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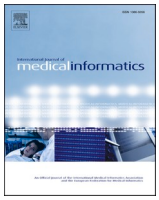

Usability of information systems: Experiences of outpatient physicians, outpatient nurses, and open care social welfare professionals from three large cross-sectional surveys in Finland

Johanna Viitanen [a,*], Mari Tyllinen [a], Elina Tynkkynen [b], Tinja Lääveri [a,c]

[a] Department of Computer Science, Aalto University, PO Box 15400, FI-00076 AALTO, Finland
[b] Faculty of Information Technology, University of Jyväskylä, PO Box 35, FI-40014 University of Jyväskylä, Finland
[c] Infectious Diseases and Meilahti Vaccine Research Center MeiVac, Inflammation Center, University of Helsinki and Helsinki University Hospital, PO. BOX 340, 00029 HUS, Finland

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ABSTRACT

Background: Many European countries are integrating healthcare and social welfare services; some also include joint information systems (ISs) in this process. Despite this, large national survey studies examining and comparing the experiences of the major professional groups regarding the usability of their health (HISs) and client information systems (CISs) are lacking.
Methods: We combined the responses from three national cross-sectional surveys conducted among physicians and nurses in 2017, and social welfare professionals (SWPs) in 2019 in Finland. We selected the responses of 1,826 physicians and 774 nurses working in outpatient clinics in specialized and primary care, and 669 social workers and other SWPs working in open services. The questionnaires were adjusted from a validated instrument. In this study, we analyzed 11 usability-related statements.
Results: The healthcare professionals (HPs) were more critical of the stability and responsiveness of their ISs than the SWPs (27–48% vs 58–65% agreed). The physicians were most dissatisfied with IS support for routine tasks (24–26% agreed). Less than half of all respondents agreed with statements concerning the ease of documentation, arrangement of fields, and terminology. While the HPs were satisfied with IS support for collaboration and information exchange between professionals in the same organization, all professional groups were dissatisfied with cross-organizational support and communication with patients and clients. Almost half of the HPs considered that HISs improve the quality of care, but 80% of the SWPs disagreed that CISs help improve the quality of services.
Conclusions: Overall, the physicians, nurses, and SWPs were dissatisfied with the usability of their HISs and CISs. Based on our findings, ISs should be further developed to support routine tasks, inter- and cross-organizational collaboration, and information exchange. ISs for the integration of care and services should be designed to accommodate various professional groups' different work contexts and needs.

1. Introduction

1.1. Background

Many European countries, including Finland, intend to integrate their healthcare and social welfare services [1–3]. The use of health services is impacted by the social determinants of health such as unemployment, low educational levels, being on a disability pension, alcohol abuse, and the need for financial social assistance [4–9]. On the other hand, patients with poor physical or mental health are likely to need social welfare services such as income support and child protection services [10–12]. Indeed, the same individuals are often the "top attendants'' of both healthcare and social welfare services [13]. In Finland, an estimated 10 % of inhabitants account for 81 % of healthcare

Abbreviations: CIS, Client Information System; HIS, Health Information System; HP, Healthcare Professional; IS, Information Systems; NuHISS, National usability-focused Health Information System Scale; SWP, Social Welfare Professional.

* Corresponding author.
E-mail address: johanna.viitanen@aalto.fi (J. Viitanen).

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and social welfare expenses [14]. Similarly, in the USA, 5 % of the population is considered to be responsible for 50 % of the total healthcare expenditure [15].

To coordinate care, stakeholders must be able to share patient and client data [16,17]. For example, insufficient information exchange between healthcare and social welfare has reportedly endangered the well-being of children [18]. In addition to sharing data, information systems (ISs) can also be used to transform healthcare and social welfare services, such as by improving professional performance and supporting the reallocation of work processes [19–21]. In Finland, ISs are expected to support strategic policy objectives, including the usability, interoperability, and utilization of data [22]. Currently, there are large-scale projects to implement healthcare (HISs) and client information systems (CISs) that cover specialized and primary care as well as social welfare in, for example, Southern Finland [23] and Mid-Norway [24].

The usability of HISs has been a central topic in the health informatics field over the past decades [25–28]. By contrast, research into the usability of CISs in the social welfare sector has only evolved in recent years [29–31]. Usability impacts efficiency and effectiveness of IS usage, and user satisfaction [35]. Notably, poor usability has a downstream effect on the care and services that patients and clients receive. The failure to minimize the cognitive load has been identified among the most common usability problems in HIS design [38]. Recent studies have linked cognitive load and risk of burnout among physicians [39,40] and other healthcare professionals [40]. To design systems with good usability, developers must apply the known universal principles of good user interface design [36,37] and also understand the context of use and end users' workflows [35].

While studies have reported end-user dissatisfaction with HISs and CISs [31,41–47], large studies comparing the experiences of the major professional groups are scarce. In Finland, user experiences of physicians have been monitored since 2010 and of nurses since 2017 [32–34]. The first national survey among social welfare professionals (SWPs) was only conducted in 2019 [31]. In response to the research gap, we set to compare the experiences of physicians, nurses, and SWPs regarding the usability of their HISs and CISs. We combined data from three nationwide usability-focused surveys conducted in Finland 2017–2019. We focused on public sector organizations and six user groups that work in outpatient and open care social service settings: physicians in (1) specialized and (2) primary care, nurses in (3) specialized and (4) primary care, (5) social workers, and (6) other SWPs.

