

Same Goals, Yet Different Outcomes: Analysing the Current State of eHealth Adoption and Policies in Austria, Germany, and Switzerland Using a Mixed Methods Approach

Laura Naumann^{a*}, Moritz Esdar^{a*}, Elske Ammenwerth^b, Dieter Baumberger^c, Ursula Hübner^a

^a Health Informatics Research Group, University AS Osnabrück, Osnabrück, Lower Saxony, Germany

^b Institute of Medical Informatics, UMIT – University for Health Sciences, Medical Informatics and Technology, Hall in Tyrol, Tyrol, Austria

^c Research and Development, LEP AG, St. Gallen, St. Gallen, Switzerland

*Contributed equally to this work.

Abstract

Despite similar policy goals, the adoption of eHealth practices took different paths in Austria (AT), Switzerland (CH), and Germany (GER). We seek to provide a rigorous analysis of the current state of hospitals by focusing on three key eHealth areas: electronic patient records (EPR), health information exchange (HIE), electronic patient communication. For validation and in order to gain better contextual insight we applied a mixed method approach by combining survey results from clinical directors with qualitative interview data from eHealth experts of all three countries. Across countries, EPR adoption rates were reported highest (AT: 52%, CH: 78%, GER: 50%), HIE-rates were partly lower (AT: 52%, CH: 14%, GER: 17%), and electronic patient communication was reported lowest overall (AT: 17%, CH: 8%, GER: 19%). Amongst others, results indicate patient awareness about eHealth to be equally weak across countries, which thus may be an important focal point of future policy initiatives.

Keywords:

Electronic Health Records, Health Information Exchange, Health Policy

Introduction

Widespread diffusion and usage of electronic health records across care settings are a major issue on health policy agendas worldwide [1–3]. Also, Austria (AT), Switzerland (CH), and Germany (GER) aspire to improve continuity of care by fostering eHealth. Although, there are similarities between the major German-speaking regions in Europe, there are also crucial differences (Tab. 1).

Table 1 – Country characteristics

	AT	CH	GER
Population (2013)*	8.5 Mill.	8.1 Mill.	80.6 Mill.
Federal States	9	26	16
Welfare type	SHI	Public/Private	SHI
Hospitals (2016)*	273	283	1,951**
Expenditure on hospitals (2016)*	4.0% of GDP	4.3% of GDP	3.2% of GDP

SHI: Social Health Insurance, GDP: Gross Domestic Product
*see www.stats.oecd.org, **see www.destatis.de (accessed 10/25/2018)

Correspondingly, eHealth legislation took different paths in the three countries (Fig. 1). For instance, Germany has seen a rather long process of eHealth legislation with changing goals and approaches, dating back to 2003 but medically useful

applications are not available up to this point. In Austria, the introduction of the Electronic Health Record (“ELGA”) has already started, allowing health care providers and patients to access selected structured patient documents. In Switzerland, the federal government regulations of the Electronic Patient Dossier (EPD) stipulate that health professionals in hospitals are technically able to store essential patient information required for further treatment until 2020 (see Tab. 2).

Table 2 – Recent eHealth legislation

AT	ELGA (Electronic Health Record Act)
	<ul style="list-style-type: none"> Focus on the “Elektronische Gesundheitsakte” (ELGA) to exchange discharge letters, laboratory data, medical imaging, medication data Mandatory participation for health care providers Citizens participate unless they object (Opt-Out) Defined structure, format and standards for ELGA data
CH	EPDG (Federal law on the electronic patient dossier)
	<ul style="list-style-type: none"> Focus on the “Electronic Patient Dossier” (EPD) Mandatory participation for in-patient care providers Voluntary participation for out-patient health care providers and citizens (Opt-In); patients themselves determine access rights National subsidies to fund and build the necessary preconditions for the EPD Defined monetary penalties in case of misuse Defined standards, which are to be used to get certified (legal obligation)
GER	E-Health-Gesetz (Act for Secure Digital Communication and Applications in the Healthcare Sector)
	<ul style="list-style-type: none"> Planned: Medication summary, telemedical applications, emergency data management, electronic patient records Subsidies for sending and receiving medical eSummaries Penalty for out-patient health care providers in case the insurance data is not up to date Implementation of an interoperability register

