Context Sensitive Health Informatics: Many Places, Many Users, Many Contexts, Many Uses
E.M. Borycki et al. (Eds.)

doi:10.3233/978-1-61499-574-6-138

Monitoring the Amount of Practical Use of eHealth on National Level by Use of Log Data: Lessons Learned

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Abstract. This paper set out to define the lessons learned from the process of characterizing the amount of practical use of eHealth on national level by collecting and comparing log data harvested from national logs in the Nordic countries. The health systems of the Nordic countries are quite similar in structure and their eHealth strategies include similar elements, however when confronted with the specific context in the different systems it proved challenging to define a common set of indicators for monitoring the practical use of eHealth. A thorough analysis of context leading to the definitions of the indicators is the basis needed due to the complexity of the data in the national logs. A comprehensive knowledge of the structure that underlines these logs is of utmost importance when striving for collecting comparable data. Although challenging, the process of defining indicators for practical use of eHealth by data harvested trough national logs is not an impossible task, but a task that requires in depth discussions of definitions of indicators as well as a substantial insight into the architecture and content of the national databases. There is need for continuous work on these indicators to ensure their quality and thus make sure that the defined indicators can meaningfully inform eHealth policies.

Keywords. eHealth, Log data, Indicator, Monitoring

1. Introduction

Several countries have formulated national eHealth policies and developed strategies for implementation [For a list of European strategies see: http://www.ehealth-era.org/database/database.html]. The Nordic countries have health systems that are quite similar in structure and their eHealth strategies include similar elements [1,2]. However, they lack comparable criteria for evaluation of the strategies. Hence monitor-

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ing the progress in development and implementation becomes strenuous. The most common approach to monitoring has been focusing on adoption or availability of functionalities and specific solutions. In 2012, the European Commission Joint Research Centre launched a survey to benchmark deployment of e-Health services [3]. The project gathered information on eHealth adoption in acute hospitals in all 28 EU Member States as well as Iceland and Norway. Use of the services was surveyed on a very coarse scale - "routinely", "occasionally" or "not used". The Organisation for Economic Co-operation and Development (OECD) launched in 2008 a multi-stakeholder initiative to develop a robust measurement framework and comparable cross-national measures. The task was accomplished in 2013 with the publication "Guide to Measuring ICTs in the Health Sector" [4]. The guide was developed by an expert group representing 30 countries and four task forces within i) Personal Health Record, ii) Telehealth, iii) Health Information Exchange, and iv) Electronic Health Records. The guide contains a model survey composed of self-contained modules that ensure flexibility and adaptability to a rapidly changing environment. A second part contains a methodological guide to aid implementation and promote validity and comparability of resulting benchmark measures. The European Commission applying their own survey measure and the OECD is relying on national data collection using the OECD model survey questions to achieve availability measures.

The Nordic eHealth Research Network (NeRN) has developed, tested and assessed a common set of indicators for monitoring eHealth in the Nordic countries (Denmark, Finland, Iceland, Norway, and Sweden) for use by national and international policy makers and scientific communities in order to support development of Nordic welfare [1]. The experience from this work can be found in the study by Gilstad et al. [5]. At present, there are several national monitoring activities, however, harmonizing indicators for data collection among the Nordic countries is still in its early stages. The definition of the Nordic indicators has been developed iteratively using data from international workshops, stakeholder interviews, policy analysis and analysis of literature and existing surveys [1]. Availability of eHealth has been first line of monitoring, but the interesting part comes, when availability has reached a distribution level of 100% among all users. Then, the practical use is of great importance. It becomes interesting to know how much the available functionality is being used, and to what extent it is being used as originally intended.

As the Nordic countries are all close to 100% national distribution of the most significant eHealth functionalities (e.g. Health Information Exchange and Patient Portal functionalities) among all users, the NeRN group has developed a number of variables that measure practical use of eHealth systems by log data harvested from central servers. At first sight it appears to be an easy, reliable and valid approach. However it once more turns out that the "devil is in the detail".

The purpose of this paper is to discuss the lessons learned from the process of characterizing the amount of practical use of eHealth on national (or regional) level by identifying the main challenges when collecting and comparing log data harvested from national logs in the Nordic countries

2. Methods

The NeRN group has been developing, testing and assessing a common set of indicators for monitoring eHealth in the Nordic countries since 2012. At a meeting in De-

cember 2014 in Aalborg, Denmark, the NeRN members met to discuss the definition of indicators related to the usage of eHealth, in respect to national log data availability. Finland, Sweden, Norway, Island and Denmark were each represented by one to five participants.

After reviewing the list of indicators with experts in each country, a second meeting was held in Oslo, Norway in February 2015. Here, the definition of the indicators was determined further. The total number of eHealth intensity of use indicators was 21. At this meeting, the main difficulties were further discussed, striving for comparable data across the Nordic countries in order to learn and prepare for future comparisons. The process of specifying the main challenging in the collection of comparable log data is further detailed below.

