSs, and their implementation and use in practice. One suggested aspect of such involvement was that caregivers could assist designers in determining and iteratively improving AI-DSSs' logics during both the initial design and the practical use of these systems. Multiple participants advocated that caregivers with domain-specific knowledge and an affinity to technology assist designers, who may lack such contextual knowledge, in drawing up and testing assumptions regarding how specific data can be converted into meaningful insights to support the nursing process. Also, a few participants suggested that caregivers could be involved in labeling or annotating data in training datasets for AI-DSSs. In addition, some participants proposed that some caregivers could reinforce the learning process of AI by assisting designers in overseeing that adaptive AI-DSSs adequately refine their outputs based on new data and user feedback. In a similar vein, multiple participants mentioned that caregivers who actually use AI-DSSs in practice should have options to review AI-generated outcomes and provide feedback that reinforces the learning capabilities of AI-DSSs. For instance, some participants suggested to enable caregivers to set the specific threshold values from which a certain alarm should be generated for specific clients, indicate how they followed up on specific AI-generated insights and why, and manually enter relevant matters that have been overlooked by the system. A nurse (participant 6) stated, *"It may be good to have the possibility to also add information as a professional, important data that may affect the client and care. [...] If someone does absolutely not want physiotherapy, but that is recommended by the system every time, then you want to be able to indicate somewhere that this is no longer an option, so that the system can take that into account, and look for a second best option."*

Another suggested aspect of human-centric learning loops was that caregivers could support each other in the utilization of AI-based insights in practice. Several participants commented that caregivers who are progressive with and at the forefront of using AI-DSSs could be assigned with the responsibility to facilitate the use of AI-DSSs by other caregivers who may lack experience, be hesitant to use AI-DSSs, or not know how to deal with the systems' outcomes. In a similar vein, some participants suggested that in the context of AI-assisted decision-making, it might be relevant or necessary to involve interdisciplinary care professionals who act as intermediaries between care and technology. As suggested, these professionals could for instance assist less data-savvy caregivers in interpreting data and AI-based outputs to formulate care strategies.

## 7) Routinization of Using AI-DSSs

Finally, the use of AI-DSSs should become routinized, promoting commitment to naturally take AI-based insights into consideration when making decisions. Several participants argued that caregivers have a responsibility to critically examine what care is needed and appropriate in the context of an individual client, and to use all available input, including insights generated by AI-DSSs. This might imply that consulting AI-DSSs might over time become the norm as more evidence becomes available about these systems' added value for the quality and efficiency of care, and trust increases. In this vein, multiple participants mentioned that AI-DSSs should be adequately integrated into the broader work processes of caregivers, for them to be able to optimally utilize AI-based insights. As a data specialist (participant 23) put it: *"I think you should arrange implementations of algorithms in such a way that caregivers cannot actually work around them. You have to make the process foolproof. For example, as we have done here. [...] We have arranged*

*that every client with a positive outcome on the algorithm must be discussed by the coordinating practitioner and the manager. Then caregivers are still the ones who decide about what happens and the manager is the one who asks questions.”* In addition, participants mentioned multiple factors that are important to the routinization of using AI-DSSs. For instance, multiple participants mentioned that caregivers should have the freedom to deviate from, or disregard outcomes of AI-DSSs, provided that they do so thoughtfully. In this line, some participants argued that it may be essential that caregivers comprehensively report on their decisions and actions in the care process. Also, it was suggested a few times that care protocols and agreements within care organizations – or the care sector more broadly - regarding caregivers’ authorities and decision-making power should be regularly evaluated.

## Discussion

### Main Findings

The aim of this study was to gain insight into the perspectives from nurses and other professional stakeholders in LTC on opportunities and prerequisites for responsible AI-assisted decision-making in the nursing process. As our results show, professionals’ stance towards the use of increasingly advanced AI-DSSs is not a matter of purely positive or negative expectations, but rather a nuanced interplay of positive and negative elements that lead to a weighed perception of opportunities and prerequisites for responsible innovation in this context. Our findings provide insight into potential supportive roles of AI-DSSs in nursing practice, provided that these systems are embedded in practice under the right preconditions. For instance, it is anticipated that AI-DSSs can elevate the remote and early anticipation of care needs by harnessing data from various sources (eg, care technologies) and swiftly uncovering overlooked issues or emerging trends related to a client’s health, well-being or behavior. Also, AI-DSSs are expected to foster adaptive, data-informed decision-making about person-centered care strategies, as well as shared decision-making by clients and their (in)formal caregivers. In addition, the use of AI-DSSs is expected to potentially alleviate caregivers’ cognitive load and improve their work experience by saving them time in repetitive, intricate and burdensome analytical and monitoring tasks. AI-DSSs are not regarded as potential decision-makers in the nursing process, but rather as instruments – and by some even as anthropomorphized agents such as personal coaches or mentors - that could proactively aid caregivers in becoming aware of certain care needs and adaptively responding to these needs. Yet, notwithstanding these positive viewpoints regarding the potential supportive roles of AI-DSSs in the nursing process, care professionals generally expressed a cautionary sentiment about AI-DSSs’ potential impact.