Recent studies show that Germany is lagging behind Austria and Switzerland when it comes to diffusion and use of health IT applications in hospitals [4–7]. Spreading medical innovation in health care, hospitals are crucial hubs also for national eHealth infrastructures [8]. While there is information about the current state in terms of numbers, little is known about how the stakeholders perceive and evaluate this situation against the background of the national eHealth legislation and

the respective healthcare ecosystem. In order to find out how high-level survey data go along with the perceived reality, a combination of quantitative and qualitative methods is helpful to yield the full picture and cross-validate findings.

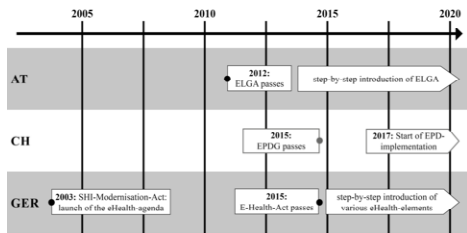


Figure 1 – Timeline of eHealth-laws

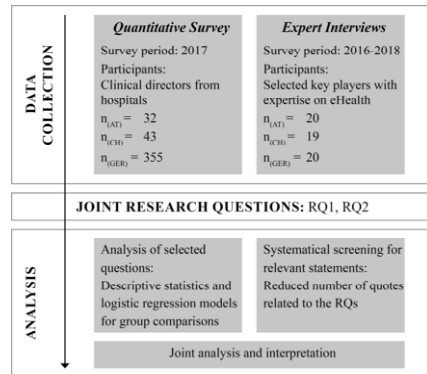


Figure 2 – Research process

This study thus aims at investigating the current state of development and the combined views from a broad range of stakeholders in Austria, Germany, and Switzerland in the key areas: a) hospital internal electronic patient records (EPR)¹, b) health information exchange (HIE) across settings, and c) electronic communication with patients.

RQ1: Do quantitative data and qualitative findings provide a similar picture in the three key eHealth areas?

RQ2: Can qualitative findings explain potential quantitative differences between the three countries?

Methods

We used a parallel mixed method study design (Fig. 2) in which the data of both sets were collected simultaneously, hence providing a point in time observation [9]. Quantitative data were obtained from clinical directors (either nursing or medical directors) as hospital representatives using the standardised online survey *IT Report Healthcare 2017* [5] that measured various aspects of IT adoption [4]. Qualitative data were obtained from 59 health care experts representing a broad field of expertise (Fig. 2): health care delivery (hospitals, out-patient-care, nursing, telemedicine), industry (IT-provider, pharma industry), health care policy, and others (academia, data protection, patient organisations). Phone interviews were conducted using a guideline covering the national eHealth initiatives. Using the software *MAXQDA*[®], interview data was screened systematically for statements regarding the three key eHealth areas in each country. Relevant quantitative data from the survey respondents (Fig. 2) was tested for country differences using logistic regression models in each area. In order to synthesise both data sets, the quantitative data was then complemented by selected quotes from the expert interviews. The screening of the qualitative interview material for hospital related statements lead to 547 initial hits of which we retained 97 statements for further analysis that were relevant to the research questions (AT=28, CH=29, GER=40.). The quantitative survey yielded a response rate (RR) of 17.8%. Out of 2,421 hospitals contacted (contact data were missing for some hospitals), we received 430 responses – 32 from Austria (RR = 12.3%), 43 from Switzerland (RR = 20.4%), and 355 from Germany (RR = 18.2%). Bigger and non-private hospitals were slightly overrepresented in our samples.