2.1. Main Challenges when Collecting and Comparing Log Data

At the second meeting (February 2015) the main difficulties, when striving for comparable data across the Nordic countries, were discussed. All countries were asked to name the top three most difficult challenges in *collecting* and *comparing* log data regarding ePrescriptions; how many ePrescriptions are made, viewed by professionals and patients, and number of electronic renewal requests. All challenges were noted on the whiteboard (see Fig 1), and the group was then asked to individually prioritize the ones they found most important.

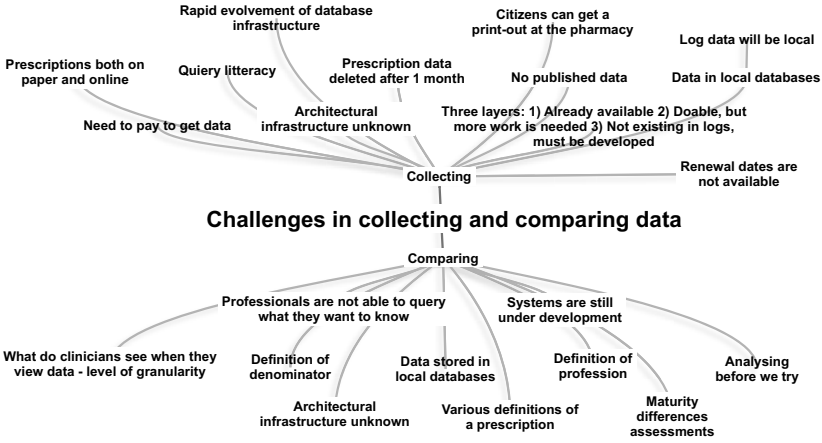

Figure 1. Map containing the most important challenges in collecting and comparing ePrescriptions data across the Nordic countries as named by the country representatives. Challenges chosen for prioritization are marked with grey.

This involved multiple steps in deciding on the challenge and ranking them in the order of importance: First, each individual participant chose the challenge most important to him/her and wrote it on a piece of paper. Second, all participants switched papers and teamed up in pairs. Through an iterative process of five rounds, in which each team used a 0-7 scale to rank two challenges for next to switch paper with another team,

generated a list of 7 prioritized challenge areas. The list was noted on the board and a consensus was reached on the prioritization of the challenges (see section 2).

3. Results

Through the NeRN meetings, the indicators evolved and the challenges in collecting and comparing data became more apparent.

Functionality and data availability, as known to the country representative, of indicators regarding ePrescriptions is noted in table 1. Table 2 gives an overview of the functionality and data availability in general of the 21 indicators regarding the intensity of use of eHealth in the Nordic countries.

Table 1. Functionality and log data availability of health information intensity of use indicators regarding ePrescriptions

Indicator	Functionality availability	Log data availability (1)
No. of prescriptions made electronically / all prescriptions made per year	DK, FI, IS, NO, SE	DK, FI, IS, NO
No. of prescription viewings by professionals (in or via a national database or system) / electronic prescriptions made per year	DK, FI, IS, NO, SE	DK, FI, IS, NO
No. of prescription viewings by patients (in or via a national database or system) / electronic prescriptions made per year	DK, FI, IS, NO, SE	DK, FI, NO
No. of electronic medication renewal requests made by patients / population of the country	DK, FI, IS, NO, SE	FI, SE
(1) The availability is stated by the country representative. Actual availability of data may vary, since data has to be collected through various organizations or databases.		

Table 2. Functionality distribution of the 21 health information intensity of use indicators

Availability	No. of indicators	Notes
Indicators with full cross country functionality AND log data availability	6	Mainly regarding prescriptions and medication errors
Indicators with full cross country functionality but NOT log data availability	2	Electronic bookings and renewal requests
Indicators with neither full cross country functionality or log data availability	13	Indicators regarding viewings of notes, test results, immunizations, ability to add supplement by patients, medicine lists etc.

The method of prioritization gave a common overview of the main challenges in collecting and comparing log data across the Nordic countries regarding ePrescriptions. The complete list can be seen in figure 1.

After reaching consensus, the main challenges in prioritized order were:

1. Definition of the denominator
2. No published data available
3. Prioritized equally:
    a. Query literacy – skills to perform queries that provide the wanted information

   b. Rapid evolvement or functionalities under development
4. Data stored in local databases
5. Prioritized equally:
   a. Analysing before doing – acquiring data relevant for the indicator may be more complex than first assumed.
   b. Citizens print out at pharmacy – which eschews usage rates
6. Need to pay to get data
7. Three layers in data availability: i) Data already available; ii) Data collection doable, but more work is needed before we can collect data; and iii) Data not existing in logs, so it must be developed.

4. Discussion

As the Nordic countries all are close to a distribution level of 100% among all users of the most significant eHealth functionalities, the interesting aspect of monitoring eHealth shifts towards practical use of eHealth instead. Monitoring how much the key functionalities of national information systems are used and if these systems are used as intended is needed to follow up on national eHealth strategies. In order to obtain monitoring data not compromised by low external validity or selection bias, log data harvested from central servers seems to be an easy, reliable and valid approach to collecting data regarding practical use of eHealth. However, as we go deeper into details collecting and comparing data, the challenges in using log data become apparent.

