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ISBN 978-92-893-4165-3 (PRINT)
ISBN 978-92-893-4167-7 (PDF)
ISBN 978-92-893-4166-0 (EPUB)

<http://dx.doi.org/10.6027/TN2015-539>
TemaNord 2015:539
ISSN 0908-6692

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Layout: Hanne Lebech
Cover photo: ImageSelect

Print: Rosendahls-Schultz Grafisk
Printed in Denmark

This publication has been published with financial support by the Nordic Council of Ministers.
However, the contents of this publication do not necessarily reflect the views, policies or recommendations of the Nordic Council of Ministers.

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Preface

The Nordic countries have progressed far in development and implementation of national health information systems. The differences in eHealth policies, architectures, and implementation create a fruitful basis for benchmarking and learning from each other.

This report is a continuation of work which started in 2012. At that time the Nordic Council of Ministers set up a Nordic eHealth group to bring eHealth higher on the Nordic agenda. One priority for the group during period 2012–2015 has been to benchmark the deployment and use of health IT within the Nordic countries. The eHealth group established the Research Network to develop, test and assess a common set of indicators for monitoring eHealth in the Nordic countries, Greenland, the Faroe Island and Åland, for use by national and international policy makers and scientific communities to support development of Nordic welfare.

The Research Network published its first report in 2013, where a methodology was presented to generate eHealth indicators, and the first common indicators were tested (1). This second report presents the benchmarking results of altogether 49 common Nordic health IT indicators, of which for 48 there were data available at least from some Nordic countries. As such, the report offers a unique view to the state of the art of health IT in the Nordic countries, for continuing work on health IT policies and to support high-performance health systems and quality and efficiency of health care and services.

Dagfinn Høybråten
Secretary General
Nordic Council of Ministers

Abstract

This report presents the results of the Nordic eHealth Research Network, a subgroup of the eHealth group established by the Nordic Council of Ministers. The report is a continuation of the first report of the Network (1), where a methodology was presented to generate common Nordic eHealth indicators, and where it was tested for benchmarking with four common indicators. The current report presents benchmarking results of altogether 49 eHealth indicators from the Nordic Countries in 2014, to the extent that data are available from different countries.

Methods to generate the common list of important functionalities to be monitored included content analysis of the national eHealth surveys to provide a long list of variables. This was completed with identified variables presented in the eHealth evaluation literature. These were prioritized with help of a rating survey conducted to the key stakeholders (benchmarking information users), mapping them against the common policy goals and variables in the OECD model survey.

Tables 2–4 present coverage of the indicators in each country. The Nordic team focused on Health Information Exchange (HIE) and Patient Portal functionalities, for which availability information was eventually obtained from all the Nordic countries. All the Nordic countries have implemented or are in a process of implementing a National Health Information System (NHIS), and Finland and Sweden also have regional repositories. Information on availability of specific national level HIE functionalities was collected from experts, regional level from organisational surveys. Patient Portal functionalities are either local or national, and availability information was collected from experts or national organisation surveys.

Intensity of use of different HIE and Patient Portal functionalities via the national system was much more sporadic. Where available, it was collected mainly from the log data of National databases or citizen survey. Usability data was collected comprehensively with national usability surveys only from Finland and Iceland. The report also presents potential outcome indicators from literature, for which register data would be needed, which was out of scope of this mandate period.

The results at a glance for 2014 are presented in Annex 8 as spider web diagrams. The results show in practice places for learning across

the Nordic countries. Public specialized care organisations offered on average better access to patient information outside own organisation than primary care. Of the 7 measured *HIE* functionalities, 2 (“mediating prescriptions electronically to be dispensed from any pharmacy” and “viewing list of patient’s prescriptions”) were available in 100% of public organisations in all the Nordic countries. *The proportion of ePrescriptions of all prescriptions* made in 2014 exceed 60% in all the Nordic countries. Intensity of use of the available functionalities remained surprisingly low except in Denmark. In Finland prescription data and in Iceland immunization data were also viewed relatively frequently.

Of the 5 measured *Patient Portal* functionalities, Sweden had 100% availability of 4 of them, Denmark of 3 and Finland and Norway of 1. *Patient’s viewing of own list of prescriptions* was the most commonly available functionality, and *patient supplements of measurement data* least commonly available. Data on intensity of use of Patient Portal functionalities by patients was low, except in Denmark. Many of the Patient Portals were still local, and data on intensity of use by patients were not available.

Usability benchmarking data were only available from Finland and Iceland, for some variables also from Sweden, and for one from Denmark. Doctors in Iceland were the ones that had the most positive experiences of their health information systems (for 9 out of 14 variables). The Swedish data were from 2010 and not for all variables. Their experiences were most positive for three variables, whereas the Finnish systems scored best in two – patient safety and the least number of daily log-ins required.

Lack of monitoring data for many of the variables calls for planning the collection, analysis and reporting of eHealth monitoring on a national basis. The existing – albeit fragmented – results show potential for eHealth benchmarking, with clear similarities and differences emerging. The availability of information on national level is increasing rapidly, which increases the importance of monitoring intensity of use of the stored data, and eventually benefits of use. Logs need to be developed and access to aggregate level data ensured for monitoring purposes. There is also still a lot to do in harmonizing existing and new indicators (for new policy goals and citizens’s views) and in developing a dynamic way to visualize the benchmarking results. For profound learning across the Nordic countries, comprehensive data with a more detailed comparison of the National Health Information system functionalities would also be required. Still, the current work presents a solid basis for continuing work towards the ultimate goal: generating eHealth benchmarking data for supporting development of Nordic welfare.

Introduction

The Nordic eHealth Research Network (NeRN) was established in 2012 by the Nordic Council of Ministers eHealth group. The aim of NeRN is to develop, test and assess a common set of indicators for monitoring eHealth in the Nordic countries and Greenland, Faroe Islands and Åland for use by national and international policy makers and scientific communities to support development of Nordic welfare. The results of the first Mandate period (2012–2013) were published in the Nordic Council of Ministers report (1). The report contained the indicator methodology, which was also discussed in scientific articles targeted to the medical IT community (2), and testing of four common Nordic Indicators:

Availability indicators

- Proportion of public organizations offering clinicians access to sending/mediating prescriptions electronically to be viewed by any pharmacy.
- Proportion of public organizations offering clinicians electronic access to viewing a list of patient's current prescriptions within and outside own organization (nationally or regionally).
- Proportion of public organizations offering patients electronic booking to (any) services.

Usage rate indicators

- Proportion of prescriptions sent/mediated in electronic format of all prescriptions written.

The aim of the second mandate period (2014–2015) was to extend the list of these common indicators with other possible common indicators. The extension is considered from three viewpoints: 1) in terms of *additional functionalities*, for which the availability and use benchmarking data would be needed, 2) in terms of *additional indicator domains* beyond availability and usage rate, and 3) in terms of *other data sources* than surveys. This work has been carried out in co-operation with OECD indicator work (3) in order to find a broader international perspective.

As a result, 7 comparable Health Information Exchange (HIE) availability, 9 HIE Usage rate indicators, 5 comparable Personal Health Record (PHR) or Patient Portal availability, 11 patient portal usage rate indicators, 12 comparable usability (see Annex 7 for definitions) indicators, four impact indicators and 5 administrative indicators have been defined, for which benchmarking results are presented to the extent that data were available from different Nordic countries (see a list of all the indicators in list of figures and in Annex 5).

The domains monitored by the indicators are depicted in the figure below, which presents two parallel frameworks for eHealth assessment: DeLone and McLean's IS success model and the OECD framework for information society measurements. The latter complements the former in showing how monitoring eHealth availability precedes monitoring use and user satisfaction and how monitoring level of use precedes monitoring of impacts.

Figure 1. A conceptual framework for the indicator domains

Most of the benchmarking results are related to eHealth readiness of organisations and intensity of use of *Health information exchange (HIE)*¹ and *PHR or Patient Portal* (see annex 1 for definitions) functionalities via the national or regional health information systems in the Nordic countries. The monitoring results have been limited to *public sector organisations* (see Annex 2 for definitions). The usability and experienced benefit variables were only compared from *responses of doctors*. The OECD model survey questions focus in addition on local EHR- and Telemedicine -functionalities within own organisation. The availability and use of local Electronic Health Record (EHR)-functionalities are mainly saturated in the Nordic countries. The Telemedicine functionalities were not included in the set of common Nordic indicators due to the focus being on HIE via national or regional health information systems.

Contextual issues have direct impact in the definition as well as the values of each of the presented indicators. Common background variables were defined to try to grasp the essence of the context for replies from different countries. Most important of these are the elements of the health care delivery systems (Annex 2) and the national health information architectures (Annex 6).

¹ We define Health information exchange (HIE) here as “the transmission of healthcare-related data among facilities, health information organizations (HIO) and government agencies according to national standards” (<http://searchhealthit.techtarget.com/definition/Health-information-exchange-HIE>), here restricted to exchange via the regional or national health information system. Thus point-to-point information exchange used e.g. for sending referrals and care summaries are excluded from the data.

Materials and methods

The work was performed as four consequent tasks, with three internal reports, from which data was extracted for the final publication:

1. Prioritizing functionalities, for which common indicators are needed, and defining measures for availability, usage rate and usability (Responsibility: National Institute for Health and Welfare (THL), main authors Hannele Hyppönen and Sabine Koch).
2. Collection and reporting of results of eHealth functionality availability, usability and benefit-variables from national surveys (Responsibility: University of Oulu, main authors Maarit Kangas and Jarmo Reponen).
3. Defining the availability of common usage rate variables from log files (Responsibility: University of Aalborg, main authors Christian Nøhr and Sidsel Villumsen).
4. Reporting of results of Nordic eHealth access, usage rate, usability and benefits (Responsibility: THL).

Methods to create a prioritized list of variables

The first internal deliverable reported a prioritized list of variables (priorities of content and data collection frequency). Following materials/data and methods were used in order to produce the list:

Materials

1. The eHealth survey Questionnaires administered in different Nordic countries (translated into English to facilitate comparison).
2. The OECD model survey.
3. The eHealth policy analysis results from Mandate period I.
4. Variables presented in the eHealth evaluation literature.
5. Results of a variable Rating survey, constructed with help of i–iv.

Methods

1. Content analysis of the surveys to provide a long list of variables measured, completed with identified variables presented in the eHealth evaluation literature, mapped against the common policy goals and the OECD model survey.
2. Quantitative and qualitative analysis of rating survey results to identify common priorities.
3. Policy analysis results.

The work was conducted in close collaboration with key eHealth policy stakeholders in order to define the most urgently needed variables and data for eHealth Monitoring and comparison in the Nordic countries. Close collaboration was also needed with national survey administrators to make sure that the priority variables would be implemented in the national data collection instruments.

The rating survey that was constructed on the basis of the materials described above, presented a long list of thematically grouped variables that are currently monitored in the different eHealth surveys as well as variables presented in the literature. The respondent groups were:

- Doctors associations (subgroup of eHealth).
- Nursing associations (expert group).
- Medical secretary associations (one answer).
- National policy makers (eHealth task force).
- National bodies in charge of ICT implementation (e.g. OPER in Finland).
- Regional bodies in charge of ICT implementation.
- 7 local and municipal authorities (e.g. Association of Municipalities in Finland).
- Scientific communities (e.g. EFMI national associations).

The respondents were instructed to rate the importance of monitoring each of the variables (1 = green = necessary/2 = yellow = questionable/3 = red = not important). The prioritized list of common variables was defined using the following rules for inclusion:

1. Existence of the variable in current surveys/other data (needed to be available in at least two countries).
2. Importance index, calculated as an average of ratings from different countries for the rating survey. (Items with average <1.5 were included; items with average 1.5–2.5 were questioned, and items with average ≥ 2.5 were excluded).
3. Existence of the variable in the OECD model survey.
4. Existence of the goal or target measured by the variable in policies.

The end result was taken to a NeRN group meeting, where the final decision was made on which variables to include as common Nordic eHealth variables. The results pinpointed the importance of monitoring development within two main eHealth functionality-groups: health information exchange (HIE) and electronic services to patients (Patient Portal- and PHR-functionalities).

Methods to extract and compare data for availability, usability and experienced benefits

Based on the rated list of variables/indicators in the Deliverable I, the final comparability of the wordings of the selected variables in the surveys conducted in the Nordic countries (see Annex 3) was assessed. A template was prepared for feeding in the required data from different Nordic countries and one of the autonomous regions, Åland. Data from time period 2010–2014 were considered.

Originally it was planned that the results from primary and secondary health care sectors would be presented separately. However, based on the differences in organization structures (Annex 2) the separation of these sectors was not possible for all countries. This may also be the case because of the nature of the surveys.

Identical usability-surveys were conducted in Finland and Iceland, the Swedish questions were less compatible with the Finnish and Icelandic questions, not measuring all aspects of usability. Since Finland had collected usability data only from doctors, only the responses of

doctors could be compared, even if Iceland and Sweden had both conducted usability surveys also for other professional groups.

Usability indicator values as average experienced satisfaction with functionality are presented as average of Likert-scale of 1–5 due to different scales used in different countries² (the satisfaction with the functionality is categorized as 1= Very poor; 2= Rather poor; 3=Not good or poor; 4= Rather good; 5= Extremely good). For data analysis “I don’t know” –type of answers were excluded. If a likert scale other than 1–5 was used in the original national survey, the average was modified to 1–5 scale. For example, if 1–6 likert scale was used, the average value from raw data was multiplied by 5/6. General satisfaction was rescaled to 1–5 from 0–10 in Iceland and from 4–10 in Finland. For example if Finland average of 6.6 was calculated from the raw data, it was rescaled to 1–5-Likert by calculating $(6.6 - 3)/7*5$.

Methods to harvest log data

Methods to harvest log data varied in different countries. In Denmark, the logs for the national health information services (www.sundhed.dk) are divided between several partners. MedCom (www.medcom.dk), a public funded, non-profit organization facilitating the cooperation between authorities, organizations and private firms presents statistical information publicly about the usage of sundhed.dk (e.g. how many patients and health care professionals have looked-up health information through Sundhed.dk). Yet, the number of data stored and viewings of specific data types are not publicly available. Information about viewing needs to be acquired through contacts in MedCom to whom a list of required information was prepared, and a query was sent. Only data readily available were asked to be provided. The data about medication are located in the common medication record (FMK) run by the National Health Informatics Board (NSI) who also has been asked to retrieve the required information.

In Finland, the logs for the national health information services are kept by Social Insurance Institute (SII), which has by legislation, obligation to act as a technical operator of the national services (Kanta-

² Likert average is not an optimal way to compare responses. We could not use the proportion of respondents who agreed with the statement due to scale differences (1–6 vs 1–5-point scales).

services). There is to date no statistical information publicly available about usage of the Kanta-services (either amount of stored documents or amount of viewed documents). Therefore, a list of required information was prepared, and a query was sent about availability of different data types to the CIO of the Kanta-services. In the consequent meetings, variables were grouped into three groups: 1) instantly available at request 2) available in current logs, but requires additional work 3) not available prior to re-definition of the contents of the logs and development of the analytic tool. A work order was sent to SII about provision of data for group 1 variables and those group 2 variables, which can be provided within 3 working days. For other data, it was agreed that a specification project will be established.

In Iceland the Directorate of Health has developed two national health portals, Vera for citizens and a separate portal for health professionals. Currently Vera contains for example “My immunizations”, “My prescriptions”, “My e-Prescription renewal”, “My GP”, “e-Booking”, “Secure e-Mail with health professionals” and information on the individual’s perspective on being an organ donor. The health professional portal currently contains information about patient prescriptions, allows the physician to prescribe medication via the secure portal, and to view lab results for cancer screenings. The electronic health records (EHR) used within public hospitals and primary health care are all connected via the IcelandicHealthNet (Hekla). The logs for the national health information services are available to health authorities either directly via the national databases located at the Directorate of Health (DoH) or by weekly reports sent to the DoH. Logs from the national immunization database and e-Prescriptions are accessible directly via the DoH databases. Citizens’ lookups or viewings are logged via the IcelandicHealthNet as are logs for professional lookups within the interconnected EHR, and weekly reports sent to the DoH. However, lab requests and results as well as imaging are located within different databases, both publicly and privately owned. Logs for these databases are not publicly available and difficult to access this information. Moreover, the interpretation of log data can be complicated and depends much upon the way log files are defined within the specific databases and presented. The complexity of gathering comparable log data for the NeRN group did come as a surprise, and shows clearly the importance of the work being conducted by the group.

In Norway, the Directorate of Health has established a national health portal, helsenorge.no, where general health information can be accessed. The portal contains several solutions for the citizens, for example

“mine vaksiner” (My immunizations) and “minhelse” that include “mine egenandeler” (deductibles), “mine resepter” (MyPrescriptions), “min fastlege” (My Generalpractitioner), “kjernejournal” (a pilot in Mid- and Western Norway) and “eBooking” (pilot in Western Norway). Kjernejournal is accessible for both healthcare workers and patients, and contains critical information from the GP, the patients personally registered data and medication list. Logdata for My immunizations is derived from the national immunization register, SYSVAK, administered by the Norwegian Institute of Public Health. Logdata from MyPrescriptions is derived from the national database, “Reseptformidleren” (Prescription Intermediary), administered by the Directorate of Health. Most information in the pilot kjernejournal is derived automatically from other public registers: Personal information is from the National Registry, the service for request of or change of GP is saved in the regular GP Registry, pharmaceuticals dispensed in Norwegian pharmacies is from Reseptformidleren (Prescription Intermediary) and previous contact with the specialist is collected from Norwegian Patient Register. The method for collecting logdata has been through personal contact by e-mail and telephone with contact persons in the different registers. Many of the services are under construction on a national level, and logdata is missing for several of the services. Some key figures about eHealth in Norway are available in the web portal www.ehelse.no, but this service is still a beta version (19th March 2015).

In Sweden Data has been collected from several sources. Most of the log data comes from national services and from the organizations that are responsible for the service. Some of the logdata are not publicly available. Those data had to be processed and adapted. The logdata from the National Patient Summary and immunization data comes from Inera who are responsible for the service. Logdata concerning bookings and messaging comes from My Health Care Contacts. Stockholm County Council is responsible for the service contracted by Inera. The Swedish eHealth Agency is responsible for national services for medication and e-prescription. The logdata comes from the e-prescription databases. The information about patients’ access to information comes from the Sustains-project in the County Council of Uppsala. Finally some data are collected from the “SLIT-report. eHealth in Sweden 2014”.

Methods to analyse log data results

A two-day workshop was arranged to compare and further define usage rate variables in order to make data comparable. Final definitions were added as footnotes in the graphs prepared from the collated data. Two units were used to present the usage rate data from logs:

1. Proportion of each data type stored in the national (or regional) databases per total amount of data type generated annually (e.g. for ePrescriptions) or per population size.
2. Proportion of queries/viewings for each data type per amount of data type stored annually or population size.

A template was prepared that contained those variables, where countries had identified available log data (both nominator and denominator values). The template included ready-made formulas to calculate the indicator values, and graphs that updated automatically when countries filled in the nominator and denominator values. When all the available data were harvested, the graphs were pasted to the report, where country representatives had written required footnotes for each variable.

Notes on compatibility of the common eHealth measures

This chapter presents methodological limitations of the defined common eHealth indicators, with their rationale. These issues are important to understand prior to viewing the key benchmarking results in the next chapter. A list of the common indicators is presented in Annex 5.