1.2. Context of the study

1.2.1. Healthcare and social welfare in Finland

Municipalities (n = 311 in 2019) are responsible for organizing social welfare services and primary healthcare (health centers) in Finland. Twenty hospital districts, jointly owned by the municipalities of the region, organize specialized medical care. Five university hospitals provide tertiary care. The private sector is responsible for a smaller proportion and variety of healthcare services than the public sector [48]. In social welfare, municipalities or federations of municipalities may purchase services from private service providers and non-governmental organizations (n = 3,971 in 2017) [49]. In 2017–18, there were 19,627 working-age physicians, 70,198 nurses, 4,084 social workers, and 10,022 social counselors in Finland. While practical nurses are the largest group of SWPs, they mainly work in home care and institutional services.

1.2.2. Healthcare and social welfare ISs in Finland

HIS coverage in public healthcare had almost reached 100 % by 2007 [50,51]. All public hospitals and health centers had joined the national Patient Data Repository (Kanta) and the electronic prescription system by 2015 [50,51]. By contrast, the availability of CISs in public social welfare had reached 90 % by 2017 [49], and the implementation of the national data repository has only just begun.

Within the same hospital or municipality, the same HIS brand is used in both inpatient and outpatient care. However, larger municipalities employ different CIS brands for different service lines.

At the time of the surveys (2017 and 2019), the HIS and CIS brands used by Finnish healthcare and social welfare provider organizations had remained practically unchanged for several years [49]. Before 2019, none of the IS brands covered all three sectors: primary care, specialized care (including tertiary care), and social welfare. However, after the surveys, in 2018 a new HIS brand was deployed in one hospital, and shortly after the SWP survey in 2019, the same brand expanded into primary healthcare and social welfare in one municipality. By the end of 2021 the HIS/CIS brand covered the rest of the university hospital and three other municipalities with 47,000 users and one fifth of the Finnish population.

2. Materials and methods

2.1. Data collection

Three separate national surveys on the experiences of physicians, nurses, and SWPs as users of HISs and CISs were conducted in 2017 and 2019. In 2017, 4,018 physicians (approximately 20 % of all physicians in Finland) and 3,607 nurses (5 % of the theoretical target group, 12 % of the sample, and 35 % of all recipients who opened the email) responded to their respective surveys [44,52]. In 2019, 1,145 SWPs (approximately 10 % of the theoretical target group) responded to the survey [31]. For the purposes of this study, we selected the responses of physicians (n = 876) and nurses (n = 360) working in public sector specialized care outpatient clinics, physicians (n = 950) and nurses (n = 414) working in public sector primary care health centers, and social workers (n = 276) and other SWPs (n = 393, mainly social counselors) providing open services (Fig. 1).

2.2. Questionnaires

The national questionnaires for nurses and SWPs were adjusted from a validated national usability-focused HIS scale (NuHISS) instrument for physicians [53,52,31], which includes seven dimensions: technical quality, ease of use, information quality, internal collaboration, cross-organizational collaboration, benefits, and feedback. The statement items included in each dimension are assessed with a five-point Likert scale. The questionnaires are available online [54,55]. The NuHISS instrument has also been applied in Iceland [56], Denmark [56], and Australia [57] to study the experiences of healthcare professionals (HPs).

For this study, we chose 11 statements (Table 1) from the core set of NuHISS statements [53] that were related to usability and typical HIS and CIS tasks in the six selected user groups. The statements were either identical or comparable in the three questionnaires.

2.3. Statistical analyses

Statistical analyses were conducted using SPSS 22 (IBM Corp., Armonk, NY). Analysis of variance (ANOVA) and Bonferroni's post-hoc tests were conducted to compare the results between the professional groups. Statistical significance was set at $p < 0.05$.

3. Results

3.1. Demographics

Table 2 presents the respondents' characteristics. In brief, 68–72 % of the physicians but 94–96 % of the registered nurses, social workers, and other SWPs were female. In total, 47–68 % of the respondents were 45 years of age or older. While 39–67 % of all respondents had used their respective ISs for six years or longer, 31–41 % of the SWPs, 17–25 % of

