

Regional health information exchange outside of the centralized national services for public health care in Finland: A national survey

Niina Keränen^{1,2}, Timo Tuovinen^{1,2}, Jari Haverinen^{1,3}, Ronja Ruotanen¹, Jarmo Reponen^{1,2}

¹ FinnTelemedicum, Research unit of Medical Imaging, Physics and Technology (MIPT), University of Oulu, Oulu, Finland; ² Medical Research Center Oulu (MRC Oulu), Oulu University Hospital and University of Oulu, Oulu, Finland; ³ Finnish Coordinating Center for Health Technology Assessment (FinCCHTA), Oulu, Finland

Niina Keränen, MD, MHSc, Research Unit of Medical Imaging, Physics and Technology, Faculty of Medicine, University of Oulu, P.O. Box 5000, FI-90014 University of Oulu, FINLAND. Email: Niina.S.Keranen@oulu.fi

Abstract

Health information exchange (HIE) is the mobilization of health care information electronically across organizations within a region, community, or hospital system. Nordic countries have been developing their health portals including national HIE services systematically. In Finland HIE begun with various regional health information exchange (RHIE) pilots in since 1998. The Kanta patient data repository component in the national HIE has been adopted in routine use since 2012. The current role of non-Kanta RHIE in relation to Kanta services is somewhat unclear. Our research questions are following: 1) Has the availability of RHIE services changed during 2017-2020? 2) What functional types of RHIE are there in Finland in 2020? 3) From the point of view of healthcare provider organizations, at what level is the availability to combine regional information seamlessly into the same view of local patient record systems?

Data used in this study were collected using web-based questionnaires in 2017 and 2020 as part of the surveys for monitoring and assessment of social welfare and health care information system services in Finland. This study reported in this article covers all 21 public hospital districts and nearly all public primary health care centers. The quantitative data provided by the organizations were analyzed using SPSS software (version 25). The availability of a particular service or function was calculated as a percentage of all respondents in each sector.

The results of this study show that the overall availability of RHIE services has not markedly changed 2017-2020. Functional types of RHIE meaning the role, use and types of RHIE in hospital districts in Fin-

Published under a CC BY 4.0 license (<https://creativecommons.org/licenses/by/4.0/>).

land varies greatly in 2020. We recognized three different types of non-Kanta RHIE in the non-combination organizations (one-way, symmetrical, full symmetrical). Seamless integration of at least some Kanta data into the same view as the main patient health record system data was more common than seamless integration of at least some non-Kanta regional data.

Keywords: health information systems, health information exchange, electronic health records, technology assessment

Introduction

Healthcare is very information-intensive by nature and the information used in healthcare is very complex. Health information exchange (HIE) as the ability to exchange patient information across clinical contexts has a potential to improve patient care quality, reduce cost and increase patient satisfaction [1,2]. Typically, HIE is used to exchange health data between different owners of electronic health record (EHR) register data, either in a regional or national context. However, countries vary widely in levels of adoption of electronic health records (EHR), availability of health record information in form suitable for HIE, and in the information technology infrastructure to be used for transmission [3].

Nordic countries have been developing their national health portals systematically and included HIE services, too. All of them have introduced a national service portal for citizen, but especially Denmark, Iceland and Finland have included national HIE services for healthcare professionals [4]. In the Danish health portal Sundhed.dk laboratory results have been gradually available since 2004 and EHR texts from hospitals since 2009 [5]. Iceland has been building a comprehensive EHR system in a national level, including the HIE functions for professionals and citizens [6]. All Nordic countries have however now developed a four-tier HIE system with data suppliers, data repositories, information access services and user interfaces for different user groups including healthcare profes-

sionals, organizations, authorities and citizens either in regional or national level [7,8].

In Finland HIE development begun with various regional health information exchange (RHIE) pilots in since 1998, most importantly the Satakunta Macropilot Project [9] and followed in early 2000s by operative RHIEs in public healthcare between hospitals and primary healthcare centres in their responsibility areas. Those resulting RHIEs were utilizing mainly three different models like 1) the master patient index model with a separate common database for information exchange, 2) the web distribution model with unilateral information sharing from the hospital EHR and 3) the regional sharing of integrated electronic patient record model [10-12], all of those containing differences in terms of included shared data and its visibility to the using hospital and primary healthcare centres [13]. The HIE development path was finalized with the uptake of the centralized Finnish national Kanta HIE services 2012 onwards. The Kanta patient data repository was largely adopted in public healthcare in 2014. Today the Kanta services consist of digital data exchange and storage services for pharmacies (Prescription Centre, Pharmaceutical Database), healthcare and social welfare service providers (Patient Data Repository and Client Data Archive for Social Welfare), and online access to electronic health records for citizens (My Kanta Pages). The services are extended with Patient Data Management Service and Kanta Personal Health Record. [14] These national level data systems were built on top of regional and local data

systems [15], that serve as a primary source of daily data.