Differences in data collection methods

In the Nordic countries, monitoring data about eHealth services is collected by five different methods: 1) national surveys targeted to the CIO's of the health care organizations (availability of services) 2) national surveys targeted to different professional groups (either availability or usability and experienced benefits of services), 3) log data (usage rate of stored data) 4) national statistics or 5) based on the professional expert knowledge and legal requirements. In many cases, the expert knowledge is used, when a functionality is fully saturated or nonexisting. The Nordic surveys are compared in detail in Annex 3 (References 11–30). The OECD model survey monitoring availability and frequency of use is targeted to CIO's for specialized care organisations and physicians for primary care organisations. The differences in data collection methods, targeting and sampling set limitations to comparability of the results, which need to be remembered.

Differences in foci of monitored functionalities

Apart from the background variables, the OECD model survey cover four types of eHealth functionalities:

- EHR-functionalities within own organisation.
- Health information exchange (HIE) functionalities.
- Patient Portal/Patient Health Record (PHR)-functionalities.
- Telemedicine functionalities.

EHR-functionalities were regarded as saturated in the Nordic countries. The only variable that is collected as a background data is the actual name of the EHR-system, which is an important background variable for national data collection. Thus, the OECD model survey asks if the EHR-system is in use, the Nordic countries ask instead, *which* EHR-system is in use.

HIE-functionalities were selected as the primary focus for the common Nordic eHealth indicators. For these, the OECD model survey does not distinguish between different ways for HIE. In the Nordic countries, health information exchange based on national or regional databases was included, point-to-point health information exchange excluded. With PHR-functionalities, focus was on national Patient Portal functionalities, even if for some variables, also availability locally was monitored.

Telemedicine functionalities in the OECD model survey focused on the PHR (or Patient Portal) functionalities. This was selected as the second focus for the common Nordic eHealth indicators.

Contextual variables

The contextual variables are important for grouping of the results. Of the contextual variables, the OECD model survey distinguishes private and public; ambulatory and institutional: primary and specialized care, and size of the community, which is served by the organisation. For some of the Nordic surveys, private –public and primary-specialized distinction can be made (see Annex 2), but not the ambulatory-institutional, since all organisations also offer ambulatory care. Size of the community served and size of the organisation cannot be collected in the organisational surveys, since an organisation in the Nordic countries is a county council, hospital district or a municipality, and survey respondents do not know how many physicians work there at any time or how big population the organisations serve. However, some Nordic countries collect

information on name of the respondents region, hospital district or county council, whereby the number of physicians and citizens can be derived from other sources.

There are some basic differences in the Nordic countries in organization, personnel and financing of health care, which influence the implementation of information systems within health care, and impact especially grouping of the results (primary-specialized/public-private). In order to understand the availability and usability indicators in the right context for each country, a background description of the health care organization structure for each of the Nordic countries is shortly described (Annex 2).

The national health information system architectures also differ, which needs to be taken into account when interpreting the benchmarking results. Annex 6 presents an overview of the health information exchange in different Nordic countries, but it is too generic to understand phase-to-phase differences in different HIE and PHR functionalities, which may impact both usage rate and usability.

Table 1 depicts the common Nordic background variables, measured by the original national source surveys targeted to health care organizations or professional groups or derived from study target groups, and notified in the first NeRN report (1). *The values of these data items have not been collected from the Nordic source surveys for benchmarking.* They function as grouping variables in national use, only care sector and level have been used here to group Nordic results. Most of the background variables have been estimated to be compatible with the corresponding OECD survey at the time of writing this report (first quarter of 2015). See more details in social and health care contexts in the Nordic countries in Annex 2.

Table 1. Background variables for Nordic health indicators

Topic (OECD-compatibility: comparable = *)	OECD question	Variable	Countries measuring	Data sources
Respondents job title	-	Job title of the respondent	FIN, ISL, NOR, SWE	Organizational questionnaires (F,N,I); Target group (S)
Care sector*	A3	Employment/care sector (public, private)	DEN, FIN, ISL, NOR, SWE	Organizational questionnaires (D,N,I) or based on questionnaire targeting (F,S,I)
Care level*	A1	Level of care (primary, secondary, tertiary)	DEN, FIN, ISL, NOR,	Organizational or professional (F) questionnaires or based on questionnaire targeting (F)
Geographical area*	A2	Geographic location: size (large, mid-small city, rural town); name (municipality, region, hospital district)	DEN, FIN, ISL, NOR, SWE	Organizational or professional (F) questionnaires, or based on target group (S)
Age, sex, professional background, EHR experience level of respondent	-	Age Gender Speciality Experience of use (scale 1–5)	DEN, FIN, ISL, SWE	Professional questionnaire
EHR-name (as a grouping variable)	(B1)	Proportion of public/private organizations where xx (name list) EHR – journal system is available	FIN, ISL, NOR, SWE	Organizational questionnaires, Professional questionnaires

In addition to contextual variables defined by the OECD model survey, some Nordic countries are interested in collecting information on data management and administrative issues from organisations (existence of disaster recovery plan, information security plan, and electronic management of consents), as well as on data structures used. Benchmarking results of these indicators have also been presented.

Availability data

Availability of 8 different HIE functionalities and 5 PHR-functionalities were agreed upon as the common core indicators from the Nordic countries. Availability data are collected in the Nordic countries *with surveys* either targeted to health care professional groups (Denmark, Norway) or the CIOs of health care organisations (Finland, Sweden, Iceland). Some of the availability data are also based on the *expert knowledge* of the participants. The OECD availability survey is targeted to (CIOs or CMO's) for specialized care (hospitals) and to physicians in primary care. The differences in the respondent group needs to be taken into consideration when comparing availability data in different Nordic countries and the OECD.

Table 2 presents the selected Nordic eHealth functionalities, for which availability is monitored, with comparability to the OECD model survey. The values are presented in the following chapter as percentage of *public sector organizations*³ having the functionality in question. National total values can be either a given value or a calculated value as an average from primary and specialized care.

³ See Annex 2 for details about the health care system actors in the Nordic countries.

Table 2. Availability indicators, countries monitoring and data sources

Availability from another organisation (OECD comparability: comparable = *)	The OECD indicator	Countries measuring	Data source **
Availability of Health Information exchange functionalities			
1. Availability of detailed clinical notes*	B2b	D, F, I, N, S	Organisational questionnaires (F), Expert (D, I, N, S)
2. Availability of patient summaries ^{4*}	B6d	D, F, I, N, S	Organisational questionnaires (F), Expert (D, I, N, S)
3. Availability of laboratory results*	B6i	D, F, I, N, S	Organisational questionnaires (F), Expert (D, I, N, S)
4. Availability of imaging results*	B6j	D, F, I, N, S	Organisational questionnaires (F), Expert (D, I, N, S)
5. Availability of immunization data*	B2h	D, F, I, N, S	Expert (D, F, I, N, S)
6. Availability of a list of medication prescribed for a patient in other organisations* ⁵	B4b-c	D, F, I, N, S	Expert (D, F, I, N, S)
7. Availability of mediating electronic prescription to a national database to be viewed by any pharmacy*	B3a	D, F, I, N, S	Expert (D, F, I, N, S)
8. Availability of active list of patient's current medication	B2e	-	-
Availability of PHR/Patient Portal functionalities			
1. Availability of viewing patient's own medication data*	C1b	D, F, I, N, S	Expert (D, F, I, N, S)
2. Availability of electronic medication renewal*	C4a	D, F, I, N, S	Organisational questionnaires (F), Expert (D, I, N, S)
3. Availability of electronic appointment booking*	C3	D, F, I, N, S	Organisational questionnaires (F), Expert (D, I, N, S)
4. Availability of mediating patient's measurements (No Nordic comparability)	C2a	D, F, I, N, S	Organisational questionnaires (F), Expert (D, I, N, S)
5. Availability of asynchronous com- munication between patient and carer	-	D, F, I, N, S	Organisational questionnaires (F), Expert (D, I, N, S)

** Expert refers to people in organisations responsible for national health information systems, who have provided the information for the report.

⁴ See Annex 4 for contents of patient summaries in different Nordic countries.

⁵ OECD monitors availability of active/current medication list. The NeRN group used as proxy data in the previous report "Availability of a list of medication prescribed to a patient in other organisations". Data contents for active medication list is different from a list of prescriptions made to the patient, and measures are thus not identical.

The OECD model survey HIE indicators monitor availability and usage rate of data generated from outside own organisation. Data types include Patient demographics (e.g., age, gender), Detailed clinical notes from encounter with clinician/medical history/anamnesis, Problem list, Diagnoses, Active/current medication list, Vital signs, Allergies, Immunizations. From these the Nordic benchmarking data are presented about availability and usage of Detailed clinical notes, Medication lists and Immunizations. Availability of the Patient demographics is not monitored in the Nordic Countries, since it is 100%, no patient data are exchanged without personal identification information, which includes age and gender.

The OECD model survey also has questions monitoring electronic prescribing. The EHR-functionality of generating an electronic prescription is saturated in all the Nordic countries, as is making the prescription available in any pharmacy. Access to information about dispensing status of the prescriptions is a functionality of the National information system, and in the Nordic data collection we queried what can be viewed when viewing a list of prescriptions made to the patient. Access to a list of medications ordered from outside own organization and list of dispensed medication is also surveyed by the OECD.

The Nordic group did not find comparable data for the OECD model survey variables for listing patients due for tests (Routine clinical functions, and General health management variables). Same applies for the OECD variables on decision support. Receiving and sending patient information securely outside own organisation were regarded identical with the OECD HIE-questions of availability of sending and receiving patient data, patient summaries. Availability of referrals and referral reports and epicrisis were not benchmarked in the Nordic context. Availability of the laboratory orders were not benchmarked, test results for laboratory and radiology were.

There were 3 issues decreasing comparability between the Nordic and OECD *availability* measures: 1) the Nordic variables focused either on availability via the National or regional information system 2) data source was either organisational survey or expert data) 3) medication list and patient summary had 2 interpretations: medication list as a list of prescriptions or active medication list; patient summary as a document or individual data types.

Usage rate data

Table 3 depicts the common Nordic usage rate variables and comparability with the OECD variables. Usage rate data are the basis for usability and benefit-data: if functionality is available but unused, no usability and benefit information can be collected. The rationale behind monitoring Usage rate of nationally stored data is to get an overview of amount of use of different data types that are stored to the national databases. Usage rate is also a proxy indicator for utility of each type of cross-organisational data: The more used the data are, the more useful they most likely are. Usage rate of test results is also a proxy indicator for productivity: National databases aim to reduce number of the duplication of tests. A proportion of viewings of test results of test made (= stored results) monitors this anticipated impact.

The Nordic countries identified log data as the primary source of data about usage rate of eHealth services. Those data focus on two types of indicators: Proportion of data STORED in electronic format in a national information system of all data generated, and proportion of VIEWINGS or QUERIES of the stored data via the national information. For the latter, we used mainly population size as a denominator.

The OECD model survey format for mapping frequency of use is a 5 point likert scale where availability and usage rate are queried simultaneously: Yes [functionality is available and], used routinely; Yes, used occasionally, Yes, but not used, No [functionality is not available] and Don't know.

Table 3. Usage rate indicators, countries monitoring and data sources

Usage rate variables	The OECD indicator*	Countries monitoring	Source
Usage rate of HIE functionalities			
1. Proportion of viewed detailed clinical notes by professionals of population size ⁶	B2b	D, S	National log files
2. Proportion of patient summaries viewed by professionals of population size	B6d	D	National log files
3. Proportion of laboratory test results viewings by professionals of population size	B6i	S	National log files
4. Proportion of viewings of imaging reports by professionals of population size	B6j	S	National log files
5. Proportion of viewings of immunization data by professionals of immunized people in the database	B2h	I	National log files
6. Proportion of prescriptions made electronically of all prescriptions made per year	(B2e)	F, I, N, S	National log files
7. Proportion of prescription viewings by professionals of all prescriptions made per year	(B2e)	F, I, N, S	National log files
8. Proportion of prescription viewings by professionals of <i>electronic</i> prescriptions made per year	(B2e)	F, I, N, S	National log files
PHR functionalities			
1. Proportion of prescription viewings by patients by all prescriptions made per year	C1b	F, N, S	National log files
2. Proportion of prescription viewings by patients by electronic prescriptions made per year	C1b	F, N, S	National log files
3. Proportion of electronic renewal requests made by patients of Population of the country	C4a	F, S	National log files (S), Citizen survey (F)
4. Proportion of electronic GP bookings made by patients of all GP visits per year	-	F, S	National log files (S), Citizen survey (F)
5. Proportion of patient supplements to national health records per year of Population	C2a	F	Citizen survey (F)
6. Proportion of patient messages to GP per year of All GP visits per year	-	F, S	National log files (S), Citizen survey (F)
7. Proportion of laboratory test results viewings by patients of population size	C1a**	F	Citizen survey (F)
8. Proportion of viewings of imaging reports by patients of population size	C1a**	-	-

⁶ Stored notes refers to notes stored in a regional or national health information database, viewings refers to queries made for the particular data type.

Usage rate variables	The OECD indicator*	Countries monitoring	Source
PHR functionalities			
9. Proportion of viewed detailed clinical notes by patients of population size	-	D, F	National log files (D, Citizen survey (F)
10. Proportion of patient summaries viewed by patients of population size	-	D	National log files
11. Proportion of viewings of immunization data by patients of immunized people in the database	-	I, S	National log files

*OECD has a 3-point scale (routine, occasional, nonexistent use, and not available). The Nordic countries have defined a nominator and denominator to measure Usage rate.

**OECD asks about patient access to test results in general and frequency of use.

There were thus 4 issues decreasing the comparability between the Nordic and OECD *usage rate* variables: 1) different data sources 2) different scales 3) level of maturity (National system vs point-to-point data transfer) 4) different level of detail.

Usability and experienced benefits

Usability and user experience variables (see definitions of terms in Annex 7) are presented in table 4. Ideally, usability of documenting as well as searching/viewing of each type of information should be monitored for each functionality. This would, however, result in an extremely long survey, which would not get adequate response rates. Therefore more generic Finnish physician survey questions on user experiences of health information systems used by the professional were taken as a basis of common usability variables.

The OECD model survey does not contain any usability and experienced benefit variables at present. Few common variables were found in the Nordic professional surveys for monitoring usability and experienced benefits of the EHR and HIE functionalities on generic level. The Finnish and Icelandic surveys were made identical, but the Swedish data were collected earlier and in different ways making the comparison of values less reliable.

In Finland and Iceland the total population of physicians working within public hospitals and primary health care were the targeted population. In Finland the private sector physicians were also included in the survey, but excluded from the results presented here. In Iceland, only 17.1% participated in the survey, in Finland ca. 23%. Hence, the study results should be taken with caution. The low response rate may have several explanations. First, this was the first time that a national study examining physicians' use of an electronic health record was conducted in Iceland. Second, the survey was online, however, letters were sent out by regular mail with information about the survey's Uniform Resource Locator (URL) which physicians had to log on to, in order to participate in the study. Furthermore, the study wasn't advertised. It might have yielded better response rate to send an e-mail to the physicians participating in the study with a live link to the on-line study, and advertise it in the Icelandic Medical Journal. Despite the low response rate some lessons can be drawn from the results of the study to further improve the EHR systems.

In Sweden all usability indicator values were measured with a 6-point Likert scale, and for this document values were converted to 5-point scale as discussed above. The respondents of the Swedish user survey belong to four different professional groups (physicians, nurses, assistant nurses and medical secretaries) working in different care settings (hospital, open specialist care, primary care, municipality) in both public and private healthcare. Given a total number of respondents of $n=1253$, about 0.4% of the target population was reached with medical secretaries/clinical administrators being the largest group represented by 2.1% of this work population. In contrast to the data from the other countries, the Swedish usability data do not contain the name of the EHR system as a grouping variable. The type of IT system that is considered to be the most important and the questionnaire thus is answered for is captured. Functionalities of the system were not asked for. This means Swedish data cannot report about the features of the IT systems that were used as objects for responses thus rendering indicators non-comparable. Nevertheless some original data will be presented under the respective usability indicator if applicable. Detailed reported data from the Swedish measurements can be found in (4).

Table 4. Usability indicators, countries monitoring and data sources

Variable	Countries	Data sources
1. Overall user satisfaction	F, I	Professional questionnaires
2. Experienced system quality	F, S, I	Professional questionnaires but different measurement scales in the different countries
3. Experienced response time	F, S, I	Professional questionnaires but different measurement scales in the different countries
4. Experienced ease of learning	F, S, I	Professional questionnaires but different measurement scales in the different countries
5. Experienced error recovery	F, S, I	Professional questionnaires but different measurement scales in the different countries
6. System integration	D, F, I	Professional questionnaires
7. Perceived time saved	D, S, I	Professional questionnaires
8. Potential for saved time with ideal system functionality	D, S, I	Professional questionnaires
9. Support for collaboration	F, S, I	Professional questionnaires but different measurement scales in the different countries
10. Impact on conformity to guidelines	F, I	Professional questionnaires but different measurement scales in the different countries
11. Patient safety	F, S, I	Professional questionnaires but different questions posed in the different countries
12. Patient centredness	F, S, I	Professional questionnaires but different questions posed in the different countries

1. Benchmarking of HIE functionalities

The Nordic eHealth benchmarking results are presented per functionality or information type, presenting availability and usage rate of each of the selected eHealth functionalities or information types (to the extent that the information was available at the end of 2014). Usability and experienced benefit-indicator values are presented in a separate chapter. Summary of the availability results is presented in Table 5, intensity of use-results in Table 6 and usability results in Table 7, and 2014 results at a glance in Annex 8.

1.1 Detailed clinical notes

1.1.1 Availability

This indicator means having secure electronic access to clinical data at point of care documented by a clinician working in other health care facilities. Hence, the health care professional is able to gain immediate knowledge about diagnoses and treatment provided to the patient in another location. The goal is to provide safer patient care. The indicator is comparable to the OECD indicator B2b (provides data for alternatives yes/no, when data is generated from outside own organisation), and can be used also for B6a-b (outside own organisation).

Figure 2. Proportion (%) of public organisations where detailed clinical notes outside own organization are available for professionals

*Total calculated as an average from P and S.

Notes:

DEN: National functionality, P 0%. Primary care can access hospital data, which is 100% available, but specialized care cannot view primary care data, since primary care does not provide data to be viewed across organisations. Source: expert.

FIN: Regional functionality, not national yet at the time points of 2010 and 2014 questionnaire studies. From autumn 2014 forward the national health information exchange (HIE) system Kanta will contain also detailed clinical notes in national level. By end of 2014, 70% (125) of public care organisations had joined Kanta. Source: org.survey (Kanta users: expert).

ISL: National functionality. All public health care institutions have interconnected EHR's via the Icelandic Health Net (Hekla) and using a patient index. GP's can view detailed clinical notes from other GP's and most of the hospitals within the country. Hospital personnel can view detailed clinical notes from GP's and most of the hospitals within the country i.e. 76% of public health institutions have this access to detailed clinical notes outside their own health care organization. This is expected to be at a national level in the beginning of April 2015. Source: expert.

NOR: Tot: 0%, only referrals and discharge reports available. Source: expert.

SWE: National functionality. Starting from year 2013, Swedish National Patient Summary ("NPÖ"). Share of County Councils, private contractors and some municipalities that produce information for the NPÖ. Source: expert.