Despite their limited prior knowledge and expertise regarding risks of AI, care professionals discussed a diverse array of risks of AI-assisted decision-making in the nursing process. In accordance with conceptual and empirical analyses from previous studies on the ethical implications of using AI-DSSs in healthcare (eg, [24,38–41]), care professionals’ comments encompass interrelated concerns about an excessive reliance of caregivers on technology, potentially eroding caregivers’ critical decision-making capabilities and causing misguidance towards unsuitable care strategies. These viewpoints tie in with how Nyholm [42] sketches the dual effects of AI on human intelligence; the prospect that AI technologies might serve as a form of cognitive enhancement and the cautionary notion that heavy reliance on AI technologies might also make people less intelligent. Other risks frequently discussed by care professionals are that AI-DSSs may cause a false sense of security, as it may overlook important issues and care needs, or that it could contribute to over-problematization of health and aging by flagging many trends in data as potentially problematic. Furthermore, concerns were expressed related to privacy and trust, and the deterioration of

caregivers' work experience due to increased cognitive load or a reduced sense of professional fulfillment.

Expanding upon both the potential supportive roles of AI-DSSs in the nursing process and the identified risks, the care professionals participating in this study were able – to varying degrees – to articulate factors that might be important to responsibly embed increasingly advanced AI-DSSs into nursing practice. Overall, care professionals' reasoning about the responsible design, implementation and use of AI-DSSs in the nursing process centered around seven interrelated categories of prerequisites: (1) regular deliberation on data collection, (2) a balanced proactive nature of AI-DSSs, (3) incremental advancements aligned with trust and experience, (4) customization for all user groups including clients and caregivers, (5) measures to counteract bias and narrow perspectives, (6) human-centric learning loops, and (7) routinization of using AI-DSSs. These findings extend beyond mitigating the risks of AI-DSSs deployment in LTC, as they provide insight into the envisioned interactions between people and technology and how these interactions can be responsibly (re-)shaped as both technology and people's needs and values evolve.

### **Implications for Research and Practice**

Although this empirical study merely provides a first set of insights about opportunities and prerequisites for responsible AI-assisted decision-making in the nursing context, various practical implications can be drawn from our results. An overarching lesson to be learned from the identified opportunities and prerequisites for responsible AI-assisted decision-making in the nursing process is that care professionals perceive that, regardless of AI's increasing capabilities, AI-DSSs should be used as tools to support shared decision-making by clients and their care network. Responsible AI-assisted decision-making hinges on mutual reinforcements between users and technology. In order to maximize the benefits and minimize negative implications of AI-assisted decision-making, the ways in which AI-DSSs support the nursing process and interact with caregivers and other stakeholders require continuous refining 'in context'. This means iteratively tailoring the design, implementation and use of increasingly advanced AI-DSSs to individual clients' and caregivers' interests, experiences and roles in the care process, and to the physical care environment.

The prevailing perspective suggests that inundating nurses, care coordinators and other care professionals with excessive (aggregations of) data could impede rather than enhance their decision-making capabilities. In this line, it is anticipated that the use of AI-DSSs can ease caregivers from data-intensive analytical tasks, proactively directing their attention to issues and trends in data that may need their attention, and possibly even guiding them towards certain care strategies (see prerequisite 2). These findings align with previous studies that actually position the use of AI as a 'technical fix' to mitigate existing risks related to the remote monitoring of older adults, such as caregivers' potential cognitive overload [29,43]. However, the anticipated utility of proactive AI-DSSs must be carefully balanced against the predominant viewpoint that automation of decision-making in the nursing process should be avoided (prerequisite 2), that AI-DSSs might only be introduced in practice through incremental steps that are aligned with users' evolving trust in, and experience with the use of these systems (prerequisite 3), and that vigilance is required to prevent that caregivers become overly reliant on AI-DSSs and are led astray towards unsuitable care strategies (see also [44,45]). In this regard, our findings highlight the importance of actively counteracting bias and narrow perspectives during both the design and use of AI-DSSs (prerequisite 5) (see also [46-48]), and setting up human-centric learning loops through which caregivers can actively contribute to meaningful and responsible design, implementation and use of AI-DSSs (prerequisite 6) [48,49]. These findings resonate with Hindocha and Cosmin Badea [38], who argue that care professionals will be integral to the responsible design, deployment and use of AI in healthcare, as they can act as the moral exemplar for the virtuous machine. Moreover, caregivers play an important role in