Even though all public healthcare organizations have now joined Kanta, much of the information exchange is still taking place in the regional level. Partial reasons for this are legacy systems; organizational changes bringing primary and secondary care together; and Kanta not meeting the usability needs of some users. Studies have shown that there are also many EHR subsystems which are oriented to a particular medical speciality or task and lack full integration to the main EHR system [16]. The local and regional health service providers have built the e-health services intended for citizens with connectivity to their existing information systems [17]. As mentioned, the hospital districts in Finnish public health care use a RHIE system parallel to the national HIE. However, information retrieval from other organizations is an important issue in user experience studies targeted to physicians and nursing staff. According to recent results under one fifth of doctors think information systems support the flow of information between organizations well [18]. In order to understand the current use cases for non-Kanta RHIEs and their relation to national Kanta HIE, the availability of different regional information exchange models and their services requires clarification.

Our research questions are following: 1) Has the availability of RHIE services changed during 2017-2020? 2) What functional types in terms of data availability of RHIE are there in Finland in 2020? 3) From the point of view of healthcare provider organizations, at what level is the availability to combine regional information seamlessly into the same view of local patient record systems?

Materials and methods

This study was based on the “Availability and Use of Information and Communication Technology in Finnish Health Care” survey data from 2017 and 2020. The 2020 survey was conducted as part of the STEPS 3.0 project and the earlier 2017 survey was conducted as a part of STEPS 2.0 project for monitoring and assessment of social welfare and health care information systems [19,20]. Responses to the latest survey were requested according to the situation on 1.3.2020. Survey data were collected using web-based questionnaires (Webropol©). The questionnaires were sent by e-mail to medical directors and IT leaders (CIOs) in specialized health care and chief physicians in primary health care.

Responses were compiled from the entire organizational level. In the hospital districts, where specialized health care providers were also responsible for the primary health care of the municipalities, only the questionnaire for specialized health care was sent. In these areas, the responses of the specialized health care providers were transferred to the surveys for primary health care. At the end of the official response time, unanswered organizations were reminded by email and telephone. Reply forms were checked and insufficient responses were completed by phone or email with respondents from the organizations.

This study covered all 21 public hospital districts in 2017 and 2020. For public primary health care, the response rate (number of organizations) 86% (121/141) in 2017, and 96% (130/136) in 2020, resulting in population coverages of 95%, and 99%, respectively. This variability in the number of participating organizations in primary care between the survey years is due to changes in municipal health care arrangement models.

Quantitative data were analyzed using SPSS software (version 26).

For this study the following questions for regional healthcare exchange were analyzed:

1) The visibility of various types of patient data from hospital district to primary healthcare unit or vice versa. Types of data were: Patient record text; laboratory results; imaging reports; and imaging results (images). Hospital districts could respond with “All/In part/No”; primary healthcare units could respond with “Yes/No”. (For each data type, for hospitals: “Is the hospital district’s information visible to the health centres in the hospital district (not including Kanta)?”; “Is the health centre information visible to specialised medical care (not including Kanta)?”; for health centers: “Do you see information from specialised medical care in your hospital district?”, “Do you share information with your hospital district?”.)

2) Ability to view information from Kanta or a non-Kanta RHIE seamlessly in the same view as information from the local systems. (“Can you seamlessly integrate the following with your local pa-

tient information system: Regional information system data/Kanta system data”, Yes/No)

Additionally background information was gathered:

3) Primary patient record system

4) IT administration collaboration between primary and secondary care (Separate; Separate with coordination; Shared).

Hospital districts functioned as combination organizations directly responsible both for the secondary and the primary healthcare in their regions in nine cases. In their regions, information exchange was assumed to be similarly available both in specialised and primary care in all four main data types (text, laboratory results, imaging data and imaging reports) due to common regional information systems.

Results

Between 2017 and 2020, some individual increases but no systematic change is seen in the visibility of non-Kanta regional data (Table 1).

Table 1. Visibility of different types of data in both directions, according to hospital and primary care responses 2017 and 2020. Includes data from all 21 hospital districts.