1.1.2 Usage rate – professionals

This variable is comparable to the OECD variable 2b (provides data for frequency of use, when functionality is available)

Figure 3. Proportion of viewings of detailed clinical notes by professionals/ population size

Notes:

DEN: via national system.

FIN: Data not available.

ISL: Data not available. This will be monitored via log files from 2015.

NOR: data not available.

SWE: Based on logdata from National Patient Summary.

1.1.3 Usability

Usability of viewing detailed clinical notes from outside own organisation has not been monitored in the Nordic countries. Health care professionals' views on eHealth usability have been monitored more than once in Sweden and Finland, and for the first time in Iceland during the NeRN work.

The existing surveys did not have comparable variables measuring ease of use of accessing *specific information types* from outside own organisation. This is a question that needs to be taken into account in the consequent benchmarking of usability.

The HIE functionalities are mainly used by professionals either via the clinician's own EHR-systems or via separate portals. EHR systems can realize the HIE-functionalities in many ways, from full integration

with the EHR-system to a separate link requiring own log-in procedures. Ease of use of accessing data from outside own organisation may greatly impact usage rate of this information, and thus also benefits.

1.1.4 *Efficiency and Quality: Potential additional indicators*

Access to detailed clinical notes outside own organisation at point of care has potential to improve efficiency and quality of care. Prerequisite for benefits is that these history notes are viewed. The mechanism behind improved efficiency for professionals lies in the capacity of detailed notes or patient history to reduce time-consuming queries to other health care organisations. Viewing patient's medical history in other organisations can also lead to a reduction in the number of longer hospital readmissions and single-day admissions for patients (5). Quality of care may be improved with impact on care decisions with a more holistic picture of care episodes and results (<http://nchie.org/health-information-exchange-has-it-held-up-to-its-expectations/>). These variables could be monitored either using up-to-date registers on care episodes, e.g. <http://urn.fi/URN:ISBN:978-952-302-273-7>, or by similar data from the patient information in the national databases. Access to this data would require a specific research plan and permit, since patient data would be required. Availability of the patient data in the national information systems for other than care purposes is regulated, and not available for research in all the Nordic countries.

1.2 Patient summaries

1.2.1 *Availability*

Contents of the patient summaries in different Nordic countries are depicted in Annex 3. The data access can be regional or national. The OECD model survey has 2 questions related to patient summaries: The first question (B.2) asks about availability of specified data contents, most of which are included in the patient summaries (Patient demographics (e.g., age, gender), Detailed clinical notes from encounter with clinician/medical history/anamnesis, Problem list, Diagnoses, Active/current medication list, Vital signs, Allergies, Immunizations). The second question (B.6.d) asks if receiving patient summaries from outside own organisation is possible. The Nordic indicator monitors availability

of the patient summary on document level, *similarly to the B.6.d OECD indicator*. The contents of each summary (for answering the B.2 OECD indicator) are listed in Annex 4.

Figure 4. Proportion (%) of public organizations where patient summaries from outside own organization are available for professionals

*Total calculated as an average from P and S.

Notes:

DEN: * *National functionality*. GPs can access the hospital data, not other way around, and no GP-GP. DEN P= 0%. Source: expert.

FIN: * *Regional functionality*. National level patient summary –view (via Kanta Tiedonhallintapalvelu) will be available in 2017. For this variable, data from Åland was not available. Source: org.survey.

ISL: *National functionality*. This will be at a national level (100%) by April 2015. Source: expert.

NOR: Prospective national functionality, Kjernejournal/core record, presently (March 2015) piloted for citizens in the Mid- and Western part of Norway. In use at St.Olavs hospital (1/20), but yet not a full scale national service. NOR P = 0%. Source: expert.

SWE: *National functionality*. Starting from year 2013, Swedish National Patient Summary (“NPÖ”). Share of County Councils, private contractors and some municipalities that produce information for the NPÖ. Source: expert.

The information included in patient summaries varies between the Nordic countries: in Denmark primary care units do not share their summary data, but the special care summary data are available at a national level; in Finland both primary and secondary care can already share their summary data in many regions and the national level service is currently under development; in Iceland the national level service is being built and will be officially launched in April 2015; in Norway the national level service is in pilot phase and; in Sweden the regional sum-

mary data have been available in those county councils, which have a joint medical record and the summary data are available through the national service, too. (Sweden has here the benefit of holding the primary and the secondary care under the same administration.)

1.2.2 Usage rate – professionals

This variable provides data for the OECD model survey question 6d frequency of use.

Figure 5. Proportion of viewings of patient summaries by professionals by population size

Notes:

DEN: Via the national system.

FIN: Data not available.

ISL: Data not available. Will be monitored in 2015.

NOR: Data not available.

SWE: Based on logdata from National Patient Summary.

1.2.3 Usability

The existing surveys did not have comparable variables measuring ease of use for professionals of viewing patient summaries from outside own organisation as ease of use was only measured for the entire EHR but not for specific information types or functionalities. This is a requirement that needs to be taken into account in the consequent usability monitoring surveys.

1.2.4 Efficiency and Quality: Potential additional indicators

Patient summaries may have similar potential benefits to detailed clinical notes from the viewpoint of clinicians as well as patients. The collated information on tests and their results as well as immunizations may reduce number of unnecessary (repetitive) tests. Up-to-date information on diagnoses and current medication may have direct impact on medication errors. Information on allergies and vital signs also has direct impact on clinical decisions and patient safety. If the summary includes a care plan, this may impact continuity of care. Prerequisite for these impacts is that the summaries are viewed by professionals. Monitoring these impacts would require access to patient data in the national database.

From patient's perspective, frequency and usability of correction requests for the summary data could be added to the citizen survey, to the extent that those data cannot be accessed via log files. This variable could be a proxy indicator for data quality in the national database.

1.3 Laboratory test results

1.3.1 Availability

This indicator measures proportion of public health care organizations where laboratory results from outside own organization are available. Depending on the health care structure, the viewpoint could be regional or national. *This indicator is similar to the OECD indicator B6i, with limitations depicted in the beginning of chapter on HIE benchmarking.*

Figure 6. Proportion (%) of public organizations where laboratory results from outside own organization are available for professionals

*Total calculated as an average from P and S.

Notes:

DEN: National functionality. The laboratory results that are ordered at laboratories, which are only found at hospitals, are all available on a national basis through Sundhed.dk log-in. However more blood/urin test are now also done at the GP's clinic, and they will not be available outside their clinic. Source: expert.

FIN: Regional functionality, (Åland based on the data from 2011), By end of 2014, 70% (125) of public care organisations had joined Kanta, via which this information is available on national level. Source: org.survey (for regional data), expert (for national data).

ISL: A majority of laboratory results are kept within a database located at the University hospital in Reykjavík, which has a national functionality. However, there are also some privately run laboratories where tests and results are only available locally. Source: expert.

NOR: 0%, these data are still imported (and then, e.g. duplicated when a copy is made within the institution-bounded system). Source: expert.

SWE: Regional functionality. (NPÖ). For 76% of population laboratory results are available also outside their own county council. Source: SLIT-report.

1.3.2 Usage rate – professionals

This variable provides data for the OECD variable 6i frequency of use outside own organisation.

Figure 7. Proportion of viewings of laboratory test results by professionals of population size

Notes:

DEN: Data will be available later.

FIN: Data not available.

ISL: This information was not available in Iceland for the time being, as there was some work going on upgrading the system at the National Hospital. Other log data located in different places.

NOR: Data not available.

SWE: Based on logdata from National Patient Summary.

1.3.3 Usability

The existing surveys did not have comparable variables measuring ease of use for the professionals of viewing laboratory test results from outside own organisation. This is a requirement that needs to be taken into account in the consequent usability monitoring surveys.

1.3.4 Efficiency and Quality: Potential additional indicators

Information on laboratory test results is included in patient summaries. The main benefit for clinicians of getting this information at point-of-care from outside own organisation is to reduce number of unnecessary tests. The information can also impact care decisions. A proxy impact indicator for this is the number of laboratory tests made per e.g. population size. The functionality may also impact number of contacts to carers. Values for these indicators have not been reported in this report.

From patient perspective, benefits of this functionality may include saving of time and money due to saved visits or phone contacts, as well as reduced anxiety via shortened waiting time for results. These potential impacts could be included in the citizen survey.

1.4 Imaging results

1.4.1 Availability

This indicator depicts only availability of the written documents i.e. radiologist's reports, not availability of the medical images. That means that no PACS (Picture Archiving and Communication System) availability information is presented here. *The indicator is comparable to the OECD indicator B6j.*

Figure 8. Proportion (%) of public organisations where imaging results outside own organization are available for professionals

*Total calculated as an average from P and S.

Notes:

DEN: *National functionality*. Part of the clinical notes in the EHR. Source: expert.

FIN: *Regional functionality* (Åland based on the data from 2011). Please note that in Finland imaging is performed also in most primary health centers. By end of 2014, 70% (125) of public care organisations had joined Kanta, where this information is available. Source: org.survey (for regional data), expert (for national data).

ISL: *National functionality*. Available at a national level. Source: expert.

NOR: No service at the national level, Helse Midt-Norge, Vest (and Nord) has regional services, 3/20 hospitals. NOR P not applicable since no imaging is performed by primary health care. Source: expert.

SWE: *National functionality*. NPÖ can show radiology results but specific statistics are not available. Source: expert.

1.4.2 Usage rate – professionals

This indicator provides data for the OECD indicator 6j frequency of use or viewing imaging reports via the national system.

Figure 9. Proportion of viewings of imaging reports by professionals by Population size (in or via a national database or system)

Notes:

DEN: Data not available.

FIN: Data available later. No. of documents with imaging requests-results available, not no.. of results.

ISL: Log data unavailable, located in multiple places.

NOR: Data not available.

SWE: Based on logdata from National Patient Summary.

1.4.3 Usability

The existing surveys did not have comparable variables measuring ease of use for the professionals to access specific information types from outside own organisation. This is a requirement that needs to be taken into account in the consequent usability monitoring surveys.

1.4.4 Efficiency and Quality: Potential additional indicators

Information on imaging test results is included in patient summaries. The main benefit for clinicians of getting this information at point-of-care from outside own organisation is to reduce number of unnecessary tests. The information can also impact care decisions. A proxy impact indicator for this is e.g. the number of imaging tests made (i.e. results stored in a national database) per population size or some other agreed denominator. This variable has not been reported in this report.

1.5 Immunisation data

1.5.1 Availability

Immunization and medication data are typically needed in all health care institutions taking part in patient care. Data are needed when the patient is travelling through the care chain for a specific disease, but also during ad hoc visits and for other purposes. Maintaining up-to-date medication information is a challenge due to many stakeholders. The viewpoint here can be regional or national. *The indicator is similar to the OECD indicator B2h when generated from outside own organisation.*

Figure 10. Proportion (%) of public organisations where immunization data outside own organization are available for professionals

Notes:

DEN: National functionality. Taken into use in 2013 as part of the “Shared Medication Record” (FMK). Source: expert.

FIN: National functionality. By end of 2014, 70% (125) of public care organisations had joined Kanta, where this information was available. Structured data at organizational EHR level includes all immunizations documented in patient records, also influenza immunizations, in Kanta as text or structured. Source: Expert.

ISL: National functionality. National database and integrated within the EHR. Source: expert.

NOR: National service coming to the health portal helsenorge.no from SYSVAK (The Norwegian Monitoring System of Immunization) administered by the Public Health Institute. Statistics available on request. Data registered: childrens immunizations from 2007 (?), and flu vaccines and other vaccines from grown-ups from 2011. Source: expert.

SWE: Regional functionality. County councils (those given by private doctors are not included). Source: SLIT-report.

1.5.2 Usage rate

This indicator provides data for the OECD indicator 2h frequency of use of immunization data from other organisations.

Figure 11. Proportion of viewings of immunization data by professionals (in or via a national database or system) by population size

Notes:

DEN: Data not available.

FIN: Data available on number of stored documents containing immunization data, not viewings. These may contain several immunizations for the single patient Individual immunizations.

ISL: In 2014 there were 102,459 immunizations given to 76,824 individuals. Source: Data retrieval from the National Immunization Database.

NOR: National service coming to the health portal helsenorge.no from SYSVAK (The Norwegian Monitoring System of Vaccination) administered by the Public Health Institute. Statistics from 2000 available on request. Data registered: children's immunizations, and flu vaccines and other immunizations from grown-ups. Source: expert.

SWE: Logdata from national database/service Svevac. The figures are based on unic users per day, i.e. only one access per day is recorded. Probably more viewings – the figures are underestimated.

1.5.3 Usability

The existing surveys did not have comparable variables measuring ease of use for the professionals to view immunization data from outside own organisation. This is a requirement that needs to be taken into account in the consequent usability monitoring surveys.

1.5.4 Efficiency and Quality: Potential additional indicators

Information on immunizations is included in patient summaries. The main benefit for clinicians of getting this information at point-of-care from outside own organisation is to help in adhering to the national immunization programmes. A proxy impact indicators for this could be e.g. proportion of immunized people of the population and proportion of immunized people with full compliance to national immunization programme. To monitor adherence to the national immunization programmes, access to patient data in the national databases would be required.

1.6 List of patient's prescriptions

1.6.1 Availability

The values for this indicator were presented for the first time in the previous report (1). The indicator describes the availability of a list of prescriptions that have been written to a patient within and outside own organisation. The precise contents of the list of prescriptions vary from country to country. The contents of a national list of prescriptions is not the same as patient's current medication list: List of prescriptions contains all valid prescriptions for the patient, not all medication that the patient is taking. The OECD model survey question is measuring availability of an up-to-date list of medication that patient is currently taking (2e), which includes medication from different organisations, as well as availability of list of prescriptions ordered from outside own organisation, and dispensed outside own organisation (4b and 4c routine clinical functions). *The Nordic indicator is thus similar to the OECD indicator B4b-c, not to B2e.*

Figure 12. Proportion (%) of public organisations where a list of prescriptions made to the patient outside own organization is available for professionals

Notes:

DEN: *National functionality*. 100% since 2011, including all types of prescriptions. Dispensing status is available in the Shared Medication Record. Source: expert.

FIN: *National functionality*. National prescription database shows prescribed and dispensed medication (not those administered during hospital stay, not per paper or telephone) to health care organisations. Citizen's can forbid the availability of the data; action cannot be noticed by professionals. Does not include paper or via phone prescriptions, nor those related to social care. From 2015, the national Kanta-system will generate a comprehensive list of medication that has been prescribed to the patient from the prescription database and data from individual EHR-systems, including medication administered during hospital stay (v-lää-view). Source: expert.

ISL: *National functionality*. 100% (2014). Includes all e-prescriptions, both prescribed and dispensed as well as some paper and telephone prescriptions. All paper and telephone prescriptions will be available by beginning of 2015. Does not include the medication administered during hospital stay. Only physicians and citizens themselves have access to the National Medication Database. Citizens cannot forbid physician's access to their medication data. Other health professionals have access to medication data via the EHR. Source: expert.

NOR: *National functionality* via ePrescription. As in Finland, prescribed and dispensed medication from primary care (not hospitals yet). Citizens can reserve themselves from professional accessing their personel data. Source: expert.

SWE: *Regional functionality*. 100% since 2012. Citizen can hide the medication; this action can be noticed by professionals. Very few patients do so, 3–4.000 patients out of 9 million. Source: SLIT-report.

1.6.2 Usage rate

This variable provides data for the *OECD variable 4b-c* frequency of use of prescription data from outside own organisation (Via national or regional system).

Figure 13. Proportion of viewings of prescriptions by professionals by all prescriptions made per year

Notes:

DEN: in the second part of 2014 (july–december), 327,000 unique patients (with 2.6 million viewings) and 53,000 unique health care professionals (with 136 million viewings) have looked up prescriptions and medication (it is in the same system and can not be distinguished in these data). These data has been doubled in order to obtain yearly measures, and cut in 100%, since the nominator (272 million viewings) grew bigger than the denominator (31.2 million prescriptions).

FIN: No. of viewings of prescription database by health care organisations (not including pharmacies). Denominator = no. of prescriptions with Social Insurance compensation, which is ca. 90% of all prescriptions made.

ISL: Statistics from 2014. One needs to keep in mind that the usage rate calculated for doctors' viewing of medication data across institutions needs to be taken with caution as this project was still in a pilot phase for the year 2014. Furthermore, for most part of the year this functionality was not yet integrated within the EHR.

NOR: Nominator data from august 2013–august 2014 (data not accessible by December 2014).

Source: log data.

SWE: Log data on viewings of prescriptions *not* available. The figure presents logdata from Swedish eHealth Agency on viewings of a national medication list – “läkemedelsförteckningen” (data OECD B2e), which includes pharmacy and health care professionals. The variable value is not comparable with viewings of list of prescriptions (where data on patients medications is not complete), but is presented here, since the two lists are partially used for the same use purpose.

Figure 14. Proportion of viewings of prescriptions by professionals (in or via a national database or system) by electronic prescriptions made per year

Notes:

DEN: in the second part of 2014 (july–december), 327,000 unique patients (with 2.6 million viewings) and 53,000 unique health care professionals (with 136 million viewings) have looked up prescriptions and medication (it is in the same system and can not be distinguished in these data). These data has been doubled in order to obtain yearly measures, and cut in 100%, since the nominator (272 million viewings) grew bigger than the denominator (26.9 million ePrescriptions).

FIN: No. of viewings of prescription database in 22,014 by health care organisations (not including pharmacies). Denominator = no. of electronic prescriptions stored in the prescription database in 2014. Source: Kanta log data.

ISL: Statistics from 2014. One needs to keep in mind that the usage rate calculated for doctors' viewing of medication data across institutions needs to be taken with caution as this project was still in a pilot phase for the year 2014. Furthermore, for most part of the year this functionality was not yet integrated within the EHR.

NOR: Data not available on numerator.

SWE: Log data on viewings of prescriptions *not* available. The figure presents logdata from Swedish eHealth Agency on viewings of a national medication list – “läkemedelsförteckningen” (OECD B2e), which includes pharmacy and health care professionals. The variable value is not comparable with viewings of list of prescriptions (where data on patients medications is not complete), but is presented here, since the two lists are partially used for same purpose.

1.6.3 Usability

Usability of the prescription list is not currently surveyed in the Nordic usability surveys, and it is questionable, if there are grounds for adding this question, since the list of current medication may also provide information on medication history.

1.6.4 Efficiency and Quality: Potential additional indicators

Content of list of prescriptions is not identical to content of a list of current medications, since the purpose of use is different, even if the two lists can both provide information for checking patient's current medication as well as reconciliation of medication. Usefulness to clinicians depends on the actual content of the two lists and how they can be viewed: prescription list contains information on valid prescriptions whether or not patient is currently taking them. It can provide useful information for doctors especially about dispensing status of medication. A list of current medications should contain those medication that patient is actually on at any given moment, as well as information on medication history. Both lists can provide professionals valuable information on patient's medication, which is important for patient (medication) safety when prescribing new medications. A list of prescriptions is regarded especially important in Iceland. It shows the doctor whether a patient has other valid prescriptions for the same medication in the database, or prescriptions which can be contradictory. This can stop patients from "Shopping around" meaning going to several doctors for prescription of the same medication. Hence, this is of utmost importance regarding medication safety, sensible useage, and possible cost savings within the health care system. Monitoring medication safety would require access to databased patient data and a detailed evaluation plan, which are outside the scope of this work.

