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IT Infrastructure for Biomedical Research in North-West Germany

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Abstract. The efficient use of routine data for biomedical research presupposes an IT infrastructure designed for health care facilities. The objective of this study was to analyse which IT infrastructure is used in hospitals and by general practitioners' (GP) practices in the region Oldenburg-Bremen and to examine how well this supports research projects. To this end, IT managers and GPs were interviewed. The usage of hospital information systems (HIS) and data warehouse systems (DWS) in hospitals is of major importance for the study. Over 90 % use DWS for administration, 42 % for clinical research. None of the hospitals implemented consent for the use of routine data for research. Only a third of the GPs have participated in studies. The GPs' offices based EHR systems in use offer virtually no support for research projects. The study results demonstrate that technical and organisational measures are required for the further usage of routine data in the region.

Keywords. hospital information system, CIO, general practitioners, electronic health records, medical informatics

1. Introduction

"Real world data" of daily routine data are the most important sources for health system research. The usage of routine data within medical research extends from the support of clinical studies to epidemiological studies, up to studies of research in health services depending on the secondary analysis of data [1, 2]. For example, routine data are suitable to assess compliance of the use of antibiotics (inpatient, outpatient) and the reason for decisions [3–5].

Medical data gathered in electronic health records (EHR) offer potential for future medical research. There are initiatives on a European level to link the distributed and heterogeneous data resources and make efficient secondary use of hospital EHR data to support clinical research studies [6]. But to evaluate collected routine data for research, a powerful IT infrastructure is necessary. Because of the frequent use of hospital information systems data is more often available in an electronic form, yet the data quality or the access to this data for research is insufficient [2]. Apart from research in hospitals, research with routinely collected data by general practitioners is an underused resource [7]. To link research and patient-centered care, the funding concept "medical informatics" of the German Federal Ministry for Education and Research (BMBF) supports innovative IT solutions [8].

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Until now, the region Oldenburg-Bremen has been only little experienced with medical research. With the establishment of the medical faculty at the University of Oldenburg the increasing number of students and graduates need a good IT infrastructure for research.

The objective of this study was to prepare an analysis of the current status of the IT infrastructure to support research and establish new business areas in the region.

The following questions should be answered:

1. Which IT infrastructures are employed in hospitals and GP's practices?
2. How is the access to the existing electronic data regulated?
3. To what extent can the existing IT infrastructure support research projects in the present facilities?

2. Methods

After the approbation of the ethical committee we conducted two descriptive surveys: Firstly, we interviewed hospitals in north-west Germany, and secondly, we surveyed resident GPs who were interested in education and research at the faculty of Medicine and Health Sciences of the Carl von Ossietzky University in Oldenburg. Both aspects were important to describe the region, so they were combined in the study.

From 33 hospitals in the region of Oldenburg-Bremen, 25 hospitals were chosen, both rural and urban, furthermore hospitals of differing care levels and funding models. We knew from previous projects, that the remaining eight hospitals were not interested in research or did not provide any information.

In the period between August and December 2016, interview requests were sent to CIOs of 25 selected hospitals. If an interest in the study was expressed in an initial telephone request, further information and the questionnaire were sent by email. A semi-structured method served as a framework for data acquisition and evaluation. The questions were developed according to the functionality described in the literature [2, 9–12] and the development of the medical informatics funding concept initiated by the BMBF [8]. The CIOs were asked for what purpose they use the data warehouse and how the access rights are regulated; whether an electronic patient record is available; what other IT software is used for patient care; and whether patients agree to the usage of their data for research during data collection.

Subsequently a pre-test was conducted with a CIO, some changes to the questionnaire were made following his replies. The data collection for the hospital IT infrastructure included personal and telephone interviews as well as the opportunity to complete and return the questionnaire.

The network of teaching and research practices of the Faculty of Medicine and Health Sciences includes 181 general and 135 specialist practices in north-west Germany. To access potential participating GPs and to create a picture of their IT infrastructure, emails with online questionnaires were sent to 316 GPs in the network. This part of the study took place in spring 2017 over a period of four weeks. The online survey of GPs included mainly closed yes/no questions about the IT infrastructure during their medical service, also about their participation in studies in general and possible participation in clinical studies by the University of Oldenburg. The pre-test was conducted by three GPs. The survey was executed by means of the SoSci Survey software package. Both surveys were analysed with SPSS 23®.