collecting data that might eventually be used by AI tools [49]. Also, these findings emphasize that responsible AI-assisted decision-making requires an approach that focuses beyond merely the design and technical aspects of AI-DSSs. The use of AI-DSSs should be supported by caregivers who are capable of adeptly interacting with these technologies (see also [50]). Yet, our findings also suggest that different caregivers might not equally contribute to responsible innovation in this context. Though all caregivers are obliged to provide justification for their own decisions and actions [51], some caregivers might need assistance in the optimal and responsible use of AI-DSSs in practice. In the meantime, other caregivers could take on active intermediary roles between care and technology [49], both by providing such practical assistance to fellow caregivers and by supporting designers in shaping and iteratively improving AI-DSSs.

Whereas our findings suggest a recognition that the overall potential of AI – and AI-DSSs more specifically – grows with the availability of pertinent data, the findings also show reservations against the unrestrained collection of data and use of these data for AI-assisted decision-making. The predominant viewpoint highlighted by care professionals is that specific data and associated AI-based insights ought only to be generated in accordance with established goals agreed upon by key stakeholders including the client (prerequisite 1). In different terms, the collection and utilization of specific data should be proactively and continuously balanced against potential harms such as privacy infringement, cognitive overload and over-problematization of old age (see also [52–54]). While our findings underline that only relevant data should be generated as input for AI-DSSs, they also suggest that whenever it has been decided to generate certain data and have it processed by AI-DSSs, it should be part of the routine to utilize the resulting insights (prerequisite 7). In this context, it is stressed by Heyen and Salloch [20] that the more routinized the use of AI-DSSs becomes in practice, the more critically caregivers need to pay special attention to soft factors in individual client cases that cannot be comprehensively considered by AI-DSSs, such as a client's personality, life situation or cultural background (see also prerequisite 5). In a similar vein, there was a notable skepticism amongst the care professionals participating in this study regarding AI's future capacity to comprehensively anticipate – by itself – people's care needs. After all, it might be difficult or even impossible to fully capture in data and decision rules for AI what contributes to good care and quality of life of an individual person [39,40,55]. Hence, in the context of AI-assisted decision-making, it might become increasingly important to engage in shared-decision-making to get to know clients and optimally respond to their personal needs, goals, interests, preferences and values [20,56]. At the same time, the shared decision-making model is subject to pressure, for instance due to the potential opacity of algorithms leading to insufficient understanding about the rationale behind AI-based insights about care needs and possible interventions [51]. Moreover, shared AI-assisted decision-making may be particularly challenging in the care for older people, especially if those people have cognitive impairments. This may hinder older adults' ability to express their feelings and wishes and amplify the risks that nurses and other (in)formal caregivers - consciously or unconsciously - enforce what they think is right [39,40,57,58]. A fruitful direction for future research could be to explore how AI-DSSs could be adequately integrated in shared decision-making processes with older adults and their (in)formal caregivers.

## **Responsible Innovation: A Balancing Act**

As our findings and the implications drawn above indicate, initial opportunities of AI-assisted decision-making in the nursing process could turn into drawbacks, contingent upon the specific shaping of both the design and deployment of AI-DSSs. The interrelatedness of the identified prerequisites for responsible AI-assisted decision-making suggests that addressing one factor might not be sufficient due to its tight link with others. Moreover, addressing risks such as privacy infringement, for instance by limiting data collection, impacts possibilities for remote care and prevention supported by AI. Hence, we call for technology developers, caregivers using AI-DSSs and

other stakeholders - including older adults - to engage in ongoing public discourses (see also [59]) and work together to *cohesively* address different factors important to the responsible embedding of AI-DSSs in practice. In doing so, we recommend viewing the responsible use of AI-DSSs as a *balancing act* (eg, [43]). Potential or proven positive and negative impacts could be carefully weighed against each other, or stated differently, trade-offs could be made between the effects of using AI-DSSs on values such as quality of life, autonomy, privacy, transparency and fairness (see also [60]). It remains open for further exploration at what level such trade-offs can be effectively made.