1.7 Sending electronic prescriptions for dispensing from any pharmacy

1.7.1 Availability

The viewpoint here is national. The values for this indicator were already presented in the previous report (1). Since 2010, this indicator has saturated. Prescriptions for inpatients, dispensed from hospital pharmacies, are not required to be included in this indicator values, even though they are included in some countries. The indicator is similar to the OECD indicator B3a. Due to saturation in the Nordic countries by 2014, there is a need to shift to monitoring usage rate, usability and benefits of this functionality.

Figure 15. Proportion (%) of public organisations where sending a prescription to be dispensed in any pharmacy is available for professionals

Notes:

DEN: *National functionality*. In all public health organisations, professionals can send a prescription to be dispensed in any pharmacy. Electronic prescriptions are available for all public organisations. Source: expert.

FIN: *National functionality*. (for public sector). Source: expert.

ISL: *National functionality*. Availability at a national level i.e. all hospitals within the country, all GP's, all physicians within private practice and every pharmacy in the country. Source: expert.

NOR: *National functionality*. All pharmacies, general practitioners, specialists and emergency doctors, all doctors with requisition rights and soon also dentists. Source: expert.

SWE: *National functionality*. since 2011. Medication regarding inpatients is not included. Source: expert.

1.7.2 Usage rate

In the OECD model survey, frequency of use of electronic prescriptions is not monitored, only extent to which pharmacies can view the electronic prescriptions.

Figure 16. No. of prescriptions made electronically/all prescriptions made per year

Notes:

DEN: Total number of ePrescriptions has been calculated by subtracting from no. of all prescriptions (31.2 millions), the total number of paper-prescriptions (4.3 million).

FIN: Log data available on nominator, SII statistics on denominator. Denominator includes all prescriptions made in 2014 with Social Insurance compensation (ca. 90% of all prescriptions)

ISL: Statistics from 2014.

NOR: 80% of all prescriptions made are ePrescriptions (total 30 million prescriptions) Source: ehelse.no/E-resept.

SWE. Logdata from Swedish eHealth Agency.

1.7.3 Usage rate: additional indicators

“Proportion of dispensed prescriptions of *electronic prescriptions made*” and “Proportion of dispensation list viewings by professionals (excluding pharmacists) of *electronic prescriptions made*” could be additional indicators for monitoring usage rate of electronic prescriptions. For these indicators, data was not collected.

1.7.4 Usability

Usability of the list of dispensings of prescribed medication is not currently surveyed in the Nordic usability surveys. This functionality is potentially useful for professionals and could be added in the professional usability survey. Dispensing data is potentially very useful to patients, and its usability should be surveyed in the citizen survey.

1.7.5 Efficiency and Quality: Potential additional indicators

Information on dispensed medication can be potentially useful for professionals in determining patient's conformity to care as well as when deciding about future medication. The information on dispensing status provides patients information on amount of medication left, which can prevent need to contact pharmacies or carers to get this information. The potential indicator monitoring this from patients is the same as in 6.3.

1.8 Active list of patients current medication

Currently, Availability, Usage rate and Usability of an active list of patient's current medication via the National Information system was not benchmarked within the Nordic countries. This variable is necessary to be added to the list of common variables. It is monitored by the OECD model survey (B2e).

2. Benchmarking of Patient Portal functionalities

The OECD model survey section on PHR functionalities monitors patient access to and frequency of use of their own test results, Medication lists, Discharge instructions, Summary care notes and Diagnoses. The OECD questions are focused on access to local systems. In addition, there are questions about making electronic supplements (measurements and text), booking appointments and requesting prescriptions online.

The Nordic countries have comprehensive National Information Systems, whereby it was regarded important to monitor availability and usage rate of those functionalities that are available via the national Patient Portal where possible.

The following section reports the Nordic results to patient's access to and frequency of use of list of prescriptions (as proxy to Medication list) and prescription request via the national Patient Portal, and access to making supplements and booking appointments either locally or nationally (according to footnotes). In the future, it is important to monitor availability of these functionalities via a national platform i.e., the national Patient Portal or equivalent.

It is also important to monitor the availability and usage rate of patients own test results, discharge instructions – summary care notes and diagnoses. These indicators have not been tested during the 2-year mandate period, but need to be added to the next round of benchmarking.

2.1 Patient's viewing of own medication data

2.1.1 *Availability*

This indicator monitors patient's ability to view electronically his/her own *prescriptions* via the national information system. The indicator can be used for but is not identical to the *OECD indicator C1b* of monitoring patient's access to medication lists via the systems used in local practice for two reasons: 1) the Nordic indicator monitors list of prescriptions, the OECD list of active medication 2) the Nordic indicator

monitors national availability, the OECD local availability. In the Nordic countries, this functionality is part of the national information system, whereby it has not been feasible for individual practices to implement their own solutions.

Figure 17. Proportion (%) of public organisations making their prescriptions available to the patient in electronic format

Tot calculated as an average of P and S.

Notes:

DEN: *National functionality*. 100% available since 2009 for prescriptions outside hospitals. Since 2013 including prescriptions from hospitals on discharge. Source: expert.

FIN: *National functionality*. Patient access to prescriptions availability identical to ePrescribing availability. Contents: History of prescriptions, active prescriptions, expiry dates, medication left. Does not include paper, phone and inpatient prescriptions. Source: expert.

ISL: 0%. For the period of this survey data patient's in Iceland did not have electronic access for patients to their own prescribed medication data. However, this functionality has now been available for patients since October 2014. Source: expert.

NOR: *National functionality* since 2012–2013 via my prescriptions in helsenorge.no. Only the active ones. Source: expert.

SWE: *National functionality* Since 2012. National service (My healthcare contacts, MVK). Source: expert.

2.1.2 Usage rate – total

Figure 18. No. of prescription viewings by patients (in or via a national database or system)/all prescriptions made per year

Notes:

DEN: in the second part of 2014 (july–december), 327,000 unique patients (with 2.6 million viewings) have looked up prescriptions and medication. These data has been doubled in order to obtain yearly measures.

FIN: Prescription viewings = no. of log-ins by patients to prescription database during 2014. No. of all prescriptions made = prescriptions with social insurance compensation (ca 90% of all prescriptions). Source: Kanta logs.

ISL: Statistics not available for this period of time since this functionality wasn't available to patients until October 2014.

NOR: Data not available on numerator.

SWE: Logdata from Swedish eHealth Agency.

2.1.3 Usage rate – electronic

Figure 19. No. of prescription viewings by patients (in or via a national database or system)/electronic prescriptions made per year

Notes:

DEN: in the second part of 2014 (July–December), 327,000 unique patients (with 2.6 million viewings) have looked up prescriptions and medication. These data has been doubled in order to obtain yearly measures.

FIN: Prescription viewings = no. of log-ins by patients to prescription database during 2014. Source: Kanta statistics.

ISL: Statistics not available for this period of time since this functionality wasn't available to patients until October 2014.

NOR: http://www.helsenorgebeta.net/wp-content/uploads/2015/01/helsenorge_statistikk_2014_desember.pdf

SWE: Logdata from Swedish eHealth Agency.

2.1.4 Usability

Usability of viewing prescription data for patients should be surveyed. This is a requirement that needs to be taken into account in the consequent patient or citizen surveys.

2.1.5 Efficiency and Quality: Potential additional indicators

The patients can benefit from the list of prescriptions, especially if it includes information on expiry date of prescriptions and amount left to be dispensed. This information can save patients unnecessary contacts with pharmacies and health care organisations. Estimated amount of contacts saved could be included as a common Nordic variable in the citizen survey.

2.2 Electronic medication renewal

2.2.1 Availability

Availability of electronic medication renewal can be an organizational service or a national service (see footnotes for explanations). *The indicator is similar to the OECD indicator C4a*, but it has to be noted that some countries have data for local functionality, others for national functionality.

Figure 20. Proportion (%) of public organisations where electronic prescription renewal is available for patients

*Total calculated as an average from P and S.

Notes:

DEN: Local functionality. Patients send medication renewal requests to GP through the GPs local functionality (Secure communication). GP can then electronically renew the prescription via national functionality. P 100%, S not applicable. Source: expert.

FIN: Local functionality. Citizen contacts the pharmacy or primary health care center to ask for renewal. They mark the request in the National prescription centre. When prescription is renewed, patient can get a text message from the National prescription center, or ask about renewal from pharmacy or care organization. All care organisations do not accept renewal requests via prescription center. Source: org.survey.

ISL: Local functionality. Few health care institutions offered this service in 2014. However, this is currently being implemented and is expected to be at a national level before end of 2015. Source: expert.

NOR: Local functionality. GPs can offer service functionalities for patients depending on what portal provider they have chosen. No statistic available. Source: expert.

SWE: National functionality since 2012. ("My healthcare contacts, MVK"). MVK is a personal service on the Web that enables secure communication between patient/consumer/customer and healthcare and long-term care. Via the Internet, you can book and rebook time, renew prescriptions or ask reception to get in, and also order a copy of your patient record. Source: expert.

2.2.2 Usage rate

This variable provides data for the OECD variable C4a frequency of use of electronic prescription renewal requests by patients.

Figure 21. No. of electronic renewal requests made by patients/population of the country

Notes:

DEN: Data not available.

FIN: Log data not available (No. of renewal requests via Omakanta). Current figure: No. of electronic renewal requests calculated from responses to citizen survey summer 2014 (3% of respondents reported that they had made a request electronically during previous year). Source: citizen survey.

ISL: Data not available. Will be available for 2015.

NOR: Data not available. Via General practitioner. Not national database. Source: expert.

SWE: Logdata from My Health Care Contacts (MVK).

2.2.3 Usability

Usability of electronic renewal requests for prescriptions is not currently surveyed in the Nordic professional usability surveys, and there is no reason to add it there, since it is mainly a patient activity. It should be surveyed in the citizen survey.

2.2.4 Efficiency and Quality: Potential additional indicators

Electronic renewal requests can benefit health care organisations by reduction of prescription renewal visits or telephone contacts. Patients can benefit due to saving of time and money. To monitor reduction of number of visits would require data about no. of visits where the reason for visit is renewal of prescriptions. Potentially experienced benefits by patients could be monitored by surveying number of avoided visits per year due to this functionality in citizen surveys.

2.3 Electronic appointment booking

Electronic appointment booking is one of the PHR-indicators in the OECD-model survey (question number C3). The PHR indicators monitor services targeted to individual citizens and patients. This group includes both PHR and Patient Portal services. Their purpose is to make the services and information more accessible to patients and also increase information exchange between professionals and citizens. Typically these services include appointment services, data exchange and possibilities to use patient provided health data. The services require advanced security measures and integration of the information systems.

2.3.1 Availability

Availability of eAppointment booking means here electronic booking in the form of an on-line booking, not sending an e-mail in order to ask for an appointment. Services for which appointments can be made electronically are not defined in the indicator. This indicator is similar to the *OECD indicator C3*.

Figure 22. Proportion (%) of public organisations where online booking of an appointment is available for citizens

*Total calculated as an average from P and S.

Notes:

DEN: *Local functionality* available for all GPs. Trend towards drop-in services. GP systems sometimes autoreply to make a call instead of eAppointment. Source: expert.

FIN: *Local functionality*. Functionality not available in Åland. Most frequent services were laboratory services followed by lower frequency of maternity care and Dental health appointment booking. Source: org.survey.

ISL: For the period of this survey data only 13% of patient's in Iceland had access to e-Appointment Booking. However, the process to implement this started in October and will be available to the total population within the country by the end of 2015. Source: expert.

NOR: *Local functionality*. Functionality to see the booked appointment time exists in special health care organizations (20%). GPs can offer service functionalities for patients depending on what web portal provider they have chosen. No statistic available. Pilot project, not national eHealth service: Vestlandspasienten via helsenorge.no Source: expert.

SWE: *National functionality*. National service to which healthcare organizations can connect to. National service ("My healthcare contacts, MVK"). Some also uses an older technical solution where electronic booking is available for one service only. All county councils have at least one service for electronic booking, most have several services. Source: expert.

2.3.2 Usage rate

Usage rate of electronic appointment booking is not monitored by the OECD model survey.

Figure 23. Proportion of electronic primary care bookings made by patients of all primary care visits per year

Notes:

DEN: Local functionality. Statistics not available.

FIN: No. of electronic bookings calculated from responses to citizen survey summer 2014 (13% of respondents had made an electronic booking previous year). No. of all primary care visits per year (including all primary care professionals) obtained from THL statistics 2013, Sources: nominator: citizen survey; denominator: national statistics.

ISL: Will be monitored using log data for 2015.

NOR: No statistic available on usage rate. Functionality to see the booked appointment time exists in special health care organizations (20%). GPs can offer service functionalities for patients depending on what web portal provider they have chosen. Pilot project, not national eHealth service: Vestlandspasienten via helsenorge.no. Source expert.

SWE: Logdata from My Health Care Contacts (MVK). Includes all bookings, rebook and cancelations (not only GP's). The nominator includes all visits to GP, other professions, hospitals and contracted private caregivers.

2.3.3 Usability

Usability of electronic appointment booking is not currently surveyed in the Nordic professional usability surveys. Usability of electronic appointment booking is potentially useful especially to patients, and should be surveyed in the citizen survey.

2.3.4 Efficiency and Quality: Potential additional indicators

Electronic appointment booking can benefit health care organisations by improving capacity use rate (reduction of unused times) as well as by automating booking processes. These indicators would require process timing data from health care organisations, which is beyond the scope of monitoring work. Potentially experienced benefits could be monitored adding variables to surveys administered to clinical secretaries.

2.4 Patient-produced measurement data

2.4.1 Availability

The proportion of public organisations that offer patient's the possibility to mediate patient-produced measurement data to professionals, measures the availability for professionals to view patient produced measurement data (not text). The indicator is similar to the OECD indicator C2a.

Based on the background data, the indicator on patient produced data in EHR is strongly affected by national legislations, since for example in Finland it is legally acceptable to include these data into the EHR, as long as the data are separated from data produced by professionals. On the other hand in Sweden this is not legally acceptable. However, a lot of pilots are active in the Nordic countries (Sweden, Norway, Finland and Iceland).

- **DEN: Local functionality.** In Denmark this kind of functionalities are available (eg. Immunizations, and in home monitoring pilot projects), but no measured values exist on the availability. The possibility for patients to enter supplements to their HER/PHR is challenged by the fact that for care personnel, this generates extra work that is currently not paid for. Source: expert.
- **FIN: Local functionality.** Based on the organizational surveys in Finland 2014, 19.8% of public primary health care organization and 28.6% of public secondary health care organizations provided functionality where patient could send actively or inactively their own measurements for healthcare personnel to view. For example City of Espoo has this kind of functionalities. A Finnish survey (6) indicated that 60% (46 projects) eService projects in Finland in 2010

were local or regional projects aiming on developing people's Personal Health Records. Source: org.survey.

- ISL: In Island the availability of this functionality is 0%. However, a pilot project has now been launched with hypertensive patients. Source: expert.
- NOR: *Local functionality*. In Norway there are diabetes home solutions and projects on patient rights to see the information and the next step would be to add own data. Source: expert.
- SWE: In Sweden there are legal issues to be addressed regarding mediation of patient –produced measurement data to professionals. Source: expert.

2.4.2 Usage rate

Figure 24. No. of patients sending supplements to health records per year/population of the country

Notes:

DEN: Data not available.

FIN: No. of patients having send supplements calculated from responses to citizen survey summer 2014 (1% of respondents had sent electronic supplements previous year). Sources: citizen survey.

ISL: Not currently an available function for citizens.

NOR: Kjernejournal, pilot project in Mid- and Western Norway, not national eHealth service. Source: expert.

SWE: The service providers are not paid for the time they spend on emails (e.g. replying to patients on their supplements).

2.4.3 Usability

The usability of patient supplements could be surveyed both from professionals as well as patients. This is a requirement that needs to be taken into account in the consequent patient as well as professional surveys.

2.4.4 Efficiency and Quality: Potential additional indicators

The patient supplements can enhance patient empowerment (self-management of care), patient's conformity to care and care coordination as well as shortening the time to address problems that may arise. (<http://www.healthit.gov/providers-professionals/faqs/what-are-benefits-personal-health-records>)(7). Assessment of these impacts require access to the databased patient data. It is unlikely that monitoring of these could be done on national level, since these impacts are mainly generated in chronic care contexts.

2.5 Asynchronous communication between patients and professionals

2.5.1 Availability

Asynchronous communication between patients and professionals could be provided at the organizational level or at the national level depending on the type of the services provided and the health care infrastructure. See footnotes for explanations. The OECD model survey is not monitoring this functionality.

Figure 25. Proportion (%) of public organisations where asynchronous communication between patients and professionals is available

Notes:

DEN: *Local functionality* provided between GP and patient since 2013 (100%). Asynchronous communication between patient and hospital is still on project basis and is not measured systematically. Source: expert.

FIN: *Local functionality*. This is an organizational service. The figure shows combined propositions of organizations offering either txt-message, Q&A service or email with identification. Service not available in Åland. Source: org.survey.

ISL: Not available at this point in time i.e. 0%. Will be available in 2015. source: expert.

NOR: *Local functionality*. Digitale innbyggertjenester (Preproject 2014, stat-up 2015) [30]. The specialist healthcare will establish these services. Source: expert.

SWE: *National functionality*. National service ("My healthcare contacts, MVK"). MVK is a personal e-mail service on the Web that enables secure communication between patient/consumer/customer and healthcare (primary care and hospitals) and long-term care. Via the Internet, you can book and rebook time, renew prescriptions or ask reception to get in. Also order a copy of your patient record. 100% since 2012. Source: expert.

2.5.2 Usage rate

Figure 26. No. of patient messages (to GP – primary care) per year/all (GP – primary care) visits per year

Notes:

DEN: Local functionality. Data not available.

FIN. No. of patients having sent electronic messages calculated from responses to citizen survey summer 2014 (1% of respondents had sent messages previous year). No. of visits include all primary care visits (primary care doctor visits can be distinguished, but often nurses handle eMessaging with patients) Source: nominator: citizen survey, denominator: national statistics.

ISL: Data not available. Will be logged for 2015.

NOR: (Nominator) data not available Local service, Denominator value available in statistics (number of visits for GP).

SWE: Logdata from My Health Care Contacts (MVK). Includes all bookings, rebook and cancelations (not only GP's). The nominator includes all visits to GP, other professionals, hospitals and contracted private caregivers.

2.5.3 Usability

The usability of patient messages could be surveyed both from professionals as well as patients. This is a requirement that needs to be taken into account in the consequent patient as well as professional surveys.

2.5.4 Efficiency and Quality: Potential additional indicators

Patient messaging is a functionality of PHR-or Patient Portal systems, which has many of the similar anticipated impacts as patient supplements: it can enhance patient empowerment (self-management of care), patient's conformity to care and care coordination as well as shortening the time to address problems that may arise. (<http://www.healthit.gov/providers-professionals/faqs/what-are-benefits-personal-health-records>) (7). Objective Assessment of these impacts require access to the data-based patient data. It is unlikely that monitoring of these could be done on national level, since these impacts are mainly generated in chronic care contexts. However, experienced benefits can be monitored via citizen surveys.

2.6 Additional Patient Portal indicators

National portals offer patients also other functionalities than those defined above. *The OECD-defined indicator on access to viewing and usage rate of test results (C1a)* was covered by two variables in the Nordic benchmarking: usage rate of laboratory results and imaging reports. The OECD-defined indicators on availability and usage rate of patients to see their discharge instructions, summary care notes and diagnoses have not been tested during the 2-year mandate period. These should be added to the common Nordic indicator list, since information on test results may impact number of contacts to carers and thus efficiency of care.