		Hospital responses*		Primary care responses	
		2017	2020	2017	2020
Patient record text	Hospital → Primary care	90%	95%	72%	70%
	Primary care → Hospital	81%	81%	56%	52%
Laboratory results	Hospital → Primary care	86%	95%	75%	75%
	Primary care → Hospital	81%	95%	66%	66%
Imaging	Hospital → Primary care	100%	100%	79%	84%
	Primary care → Hospital	95%	100%	77%	82%
Imaging reports	Hospital → Primary care	100%	100%	75%	82%
	Primary care → Hospital	95%	95%	69%	74%

* “in part” or “yes”

For the 12 hospital districts that did not also manage primary healthcare in their region, the most common types of non-Kanta information exchange were in imaging: Images were available at least in part from hospital district to primary healthcare according to 100% of the hospital districts and 83% of primary healthcare units, and reports according to 100% and 81% respectively. The least common type of non-Kanta information exchange was that of patient record text from primary healthcare to hospital districts, available at least in part according to 67% of hospital districts and 49% of primary healthcare units. These are shown in Fig. 1.

symmetrical, where all types of information exchange between hospital districts and primary care were bidirectional and typically high level (4 hospital districts); 2) One-way, where visibility from hospital districts to primary healthcare was more prevalent than visibility from primary healthcare to hospital district (4 hospital districts) and; 3) Symmetrical, where information visibility was bidirectional, but some of the four information types were less used (2 hospital districts). Two districts did not clearly fit these categories. The responses of hospital districts and primary healthcare were mostly in agreement regarding information visibility in the region. (Fig. 2.)

There were three distinguishable RHIE -types for the non-combination hospital districts: 1) Full

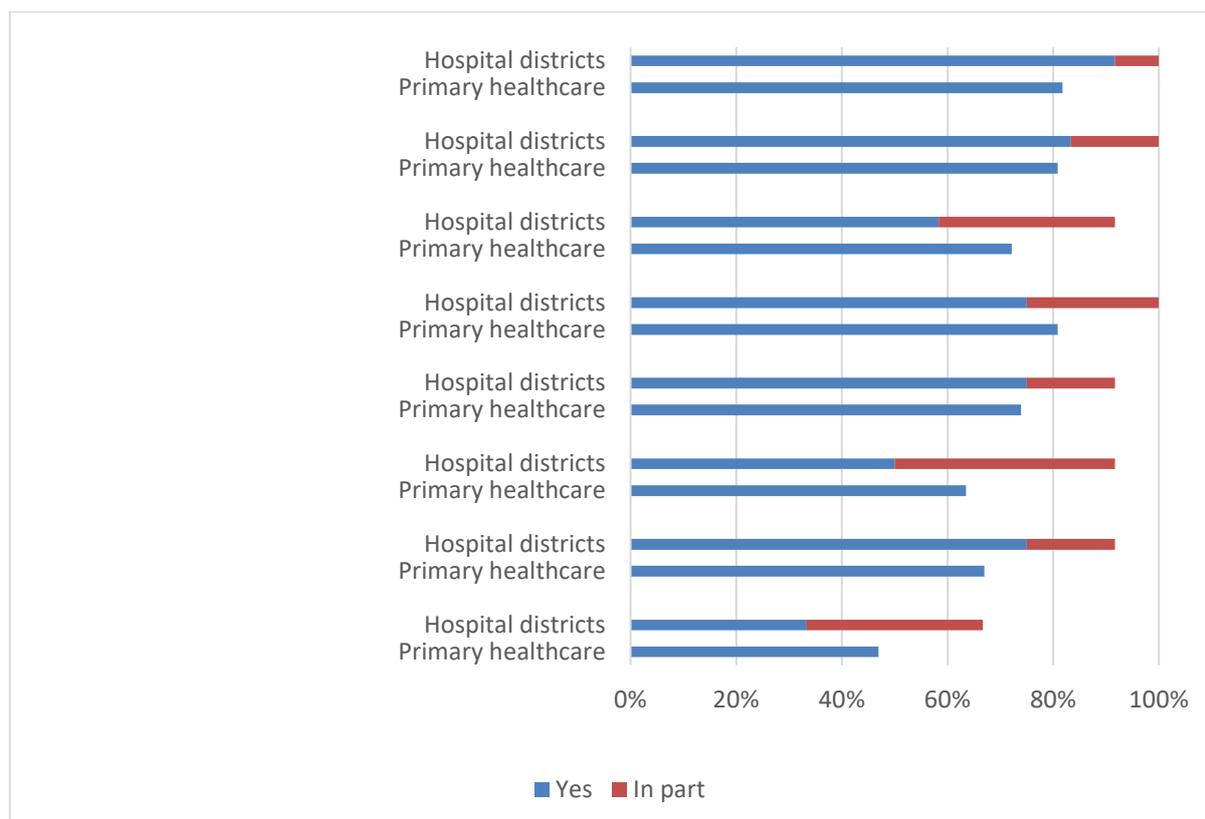


Figure 1. Sharing and visibility of different types of data between secondary care and primary healthcare in the 12 non-combination organizations in 2020, according to hospital district and primary healthcare responses. Primary healthcare units responded yes/no; hospital districts yes/in part/no. All 9 combination organizations had common information systems and bidirectional information exchange of all types of data, and are not included here.