3. Results

Data from twelve CIOs (response rate 48 %) and 64 practitioners (response rate 20 %) were included in the analysis. The results are indicated in table 1 and table 2.

Table 1. Answers of the Chief Information Officers of 12 hospitals

Answers CIOs	**n**	**% of 12**
Electronic Medical Record in use	8	67 %
Internal electronic transmission of medical findings	12	100 %
External electronic transmission of medical findings	5	42 %
Software implemented to improve drug safety	3	25 %
Data warehouse in use	11	92 %
for administration/operational purposes	11	92 %
for archiving in clinical trials	5	42 %
Heads of clinical department have access to data warehouse for research purposes	2	17 %
Use and access rules for clinical research implemented	7	58 %
Established graduated consent management for data usage	7	58 %
Implemented consent for the use of routine data for research	0	0 %

Table 2. Answers of the 64 general practitioners

Answers practitioners	**n**	**% of 64**
Participation in studies (last three years)	**33**	**21 %**
epidemical studies	9	22 %
observation studies with other principals	9	22 %
application monitoring	8	20 %
drug trials	8	20 %
Sponsors of the studies		
university institutes	13	45 %
pharmaceutical companies	8	28 %
Medical information system (for general practitioner offices)	**64**	**100 %**
Medistar (CompuGroup, Germany)	13	20 %
x.concept (Medatixx, Germany)	11	17 %
Turbomed (CompuGroup, Germany)	9	14 %
Other (16 other systems with four or less installations)	31	49 %
Existing medical information system support for carrying out studies	1	5 %
Interest to take part in clinical or health system research in collaboration with the University of Oldenburg	52	81 %

4. Discussion

One third of all the hospitals in the north western region took part in the survey. It can be assumed that the non-responding hospitals have a lower interest in research and the implementation rates are over-estimated.

Over 90 % of the CIOs surveyed in hospitals use a DWS in addition to a hospital information system. However, in a great majority of cases the full functionality of the DWS is not fully used, for example only two chief physicians are allowed to use the DWS for research. In a European study of the developmental status of electronic information systems German hospitals ranked in the lower third - far behind the Benelux and Scandinavian countries; only 60 % of the 201 surveyed hospitals use electronic patient record [13]. The difference in the distribution of DWS and processes for an informed consent for data usage for biomedical research indicates that building an infrastructure for biomedical research is not only a big technical but also a big organisational challenge. There are some technical improvements necessary and possible, but the required human and technical resources are the leading problems [2, 9, 10]. In our survey, the DWS is used mainly for medical controlling and financial purposes and thus serves the management in business. According to a study of the role of IT in German hospitals, user access to the IT resources in hospitals is defined (up to 90 %) by the management board [14]. Apart from the lack of clarity in the legal position regarding data usage, the costs for additional IT or the lack of interest in research could be causative. To use the data collected by the HIS for research purposes, the implementation of a HIS-based recruiting support could be useful, however a most complete documentation is required for this [15]. Furthermore, hospitals must set up guidelines for data protection, access, and data standardisation.

The results of the GP study show that more than half of the surveyed GPs use the medical information systems Medistar, x.concept and Turbomed. A study by Schmiemann et al. also showed these three medical information systems to be the most commonly used systems in the Bremen/Lower Saxony region. [16].

There were relatively few studies (33 %) carried out by GPs involved in this study. A survey of 408 German GPs in 2010 revealed that 53 % of those surveyed had experience of observation studies and 69 % were generally prepared to participate in studies [17]. Over 80 % of our participants indicate willingness for research; however, the survey results show that the practice software does not support the execution of studies. Through the establishment of research networks as they have existed for many years in the United Kingdom [18], individual solutions can be developed for study implementation because of the inter-professional collaboration of practice owners and scientists. An example is the usage of open and free data management systems. In the field of health system research there is no alternative to the expansion of multiple use of care data. In doing so it cannot be restricted to secondary routine or social data, but rather include the primary treatment documentation [19].

In our study we only questioned GPs in a close networking with the University of Oldenburg. This can be an indicator of greater interest in research compared to other GPs. There are many IT systems with functions usable for biomedical research. But there is still a technical and an immense organisational challenge to implement an IT infrastructure to use routine data for biomedical research. The IT infrastructure in medical practices was found not suitable for clinical research. The health facilities must set up guidelines for data protection, access, and data standardisation to encourage biomedical research.

Acknowledgements and Conflict of Interests

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