2.6.1 Patient's viewing of laboratory test results – usage rate

Figure 27. No. of viewings of laboratory test results by patients/population size

Notes:

DEN: Data will be available later.

FIN: Currently a *national functionality*. Availability as for professionals. Log data on patients viewings not available. The figure presents *proportion of patients* having viewed test results *locally* calculated from responses to citizen survey summer 2014 (5% of respondents had viewed their lab results electronically previous year). Source: citizen survey.

ISL: Not yet an available functionality.

NOR: Service not available.

SWE: Data not available on national level. Results from the Sustain-project in County Council of Uppsala (CCU) indicate approx. 9% of the citizens who were offered the service used it. In CCU the service includes the complete medical record – not only a patient summary. (Sustains. Document D3.10. Final pilot evaluation report version 1.0, March 2015).

2.6.2 Patient's viewing of imaging reports – usage rate

Data to monitor intensity of use of patients to view their radiology reports was not available in any of the Nordic countries. Main reasons were granularity of log data (not monitoring in detail different documents viewed by patient). A question was also raised to what detail is it ethically appropriate to monitor patient's navigation within the Patient Portals.

Notes:

DEN: Log data on patient viewings not available.

FIN: Log data on patients viewings not available.

ISL: Not yet an available functionality.

NOR: Log data on patient viewings not available.

SWE: Data not available on national level. Results from the Sustain-project in County Council of Uppsala (CCU) indicate approx. 9% of the citizens who were offered the service used it. In CCU the service includes the complete medical record – not only a patient summary. (Sustains. Document D3.10. Final pilot evaluation report version 1.0, March 2015).

2.6.3 Patient's viewing of detailed clinical notes – usage rate

Figure 28. No. of viewings of detailed clinical notes by patients/population size

Notes:

DEN: Via national portal.

FIN: Availability via national portal as for professionals. Log data on patients viewings via national portal not available. *No. of patients* having received detailed clinical notes *as local functionality* calculated from responses to citizen survey summer 2014 (2% of respondents had received their notes electronically previous year). Source: citizen survey.

ISL: Not yet an available electronic functionality.

NOR: Log data not available.

SWE: Data not available on national level Results from the Sustain-project in County Council of Uppsala (CCU) indicate approx. 9% of the citizens who were offered the service used it. In CCU the service includes the complete medical record – not only a patient summary. (Sustains. Document D3.10. Final pilot evaluation report version 1.0, March 2015).

2.6.4 Patient's viewing of patient summaries – usage rate

Figure 29. No. of viewings of patient summaries by patients/population size

Notes:

DEN: Via national Patient Portal.

FIN: Currently Local functionality. Log data on patients viewings not available.

ISL: Not yet an available functionality.

NOR: Data not available.

SWE: Data not available on national level. Results from the Sustain-project in County Council of Uppsala (CCU) indicate approx. 9% of the citizens who were offered the service used it. In CCU the service includes the complete medical record – not only a patient summary. (Sustains. Document D3.10. Final pilot evaluation report version 1.0, March 2015).

2.6.5 Patients viewing of immunization data – usage rate

Figure 30. No. of viewings of immunization data by patients/population size

Notes:

DEN: Data not available.

FIN: National functionality. Availability as for professionals. Log data on patients viewings not available.

ISL: Data not available. Will be logged for 2015.

NOR: Pr. 31/12-14 there were 3,847,662 persons registered in the database (denominator). Nominator is the sum of monthly log in to the national service "My immunizations"/"mine vaksiner". Source: log data.

SWE: Data not available.

3. Benchmarking HIS usability and experienced benefits

As stated in the usability-section under each data type, there are not comparable data about usability of those key functionalities, which are available (e.g. usability of patient's prescription list). Instead, usability questions tend to focus on user's experiences of the entire health information system. The same applies for the variables of experienced benefits. In order to monitor benefits of specific eHealth functionalities, their impact mechanisms (e.g. of common medication list improving medication safety) should be defined. Some potential benefits and ways to monitor these in future have been suggested. For these reasons, this chapter is presented separately instead of integrating the results into the previous chapters, where availability and usage rate of specific functionalities is depicted.

Even if usability surveys were targeted to different professional groups, this section presents *results of physicians' experiences only*.

3.1 Overall satisfaction

This indicator reflects the users' overall satisfaction with the main EHR systems they are using. The higher score refers to higher satisfaction. The question was asked using the general school grade in Finland and Iceland. The grades were rescaled to the same coordinates as described in materials and methods. Although nonspecific, this indicator could be used in comparison of evolvement of user satisfaction in repeated surveys.

Figure 31. Mean overall satisfaction with the information system (scale 1–5)

*Total calculated as average of P+S.

Notes:

FIN measured satisfaction with schoolgrade (4–10), ISL with scale 1–5. Finland's grade was rescaled to 1–5 to be comparable.

Data missing: SWE, DEN, NOR.

3.2 Satisfaction with system reliability

This indicator presents mean value of physicians' agreement with a statement: EHR system is stable in terms of technical functionality (does not crash, no breaks in operation, where 1 = disagree completely, 5 = agree completely). The stability is a basic requirement for more sophisticated usability.

Figure 32. Mean experienced satisfaction with system reliability (scale 1-5)

*Total calculated as average of P+S.

Notes:

Data missing: DEN, NOR.

SWE: Figures for physicians only (4). NOTE: Only max. 300 respondents (whereof 186 working in hospitals); includes all IT systems used by physicians, i.e. not only EHR (EHR = 83%); does not take sensitivity analysis to eliminate questionnaires with no answers into account.

3.3 Experienced response time/responsiveness

This indicator measures users' agreement with a statement: the system reacts quickly to commands.

Figure 33. Mean experienced satisfaction with response time (scale 1–5)

*Total calculated as average of P+S.

Notes:

Data missing: DEN, NOR.

SWE: Figures for physicians only. (4) NOTE: Only max. 300 respondents (whereof 186 working in hospitals); includes all IT systems used by physicians, i.e. not only EHR (EHR = 83%); does not take sensitivity analysis to eliminate questionnaires with no answers into account.

3.4 Experienced error recovery

This indicator measures users' agreement with a statement: The correction of errors (such as login error, ending up in the wrong view, changing selections, etc.) is easy.

Figure 34. Mean experienced satisfaction with error recovery (scale 1–5)

*Total calculated as average of P+S.

Notes:

Data missing: DEN, NOR.

SWE: Swedish measurement restricted to experienced easiness to correct wrong data entries.
Question needs reformulation to render completely comparable results.

3.5 Experienced ease of learning

This indicator measures users' agreement with a statement: Learning to use the system is easy.

Figure 35. Average experienced satisfaction with ease of learning (scale 1-5)

*Total calculated as average of P+S.

Notes:

Data missing: DEN, NOR.

NOR: The questionnaires (8) included a question on HOW they were taught to use the EPR in respectively primary and specialist health care. This was not considered comparable with the indicator question.

SWE: Figures for physicians only based on (4) NOTE: Only max. 300 respondents (whereof 186 working in hospitals); includes all IT systems used by physicians, i.e. not only EHR (EHR = 83%); does not take sensitivity analysis to eliminate questionnaires with no answers into account.

3.6 Potential for saved time with ideal system functionality

This indicator was formulated differently in the Nordic country surveys, and it was not possible to convert them to uniform format.

- DEN: Potential to save 39 min/day for nurses, 44 min/day for physicians and 50 min/day for secretaries if system would work as expected.

- ISL: Tot 93.3% think they could save time (<10–120 min) if system operated ideally; Primary: 91.7%; Specialized: 94.3%.
- SWE: Potential to save 35 min/day for nurses, 17 min/day for assistant nurses, 56 min/day for physicians and 42 min/day for secretaries if system would work as expected.

3.7 System integration

System integration was assessed as an average number of clinical systems that the users log in during a workday. This may be either asked directly or as a number of passwords used during a day. A smaller number is better here; the scale is not a Likert scale. The log-ins do not include administrative or office systems, which usually require their own user names for log-in.

Figure 36. Average Number of clinical systems a physician has to log-in during a workday

* Total calculated as average of P+S.

Notes:

Data missing: SWE, NOR.

NOR: Survey asked how the healthcare personnel experience the login (login time, logoff time and conflicting logins with colleagues) but not number of logins (8), thus it was not considered to be comparable with the Nordic indicator.

3.8 Experienced impact to care process and outcomes

This thematic set of indicators discuss the users' experiences on IT systems 1) impacting the care process, 2) supporting collaboration between care providers, and towards patients, and 3) impacting patient safety and patient centeredness.

3.8.1 Impact on conformity to guidelines

This indicator measures users' experiences to a statement: IT systems support implementation of care guidelines.

Figure 37. Mean experienced impact of IS on conformity to care guidelines (scale 1-5)

*Total calculated as average of P+S.

Notes:

Data missing: SWE, DEN, NOR.

3.8.2 Support for collaboration

This indicator presents users' experiences to a statement: The information systems support cooperation and the flow of information between physicians in the same organisation, physicians across organisations, physicians and nurses and physicians and patients.

Figure 38. Mean experienced Support from IS for collaboration between doctors working in the same organization (scale 1–5)

*Total calculated as average of P+S.

Notes:

Data missing: DEN, NOR.

SWE: Not included in this figure. Has a theme related question with different grouping; collaboration within team (SWE P 3.4, SWE S 3.2 and SWE Tot 3.2) and Collaboration with other units within the same organization (SWE P 2.9, SWE S 3.4 and SWE Tot 3.3). Data (4). NOTE: Only max. 300 respondents (whereof 186 working in hospitals); includes all IT systems used by physicians, i.e. not only EHR (EHR = 83%); does not take sensitivity analysis to eliminate questionnaires with no answers into account.

Figure 39. Mean experienced Support from IS for collaboration between doctors working in different organizations (scale 1-5)

*Total calculated as average of P+S.

Notes:

Data missing: DEN, NOR.

SWE: Figures for physicians only based on (4). NOTE: Only max. 300 respondents (whereof 186 working in hospitals); includes all IT systems used by physicians, i.e. not only EHR (EHR = 83%); does not take sensitivity analysis to eliminate questionnaires with no answers into account.

Figure 40. Mean experienced Support from IS for collaboration between doctors and nurses (scale 1-5)

*Total calculated as average of P+S.

Notes:

Data missing: SWE, DEN, NOR.

SWE: Not included in this figure. Has a theme related question with different grouping, see note under the figure 38.

Figure 41. Mean experienced Support from IS for collaboration between doctors and patients

*Total calculated as average of P+S.

Notes:

Data missing: SWE, DEN, NOR.

SWE Figures for physicians only, based on (4). NOTE: Only max. 300 respondents (whereof 186 working in hospitals); includes all IT systems used by physicians, i.e. not only EHR (EHR = 83%); does not take sensitivity analysis to eliminate questionnaires with no answers into account.

3.8.3 Patient safety

Patient safety was measured as users' responses to a statement: "Faulty system function has caused or has nearly caused a serious adverse event for the patient." The scales were reversed so that those who agreed scored lower and those who disagreed, scored higher, i.e. higher number implies a better safety.

Figure 42. Mean experienced support from IS on reduction of adverse events (scale 1–5)

*Total calculated as average of P+S.

Notes:

Data missing: DEN, NOR.

NOR: Has theme related questions that are phrased differently, thus they were not considered to be comparable with the Nordic indicator.

SWE: Figures for physicians only, based on (4). NOTE: Only max. 300 respondents (whereof 186 working in hospitals); includes all IT systems used by physicians, i.e. not only EHR (EHR = 83%); does not take sensitivity analysis to eliminate questionnaires with no answers into account.

3.8.4 Experienced impact on Patient centeredness

This indicator measures users' responses to a statement: the use of the information systems frequently takes attention away from the patient. The scale was reversed in order for a *higher* number to imply a *better* patient centeredness here.

Figure 43. Mean Experienced support from IS for patient centeredness (scale 1–5)

*Total calculated as average of P+S.

Notes:

Data missing: DEN, NOR.

NOR: Theme related questions that are phrased differently, thus not considered comparable with the Nordic indicator.

SWE: Figures for physicians only based on , increased possibility to adapt care to each patient.

NOTE: Only max. 300 respondents (whereof 186 working in hospitals); includes all IT systems used by physicians, i.e. not only EHR (EHR = 83%); does not take sensitivity analysis to eliminate questionnaires with no answers into account.

3.8.5 Medication safety

One of the key impact mechanisms (or goals set for development) of common, up-to-date lists of patient's current medication is prevention of medication errors. However, the medication errors are not directly linked to the medication lists. For example in DK the error reporting system is an independent system, where professionals AND patients can report errors or nearly-errors into different categories. Medication errors is one of the categories. Medication errors include wrong medication, wrong dosage, wrong time, forgotten medication, wrong patient given to etc. It is a broad category and it is recorded per incident – and not automatically. For every incident, the professional or patient should record it.

Since the systems for reporting patient safety incidents are different in different countries, the results cannot be directly compared, even if they are presented here.

Figure 44. No. of medication errors reported during a year/population of the country

Notes:

DEN: National functionality. Medication errors are reported to a national patient safety database. Cumulated data are publicly available after one-year delay. Source: expert.

FIN: No national database. Value scaled to national level from the largest hospital district patient safety events in 2012 (of which 50% reported to be medication errors). Sources: http://www.mylab.fi/fi/puheenvuoro/laakitysvirheet_ovat_yleisimpia_vaaratilanteita/ and <http://www.kunnat.net/fi/kunnat/sairaanhoitopiirit/Sivut/default.aspx>

ISL: Medication errors are reported to a national adverse event database located at the Directorate of Health. Statistics in this report are for the year 2013. Source: expert.

NOR. In 1357 messages (19%) were registered as errors related to drugs. Provision of drugs is a vulnerable process. Given the wrong drug and given drug in the wrong dose, strength or frequency, were frequently occurring. Source: knowledge center.

SWE: Data not available.

4. Generic (administrative) indicators

4.1 Availability of Common information structures

The proportion of public organisations, which have implemented common structures for patient data was selected in the Nordic countries to measure degree of interoperability of patient information stored in different organisations. It is also a proxy indicator for quality of information collated from different EHR-systems.

The OECD model survey does not include this indicator. The comprehensiveness of the information structures is not taken into account, because there are so many country by country variations. Some countries report the most important common infrastructures like diagnostic, therapy and test codes here, while some report full agreement with the national HIE information infrastructure (see notes). Therefore the present situation is only indicative. The agreement with a national infrastructure is in the future the most suitable indicator.

Figure 45. Proportion (%) of public organisations where national information structures are available (implemented)

*Total calculated as average of P+S.

Notes:

DEN: P = 0%. All secondary health care organizations (hospitals) use common structures. Some of the specialized health care is in private clinics, and for these private clinics they do use a common information structure to send and receive data, but other organizations do not have access to data in these private clinics. Some of the elements are structured, some are not. Tot* was calculated as an average of P and S. source: expert.

FIN: Here the numbers are based on number of health care organizations (primary or secondary) joined to national Kanta HIE infrastructure by May 2014. When joined to Kanta all major codings are made according to national structures. Based on the law all public health care organization should be joined before September 2014. However, this time point has been postponed until 2015 in many organizations. Already well before joining the Kanta, the 2014 organization study revealed that e.g. 98% of the Finnish primary health care centres used ICD-10 for medical diagnoses, 86% used ICPC for reason of visit and 84% used laboratory codes for tests. The usage numbers are higher for specialized care. The national code server provides common structures for all service providers in the country. The Kanta connectivity was however chosen to be presented here for future compatibility. Source: expert.

ISL P and ISL S. It is mandated in Iceland to code health information using ICD-10 for medical diagnoses, NCSP for surgical procedures, ATC for prescribed medication, ICPC for reason for visit, ICNP for nursing diagnoses and interventions. Source: expert.

NOR: 0% in 2008, agreement on the structure of data that are to be shared in the "Kjernejournal" has been reached as part of the "Kjernejournal" project. source: expert.

SWE: NPÖ. In some county councils they still have different information structures. Source: expert.

Availability of common information structures should be monitored more specifically, by key structures and types of structures (heading structures and classifications). Usage rate of the structures could also be monitored to estimate quality of the databased data, but this would require access to databased patient data.

Another indicator for quality of the databased data is consistency of the data in the database. In some clinical fields (e.g. childrens behavioural and mental disorders), usage of alternative diagnostic codes has been seen as a problem for interoperability and re-use of the databased data. Data consistency has been assessed in previous literature e.g. by comparing data from different sources and by asking different professionals to code same patient data (9). Data consistency cannot be monitored regularly without automatic data processing techniques and access to databased patient data.

Information structures can impact also in conformity to care guidelines, patient (medication) safety, time to care, length-of-stay and availability of decision support systems (DSS) (9). All these indicators apart from availability of DSS would require access to the databased patient data. Time to care and length of stay could potentially be monitored using national care episode registers where they exist (e.g. <http://urn.fi/URN:ISBN:978-952-302-273-7>).

4.2 Data Security and Consent management

The Nordic group identified some administrative indicators, which measure how the security of valuable and sensitive health data is maintained. In digitalized health care, the health care institutes should have tested protocols how to handle technical disturbances in data access, how to ensure only authorized access to data and how to respect patient's right to regulate access to his/her data. All these functions should not restrict data availability at the point of care when needed.

4.2.1 Proportion of public organisations with a documented disaster recovery plan

This indicator shows the proportion of organizations that have a written disaster recovery plan. That is a protocol how to recover from a major failure of the IT systems in the institution. While practically all health data is now only in digital format in the Nordic countries, this capability has a strategic importance. This indicator is followed also in studies authorized by the European Union.

Figure 46. Proportion (%) of public organizations with a written disaster recovery plan

*Calculated as an average of P+S.

Notes:

DEN: Not known.

FIN: Functionality asked only from specialized care organisations. Åland has this functionality.

Source: org.survey.

ISL: A majority (93.3%) of health care institutions have a disaster recovery plan implemented.

NOR: No data available.

SWE: Data refer to the county councils.

4.2.2 Proportion of public organisations with documented information security plan

This indicator discusses the proposition of organizations that have a written information security plan. Normally that is a document, which describes how to defend information from unauthorized access, use, disclosure, disruption, modification, perusal, inspection, recording or destruction.

Figure 47. Proportion (%) of organizations with a written security plan

*Total calculated as an average from P and S.

Notes:

DEN: National, 100%. Source: expert.

FIN: Åland 2010 not determined, 2014 functionality not available. Source: org.survey.

ISL: A majority (93.3%) of health care institutions have an information security plan implemented. Source: expert.

NOR: Mandatory. Source: expert.

SWE: Data refers to the county councils. Source: org.survey.

4.2.3 Proportion of public organisations with electronic consent management system (for access to information)

This indicator depicts availability of electronic management of patients' consents to give access to their health data either within organizations, regionally or nationally. Presently, this indicator allows the consent sta-

tus either to be entered directly to the systems or transferred from an external system (even from paper documents). This area is under fast development with national initiatives within the Nordic countries.

Figure 48. Proportion (%) of public organisations where electronic consent management is available

*Total calculated as an average from P and S.

Notes:

DEN: 100% law based to ask. Consents are electronically managed for all information available through the portal Sundhed.dk. Source: expert.