While trade-offs need to be made in context, in the care for individual clients, there are also trade-offs to be made at a higher level, between the interests of individual people and broader public interests. As our findings suggest, responsible AI-assisted decision-making requires customization, for instance regarding specific care technologies to be used and data to be collected [61], how these data are processed by AI, who gets access to the data and AI-based insights, how AI-based insights are explained to users [62], and to what extent AI-DSSs proactively advice caregivers about care needs and strategies (see prerequisite 4). In other words, there might be a desire to comprehensively address context-specific needs and preferences regarding privacy protection, transparency about AI-DSSs' outcomes, and protection of caregivers from potential overreliance on AI-DSSs and eroding professional autonomy (eg, [63,64]). To achieve responsible deployments and use of AI-DSSs in practice, one might suggest that such customization should take place at the level of individual clients and caregivers. At the same time, though, full customization might be at odds with the need to offer somewhat standardized solutions, universalize applicability and foster scalability [65–67]. Future studies could explore how trade-offs could be made between the seemingly contrasting need for contextualization and customization of AI-DSSs on the one hand, and for decontextualization and standardization on the other hand. Also, it could be valuable to examine what implications such trade-offs hold for the development of AI-DSSs and their deployment in practice.

Finally, as our efforts to contextualize and operationalize high-level responsible AI principles to the context of AI-assisted decision-making by nurses and other care professionals in LTC have shown promising outcomes, we recommend conducting further research in this area. A vast amount of research has been conducted on the (potential) supportive roles of AI-based technologies in the nursing process [6–9], and into high-level requirements for responsible AI innovation [25–27]. This study builds upon previous studies in both research fields by adding the perspective of a variety of experienced nurses and other LTC professionals on opportunities and prerequisites for responsible AI-assisted decision-making. This holds particular relevance because nurses and other caregivers do not always have a say in the AI tools which are designed [6,9,48,49]. Further conceptual and empirical research on caregivers' and other stakeholders' viewpoints on how to strike a balance between opportunities and risks of AI-assisted decision-making could contribute to a more comprehensive analysis and deeper understanding about ways to ensure the responsible embedding of AI-DSSs and other AI-based technologies in care practices. Though the focus of this study was on the use of AI-DSSs in LTC, the findings might also be relevant to different sectors, contexts and AI-based technologies.

## Study Limitations

No study comes without limitations, and the main limitations of this study are related to the participants involved. For instance, by focusing on the perspectives of LTC care professionals, this study lacks the viewpoints of key stakeholders in AI-assisted decision-making in LTC such as older adults and informal caregivers. Moreover, within LTC, an increasing number of caregiving responsibilities might transition to informal care networks. This highlights the need for future studies to include both formal and informal caregivers and care recipients for a comprehensive understanding of opportunities and prerequisites of responsible AI-assisted decision-making in

nursing practice [39]. The results obtained from this study could also be further examined in future research using a quantitative approach or a larger and more diverse sample of LTC professionals with different cultural backgrounds, thereby evaluating their robustness and completeness. Furthermore, despite the diverse group of care professionals participating in this study, biases may exist due to varying experience with digital innovation, potentially skewing views towards the desirability and implications of AI-assisted decision-making. In addition, the targeted (principle-based) interview questions may have influenced participants' responses by guiding specific conceptualizations of risks. While this guidance may have positively contributed to gaining in-depth insights into prerequisites for responsible innovation, it may also have caused omissions of crucial factors such as AI's impact on the environment, digital inequality and the caregiver-client relationship, which should also be taken into account in contexts of AI-assisted decision-making.

## Conclusions

This study shows opportunities and prerequisites for responsible AI-assisted decision-making in the nursing process from the perspectives of nurses and other LTC professionals. While care professionals see broad opportunities in the use of AI-DSSs to improve the quality of care and caregivers' workload and experience, positive viewpoints about AI-assisted decision-making are generally accompanied by a wide array of concerns about risks. Our findings indicate that opportunities of AI-assisted decision-making in the nursing process could turn into drawbacks, depending on how the design and the deployment of AI-DSSs are shaped. To optimally balance opportunities and risks of AI-assisted decision-making, seven interrelated categories of prerequisites were identified for the responsible embedding of AI-DSSs in nursing practice: (1) regular deliberation on data collection, (2) a balanced proactive nature of AI-DSSs, (3) incremental advancements aligned with trust and experience, (4) customization for all user groups including clients and caregivers, (5) measures to counteract bias and narrow perspectives, (6) human-centric learning loops, and (7) routinization of using AI-DSSs. These prerequisites emphasize that, regardless of technologies' increasing capabilities, AI-DSSs should be used as tools to support shared decision-making by clients and their care network, and the ways in which AI-DSSs support the nursing process need continuous refining in context. The findings of this study highlight the relevance of engaging care professionals in understanding AI's opportunities and risks and identifying factors important to the responsible embedding of AI-based technologies into practice. These actors do not only play a pivotal role in the future use of AI-based technologies in care practice, but can also actively contribute to the articulation of strategies that ensure the meaningful, responsible and sustainable embedding of technologies in practice.