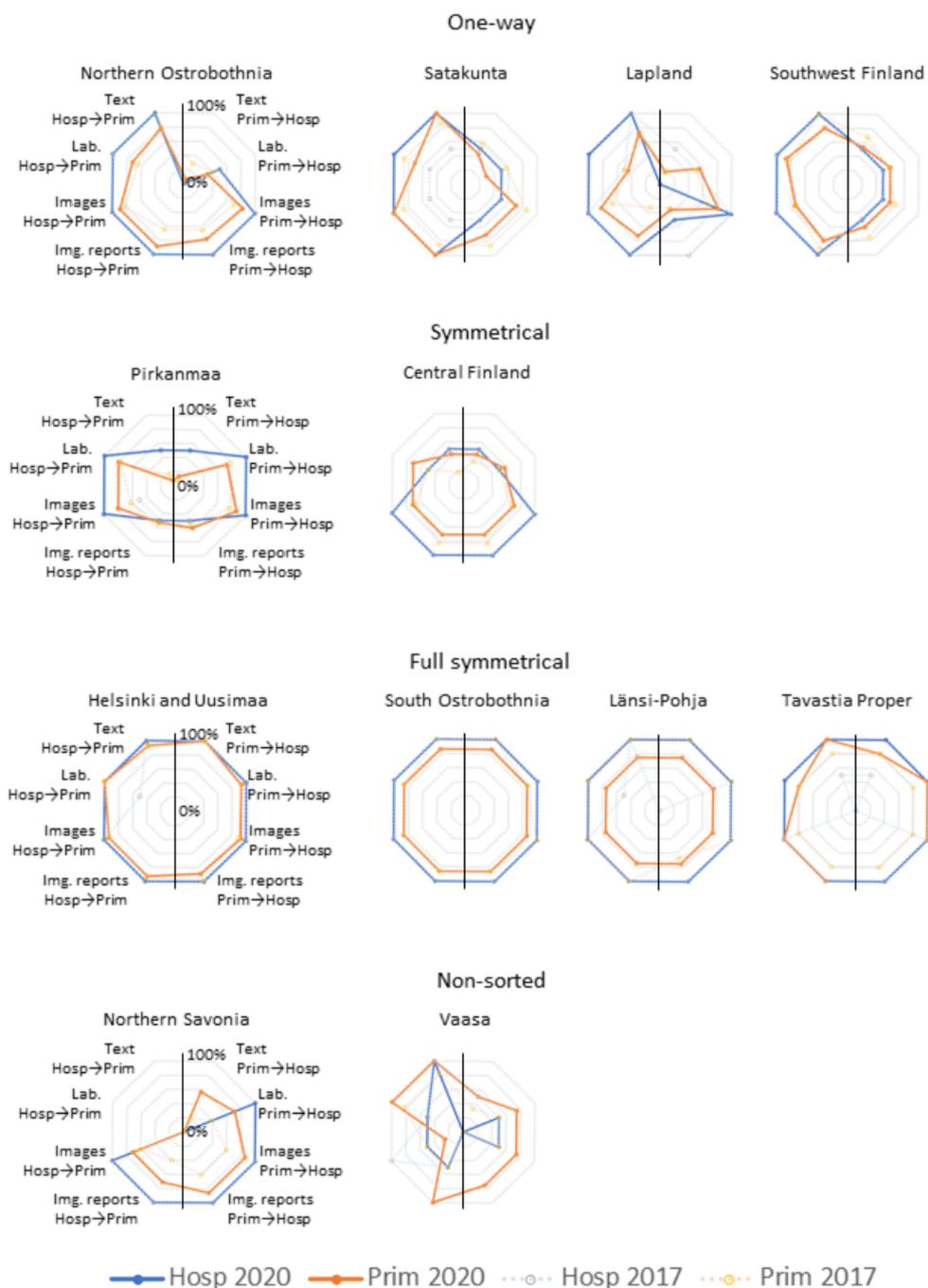


Figure 2. Types of regional information exchange in the 12 non-combination hospital districts 2017 and 2020. Visibility of patient record text, laboratory results, imaging results (images) and imaging reports from hospital to primary care and primary care to hospital. Perceptions of hospitals and primary health care centers. Responses of hospitals coded as “no/empty”=0; “in part”=50%; “all”=100%. Responses of healthcare centers as percentage of responding organizations that responded “yes”. All 9 combination hospital district organizations had common information systems and bidirectional information exchange of all types of data and are not included here.