FIN: Functionality not available in Åland. Current survey data is from organizations (public primary and secondary care) which answered a free text question. Answers combine consent management directly integrated to the system, or translated from paper forms. With the roll-out of Kanta services in 2014–2015, there will be a national service for consent management. Source: org.survey.

ISL: The Health Record Act no. 55/2009 indicates that all health care professionals who are involved in the treatment of a patient have authorized access to the patient's health record. However, the patient can prohibit access (except access to the national medication database). If the patient wants to prohibit access to own health record the patient has to go through a certain process and through the health records supervisor. Source: expert.

NOR: no such services exists. Source: expert.

SWE: Law based to ask. (Swedish Patient Data Act) Together with NPÖ there is an e-service for consent management. But the consent is also notated in the record. Source: expert.

The concept of consent may vary between Nordic countries. Thus for further analyses detailed documentation would be needed. Here, a case example from Finland is presented.

Case

Patient consents in Finland

(<http://www.kanta.fi/en/potilaan-suostumukset>)

Consents are patients' means of influencing how their information is used, giving permission to another person or party to act on their behalf or to view their medical records.

When an adult person is dealing with matters related to electronic prescriptions, oral consents are sufficient. Patients' written consent is only required in the event that a healthcare unit wishes to retrieve information from the Prescription Centre for a purpose other than treatment.

Your consents also allow you to influence how your patient records are available to the medical staff when they are treating you. In practice, you first consent to disclosure of your information between different healthcare units. If you do not want some piece of information to be disclosed, you can prevent it by refusing consent to disclose the information in question. More detailed information on consents, refusals, and patients' other ways of influencing their treatment are in the "Patient rights" section.

Consents connected with the Patient Records Archive may be given in writing. The Patient Records Archive will be deployed in phases. Therefore, consents can only be given in healthcare units that have deployed the service. Later, the consent can also be entered through My Kanta pages.

Medical records from various operational units stored in the Common Register may be disclosed without patients' consent after they have been informed about the Common Register, and when they have a treatment relationship with the unit requiring the information. Patients have the right to refuse to have their medical records passed between different operational units belonging to the Common Register. Patients may refuse to allow the municipal use of their medical records altogether. They may also limit their refusal so that it concerns records connected with a particular unit, register, in-patient period, or individual visit. The refusal is in force until further notice and can be cancelled at any time. The refusal can be given in any unit using the Common Register. Later, the refusal can also be entered through My Health Information.

Medical records stored in the Patient Data Repository are available to the operational unit that has entered the information. If patient records are disclosed to another unit, the patient's consent is required. If patient records are retrieved from another unit's patient register, it constitutes disclosure, for which the patient's consent is also required. Before giving their consent, patients must be given information about the records stored in the national archive service and their use, and the fact that patients can limit disclosure of their information. A consent given by the patient is valid until further notice and covers all medical records already held in the Patient Data Repository, as well as any records entered into it later.

Patients may limit the coverage of their consent by entering a refusal. They can refuse the use of e.g. records relating to a specific treatment visit or a certain healthcare unit. Consents connected with the Patient Data Repository must be given in writing. Official consent forms are available from healthcare services and they have to be signed by hand. A consent or a refusal can be made in person in a healthcare unit or at the internet through My Kanta pages. Because the Patient Data Repository will be deployed in phases, consents can only be given in healthcare units that have already deployed the service.

4.3 ICT Costs: Proportion of ICT-costs of the total budget in public organisations

Health ICT costs data are collected from organizations with organisational surveys alongside with the availability data. By definition this gives the proportion of IT budget compared to the total budget of the organization. The difficulty to compare health ICT costs from country to country derives from the fact that different cost drivers are included to this sum in different countries. The footnotes give an explanation which items are included in those countries that provided data here.

Figure 49. Proportion (%) of ICT costs of the total budget in health care organizations

*Total calculated as an average from P and S.

Notes:

DEN: Data not available.

FIN: data from Åland not available. In Finland the questions includes acquisition, maintenance, development and education. It can be an estimate or calculated. Source: org.survey.

ISL: the question includes information on maintenance, development, implementation and staff education. It can be an estimate or calculated. On average, less than 2% of total institutional costs are spent on IT. Source: expert.

NOR: Data not available.

SWE: including (External income (IT), Communication (IT and telephony), Equipment (purchase and depreciation of equipment, service agreements, repairs, use, etc.), Software (purchasing, depreciation, licenses, maintenance fees, etc.), External services (consultants, computer operations, fees for national eHealth), IT staff. Source: org.survey.

5. Discussion and conclusions

5.1 Summary of the results

Table 5. Availability of monitored functionalities in the Nordic Countries

Availability outside own organisation	For all public organisations	For most public organisations (50–99%)	For some public organisations ($\geq 50\%$)	Not available
HIE				
Detailed clinical notes	Sweden	Finland Iceland	Denmark*	Norway
Patient summaries	Sweden	Finland Iceland	Norway Denmark*	
Lab results	Denmark Sweden	Finland Iceland		Norway
Radiology reports	Denmark Iceland Sweden	Finland	Norway	
Immunization data	Denmark Iceland	Finland	Norway Sweden	
Mediating prescriptions electronically	Denmark Finland Iceland Norway Sweden			
Viewing list of patient's prescriptions	Denmark Finland Iceland Norway Sweden			

Availability outside own organisation	For all public organisations	For most public organisations (50–99%)	For some public organisations ($\geq 50\%$)	Not available
Patient Portal				
Patient view of medication	Denmark Finland Norway Sweden		Iceland	
Prescription renewal request	Sweden Denmark**		Finland Iceland Norway	
Electronic appointment booking	Denmark Sweden	Finland	Iceland Norway	
Patient supplement of measurement data			Denmark Finland	Iceland Norway Sweden
Asynchronous communication	Sweden	Denmark	Finland	Iceland Norway
Management functionalities				
Electronic consent management	Denmark Sweden	Finland		Iceland Norway
Information security plan	Denmark Norway	Finland Iceland Sweden		
Disaster recovery plan		Iceland	Finland Sweden	Denmark Norway
Common info structures	Iceland Sweden		Denmark Finland	Norway

*Only specialized care data is available.

**Not relevant for specialized care.

Table 5 summarizes availability of the HIE functionalities in the Nordic countries. Of measured 7 HIE availability functionalities; Sweden had 100% availability in 6 functionalities, Denmark in 5, Iceland in 4, Finland and Norway in 2. Availability of mediating prescriptions electronically to be dispensed from any pharmacy and viewing a list of prescriptions was 100% available in all the public organisations in the Nordic countries. Prescription functionalities have penetrated relatively well in the Nordic countries. In other HIE functionalities there is more variation. Public specialized care organisations provided on average better access to patient information outside own organisation (HIE) than primary care. HIE-functionalities (availability of information from other organisations) are still much more available than Patient portal functionalities. Only patient's viewing of own medication was available for 100% of public organisations

in the Nordic countries apart from Iceland. However, this functionality has now been available for patients in Iceland since the beginning of 2015.

Of the 4 *Patient Portal functionalities* viewing of own prescriptions was most commonly available for 100% of organisations (in 4 out of 5 Nordic countries).

Information on intensity of use of the patient information from other organisations is presented in table 6.

Table 6. Summary of intensity of use of key information types

	Used routinely (≥20% of cases)*	Used occasionally (0.01–19% of cases)*	Not used (0% of cases)	Not available
HIE Intensity of use outside own organisation				
Viewing of Detailed clinical notes	Denmark	Sweden		Norway
Viewing of Patient summaries	Denmark	Sweden		
Viewing of Lab results				Norway
Viewing of Radiology reports		Sweden		
Viewing of Immunization data	Iceland	Sweden		
Proportion of prescriptions made electronically	Denmark, Finland, Iceland, Sweden, Norway			
Viewing list of patient's prescriptions	Denmark, Finland	Iceland, Sweden		
Patient Portal intensity of use (either national or local)				
Patient view of prescriptions		Denmark, Finland, Norway, Sweden		
Prescription renewal request		Finland, Sweden		
Electronic appointment booking		Finland, Sweden		
Patient supplement of measurements data		Finland		Iceland Norway Sweden
Asynchronous communication				Iceland Norway
Patient viewing of detailed notes	Denmark	Finland		
Patient viewing of summaries	Denmark			
Patient viewing of immunisation data		Norway		
Patient viewing of lab results		Finland		

*Division of frequency of use to Routine, occasional or non-use was made based on observed frequencies.

Log data on intensity of use was available only sporadically and from miscellaneous sources. The reliability of comparison of log data from different countries depends on how the logs have been specified, how the national information system is integrated into the local systems as well as on how the query results have been specified.

Frequency of mediating prescriptions electronically to be dispensed was high, and in Denmark, most of the data types stored in national database were relatively frequently used, in Finland the prescription data. Immunization database in Iceland seemed also to make an exception with 27% usage rate. Sweden has progressed better than other Nordic countries in national availability of patient summaries and detailed clinical notes (in Denmark, availability was restricted to specialized care data). Still, usage rates are much higher in Denmark than in the other Nordic countries. In Iceland one needs to keep in mind that the usage rate calculated for doctors' viewing of medication data across institutions needs to be taken with caution as this project was still in a pilot phase for the year 2014. Furthermore, for most part of the year this functionality was not yet integrated within the EHR.

Experience of use of information systems is summarized in table 7. Doctors in Iceland had most positive experiences of their health information systems. The Swedish data was from 2010 and not for all variables, and at that time their experiences were most positive for three variables, whereas the Finnish systems scored best in the least number of daily log-ins required and experienced impact on patient safety.

Table 7. Summary of usability benchmarking (top rankings in italics)

Variables (average, scale 1–5) 2014	Denmark	Finland	Iceland	Sweden (2010)
Overall satisfaction		2.55	2.70	
Satisfaction with system reliability		2.95	2.63	3.15
Experienced response time		2.65	2.28	3.03
Experienced error recovery		2.40	3.10	3.20
Experienced ease of learning		2.65	3.22	3.13
System integration (no.of log-ins. lower=better)	3.20	2.45	3.04	
Impact on conformity to guidelines		3.10	3.32	
Support for intraorganisational collaboration		3.55	4.17	
Support for crossorganisational collaboration		2.25	3.63	1.65
Support for doctor-nurse collaboration		3.25	3.68	
Support for doctor-patient collaboration		2.10	2.78	
Impact on Patient safety		3.05	2.90	2.69
Experienced impact on Patient centeredness		2.05	3.07	2.22
Medication safety		2.55	2.70	

5.2 Limitations of the results

There are several limitations to the results, which need to be taken into account. A first limitation is related to *comprehensiveness* of the data: much of especially the intensity of use data were missing. Lack of monitoring data is partially due to the fact that ever since the NeRN work started, there has been discussion in Sweden and in Norway about an organisation that would be responsible for national monitoring of eHealth issues and fund the data collection in the country to guarantee sustainability of the surveys. The current review of different variables in Norway is based on the 2010 surveys made on request from the Norwegian Directorate of Health by the NTNU, who owns the data. In Sweden the CIO survey has been made on a yearly basis, and data are collected and owned by SLIT group. The Swedish professional survey was made in 2010 and data owned by Users Award/TCO Development. During the mandate period, it was decided for Sweden that SLIT group will continue with their yearly national data collection based on the current organisational survey and data will be available for 2014. The professional surveys in Sweden have only been administered twice (2004 and 2010). Therefore data are available from 2010 and future surveys will depend on the commitment of stakeholders and research agencies to follow up the 2004 and 2010 usability data. Also there is no agreement in Norway, who will administer the data collection for national monitoring. Therefore, the actual data for common variables identified in this report will be from 2010 in Norway. Lack of log data to monitor intensity of use of information types in the national information system was due to three reasons: 1) the logs were not detailed enough to record viewings of different data types 2) the data were available, but required too much work

to be provided within the 3-month period we had when requesting it 3) the data were available, but only at a cost, which the Nordic group had not anticipated in the budget.

Where available, results focus on public sector, leaving out privately funded private sector organisations. The usability results focus only on data collected from doctors. This was done merely to reduce complexity of data collection and reporting. Related to this is response rate: it remained relatively low especially the usability survey in Iceland, where it was conducted for the first time, with very little marketing.

The second limitation is the *comparability* of survey and log data: The Nordic surveys are compared in detail in Annex 3. There are differences in targeting, sampling and response rates. The varied foci and targets for different national surveys and the OECD model survey created a situation, where similar issues are queried from different professional groups in different organisational settings in different countries. For some of the Nordic surveys, data is collected separately from private, public primary and public specialized care (see Annex 3). The ambulatory-institutional distinction, which the OECD model survey is based on, cannot be made, since all organisations offer ambulatory care. In spite of all the efforts, the comparability of the survey data from the Nordic countries remained less than optimal. This is partially illustrated by the numerous footnotes for each indicator, which mainly focus on contents of the information or level of availability (regional/national or primary/specialized/total). The problem was relieved by the fact that much of the data were in the end obtained from national experts.

The comparability of the log data depends on the granularity of the information in the national database and queries. E.g. in Finland, much of the data are stored and can be viewed as documents, which can contain several immunizations, laboratory results etc. When the logs have been specified, the need for using the log data for monitoring purposes was not anticipated. The granularity differences need to be better understood to make sense of the usage rate benchmarking data. The granularity differences may also impact definitions of nominator and denominator of log data in future.

This is related to the lack of comparable way to describe the similarities and differences in the National Health Information Systems in the Nordic countries. This information would be necessary for interpreting the results. The NeRN network collated very rough illustrations of the systems in Annex 6, but they are far too generic to understand similarities and differences from the viewpoint of users – e.g. how they search for information, where, how results are presented and how they can be

utilized in the care process. Future elaboration of national functionalities and related use-processes is of utmost importance in future eHealth indicator work. This observation brings us back to the methodology, underlining further the first step: adequate definition of the relevant area or system in question (1)

Related to above, also the rapid evolvement of national health information systems in the Nordic countries challenges the comparability of the results. At least in Finland, HIE results were either regional or national. The values from the organisational survey covered availability of the regional data, and usage rate was also collected from citizen survey. Simultaneously, the national availability of these functionalities has been increasing rapidly.

A common limitation related to data collection with surveys is the wording of the questions. All Nordic questionnaires were translated to English to be processed in one language. Nuances may have been lost in translation. Also interpretation of questions can vary especially in the user experiences/usability surveys. Related to this question is the definition of the variables in a manner that is understood equivalently, and for which data are available in the surveys, logs or registers. Especially for the log and register data, this seemed to require endless discussions, and still the outcomes were sometimes far from satisfactory (e.g. availability of common information structures, medication errors reported/year).

5.3 Conclusions – recommendations

In spite of several limitations of the work, we succeeded in benchmarking availability and use of a large number of HIE and PHR functionalities, as well as one (objective) outcome indicator: proportion of medication errors per population. The indicators show that the Nordic countries have in general a very high uptake of eHealth tools and services. All the countries are in the middle of building an extensive national eHealth infrastructure. The results give rise to the following conclusions and recommendations

1. There are clear country by country differences in the results, which show the level of each indicator parameter, but also missing information from some of the countries. The Nordic countries should agree on those common eHealth indicators, for which monitoring data would be made available from all the Nordic countries. For this,

eHealth policy analysis needs to be repeated. Timing for survey data collection for monitoring availability and user experiences needs to be agreed on. The work needs to continue to harmonize variables for better comparison, and extend to other user groups (including citizens). A prerequisite is that funding will be secured in each of the Nordic countries for data collection and reporting of variables that provide most useful data for eHealth benchmarking within and between the Nordic countries.

2. All countries had problems in access to log data, which need to be solved, in order to monitor increase in frequency of use of data stored in the national systems. Nominator/denominator definitions need to be updated in order to avoid values exceeding 100%. Some more generic intensity-of-use indicators could also be developed – e.g. *no. of different people, whose data are viewed in the national database per population size*. Information-specific use is, however, also important, since intensity of use e.g. of laboratory results data may lead to reduction of tests, whereas intensity of use of patient's medication data may lead to reduction of prescriptions. Frequency of use preceeds benefits – no (clinical) benefits can be acquired from information that is not used by clinicians. Thus access to log data for monitoring must be solved, if there is interest in obtaining objective information on intensity of use.
3. The results reflect in part the differences in the national eHealth architectures. The reliability of comparison of log data from different countries depends on how the logs have been specified, how the national information system is integrated into the local systems as well as on how the query results have been specified. This calls for more detailed comparison of data retrieval processes and outcomes in different Nordic countries.
4. Usability and expected utility scores from Iceland show that there may be lessons to learn from the usability of Icelandic health record systems – especially when Iceland used a lower proportion of health care budgets to ICT compared to the other Nordic countries.
5. With close to full penetration of eHealth functionalities, and requirements set for monitoring their intensity of use and usability, focus turns to eHealth benefits. The impact mechanisms of the common functionalities (see requirement 1) should be agreed on, availability for existing quality indicators in the Nordic countries should be assessed, and data defined for comparison. Currently, there was only one variable tested for monitoring outcomes – proportion of

medication errors reported per population yearly, with register data that was not adequately defined. Reduction of medication errors is one anticipated impact of ePrescribing/comprehensive medication list. Hypothesis is that in countries, where a list of prescriptions or national list of medication is available and viewed frequently, the proportion of medication errors would be lower. In light of our data, the result is quite the opposite. There are several factors that may explain the result: 1) the patient safety reporting system may be much more comprehensive in Denmark than in other Nordic countries, whereby more errors or near-misses are reported 2) Different Nordic countries may have different units for measuring medication-related errors, and the network members may have selected more or less events accordingly 3) most of the medication error events may in fact not be associated with lack of knowledge of patient's current medication 4) list of prescriptions (as monitored currently) is not equal to the list of medication patient is currently taking, and thus does not have the same impacts. It is of utmost importance to develop more outcome measures, but it requires exhaustive description of 1) the eHealth functionalities 2) their impact mechanisms 3) the register data used to monitor the impacts. In addition, outcome data needs to be combined with data of availability and usage rate.

5.4 Exploitation of the results

The results are offered the Nordic Council of Ministers eHealth group for benchmarking of eHealth policy implementation status in different Nordic countries. The national representatives of the Nordic Council of Ministers eHealth group will be able to get a country-level profile for national policy- and implementation decisions. The results will also be exploited by the Nordic group in continuation of the indicator work. In addition the report will be mediated to the OECD, since the work has piloted some of the OECD eHealth model survey variables.

The work has raised awareness of the need to monitor intensity of use of the information stored in the databases via logs and metadata. When availability of storing data in the national databases will be nationally penetrated in the Nordic countries in a few years, developing the national system requires information on intensity of use of different data types. Knowledge of intensity of use of different data types and eHealth functionalities paves way to monitoring added value of

this information to clinical decision making and eventually to health and well-being of the citizens.

Results of the user experiences are especially useful for the information systems providers for national, and in future, perhaps also for Nordic benchmarking. In Finland, seminars have been arranged for information systems providers after publication of each of the usability survey results, where system-specific results have been presented and discussed. This has given the providers powerful feedback on successes and challenges for marketing and improvement.