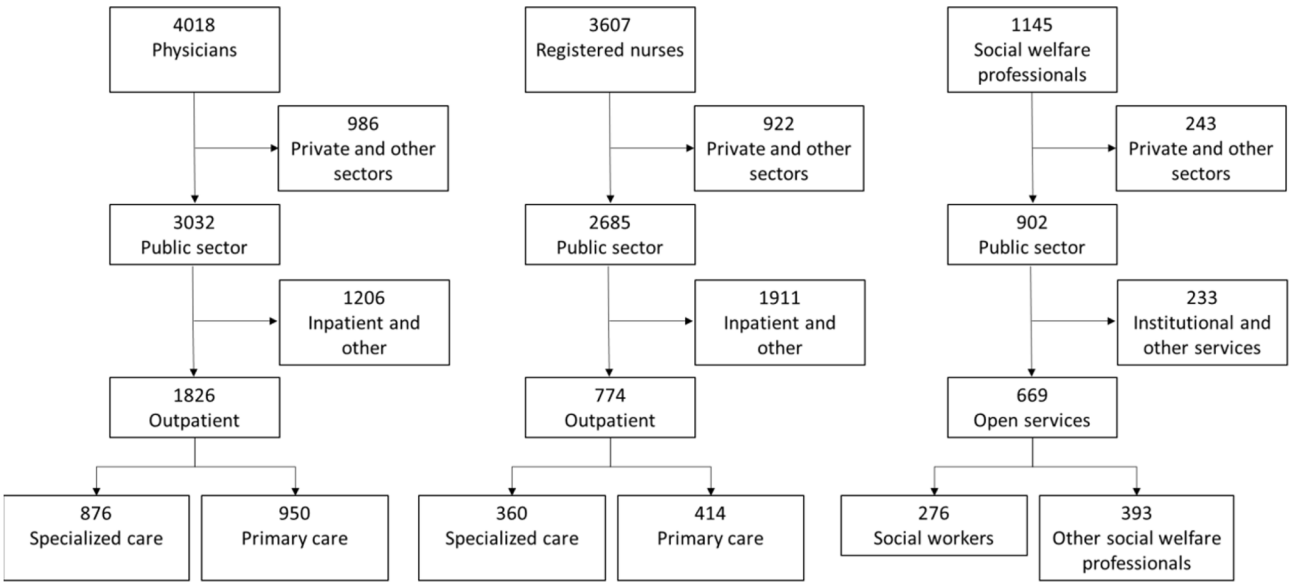


Fig. 1. Selection of data from the three Finnish national surveys used in this study.

Table 1
The set of NuHISS dimensions and statements used in this study.

NuHISS dimension	Statement
Technical quality	The system is stable in terms of technical functionality (does not crash, no downtime).*
	The system responds quickly to inputs.*
Ease of use	Routine tasks can be performed in a straightforward manner without the need for extra steps using the system.*
	Entering and documenting *patient data/nursing data/client data* is quick, easy and smooth.*[i]
	The arrangement of fields and functions is logical on computer screen.*
	Terminology on the screen is clear and understandable (for example titles and labels).*
	The system keeps me clearly informed about what it is doing (for example saving data).
Internal collaboration	How well do you consider that information systems support collaboration and information exchange between various parties? Between *physicians/nurses/SWPs* working in the same organization. **[i]
Cross-organizational collaboration	How well do you consider that information systems support collaboration and information exchange between various parties? Between *physicians/nurses/SWPs* working in different organizations. **[i]
Information quality	How well do you consider that information systems support collaboration and information exchange between various parties? Between *the physician/nurse/SWP* and the *patients/clients*.**[i]
Benefits	Information systems help to improve the quality of *care/service*.*[i]

* The five-point Likert scale assessment: Fully agree/Somewhat agree/Neither agree nor disagree/Somewhat disagree/Fully Disagree.
** The five-point Likert scale assessment: Very well/Fairly well/Neither well nor poorly/Rather poorly/Very poorly.
i = the wording of the statement slightly modified to fit the context (physicians' work/nurses' work/social welfare work).

the physicians, and 15 % of the nurses had less than three years of use experience.

Of the specialized care physicians, 19 % had specialized in medical specialties, 7 % in surgical specialties, 11 % in pediatrics, 10 % in obstetrics and gynecology, and 16 % in psychiatry. Of the primary care physicians, 60 % specialized in general practice. The questionnaire for nurses did not collect information on their specialties. Of the social workers, 24 % worked in services for working-age adults, 20 % in services for families with children, and 28 % in child welfare. Of the other SWPs, 24 % worked in services for working-age adults, 17 % in services for families with children, 13 % in elderly services, 14 % in child welfare, and 14 % in disabled services.

3.2. Results of the professional groups

Figs. 2–5 and Appendix A present the results of the selected professional groups.

3.2.1. Technical quality

The HPs were critical of the stability and responsiveness of their HISs (Fig. 2). Less than half of the HPs agreed with the statements on technical quality (27–48 % somewhat or fully agreed), whereas the SWPs were more satisfied (58–65 % agreed).

3.2.2. Ease of use

Fig. 3 shows the responses to the five ease-of-use statements. Less than half of all respondents (24–49 %) agreed that ISs support routine tasks. The physicians were the most dissatisfied group (63–69 % disagreed), while the SWPs were the most satisfied (44–46 % disagreed).

The SWPs, particularly others than social workers, were more positive (52 % agreed) about documenting client information than the HPs in specialized care (26–33 % agreed).

In total, 41–47 % of all respondents agreed that the arrangement of fields and functions was logical on a computer screen. In this case, we found no major differences between the professional groups.

Less than half of all respondents (40–48 %) agreed that the terminology was clear and understandable, and the experiences between the professional groups were similar.

Less than half of all respondents (33–49 %) agreed that ISs inform the user about what is happening. The SWPs (47–49 % agreed) and nurses in primary care (47 % agreed) had more positive responses to this statement than the nurses in specialized care (34 %) and physicians (33–36 %).

3.2.3. IS support for collaboration and information exchange

Fig. 4 displays the responses to the three statements on IS support for collaboration and information exchange. The healthcare respondents considered the support to be good (65–71 % rated support as fairly or very good) for professionals in the same organization, whereas less than half of the social care respondents agreed with this statement (41–45 %).

Table 2
Respondent characteristics.