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## Conflicts of Interest

None declared.

## Abbreviations

AI: Artificial Intelligence

AI-DSSs: Artificial Intelligence-based decision-support systems

LTC: Long-term care

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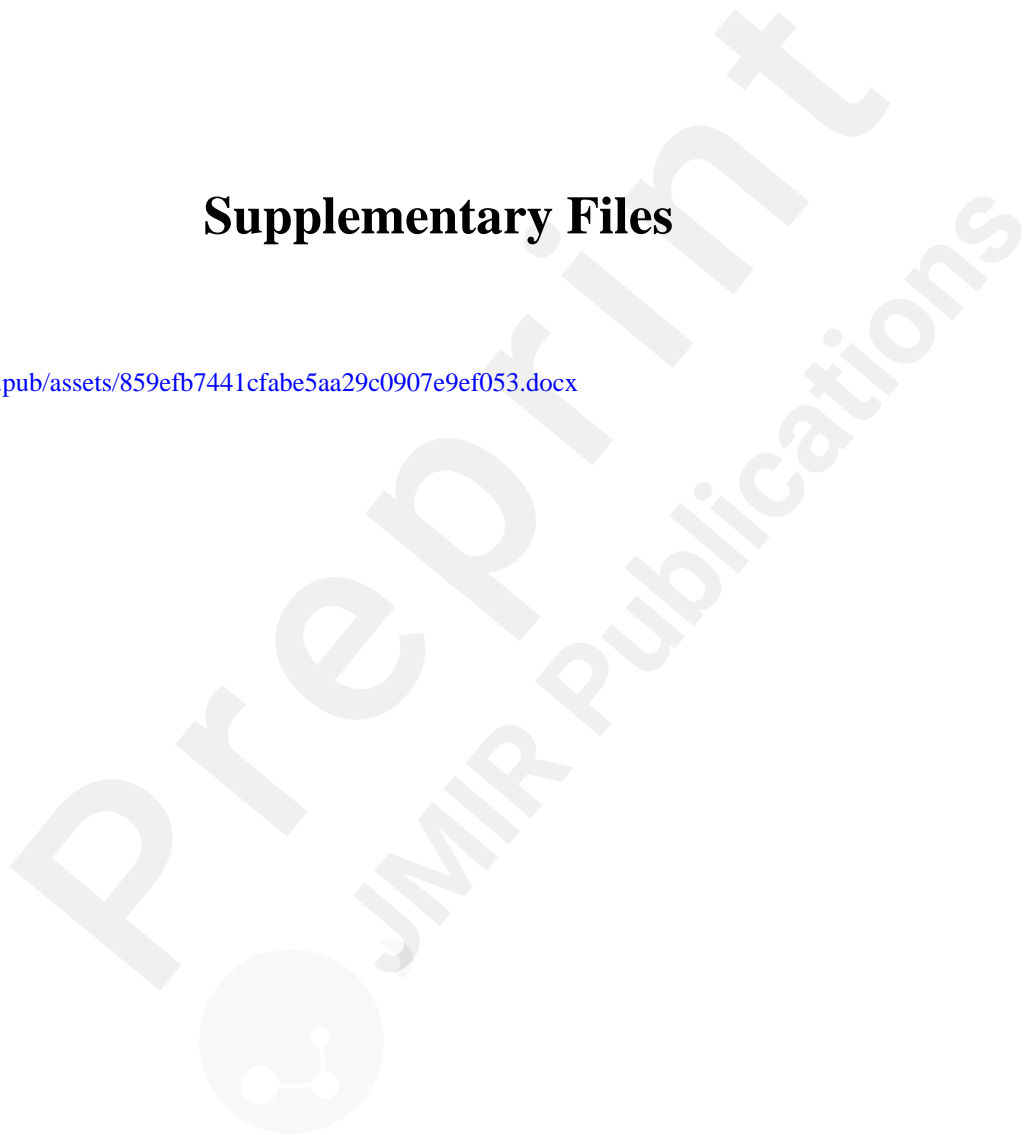
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## Supplementary Files

Untitled.

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## Multimedia Appendixes

Interview protocol (translated to English).

URL: <http://asset.jmir.pub/assets/817fd836078873159e32bdf01184cf65.docx>