5.5 Future work needed

5.5.1 *Updating Policy analysis*

The common policy goals were analysed and condensed during Mandate period I with seven common goals. Of these the following common measures were identified:

- *Access to EHR systems and specific information types across organisational borders:*
This is monitored relatively comprehensively from the viewpoint of clinicians, *not from patients or secondary users viewpoint in the current surveys*. Access to national level health information does not necessarily need to be monitored by surveys: the data types and access rights are defined in the national system specifications, and information of organisations that have joined the national systems as well as usage rate is collected by the national system logs.
- *Interoperability of systems:*
There are two common measures: no. of log-ins needed and common information structures used. Usage rate of HIE can also be used as a proxy indicator for interoperability. This goal entails an important embedded requirement – *quality of the relevant databased health information*. Unless the information in the national information system is comprehensive and consistent, it is not trusted by the users and will not be used. Missing information can also add the workload of the health care providers, and be a potential patient safety risk.

- *Information security and privacy:*
are monitored with a background variable about existence of a security plan in the organisation.
- *Usability of the systems:*
There are several common variables monitoring user experiences identified in the Nordic surveys. They are all generic, not tied to specific information types or functionalities. For key functionalities, there are questions e.g. in the Finnish usability survey, which could be added to the benchmarking in the next data collection round.
- *Improvement of process support in the Health Care system:*
There are two common variables: perceived time saved and perceived conformity to care guidelines
- *Improvement of quality and effectiveness of health care:*
This is monitored via three generic and subjective measures: perceived improvement of collaboration, patient safety and – centredness. Information on anticipated impact mechanisms of each of the functionalities *should be defined via literature reviews*, in order to connect monitoring individual functionalities with specific impacts. After this, generic health care impact measures e.g. number of physical visits, number of patients treated (productivity), and eventually, patients' health can be specified and collected from the registers. Interpretation of impact data requires simultaneous interpretation of data on availability and usage-rate of the particular functionalities, and cannot identify cause-consequences, only correlations.
- *Empowerment and activation of citizens:*
Citizen's empowerment is monitored with proxy indicators: availability and usage rate of Patient Portal/PHR- functionalities (appointment booking, messaging and mediating own measurements). Two common impact variables include perceived impact on support for collaboration and perceived impact on patient centredness. Self efficacy measures could also be added to a patient/citizen survey.

The eHealth policy documents on which the NeRN work was based were from 2007–2010, and have been updated in many Nordic countries. In Finland, new eHealth strategy was published in the beginning of 2015 (SoTe-tieto hyötykäyttöön 2020, http://www.stm.fi/julkaisut/nayta/-/_julkaisu/1900412), where there is emphasis on Patient Portal functionalities and secondary use of information. Even if many of the issues may

have remained, many may also have changed. The policy analysis needs therefore to be updated to keep the list of common variables up-to-date.

5.5.2 *Ensuring national availability of survey, log and register data*

During the entire NeRN work, availability of monitoring data has been under scrutiny. In all the Nordic countries, monitoring data provision (from surveys, logs and registers) requires national funding. The Norwegian availability data and the Swedish usability data was from 2010. In Finland, no data has been collected on usability or user experiences of nursing staff.

The national data collections provide not only benchmarking data on the Nordic level, but data for internal benchmarking within each of the participating countries (national data collection can focus also on nationally relevant questions, not only those selected for international benchmarking). The national benchmarking has proven extremely valuable at least in Finland, for regions, information system providers as well as policy makers. In addition, it has shown gaps in existing log and register data, which can be addressed in the future.

5.5.3 *Surveying Citizen's experiences of use*

Many of the HIE functionalities for professionals begin to be saturated, and construction of Patient Portal functionalities is ongoing in the Nordic countries. Many of the Nordic countries (Denmark, Finland and Norway) have conducted some data collection from citizens, and others are interested to follow suit. Since the focus of eHealth policies is turning more towards the patient, it would be important to also turn the focus of monitoring activities more to collect data from patients – both as far as usage and user experiences of Patient Portal functionalities are concerned, also from the viewpoint of e.g. availability and usage rate of patients to see via the national portal their own test results, discharge instructions – summary care notes and diagnoses – functionalities defined by the OECD model survey, but not yet tested in the Nordic countries.

5.5.4 *Developing an easy-to-use reporting system*

Currently results of the national surveys are reported as electronic publications in the websites of the organisations responsible for the surveys (e.g. https://www.julkari.fi/bitstream/handle/10024/104368/URN_ISBN_978-952-245-835-3.pdf?sequence=1). Log data are reported in different ways in different Nordic countries: In Finland, only data on names and implementation dates of organisations that have started to use ePrescription (<http://www.kanta.fi/sahkoista-reseptia-kayttavat-yksityiset-terveydenhuollon-yksikot>) and Kanta-services (<http://www.kanta.fi/potilastiedon-arkistoa-kayttavat-terveydenhuollon-yksikot>) are publicly available. In Norway, ehelse.no offers key figures on eHealth (still in beta-version).

Electronic reporting of results in PDF-format of reports is not ensuring easy access to benchmarking data (e.g. country-specific eHealth profiles) for those, who need the results. The results need to be viewed from many different aspects (e.g. generic country-profiles, functionality-specific profiles, sector-or user-specific profiles, even region- and system-specific profiles and profile changes in time). To view the results dynamically like this, an up-to-date reporting system is required, which collates key values from different Nordic countries to be presented as dynamic reports, where the user can select different views to the data, and where values can be added with each new data collection round.

A dynamic reporting system would also allow to present the results more comprehensively: The survey data are to some extent available also for private organisations and from other professional groups, and with a dynamic system these could offer alternative views to the data. If the benchmarking results would be available via an intelligent reporting system, this might also have an impact on response rates of user experience surveys, when the respondents could see that their responses matter and are used for benchmarking.

Each of the surveys collects information on the region of the respondents. Dynamic reporting could also offer possibilities to present regional differences within countries, in order to detect best practices. This information could be useful within each country, but also between countries, who aim to learn from each other.

Also the IT providers would benefit from a more dynamic reporting system: each of the surveys collect information about the brand of EHR in use in the respondent's organisation. Information on user experiences could perhaps be offered as an additional service to the providers of current systems to pinpoint successes and problems in comparison with other systems for marketing and product development.

5.5.5 Additional themes for future work

While policy analysis update, data collection from citizens and development of a more flexible and dynamic reporting system of the results have been prioritized in the future work of the NeRN group, there are still pressing themes that need to be advanced, especially related to eHealth benefits monitoring. This requires identification of key common (HIE and Patient Portal) functionalities/information types and their impacts mechanisms (against key health policy goals), identification of existing health care quality indicators and data sources related to the benefits and testing of the identified register –based eHealth benefit variables.

eHealth benefits monitoring requires close collaboration between national Health and Health care quality monitoring activities. One possible partner for collaboration to test eHealth benefits monitoring in one field of speciality is the Nordic cooperation established in 2013 on standardization, data collection and benchmarking in the emergency medical services (EMS). A goal for the EMS-cooperation is to achieve comparable data and common quality indicators from emergency medical services by 2018.

Acknowledgements

The authors wish to thank the Nordic Council of Ministers eHealth group for financial as well as substance-support to the work. We thank all the NeRN network organisations for offering the NeRN experts possibility to participate in this work mainly at own expense. We also wish to thank all the teams behind the national surveys for allowing the NeRN network to use the nationally collected data for Nordic Benchmarking. For organisations providing the log-data, we extend warm thank you for collaboration. Special thank you also for Expert physician Ilkka Lassi (THL, Operational Management unit) and LicMed Tinja Lääveri (Hospital district of Helsinki and Uusimaa) for their invaluable comments to improve the manuscript.

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Annex

Annex 1: List of abbreviations

CIO:	Chief Information Officer
CMO:	Chief Medical Officer
EHR:	Electronic Health Record
EPR:	Electronic Patient Record
HIE:	Health information exchange
HIS:	Health Information System
ICT:	Information and Communication Technology
IS:	Information Systems
MVK:	Swedish “My healthcare contacts” is a personal e-mail service on the Web that enables secure communication between patient/consumer/customer and healthcare and long-term care
NeRN:	Nordic eHealth Research Network
NHIS:	National Health Information System
NPÖ:	Swedish National Patient Summary
NTNU:	Norges teknisk-videnskabelige universitet
OECD:	The Organisation for Economic Co-operation and Development
OPER:	Unit for the Operational Management of Health and Welfare Information at the National Institute of Health and Welfare (Finland)
PACS:	Picture Archiving and Communication System
PHR:	A Personal Health Record, or PHR, a health record where health data and information related to the care of a patient is maintained by the patient (10)
SLIT group:	IT Strategists/IT Managers/CIO's in the County Councils of Sweden
TCO development:	Responsible and data owner of the Users Award professional questionnaire in Sweden

Annex 2: Health care organization structure in Nordic countries

Country	Organization	Financing and ownership	Contents of services provided	Physicians relationship to the organization	Other
DEN S	Five regions in Denmark are responsible for the public hospitals, the practicing specialists, and the General Practitioners.	Hospitals are financed by the state through taxes	Specialist health include somatic and psychiatric hospitals, outpatient clinics and treatment centers, training and rehabilitation institutions, institutions for care and treatment for substance abuse, pre-hospital services, private specialists and laboratory and radiology activity.	All hospital staff are salaried employed. Practicing specialists and GPs run private businesses on contract with the regions.	Private specialist clinics are paid by the patients and/or government funding through National Insurance depending on the problem at hand.
DEN P	99 Municipalities are responsible for all primary care initiatives as well as all home care.	Municipalities activities are financed through taxes	Primary care covers public health clinics and school health, regular GP, mental health, home care and nursing homes. Dental health is subsidized by public funding. The public healthcare offers dental services for prioritized groups. Ambulance services, is administered on a regional level	Salaried employment. Dentists are employed by municipalities to take care of school children. All other dentist are private businesses	<i>Publicly funded</i> private clinics are included in the figures, <i>privately funded</i> private sector is not included in the figures.
FIN S	20 hospital districts in continental Finland. Åland is practically the 21st hospital district. Organizations are by law in charge of arranging secondary care.	Organizations are owned by municipalities or a group of municipalities and financed by taxes with a small fee paid by the patient. Governmental subsidizes given to municipalities in order to organize services.	Run specialized hospitals, organize emergency patient transportations (ambulances)	Salaried employment	Municipalities are additionally responsible for care of elderly and people with functional disorder. Three continental hospital districts and Åland each have fused primary and secondary health care organization. Patient using private sector are subsidized by national health insurance, the service volume is around 15% of the services given.
FIN P	Local health care centers are by law in charge of arranging primary care.		Health care centers; primary care, dental care and rehabilitation. Some municipalities have contracted private sector to provide primary municipal care		<i>Publicly funded</i> private clinics are not included in the figures, <i>privately funded</i> private sector is not included in the figures.
ISL S	Seven health care regions within the country. One highly specialized university hospital located in Reykjavik, a smaller specialized hospital in the North and 12 health care centers around the country. The health care centers run the hospitals and primary health care within their health care region.	Funded by the government mainly through taxes. Co-payment by patients for some health care and prescription medication.	Highly specialized in and out patient care, long term care and rehabilitation.	Salaried employment	Nursing homes are privately run but with some funding by the government and National Insurance. Private specialist clinics are paid out of pocket and/or government funding through National Insurance depending on the problem at hand.
ISL P	Health care centers are responsible for primary health care services within their region. The Primary Health Care of the Capital area is responsible for providing primary health care services within the capital area.		Primary health care	Salaried employment	<i>Publicly funded</i> private clinics are included for primary care, not for specialized care in the figures, <i>privately funded</i> private sector is not included in the figures.

Country	Organization	Financing and ownership	Contents of services provided	Physicians relationship to the organization	Other
NOR S	Four health regions: North, Mid, West and South-East. Owned by the state.	Specialist healthcare is financed by the state with separate budgets for the health regions.	Somatic and psychiatric hospitals, outpatient clinics and treatment centers, training and rehabilitation institutions, institutions for care and treatment for substance abuse, pre-hospital services, private specialists and laboratory and radiology activity.	Salaried employment.	<i>Publicly funded</i> private clinics are not included in the figures, <i>privately funded</i> private sector is not included in the figures.
NOR P	Municipalities administer the primary healthcare.	Municipalities finance primary healthcare with subsidies from the state. GPs take small fees from the patients for their services.	Primary care covers public health clinics and school health, regular GP, mental health, home care and nursing homes. Dental health is organized in ¼ public and ¾ private institutions. The public healthcare offers dental services for prioritized groups. Dental care, as well as ambulance services, is administered on a regional level by "fylkeskommunen" (21 fylker).	Employment, GPs run private businesses.	
SWE Tot	21 swedish county councils ('landsting') are by law responsible for organizing services.	Financed by taxes with some small fees to be paid by patients.	Runs hospitals, primary care and dental care.	Salaried employment.	Municipalities responsible for care of elderly and people with functional disorder and have a close cooperation with the county councils. Primary care, patients choice (=> 1/3 private caregivers contracted). <i>Publicly funded</i> private clinics are (not?) Included in the figures, <i>privately funded</i> private sector is (not?) Included in the figures.

P = primary health care, S = secondary health care, Tot = primary and secondary health care in one.

Annex 3: National surveys in different Nordic countries

	Denmark	Finland		Iceland		Norway		Sweden	
Survey	Users	Organization	User	Organization	User	Organization	User	Organization	User
Population	Sample of physicians (P), nurses (N) and medical secretaries (S)	IT leaders (CIOs) in hospitals and municipalities, parallel to medical directors/chief physicians	Physicians in clinical practice	CEOs of public health care institutions i.e. hospitals and primary health care.	Physicians in clinical practice	General practitioner offices, municipal healthcare (nursing homes and child health clinics), regional health authorities.	Healthcare professionals in municipal nursing homes and hospitals, and in regional healthcare.	CIO's in county councils	Physicians, nurses, assistant nurses and medical secretaries
Focus	Availability, usage rate	Availability, usage rate	User experience	Availability, usage rate	User experience	Availability		Availability	User experience
Sample size	2010: P: 5,000; N: 3,353; S: 0 2011: P:1,200; N: 2,000; S: 2,000 2012: P: 4,000; N: 2,789; S: 1,500 2013: P: 3,500; N: 2,957; S: 2,963 2014:P: 3,334; N: 3,650; S: 2,000	21 hospital districts, 295 municipalities, a sample of private providers	All practicing doctors in the country (target population)	15 health care institutions (all public health care institutions within the country)	963 physicians i.e. 100% of practicing physicians within public health care.	2008: Municipalities (77 of 180 selected), GPs (93 of 150 selected) and regional healthcare(18 of 26 selected)	2010: Healthcare professionals in municipal nursing homes and hospitals (239 of 1,611), and in regional healthcare (206 of 1,352), GPs 3 (59 of 150), leaders in regional health (12 of 21) and IT-leaders in regional health (11 of 21) and IT leaders in municipalities (88 of 180)	21 county councils (all)	1253 (in 2010) whereof 306 physicians 373 nurses 252 ass.nurses 322 med.secr.
Coverage /response rate	2010: P: 27.5%; N: 27.9%; S: n/a 2011: P:35.6%; N: 35.7%; S: 26.6% 2012: P: 25.2%; N: 26.8%; S: 25.3% 2013: P: 30.7%; N: 20.4%; S: 25.2% 2014: P: 23.6%; N: 12.4%; S: 23.3%	100% of hospital districts, over 90% of primary health care centers, main private service providers included.	Return rate 2010=3,929 (27%); 2014=3,781 (23%).Responses weighed by age and sex to get a nationally representative sample	100% of the target population	Return rate 17.13% (n=165). 100% of the target population	2008: Municipalities 43% GPs offices 62% and regional healthcare 83% 2010: Healthcare professionals in municipal nursing homes and hospitals 15%; in regional healthcare 15%; GPs 39%; leaders in regional health 57%; and IT-leaders in regional health 52.38% and IT leaders in municipalities 48.8%	2010: Healthcare professionals in municipal nursing homes and hospitals 15%; in regional healthcare 15%; GPs 39%; leaders in regional health 57%; and IT-leaders in regional health 52.38% and IT leaders in municipalities 48.8%	100% of hospitals, primary care units and dental care units in county councils and private contractors	In total 0.4% of the target population but samples from all county councils

	Denmark	Finland		Iceland		Norway		Sweden	
Survey	Users	Organization	User	Organization	User	Organization	User	Organization	User
Survey timing	Yearly 2010–2014	2010 and 2014	2010 and 2014	2014	2014	2008, 2010	2010	Yearly since 2004	2010
Other specific information	Samples are done by the professional organizations. Covers public as well as private organizations in Denmark, Faroe Islands, and Greenland	*answers from private sector not included here	*target population 14,411 in 2010, 16,350 in 2014	Sample size is equal to total population under study	Sample size is equal to total population under study. Private sector excluded			Excluded are private-private healthcare	*target population ca. 306,361

Annex 4: Patient Summary components in each country

Country	Source	Data included	Other notes
DEN	Public health portal Sundhed.dk – “Sundhedsjournal”	Demographic data. Record from hospital: Treatments, diagnosis, notes (Summary) since 2000. Treatments at hospitals: diagnosis, operations, examinations, and admissions – since 1977. Outpatient visits, psychiatric- and emergency treatments from 1995. Shared medication record: All prescriptive medicine (Excluding what is prescribed during hospital admission) – for the last two years. Immunizations, allergies, laboratory results, GP visits (not GP notes).	Sundhed.dk logs all activities. Own log visible to all citizens.
FIN	Finnish National Patient Record Archive “Kanta”	In Tiedonhallintapalvelu – patient summary: Patient demographic data, diagnoses, immunization, imaging results, laboratory results, operations, essential physiological measurements, risk data, medication and health treatment plan.	“Kanta” includes log of who has accessed your info plus consent management.
ISL		Patient’s demographic data such as name, social security number, sex, marital status, address, area code and telephone number. Service elements such as diagnoses, test results, surgery, medication and other treatment, immunization, hospital admissions and discharges, hospital and primary health care outpatient visits.	
NOR	Norwegian Patient summary, “Kjernejournal” [29]	Personal registrations, medication, visit history from hospitals, critical information, log of who has accessed your information.	
SWE	Swedish National Patient Summary (“NPÖ”=Nationel Patient Översikt)	Patient’s name, social security number, address, telephone number, contact details for relatives or representatives, and if there is an interpreter needed. Journal information: Various notes and summaries of health and long-term care visits or stays. Diagnoses the patient received medication prescribed and taken out (Drug list eHälsomyndigheten). Patient contacts with health and social care. For example, if you visited the clinic, been hospitalized or talked with the doctor on the phone. Results of surveys and samplings from clinical chemistry.	All county councils, most municipalities and private contractors use NPÖ.