Higher non-Kanta data visibility was marginally associated with greater IT administration coordination between secondary and primary healthcare within the region. Shared IT administration was only seen in combination organizations. 2/4 of the non-combination districts with full information

visibility and 2/8 of the ones with some other classification reported coordination between IT administrations. Primary patient record systems of the hospitals were not clearly associated with types of information exchange. (Table 2.).

Table 2. Functional regional health information exchange (RHIE) types and background information of Finnish hospital districts 2020. In combination organizations the same organization is responsible for primary and secondary care services.

	RHIE type	Primary patient record system	IT administration
Helsinki and Uusimaa	Full	Uranus	Separate
Pirkanmaa	Symmetric	Uranus	Separate
Southwest Finland	One-way	Uranus	Separate
Northern Ostrobothnia	One-way	Esko	Separate
Central Finland	Symmetric	Effica	Separate
Northern Savonia	Non-sorted	Uranus	Separate with coordination
Satakunta	One-way	Lifecare	Separate
Päijänne Tavastia	Comb. organization	Lifecare	Separate
South Ostrobothnia	Full	Lifecare	Separate with coordination
Kymenlaakso	Comb. organization	Lifecare	Shared
North Karelia	Comb. organization	Mediatri	Shared
Tavastia Proper	Full	Lifecare	Separate
Vaasa	Non-sorted	Esko	Separate
South Karelia	Comb. organization	Lifecare	Shared
Lapland	One-way	Esko	Separate with coordination
Southern Savonia	Comb. organization	Effica	Shared
Kainuu	Comb. organization	Lifecare	Shared
Central Ostrobothnia	Comb. organization	Lifecare	Shared
Länsi-Pohja	Full	Esko	Separate with coordination
Eastern Savonia	Comb. organization	Effica	Shared
Åland	Comb. organization	Abilita	Shared

71% of all hospital districts and 65% of primary healthcare units could see Kanta information seamlessly in the same view as information in their local health record system in 2020. Of the non-combination organizations, 42% of hospital districts and 34% of primary healthcare centers could see non-Kanta regional information in the same view as their local information. If we assumed seamless visibility for the 9 combination organization, a total of 67% of all hospital districts and 38% of primary healthcare would be able non-Kanta regional information seamlessly.

Discussion

In this paper we have presented a high-level overview of the functionality of non-Kanta regional information exchange of health information within the different hospital districts in Finland in 2020.

The overall availability of RHIE services has not markedly changed 2017-2020. The large-scale uptake of Kanta patient data repository in 2014 is not reflected in the development of RHIE availability in this survey. Compared to 2017, we see very little change in RHIE services in most hospital districts or Finland as a whole. In this study it is clear that legacy RHIE systems are slow to change under current conditions.

Functional types of RHIE meaning the role, use and types of RHIE in hospital districts in Finland varies greatly in 2020. In the big picture RHIE is most used for imaging and least used for medical texts, and is more common for information visibility from hospitals to primary healthcare than vice versa. This may reflect the level of adoption of Kanta for specific use cases and data types. Even in the least frequent use case of patient record text from primary to secondary care according to primary care responders, non-Kanta RHIE is used in

49% of responding non-combination organizations.

We recognized three different types of non-Kanta RHIE in the non-combination organizations, showing the different approaches and routes to RHIE even within one country. More comprehensive information exchange was associated with the level of collaboration of IT administration in the district more clearly than with the main patient health record system, although the regional abilities made directly available by the different health record system providers vary. The responses of the secondary and primary care organizations were largely in agreement regarding the availability of different types and directions of information visibility in the hospital district.

Seamless integration of at least some Kanta data into the same view as the main patient health record system data was more common than seamless integration of at least some non-Kanta regional data. Nonetheless there are needs for immediate access to regional patient information that are not fulfilled through the national repository as it exists [18,21,22]. The types and level of Kanta information was not mapped here, and it is possible that the Kanta-services in question are the ones least relevant to information sharing between healthcare organizations, or the usability of the integration is lacking.