	Physician / Specialized care n (%)	Physician / Primary care n (%)	Registered nurse / Specialized care n (%)	Registered nurse / Primary care n (%)	Social worker n (%)	Other SWPs n (%)	Total n (%)
Gender							
male	274 (31.7)	264 (28.2)	16 (4.0)	13 (3.7)	14 (5.1)	19 (4.9)	600 (18.6)
female	591 (68.3)	671 (71.8)	389 (96.0)	340 (96.3)	259 (94.2)	370 (95.1)	2620 (81.3)
Age group							
under 35	125 (14.3)	300 (31.7)	51 (12.4)	57 (16.2)	38 (13.8)	87 (22.1)	658 (20.3)
35–44	188 (21.6)	202 (21.4)	81 (19.8)	80 (22.7)	89 (32.2)	133 (33.8)	773 (23.8)
45–54	285 (32.7)	201 (21.2)	136 (33.2)	104 (29.5)	79 (28.6)	108 (27.5)	913 (28.1)
55–64	274 (31.4)	243 (25.7)	142 (34.6)	111 (31.5)	70 (25.4)	64 (16.3)	904 (27.8)
Experience of use							
under 3 years	145 (16.6)	234 (24.8)	57 (14.8)	52 (15.3)	86 (31.2)	159 (40.5)	733 (22.8)
3–6 years	140 (16.1)	204 (21.6)	74 (19.3)	65 (19.1)	54 (19.6)	76 (19.3)	613 (19.1)
over 6 years	586 (67.3)	507 (53.7)	253 (65.9)	223 (65.6)	136 (49.3)	157 (39.3)	1862 (58.0)
Total	876 (26.8)	950 (10.8)	414 (12.7)	360 (11.0)	276 (8.4)	393 (12.0)	3269

Over half (57–64 %) of all healthcare respondents had a poor view of IS support for cross-organizational collaboration and information exchange. An even larger portion of the SWPs held this viewpoint (72–81 %).

All professional groups were dissatisfied with IS support for communication and information exchange with patients and clients. The SWPs were the most critical group (8–10 % rated as good), and the primary care nurses were the least critical group (26 %).

3.2.4. Benefits

Fig. 5 covers the perceived benefits of ISs. Of the healthcare respondents, 43–50 % agreed that ISs help improve the quality of care. By contrast, only 14–24 % of SWPs agreed with this statement. The primary care nurses were the most satisfied group (50 % agreed), while the social workers were the least satisfied group (14 % agreed).

4. Discussion

Previous research has highlighted the need for IS support to improve patient- and client-centeredness in care and service delivery [58], process integration and coordination, collaboration, and data sharing across different services [19–21]. However, to the best of our knowledge, this is the first study to explore the experiences of physicians, nurses, social workers, and other SWPs related to HIS and CIS usability.

4.1. Main findings

4.1.1. HPs more critical about technical quality

The SWPs were more satisfied than the HPs with the technical quality of their ISs. This may be explained by several factors. In healthcare, the work context is usually more hectic and the amount of discrete documentation is greater, particularly among nurses, than in social welfare. Consequently, any technical flaws impact their work. Moreover, the simultaneous use of several possibly suboptimally integrated ISs in healthcare may cause HPs to experience instability; fewer ancillary ISs are used in social welfare [49,59,60].

4.1.2. All professional groups dissatisfied with the ease of use

The physicians were particularly critical of HIS support for routine tasks. Evidence-based guidelines and discrete documentation have not yet been widely implemented in social welfare. Therefore, SWPs may paradoxically view ISs that allow for the use of free text and offer minimal guidance as not interfering with their routine tasks.

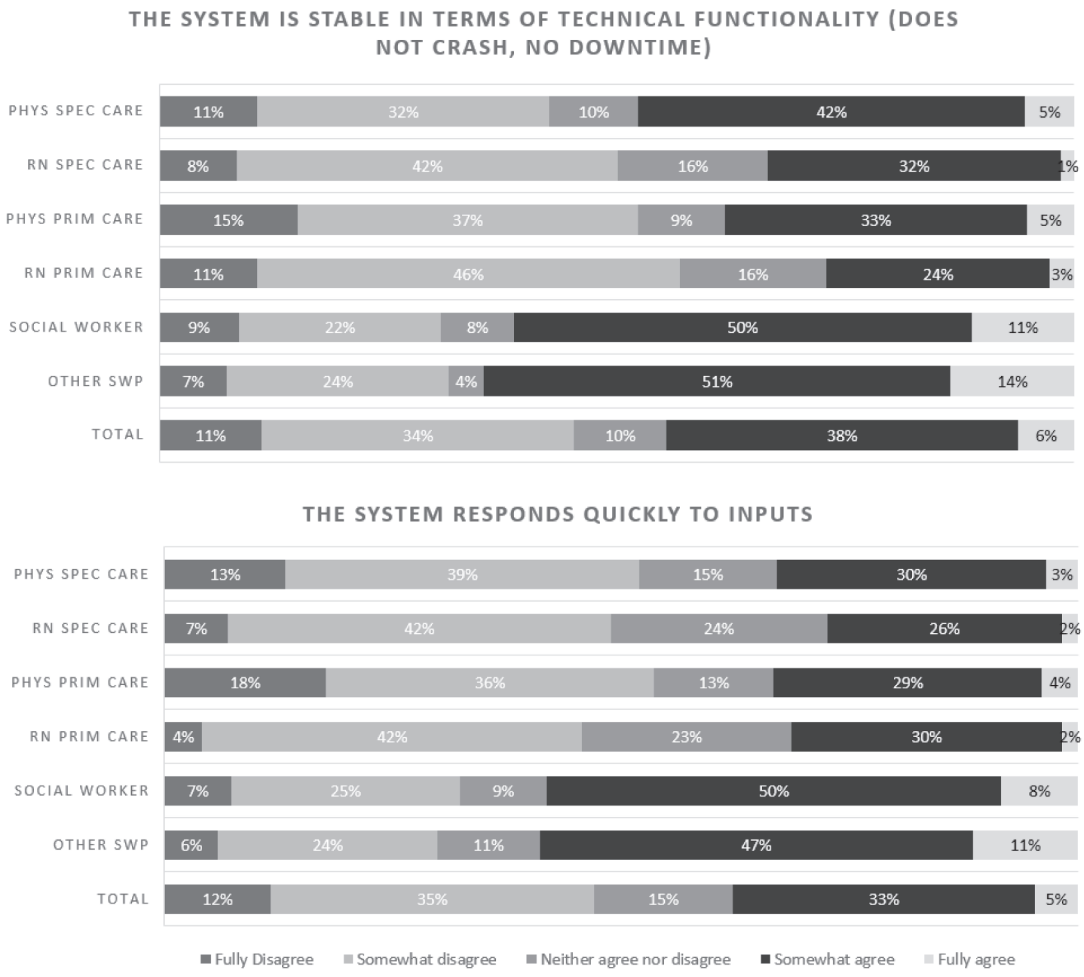
There was a relatively high proportion of dissatisfaction with the terminology used by ISs. Most of the HIS/CIS brands included in our survey have been in use for more than a decade, and users tend to get used to the terminology over time. The primary care nurses who use a narrower range of functionalities were the least dissatisfied group. Interestingly, the social workers were the most dissatisfied. Although the range of functionalities in social welfare is narrower than in healthcare, various social service lines use disparate terminologies. However, as the proportion of SWPs who agreed with the statement was equally large, it is possible that in some CIS the terminology has been adjusted to the work contexts of some service lines.