Annex 5: List of comparable Nordic eHealth indicators

ID	Indicator name	Indicator abbreviation*	Completeness: Part of Nordic countries/ All countries	Data type	Data source: L=local functionality/R= regional functionality/N= national functionality	Data collection frequency	Topic: information or functionality...	Primary Impact Type
1	Proportion of public organisations where detailed clinical notes outside own organization are available for professionals	A HIE history	All	%	R: Org. survey N: Expert	1–4 yrs	Availability	HC Input
2	Proportion of viewed detailed clinical notes by professionals/population size	I HIE history	Part	%	N: National Log	needs to be agreed	Use intensity	HC Process
3	Proportion of public organizations where patient summaries from outside own organization are available for professionals	A HIE summary	All	%	R: Org. survey N: Expert	1–4 yrs	Availability	HC Input
4	Proportion of viewed patient summaries by professionals by population size	I HIE summary	Part	%	N: National Log	needs to be agreed	Use intensity	HC process
5	Proportion of public organizations where laboratory results from outside own organization are available for professionals	A HIE lab	All	%	R: Org. survey N: Expert	1–4 yrs	Availability	HC input
6	Proportion of viewed laboratory test results by professionals of population size	I HIE lab	Part	%	N: National Log	needs to be agreed	Use intensity	HC Process
7	Proportion of public organisations where imaging results outside own organization are available for professionals	A HIE img	All	%	R: Org. survey N: Expert	1–4 yrs	Availability	HC input
8	Proportion of viewed imaging reports by professionals by Population size	I HIE img	Part	%	N: National Log	needs to be agreed	Use intensity	HC Process
9	Proportion of public organisations where immunization data outside own organization are available for professionals	A HIE imm	All	%	R: Org. survey N: Expert	1–4 yrs	Availability	HC input
10	Proportion of viewed immunization data by professionals	I HIE imm	Part	%	N: National log/register	needs to be agreed	Use intensity	HC Process
11	Proportion of public organisations where a list of medications prescribed to the patient outside own organization is available for professionals	A HIE prev	All	%	N: Expert	1–4 yrs	Availability	HC input
12	Proportion of viewed prescriptions by professionals by all prescriptions made per year	I.HIE prev-all	Part	%	N: National Log	needs to be agreed	Use intensity	HC Process
13	Proportion of viewed prescriptions by professionals by electronic prescriptions made per year	I HIE prev-e	Part	%	N: National Log	needs to be agreed	Use intensity	HC Process
14	Proportion of public organisations where sending a prescription to be dispensed in any pharmacy is available for professionals	A HIE pres	All	%	N: Expert	1–4 yrs	Availability	HC input
15	No. of prescriptions made electronically/all prescriptions made per year	I HIE pres-all	All	%	N: National Log	needs to be agreed	Use intensity	HC Process

ID	Indicator name	Indicator abbreviation*	Completeness: Part of Nordic countries/ All countries	Data type	Data source: L=local functionality/R= regional functionality/N= national functionality	Data collection frequency	Topic: information or functionality...	Primary Impact Type
16	Proportion of public organisations where a list of medications prescribed to the patient is available for patients	A PHR prev	All	%	N: Expert	1–4 yrs	Availability	HC input
17	No. of prescription list viewings by patients all prescriptions made per year	I PHR prev-all	Part	%	N: National Log	needs to be agreed	Use intensity	HC Process
18	No. of prescription list viewings by patients/electronic prescriptions made per year	I PHR prev-e	Part	%	N: National Log	needs to be agreed		HC Process
19	Proportion of public organisations where electronic prescription renewal is available for patients	A PHR renew	Part	%	N: expert	1–4 yrs	Availability	HC input
20	No. of electronic renewal requests made by patients/population of the country	I PHR renew	Part	%	N: National Log	needs to be agreed	Use intensity	HC Process
21	Proportion of public organisations where online booking of an appointment is available for citizens	A PHR book	Part	%	L: org. survey N: expert	1–4 yrs	Availability	HC input
22	Proportion of electronic primary care bookings made by patients of all primary care visits per year	I PHR book	Part	%	L: citizen survey N: National log	needs to be agreed	Use intensity	HC Process
23	No. of patient supplements to national health records per year/population of the country	I PHR supl	Part	%	L: citizen survey N: National log	needs to be agreed	Use intensity	HC Process
24	Proportion of public organisations where asynchronous communication between patients and professionals is available	A PHR com	All	%	L: org. survey N: expert	needs to be agreed	Availability	HC input
25	No. of patient messages (to GP – primary care) per year/all (GP – primary care) visits per year	I PHR com	Part	%	L: citizen survey N: National log	needs to be agreed	Use intensity	HC Process
26	No. of viewings of laboratory test results by patients/population size	I PHR lab	Part	%	L: citizen survey N: National log	needs to be agreed	Use intensity	HC Process
27	No. of viewings of detailed clinical notes by patients/population size	I PHR history	Part	%	L: citizen survey N: National log	needs to be agreed	Use intensity	HC Process
28	No. of viewings of patient summaries by patients/population size	I PHR summary	Part	%	L: citizen survey N: National log	needs to be agreed	Use intensity	HC Process
29	No. of viewings of immunization data by patients/population size	I PHR imm	Part	%	L: citizen survey N: National log	needs to be agreed	Use intensity	HC Process
30	Mean overall satisfaction with the information system	U satisfy	Part	Mean	User experience survey	3–4 years	Usability	HC Process
31	Mean experienced satisfaction with system reliability	U reliab	Part	Mean	User experience survey	3–4 years	Usability	HC Process
32	Mean experienced satisfaction with response time	U respt	Part	Mean	User experience survey	3–4 years	Usability	HC Process

ID	Indicator name	Indicator abbreviation*	Completeness: Part of Nordic countries/ All countries	Data type	Data source: L=local functionality/R= regional functionality/N= national functionality	Data collection frequency	Topic: information or functionality...	Primary Impact Type
33	Mean experienced satisfaction with error recovery	U error	Part	Mean	User experience survey	3–4 years	Usability	HC Process
34	Average experienced satisfaction with ease of learning	U learn	Part	Mean	User experience survey	3–4 years	Usability	HC Process
35	Average Number of clinical systems a physician has to log-in during a workday	U integr	Part	Mean	User experience survey	3–4 years	Usability	HC Process
36	Mean experienced impact of IS on conformity to care guidelines	UB conf	Part	Mean	User experience survey	3–4 years	Usability	HC Process
37	Mean experienced Support from IS for collaboration between doctors in own organization	UB cold	Part	Mean	User experience survey	3–4 years	Usability	HC Process
38	Mean experienced Support from IS for collaboration between doctors in different organizations	UB coldo	Part	Mean	User experience survey	3–4 years	Usability	HC Process
39	Mean experienced Support from IS for collaboration between doctors and nurses	UB coldn	Part	Mean	User experience survey	3–4 years	Usability	HC Process
40	Mean experienced Support from IS for collaboration between doctors and patients	UB coldp	Part	Mean	User experience survey	3–4 years	Usability	HC Process
41	Mean experienced support from IS on increased patient safety	UB safe	Part	Mean	User experience survey	3–4 years	Usability	HC Process
42	Mean Experienced support from IS for patient centeredness	UB center	Part	Mean	User experience survey	3–4 years	Usability	HC Process
43	No. of medication errors reported during a year/population of the country	B meder	Part	%	National register	needs to be agreed	Effect/impact	HC outcome
44	Proportion of public organisations where national information structures are available	A str	Part	%	Org. survey	1–4 years	Management	HC input
45	Proportion of public organizations with a written disaster recovery plan.	A dis	Part	%	Org. survey	1–4 years	Management	HC input
46	Proportion of organizations with a written security plan	A sec	Part	%	Org. survey	1–4 years	Management	HC input
47	Proportion of public organisations where electronic consent management is available	A cons	Part	%	Org. survey	1–4 years	Management	HC input
48	Proportion of ICT costs of the total budget in health care organizations	B cost	Part	%	Org. survey	1–4 years	Management	HC input

*A=availability, B=benefit, I=intensity of use, U=usability

Annex 6: Overview of National eHealth Communication in the Nordic countries

Overview of e-Health Communication in Denmark

Consumers: Consumers are here considered the groups that have access to look at data through the information portals. In Denmark, Citizens (Orange), GP/Specialists (Green), Hospitals (Blue) and Health Authorities (Purple) can see different information through the portals.

Information Access: These portals are the ones used when retrieving data or information on one self as a citizen, information about patients or general information for policy or research. In Denmark, we have two access points: The portal Sundhed.dk (Red), which is for citizens and professionals, and the Health Data Net (Cloud) which gives access to a variety of systems only for professionals.

Repositories: The Danish infrastructure is highly based on repositories. Data suppliers are obligated to deliver information to these repositories. The Information Portals can access the data in the repositories. As legislation still require that data are transferred via a traditional communication model a high number of standardized messages are used for communica-

tion. E.g. Discharge letters are still sent as a standardized message although the same data are readily available in the e-record repository.

Data suppliers: Due to the high number of legacy systems there are several data suppliers in Denmark. The main suppliers are the different EHR systems (Blue), the PACS systems (Blue), the different systems from GPs and specialists (Green) and the different LAB systems (Blue).

Further data sources include GP services such as e-Bookings, e-Prescriptions and e-Consultations (Green) and EDI-Messages (Green and blue). The information portals can retrieve data directly from these sources without going through repositories.

All elements are colour coded because often the consumer is also a data supplier. Therefore, hospital consumers and suppliers are both coded blue and GP/Specialists as both consumer and supplier is green.

Overview of e-Health Communication in Finland

There are currently *five models* for Health Information exchange in use in Finland (HIE): Four models for Regional Health information Exchange (RHIE) and one for National Health Information Exchange (Kanta).

1. RHIE *Master Patient Index-model*, with centralized reference database of selected information from user organizations. Authorized users access via a separate user interface to an index of the original data. Each of the indexed data items must be viewed separately.
2. RHIE *Web distribution model*, with authorized users having full access to a web based electronic record of the patient when situated in a specialized care unit. In 2010, primary care physicians could see all the information from the specialized care hospital only for those patients which they had themselves referred to the hospital. As a result, access to otherwise complete patient record information was available only to a limited group of referring physicians.
3. RHIE *Regional virtual EHR model*, where the physician has (with patients consent) direct access to the electronic patient record in another institution. Diagnostic images and laboratory data may have regional archives, which can be present as part of users EHR-system (integrated functionality) or as a separate regional data repository which the user launches through a separate interface.
4. RHIE *point-to-point model* used for Electronic referrals for transferring the responsibility of patient care, *Electronic discharge* and consultation letters. In addition to a narrative text, the letters can include results of laboratory tests and radiological examinations. There are also point-to-point messaging services for teledistribution of radiology and laboratory results. (5)
5. *The national HIE model (Kanta)* has features from the first three RHIE-models: Kanta is integrated to primary and specialized care EHR systems (as in RHIE system type 3). Where model 3 (the virtual EHR-model) has an internal database and direct user interface common to all EHR-users, Kanta has a national database with security rules and message interfaces which respond to a request sent from an EHR (there is search functionality as in RHIE model 1). Kanta returns the requested data in a predefined format as a message to the EHR, and the local EHR processes and presents it to the users. In addition, Kanta has summaries of stored data that can be sent upon request, a functionality not existing in current RHIE-systems. A web-interface is also being planned for professionals. The Kanta system will provide a specialty-specific continuous medical record (features of model 2 – web distribution model). It is different from model 2 in that technically it will operate using similar messages as the current EHR systems. The Canadian, North American, Scottish, Welsh, Irish, Dutch, Estonian, French, Swedish and Danish HIE

models have been analysed for the basis of Kanta-development. The comparison concludes that the Estonian HIE architecture is closest to the Finnish Kanta architecture (with a centralized repository (as in RHIE types 2 and 3) for textual data, and a separate user interface (as in RHIE model 2). Also the Swedish Nationell Patient Översikt (NPÖ)-system resembles the Finnish Kanta-system. The biggest technical difference is that NPÖ does not have a centralized data archive (repository), but a router service that retrieves information on demand from local EHR systems, delivering the data to the clinician requesting it (as in RHIE model 1). (5)

Overview of e-Health Communication in Iceland

Consumers: Consumers are here considered the groups which have access to look at data through the information portals. In Iceland, Citizens (Orange), Private Practice and Primary Health Care (Green), Hospitals (Blue) and Health Authorities (Purple) can see different information through the portals.

Information Access: These portals are the ones used when retrieving health data or information either own health data as a citizen, information about patients as a health professional or general health information for quality monitoring, policy or research. In Iceland, there are three access points: The portal VERA (Red), which is for citizens, the

Health Professional portal (also red) and the EHR, via the Health Data Net (Cloud) which connects access to a variety of health information systems and national databases. Citizens can use VERA to view own health information, send prescription renewal requests, send secure messages to their health professionals, e-bookings, and in the near future enter own data such as blood pressure measurements, blood sugar levels, vitamins, etc. Health Professionals can through the Health Portal view all medication prescriptions and dispensings for their patients for the past three years, write an e-prescription, and view results for various cancer screenings. All public hospitals and primary health care use the same EHR system. These systems are all interconnected via HEKLA, the Icelandic Health Net. Hence, health professionals can view patient data across different institutions and geographic boundaries. Furthermore, e-Precriptions are integrated within the systems, and all prescriptions and pharmacy dispensings can also be viewed directly from the health record.

Repositories: The Icelandic infrastructure is based on repositories and interconnected EHR's. Data suppliers are obligated to deliver information to these repositories. The Information Portals can access the data in the repositories via HEKLA the Icelandic Health Net. However, the Health Professional Portal can also access the National Medication Database directly. Real time data from EHR's is stored in a Data Warehouse at the Directorate of Health for further information processing. The dotted gray lines stand for the development of national PACS and LAB databases in the near future. Today, there are five different databases for PACS and a few LAB databases. Most can be viewed by professionals by logging into different web sites.

Data suppliers: There are several data suppliers in Iceland. The main suppliers are the EHR systems (Blue/Green), the PACS systems (Blue/Green), and the different LAB systems (Blue/Green). All elements are colour coded because often the consumer is also a data supplier. Therefore, hospital consumers and suppliers are both coded blue and GP/Specialists as both consumer and supplier is green.

Overview of e-Health Communication in Norway

Consumers: Consumers are here considered the groups that have access to look at data through the information portals. In Norway, Citizens (Orange), Emergency services (red), GP/Specialists (Green), Hospitals (Blue) and Health Authorities (Purple) can see different information through the portals.

Information Access: Norsk Helsenett administers the information “highway” that links the health consumers (see above) to the electronic health services/portals.

These portals are the ones used when retrieving data or information oneself as a citizen, information about patients or general information for policy or research. In Norway, we have Helsenorge.no (Red), which is a public health portal that includes “Min helse” (deductibles, prescriptions, GP, report side effects, order health insurance card and e-booking pilot and kjernejournal pilot). Kjernejournal pilot in mid-and western Norway gives the citizens access to view own registrations, dispensed medication, hospital visits, critical information (Gp reg) and access log.

Data repositories: The Norwegian infrastructure on some services, such as the pilot Kjernejournal and ePrescription are based on repositories. Data suppliers are obligated to deliver information to these repositories. The Information Portals can access the data in the repositories.

Data suppliers: There are several data suppliers in Norway. The main suppliers are the different EHR systems (Blue), the PACS systems (Blue), the different systems from GPs and specialists (Green), the different LAB systems (Blue) and the National quality registers.

Further data sources include GP services such as e-Bookings (local services), and EDI-Messages (Green and blue).

All elements are colour coded because often the consumer is also a data supplier. Therefore, hospital consumers and suppliers are both coded blue and GP/Specialists as both consumer and supplier is green.

Annex 7: Usability, user satisfaction, user experience – definitions

The usability studies reported in this document approach the topic from the viewpoint of subjective evaluation, which includes aspects of satisfaction, use, usability and experience. According to key scholars such as DeLone and McLean [A], one of the key measures of information system success is user satisfaction. The definitions found in the academic literature deal with user satisfaction as a psychological process involving benefits, feelings and attitudes towards user experience while using information systems [B].

However, scholars distinguish between usability, user experience and satisfaction as part of Human-Computer Interaction (HCI). The widely known and cited definition for usability is by ISO 9241-11 [C] standard: “Usability is the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use.” Further, effectiveness relates to accuracy and completeness with which users achieve specified goals, efficiency refers to resources expended in relation to the accuracy and completeness with which users achieve goals, and satisfaction refers to freedom from discomfort, and positive attitudes towards the use of the product [C]. Alongside another commonly cited definition is by Nielsen [D] and includes five quality components: learnability, efficiency, memorability, errors and satisfaction. Both these definitions emphasize the role of context when researching usability. They are also against the common misconception that usability is only an attribute of a user interface or that usability refers solely to making products easy to use.

Traditionally, usability is associated with interaction between the human and the computer, whereas the rather new concept user experience (UX) emphasizes the emotional aspects resulting from the use of a system. UX is an interesting concept which still remains vague although numerous definitions have been presented to describe it. Several widely known definitions share the idea of UX being personal experience and including aspects of emotions, beliefs and perceptions that occur before, during and after system use (e.g. [E,F,G]). ISO 9241-210 standard [E] defines UX as: “Person’s perceptions and responses resulting from the use and/or anticipated use of a product, system or service” with three additional notes “UX includes all the users’ emotions, beliefs, preferences, perceptions, physical and psychological responses, behaviors and accomplishments that occur before, during and after use.”; “UX is a consequence of brand image, presentation, functionality, system perfor-

mance, interactive behavior and assistive capabilities of the interactive system, the user's internal and physical state resulting from prior experience, attitudes, skills and personality, and the context of use.”; “Usability, when interpreted from the perspective of the user's personal goals, can include the kind of perceptual and emotional aspects typically associated with user experience. Usability criteria can be used to assess aspects of user experience.”

Furthermore, quality of use is closely related to usability. The objective of usability engineering is said to be to achieve quality of use as it lies in the interaction of the user with the system [C]. A quality of use model, described by the ISO 25101 standard [H], includes five characteristics which are effectiveness, efficiency, satisfaction, freedom from risk and context coverage. The first three of these components are also part of widely known usability definitions [C,D,I].

As part of usability measurements, satisfaction can be specified and measured by subjective rating on scales such as satisfaction with product use or discomfort experienced [C]. Several standardized usability rating scales (e.g. SUMI [J] and SUS [K]) have subscales for learnability, efficiency and satisfaction. In the field of Human-Computer Interaction (HCI), these standardized scales and survey instruments are preferred to subjective rating scales for measuring satisfaction. Such scales and instruments (e.g. SUMI and SUS) have suggested to be used for measuring usability from the viewpoint of user satisfaction and end-user experiences since they have been experimentally validated and are publicly available (e.g. [L]).

To conclude, several definitions have been presented to the concepts of user satisfaction, usability and user experience (UX) in the academic literature. In the context of this document the concepts of usability and user experience are understood as described in ISO standards [C,E]: Perceptual and emotional aspects associated with user experience can be seen as part of usability when the concept is understood broadly.

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Annex 8: 2014 Results at a glance

Figure 50. eHealth readiness HIE: availability per functionality/country

Figure 51. eHealth readiness PHR: availability per country and functionality

Figure 52. eHealth intensity HIE: use per country and functionality

Figure 53. eHealth intensity PHR: use per country and functionality

Figure 54. eHealth intensity: eHealth usability per variable

Figure 55. eHealth impacts: benefits per country

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Nordic eHealth Benchmarking

The report presents results of the Nordic eHealth Research Network, a subgroup of the eNordic Council of Ministers Health group. The network defined and collected data for altogether 49 common eHealth indicators from the Nordic Countries.

Health information was quite comprehensively electronically available from other organisations in all the Nordic countries by end of 2014. Intensity of use of nationally stored data remained low except in Denmark. Sweden had best availability of the Patient portal functionalities. Patients used patient portal functionalities rarely except in Denmark. Doctors in Iceland had most positive experiences of their health information systems.

Even with limitations, the current work presents a solid basis for working towards the goal of the eHealth network: generating comparable information to support development of Nordic welfare.

TemaNord 2015:539
ISBN 978-92-893-4165-3 (PRINT)
ISBN 978-92-893-4167-7 (PDF)
ISBN 978-92-893-4166-0 (EPUB)
ISSN 0908-6692

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