The forthcoming Finnish national reform for health and social care will bring primary and secondary care together and requires combined information systems also in regional level. It is not yet clear how much of this need can be satisfied through Kanta, and how the role of non-Kanta regional information exchange will develop. The development of Kanta so far has not solved perceived information sharing issues [18]. Some workflow and work practice type contextual information is lost

when information is archived in a document based archive like Kanta, and preliminary notes or dictation may be available earlier through non-Kanta RHIE. Based on the results, the hospital districts vary greatly with level and type of non-Kanta RHIE, therefore highlighting the need for region-specific discussions and solutions. It is possible that until now waiting for the results of the national reform and the further development of Kanta services has in part stalled the regional development of non-Kanta solutions. Those nine regions, which already have combined their specialized secondary care and primary care plus those four regions, where regional health information exchange is already fully symmetrical, have the best starting point for their future utilization of patient data in daily work. The other eight regions need additional resources to solve the deficiencies in their internal information flow.

Regional variability in HIE between primary and secondary care is common internationally depending on the structure of the health care system. In many countries specialized hospital care and primary care are provided by many different service providers. This is evident especially in countries with a insurance based health care system structure. In countries like Austria there is an effort to build a national HIE, called ELGA, which connects the hospitals and clinics among public and private care providing data of four specific document types (hospital discharge letters, radiology reports, medication reports and laboratory reports in national level [23]. Even among the Nordic countries with publicly funded health care, e.g. Norway and Denmark provide primary care services by independent general practitioners, while their secondary care is provided by public hospitals with a regional responsibility. This has led locally and regionally to separate information systems which are connected to a variable level through a nation-

al HIE platform. Iceland has one national health information system, which boosts information exchange between service providers. [7] Interestingly within Norway, in addition to national HIE functions, the Trondheim region is now aiming towards one common electronic health record platform for secondary and primary care, even though the infrastructure with separate service providers still exists [24,25]. Sweden has been the first Nordic country combining the responsibility of primary and secondary care within same public organizations with its 21 county councils. This has enabled to reach regional information exchange with a single EHR system in many Swedish counties [26]. In Finland, the new joint structure of primary and secondary health care together with social social care will make it possible to achieve seamless information flow between the public service providers within a region, when the legal and organizational barriers are removed. However even when this variability of HIE services is discussed in studies, it is generally generally averaged at country level for international comparisons [7,8,27]. National variability within a country is more rarely discussed, but is has significant quality and service equity implications [2] It is likely that similar variability as presently in Finland is also observed in other countries.

Against this look into the current status of non-Kanta RHIE, subsequent research could look into the impact of the upcoming Finnish national reform for health and social care, the correlation between user satisfaction and RHIE type, or the regional differences internationally within countries.

Strengths and limitations

This study provides a comprehensive sample of public organizations in Finland. A view of the operational situation is obtained regardless of the de-

tailed technical implementation. However, the survey data only tells the availability situation reported by the organization, but not the actual service utilization rate. One limitation is also that the survey question did not specify which Kanta services are integrated to EHR.

Ethical considerations

This study followed responsible conduct with the guidelines of the Finnish Advisory Board on Research Integrity [28]. Respondents were informed of the study and they answered as representatives of the organizations being studied. Sensitive personal information was not collected. The data were processed and stored in a secured environment according to the procedures of the University of Oulu.

Conclusions

Non-Kanta RHIE has remained an important part of health information exchange in Finland. The types and direction of data being shared vary between hospital districts. Especially those hospital districts, which currently have separate EHR sys-

tems for specialized and primary care provide different level of patient data exchange services for their healthcare professionals. There is a substantial need to improve those services during the forthcoming social and healthcare reform, which calls for common patient information systems for the benefit of everyday tasks.

Acknowledgements

The study is part of the national “Monitoring and Evaluation of Social and Health Care Information System Services” (STEPS 3.0) research project. STEPS 3.0 is co-funded by Ministry of Social Affairs and Health (STM) and participants and coordinated by the Finnish Institute for Health and Welfare (THL).

Conflicting interests

Niina Keränen, Jari Haverinen, Ronja Ruotanen, Jarmo Reponen: the employer has received funding to complete this part of the project as part of the national STEPS 3.0 project. Timo Tuovinen: No conflicting of interests.

References

[1] Walker J, Pan E, Johnston D, Adler-Milstein J, Bates DW, Middleton B. The value of health care information exchange and interoperability. *Health Aff (Millwood)*. Jan-Jun 2005;Suppl Web Exclusives:W5-10-W5-18.
<https://doi.org/10.1377/hlthaff.W5.10>

[2] Sadoughi F, Nasiri S, Ahmadi H. The impact of health information exchange on healthcare quality and cost-effectiveness: A systematic literature review. *Comput Methods Programs Biomed*. 2018

Jul;161:209-232.