4.1.3. IS support for collaboration and information exchange poor, particularly in social welfare

HISs appeared to provide relatively good support for collaboration and information exchange among HPs working in the same organization, and mostly using the same HIS brand. By contrast, all HPs had a poor view of cross-organizational support. Evidently, the national patient data repository, only partly fulfilled this need. The SWPs had a poor view of CIS support in all settings.

National legislation and IS infrastructure explain most of the identified differences between healthcare and social welfare. Sharing client data across social welfare service lines within the same organization, between municipalities, or between healthcare and social welfare is only allowed after specific consents [49]. Partly related to this, the CISs used in the various service lines within the same municipality are often different brands. Moreover, unlike in healthcare, no regional CIS or national client data repository existed at the time of the survey [60].

None of the professional groups were satisfied with IS support for communication with patients and clients. The SWPs were the most critical, and the primary care nurses the least. Since 2015, patients have had access their own health data (“My Kanta pages”) [50]. However, no supporting data can be sent to HPs, which may partly explain the physicians’ dissatisfaction. In the social welfare sector, the few client portals only allow clients to send documents to professionals; none allow clients to access their own data.



PHYS SPEC CARE = Physician specialized care, RN SPEC CARE = Registered nurse specialized care, PHYS PRIM CARE = Physician primary care, RN PRIM CARE = Registered nurse primary care, OTHER SWP = Other social welfare professional

Fig. 2. Responses to statements concerning technical quality.

4.1.4. CISs not considered to improve service quality

A greater portion of the HPs than the SWPs agreed that ISs can improve the quality of care. Decision support tools, particularly medication interaction warnings, have been widely implemented in healthcare [61–63], whereas computerized assistance tools are only being developed for social welfare. Moreover, evidence-based medicine guidelines and disease-specific quality registries have existed for decades [64–66].

4.2. Limitations

This study has some limitations. The response rates and sample sizes of the three surveys varied. The Finnish Medical Association collected the physicians' data, and its long history of conducting surveys among physicians may explain the highest response rate. Reaching nurses and SWPs is more difficult because not all of them are members of trade or professional unions. Regardless, unlike other studies on usability and user experiences [e.g., 57,67], this study used comprehensive data gathered at a national level.

Even though the data for HPs was collected in 2017 and for SWPs in 2019, the comparisons between the three professional groups can be considered reliable since there was no major development in the usability or functionality of the CIS 2017–2019 [59].

When answering their respective questionnaires, the physicians, nurses, and SWPs may have understood the same statement differently. However, this issue also applies to professionals working in different work contexts. For instance, even when using the same HIS and treating the same patients, the information needs and workflows of orthopedic surgeons and psychiatrists differ. Moreover, even though the validated NuHISS survey instrument was originally developed for physicians [53], it has since been internationally utilized also for other professional groups [57,58].

It is likely that from the professionals' point of view, the change from free text to discrete documentation and predefined workflows may be as great as the change from paper to electronic. This may explain some of the differences between the various professional groups. Based on the authors' own experiences, the HISs used both in Finland and internationally are more complex and advanced than the CISs.

Positive responses may also be explained by the IS allowing workarounds that produce low-quality care or data (e.g., free text documentation). On the other hand, negative responses may also reflect unsuccessful implementation projects or training, requirements set by national authorities and legislation, the needs of payors and quality registries, interoperability, and organizational issues related to