4.1. The Impact of the Definition of Indicators

The definition of indicators is of great importance to the interpretation of them afterwards. Apparently, very simple indicators regarding ePrescriptions proved to be quite complex because the term prescription is not perceived or translated similarly to some of the Nordic languages. As noted in Gilstad et al. [6] prescribing is a series of actions; the decision to medicate is the first step, where the health professional decides when and how the patient should be medicated. Further, the prescription is written and mediated electronically (electronic prescribing of medicine) by a *health professional to a patient* via a pharmacy, where the pharmacist retrieves, makes dispension markings to the prescription and then the medicine can be dispensed. The prescription is the document that gives the patient the right to pick up a medication at the pharmacy as well as the instruction of how to administer the medication. In the Nordic countries, these actions and information content transferred and collated vary, and there are different meanings to the terms used. Hence, when comparing data across the Nordic countries and further across the OECD countries, it needs to be agreed upon which terms should be used. Or rather – what does the used term translate into in the local settings? The choice of definition greatly influences the challenges in collecting and comparing data. Most of the indicators used in the NeRN cooperation were derived from similar indicators in the OECD collaboration. This was done to enable benchmarking of indicators. However, the deeper into the indicators the group got, the more difficult the data collection and comparisons proved to be. In the group, some of the very thoroughly discussed indicators regarded ePrescriptions. Therefore, this was chosen to be the starting point of the NeRN group´s discussion of the main challenges in collecting and comparing log data across the Nordic countries.

The prioritization of the main challenges showed that one of the most important things to consider when defining indicators from log data is the denominator. In order to compare countries, a percentage is preferable rather than absolute values that can be affected largely by the population size amongst other structural issues. With the 21 NeRN indicators on the usage of eHealth, 13 indicators use population of the country as the denominator. This applies to most of the indicators regarding viewings of data. The main reason for this choice was the sheer magnitude of effort involved in acquiring the alternative denominator, which would be "per number of data stored in or via a national database or system".

The second most important challenge was that very little of the required data is published/easily available. The NeRN was established by the Nordic Council of Ministers eHealth group to provide a common set of indicators for monitoring eHealth for use by national and international policy makers and scientific communities to support development of Nordic welfare. However, in order to collect data several different institutions and organizations in each country must be approached. This underlines one of the third most important challenges: Query literacy. When asking for data from an unfamiliar database, it can be difficult to ensure that the data wanted and the data delivered are coherent. Again, the definition of the indicators is of utmost importance when conveying it to the people in charge of data collection in the respective countries.

The fourth challenge in working with cross country data collection and comparisons is the rapid evolvement of eHealth. eHealth is continuously advancing and therefor structures and functionalities are also evolving. This again stresses the complexity in defining what to measure in order to provide meaningful indicators.

There are several other major challenges in collecting and comparing log data regarding ePrescriptions. These challenges are equally applicable to other indicators. One challenge is the need for deeper analysis of the context and data availability before determining the final definition of the indicators. Sometimes, there are real-world work-arounds that affect the measures of use and need to be addressed in order to deduce a reliable conclusion on the practical use of specific eHealth functionality. Further, the maturity of the national databases varies, with 3 layers of data availability: i) where data are readily available, ii) where data are stored in the database, but retrieving the data requires additional work, and iii) where data do not exist in the national logs or is incomplete due to e.g. voluntary registration. The last layer requires further development in order to provide data. This leads to the final major challenge in collecting data: the costs. If data are published or readily available, the costs in accessing data are minimal – if on the other hand the national databases do not encompass data on the practical use of eHealth, the costs to include these types of data could be sizeable. Further, the majority of log data are made for other purposes than cross-country benchmarking. This imposes the challenge, that even though the database superficially contains the right information, it does not necessarily have the data content required by the comparison process. This calls for an iterative process, where the national log data collection should learn from the common indicator work so the future version of logs can produce more exact data for comparison purposes.

5. Conclusion

This paper set out to define the lessons learned from the process of characterizing the amount of practical use of eHealth on national level collecting and comparing log data

harvested from national logs in the Nordic countries. The health systems of the Nordic countries are quite similar in structure and their eHealth strategies include similar elements, but still it proved challenging to define a common set of indicators for monitoring the practical use of eHealth, and the deeper into the analysis we got, the more challenges we encountered. A thorough analysis of context leading to the definitions of the indicators is the basis needed due to the complexity of the data in the national logs. A comprehensive knowledge of the structure that underlines these logs is of utmost importance when striving for collecting comparable data.

Although challenging, the process of collecting and comparing log data is not an impossible task, but a task that requires in depth discussions of definitions of indicators as well as a substantial insight into the architecture and content of the national databases, hereby their contextual frames. There is need for continuous work on these indicators to ensure their quality and thus ensure the defined indicators can meaningfully inform eHealth policies.

Acknowledgements

The authors would like to thank Lars Jervall, Thomas Pehrson, Hege Andreasen, Arild Faxvaag, and Sabine Koch for participating in the meetings and providing knowledge and insights into the challenges in defining indicators of practical use of eHealth and into collection and comparison of data harvested from national logs in the Nordic countries.

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