<https://doi.org/10.1016/j.cmpb.2018.04.023>

[3] Payne TH, Lovis C, Gutteridge C, Pagliari C, Natarajan S, Yong C, Zhao LP. Status of health information exchange: a comparison of six countries. *J Glob Health*. 2019 Dec; 9(2):020427.
<https://doi.org/10.7189/jogh.09.020427>

[4] The Norwegian Directorate of eHealth. Comparative analysis 2021: National Health Portals in the Nordics [Internet]. The Norwegian Directorate of eHealth; 2021 [cited 4 Apr 2022]. Available from:

<https://web.archive.org/web/20211123052124/ht>

[tps://www.ehelse.no/strategi/nasjonal-e-helsemonitor/_/attachment/download/4c8517d6-203e-494a-978d-b4f6442343ad:078e05c60bf0e94d9e4cb02fba7a4317dd68e8a4/2021%20Nordic%20National%20Health%20Portals.pdf](https://www.ehelse.no/strategi/nasjonal-e-helsemonitor/_/attachment/download/4c8517d6-203e-494a-978d-b4f6442343ad:078e05c60bf0e94d9e4cb02fba7a4317dd68e8a4/2021%20Nordic%20National%20Health%20Portals.pdf)

[5] Jensen TB, Thorseng AA. Building National Healthcare Infrastructure: The Case of the Danish e-Health Portal. In: Aanestad M, Grisot M, Hanseth O, Vassilakopoulou P, editors. Information Infrastructures within European Health Care: Working with the Installed Base. Cham (CH): Springer; 2017 [online 2017 May 12]. Chapter 13. https://doi.org/10.1007/978-3-319-51020-0_13

[6] Icelandic Ministry of Welfare. National Electronic Health Record in Iceland. Cost Estimation and Expected Implementation Time [Internet]. Workgroup #1; June 2012. Icelandic Ministry of Welfare; 2012 [cited 15 Oct 2021]. Available from: https://www.stjornarradid.is/media/velferdarraduneyti-media/media/rit_2013/bcg-verkefnahopur1-sjukraskra-juni2012.pdf

[7] Hyppönen H, Kangas M, Reponen J, Nöhr C, Villumsen S. et al. Nordic eHealth benchmarking. Status 2014. TemaNord 2015: 539. Copenhagen: Nordic Council of Ministers; 2015. <https://doi.org/10.6027/TN2015-539>

[8] Hyppönen H, Koch S, Faxvagg A, Gilstad H, Nohr C et al. Nordic aHealth benchmarking: From piloting towards established practice. TemaNord 2017:528. Copenhagen: Nordic Council of Ministers; 2017. <https://doi.org/10.6027/TN2017-528>

[9] Ohtonen J (ed.). Satakunnan Makropilotti: Tulostien arviointi. FinOHTA report 21/2002. Finnish Office for Health Care Technology Assessment (FinOHTA) / National Research and Development Centre for Welfare and Health (Stakes). Saarijärvi: Gummerus Kirjapaino Oy; 2002. ISBN 951-33-0536-8, ISSN 1239-6723

[10] Hämäläinen P, Reponen J, Winblad I. eHealth of Finland. Check Point 2008. National Institute for Health and Welfare report 1/2009. Helsinki: THL; 2009. <http://urn.fi/URN:NBN:fi-fe201205085004>

[11] Hyppönen H, Winblad I, Reponen J, Lääveri T, Vänskä J. Lääkärien kokemukset alueellisesta potilastiedon vaihdosta. THL Report 5/2012. Helsinki: National Institute for Health and Welfare; 2012. <http://urn.fi/URN:NBN:fi-fe201205085180>

[12] Reponen J, Kangas M, Hämäläinen P, Keränen N. Availability and Use of e-Health in Finland. In: Hyppönen H, Hämäläinen P, Reponen J (eds.) E-health and e-welfare in Finland. Check point 2015. THL report 18/2015. Helsinki: National Institute for Health and Welfare; 2015. <http://urn.fi/URN:ISBN:978-952-302-563-9>

[13] Hyppönen H, Reponen J, Lääveri T, Kaipio J. User experiences with different regional health information exchange systems in Finland. Int J Med Inform. 2014 Jan;83(1):1-18. <https://doi.org/10.1016/j.ijmedinf.2013.10.002>

[14] Jormanainen V, Reponen J. CAF and CAMM analyses on the first 10 years of national Kanta services in Finland. FinJeHeW 2020;12(4):302–315. <https://doi.org/10.23996/fjhw.98548>

[15] Reponen J, Kangas M, Hämäläinen P, Keränen N, Haverinen J. Tieto- ja viestintäteknologian käyttö terveydenhuollossa vuonna 2017: tilanne ja kehityksen suunta. THL Report 5/2018. Helsinki: National Institute for Health and Welfare; 2018. <http://urn.fi/URN:ISBN:978-952-343-108-9>