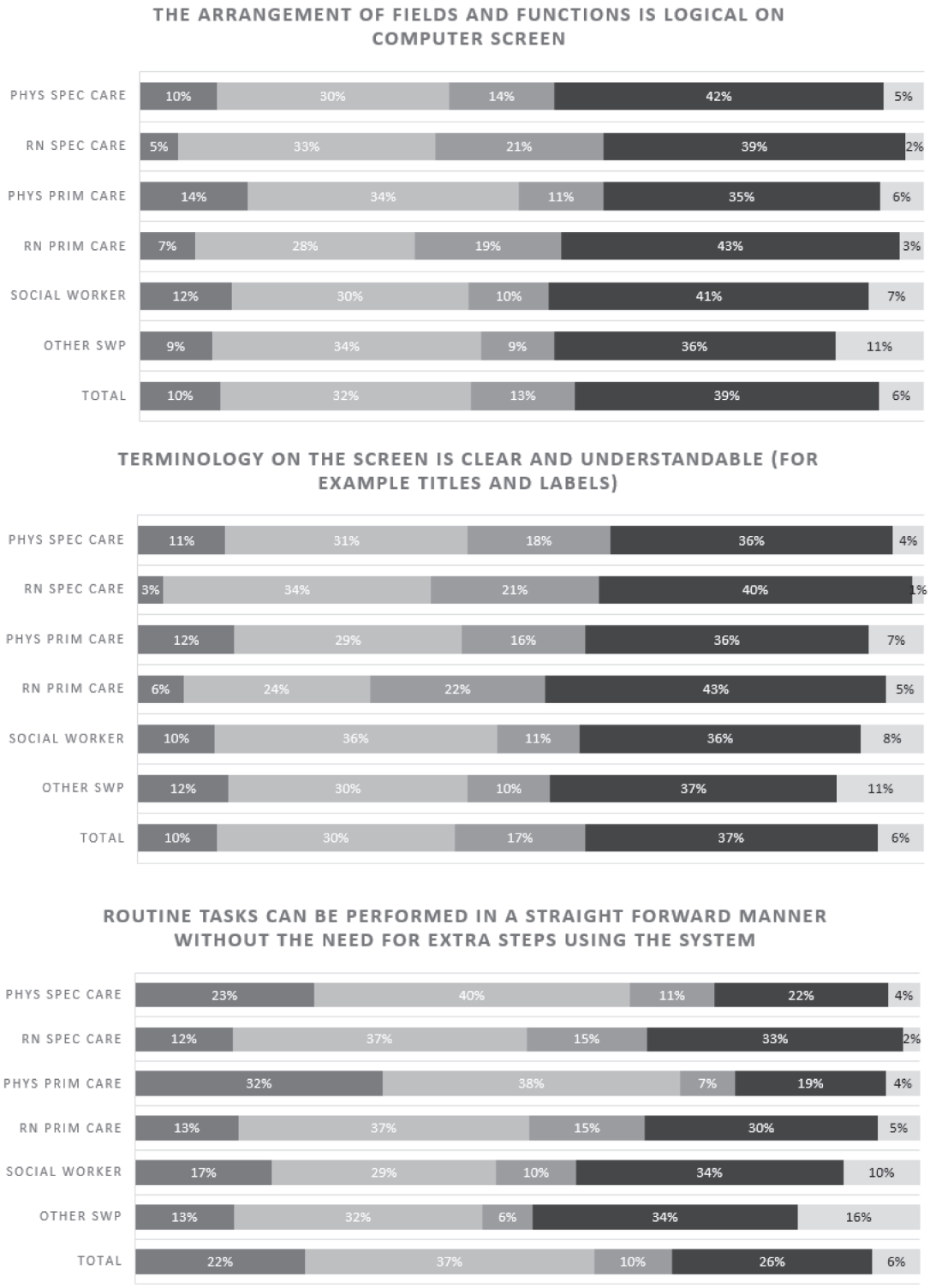


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Fig. 3. Responses to the five ease-of-use statements. (Continues in the next page).

leadership and change management, resource allocation, and the division of tasks between roles [68].

The questionnaires to the HPs did not include statements on cooperation between healthcare and social welfare. We chose to do so cause the current legislation only allows minimal information exchange despite the evident need for sharing information, for example, in child welfare services, and elderly care. Unfortunately, national interpretations of European data protection regulations are expected to

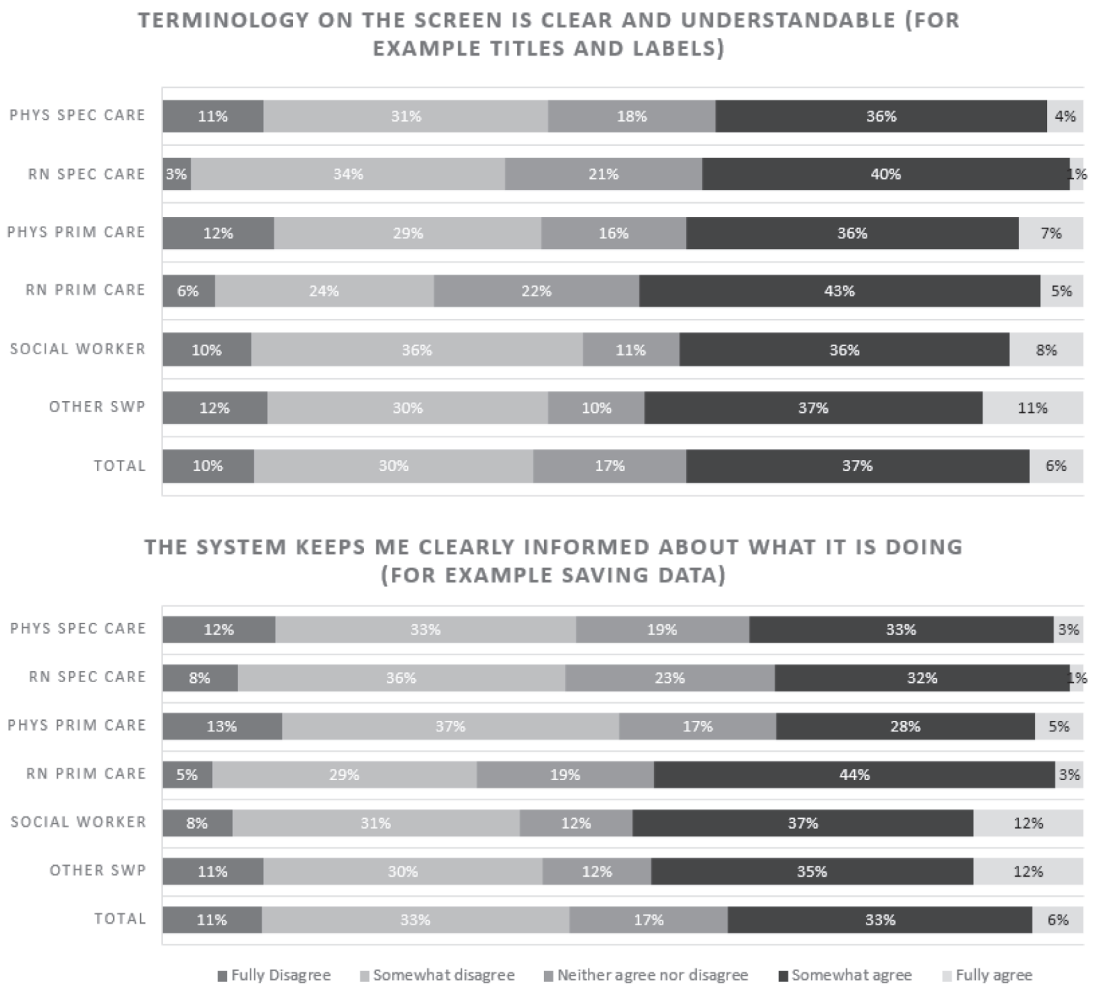

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Fig. 3. (*continued*).

make cross-organizational information exchange even more difficult.

4.3. Future research

The success of an IS as well as the integration of healthcare and social welfare services should also be examined from the patient/client viewpoint [58,69], not only from the perspective of availability of data to the patient/client [54]. Moreover, further research is needed to monitor ongoing large-scale implementation projects, such as those in the Nordic countries [23,24], and the realization of the expected benefits from the end-user groups' viewpoints.

5. Conclusions

All six respondent groups were dissatisfied with the usability of their ISs. The specialized healthcare physicians were particularly discontented with the technical quality and ease of use of their HISs. The SWPs were dissatisfied with the support for collaboration and information exchange and did not believe that CISs improve service quality. Importantly, all respondents regarded IS support for collaboration with patients and clients unsatisfactory. As the central enablers of healthcare and social welfare service integration, HISs and CISs should provide support for routine tasks, inter- and cross-organizational collaboration, and information exchange. Moreover, special focus should be given to IS' ability to bolster patient/client-centered care.

Summary table

What was already known about the topic:	What this study added to our knowledge:
The integration of healthcare and social welfare services is ongoing in many countries and includes digital services and ISs.	This study is the first to compare the experiences of physicians, nurses, and SWPs regarding their HISs and CISs on a national level.
HISs suffer from end-user dissatisfaction and usability problems.	The various professional groups were dissatisfied with different aspects of usability and had poor overall experiences with HISs/CISs as users.
Research into the usability of CISs is scarce.	ISs should be further developed to support the routine tasks of all major professional groups as well as inter- and cross-organizational collaboration and information exchange.
No previous studies have compared the end-user experiences of major professional groups in healthcare and social welfare.	