[16] Kenkimäki H, Keränen N, Haverinen J, Reponen J. Potilastietojärjestelmiin liitetyt erikoisalakohdaiset erillisjärjestelmät julkisessa erikoissairaanhoidossa 2014–2020. FinJeHeW 2021;13(3):237-252 <https://doi.org/10.23996/fjhw.107667>

- [17] Ruotanen R, Kangas M, Tuovinen T, Keränen N, Haverinen J, Reponen J. Finnish e-health services intended for citizens – national and regional development. *FinJeHeW* 2021;13(3):283–301. <https://doi.org/10.23996/fjhw.109778>
- [18] Lääkäriliitto. Työolot ja hyvinvointi. Potilastietojärjestelmät lääkärin työvälineenä 2021 - tutkimuksen ennakkotuloksia 3.6.2021 [Internet]. Helsinki: Lääkäriliitto; 2021 [cited 17 Oct 2021]. Available from: <https://www.laakariliitto.fi/laakariliitto/tutkimus/tyo-olot-ja-hyvinvointi>
- [19] Finnish Institute for Health and Welfare (THL). Sosiaali- ja terveydenhuollon tietojärjestelmä-palveluiden seuranta ja arviointi (STePS 3.0) [Internet]. Helsinki: THL; 2020 [cited 17 Oct 2021]. Available from: <https://thl.fi/fi/tutkimus-ja-kehittaminen/tutkimukset-ja-hankkeet/sosiaali-ja-terveydenhuollon-tietojarjestelmapalveluiden-seuranta-ja-arviointi-steps-3.0>
- [20] Finnish Institute for Health and Welfare (THL). Sosiaali- ja terveydenhuollon tietojärjestelmä-palveluiden seuranta ja arviointi (STePS 2.0) [Internet]. Helsinki: THL; 2019 [cited 17 Oct 2021]. Available from: <https://thl.fi/fi/tutkimus-ja-kehittaminen/tutkimukset-ja-hankkeet/sosiaali-ja-terveydenhuollon-tietojarjestelmapalveluiden-seuranta-ja-arviointi-steps-2.0>
- [21] Saastamoinen P, Hyppönen H, Kaipio J, Lääveri T, Reponen J, Vainiomäki S, Vänskä J. Lääkärien arviot potilastietojärjestelmistä ovat parantuneet hieman. *Lääkärilehti* 2018;73(34):1814–1819.
- [22] Kela, Kanta-palvelut. Asiakastyytyväisyyskysely 2020: käyttäjät haluavat osallistua kehittämiseen [Internet]. Kela; 18.2.2021 [cited 17 Oct 2021]. Available from: https://www.kanta.fi/tiedote/-/asset_publisher/cf6QCnduV1x6/content/asiakastyytyvaisuus-2020-kayttajat-haluavat-osallistua-kehittamiseen
- [23] Rinner C, Sauter SK, Endel GHeinze GG, Thurner S, Klimek P, Duftschmid G. Improving the informational continuity of care in diabetes mellitus treatment with a nationwide Shared EHR system: Estimates from Austrian claims data. *Int J Med Inform.* 2016 Aug;92:44-53. <https://doi.org/10.1016/j.ijmedinf.2016.05.001>
- [24] Westin AA, Tryggestad H, Sandberg HR. New shared laboratory system for all of Central Norway. *Tidsskr Nor Laegeforen.* 2019 May 27;139(9). <https://doi.org/10.4045/tidsskr.19.0235>
- [25] Helseplattformen. Felles pasientjournal i Midt-Norge [Internet]. Trondheim: Helseplattformen [cited 30 January 2022] Available from <https://helseplattformen.no/>
- [26] Jerlvall L, Pehrsson T. eHälsa och IT i regionerna. Maj 2020. Inventering på upplag av SLIT-gruppen [Internet]. SLIT-gruppen; 2020 [cited 30 Jan 2022]. Available from: <https://docplayer.se/200312048-Ehalsa-och-it-i-regionerna.html>.
- [27] Peterson CB, Hamilton C, Hasvold PE. From innovation to implementation – eHealth in the WHO European Region. Geneva: World Health Organization (WHO); 2016. Available from: <https://www.euro.who.int/en/publications/abstracts/from-innovation-to-implementation-ehealth-in-the-who-european-region-2016>
- [28] Tutkimuseettinen neuvottelukunta. Hyvä tieteellinen käytäntö ja sen loukkausepäilyjen käsitteleminen Suomessa. Tutkimuseettinen neuvottelukunta; 2012 [cited 25 May 2021]. Available from: <https://tenk.fi/fi/ohjeet-ja-aineistot/HTK-ohje-2012>.