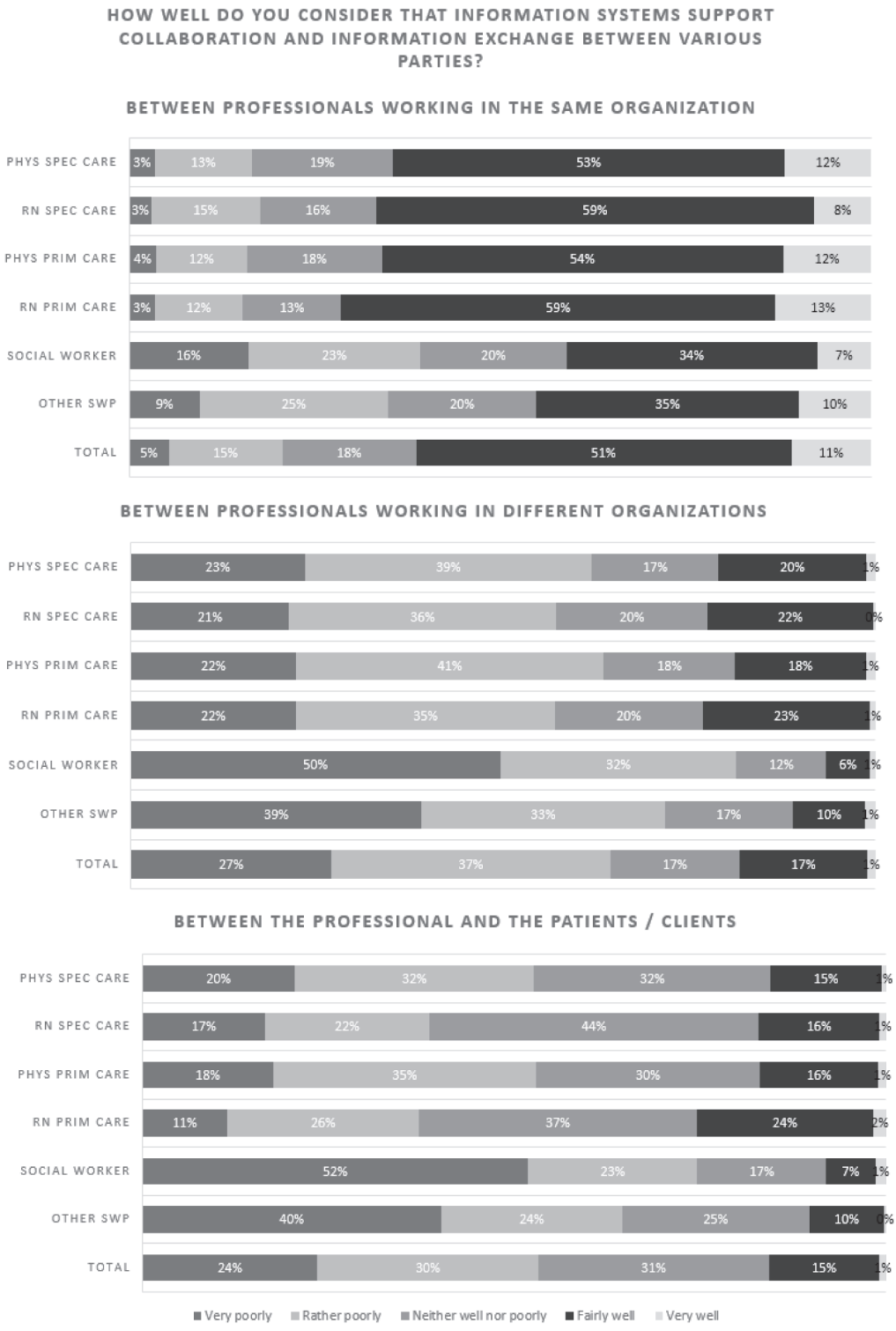

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Fig. 4. Responses to the statements on IS support for collaboration between professionals in the same organization, collaboration between professionals in different organizations, and communication with patients and clients.

Availability of data and materials

Although the datasets based on the SWPs' survey are not publicly available due to ongoing further analyses, they are available from the corresponding author on reasonable request. The physicians' and nurses' responses are available on the following webpage: https://thl.fi/en/web/information-management-in-social-welfare-and-health-care/what-is-information-management-/follow-up-of-the-information-s

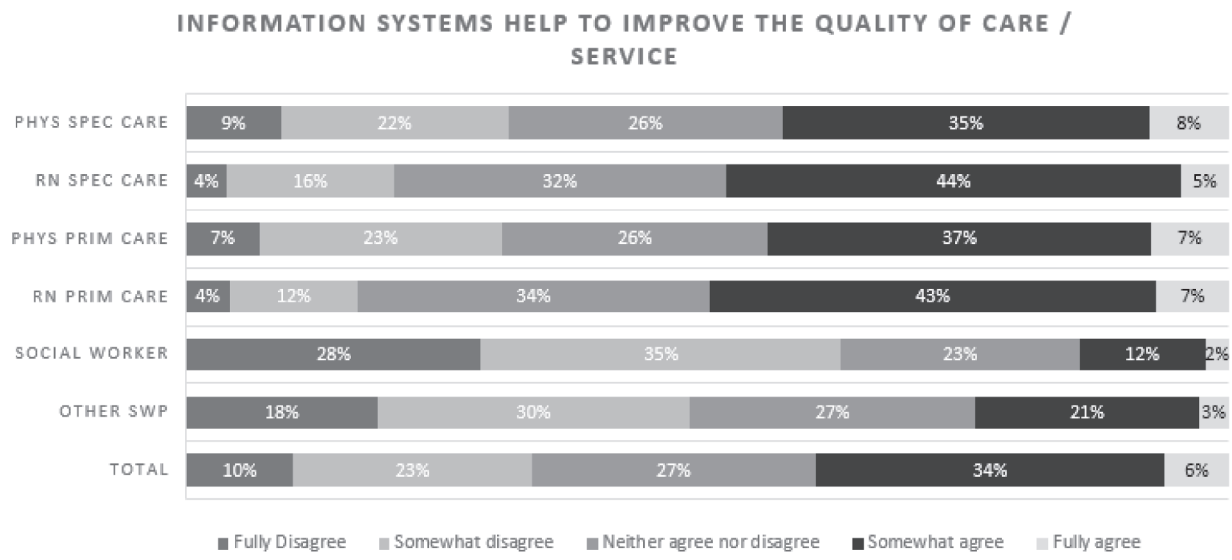

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Fig. 5. Responses to the statement on whether ISs help improve care or service quality.

ystem-services-in-social-welfare-and-health-care/indicators-of-digitalisation.

Authors' contributions

DSc (Tech.) Johanna Viitanen and MD, PhD Tinja Lääveri had the main responsibility for the manuscript. Lääveri had the main responsibility for the statistical analysis. Viitanen and Lääveri together with MSc (Tech.) Mari Tyllinen and MSc (Soc.) Elina Tynkkynen contributed to all parts of the article, including data interpretation, revision, and approval of the manuscript. Viitanen and Lääveri contributed to the design of all three survey studies as well as the development of the NuHISS instrument. In addition, Tyllinen and Tynkkynen contributed to the design of the survey for SWPs.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijmedinf.2022.104836.

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