Results

Research question 1:

Do quantitative data and qualitative findings provide a similar picture in the three key eHealth areas?

Key area a) Hospital internal electronic patient records

Adoption rates of EPR systems within hospitals showed to be similar in the German and Austrian sample while Swiss hospitals indicated a significantly higher EPR adoption rate (Tab. 3).

Table 3 – Adoption rates of electronic patient records with 95% confidence intervals (CI) and test for group differences

Question	Country	% of Hospitals with an EPR
Q1: Does your hospital have an Electronic Patient Record (EPR)?	AT (n=29)	52% (±18%)
	CH (n=41)	78%*(±13%)
	GER (n=338)	50% (±5%)

*significantly higher adoption rate (p<0.01), GER as reference category

As summarized in Table 4, experts in all three countries provided a mixed picture, with some recognizable trends: Austrian experts pointed to the progress in building the clinical IT-infrastructure but also showed to be aware of the still existing deficiencies. In Germany, experts mostly confirmed the deficiencies and only alluded to progress made in selected institutions. The Swiss experts clearly perceived some progress and an advanced state of developments without neglecting some deficiencies. The similarity in adoption rates between Austria and Germany were referred to by one Austrian expert as follows:

“In the hospital sector, I think we have approximately the same IT status as, for example, in Germany or other comparable EU-countries.”

The German experts pointed at only modest maturity levels, stressing for instance that

“talking about EPRs, hospitals are already somewhat advanced, although there are still many blank spots”.

Swiss hospitals appeared to be better off with EPR adoption rates close to 80% based on the quantitative survey. These results were supported to some extent by expert opinions in the interviews:

¹ We provided the following definition of an EPR for all respondents: “The EPR is an electronically generated and based institution-specific collection of

patient information on current and previous stays in the institution. It is supported by clinical decision-making systems and replaces paper based medical documentation as the primary source of information.”

"So many hospitals are now becoming much more active in this domain."

However, seen collectively, the interviewees also added more sceptical assessments and pointed to difficulties (Tab. 4):

"One would simply have to show much more the benefits, wouldn't one? If you are looking at the hospital processes and you are a clinical director and you know this system offers me benefits (presumably in monetary terms as well) and the processes are so much better and so on... then I consider using the system – but usually it's not like that right now."

Table 4 – Expert statements on the electronic patient record and clinical IT-infrastructure within hospitals

Expert assessments	AT	CH	GER
Existing deficiencies	6	3	6
Selected progress among individual hospitals	2	2	4
Progress in the clinical IT-infrastructure is recognisable	1	5	2
Advanced status	6	2	1
Included interview statements in total*	15	12	13

*representing 40 out of 97 or 41.2% of all included expert statements

Key area b) Health information exchange

When extending the focus to information exchange with other health care institutions, the quantitative survey data indicated lower implementation rates in German and Swiss hospitals and somewhat higher implementation rates in Austrian hospitals (Q2). Austria is also using more sophisticated technology (Q3), i.e. portals, compared to Swiss hospitals, which were using primarily email to communicate (Tab. 5).

Table 5 – Health Information Exchange with 95% CI's and tests for group differences.

Question	Country	Respondents indicating "yes"		
Q2: Are external health data usually transferred using a portal?†	AT (n=12)	52%** (±28%)		
	CH (n=20)	14% (±15%)		
	GER (n=123)	17% (±5%)		
Q3: Is the medical discharge letter (doctor's letter) provided electronically for outside practitioners?		No	Via email	Via Portal
	AT (n=26)	31%** (±18%)	11% (±11%)	58%** (±19%)
	CH (n=39)	33%** (±15%)	54%** (±16%)	13% (±11%)
	GER (n=315)	87% (±5%)	5% (±2%)	8% (±3%)

*significantly higher adoption rates ($p < 0.05$), GER as reference category

**significantly higher/lower adoption rates ($p < 0.01$), GER as reference category

† This question was addressed only to those who indicated that they electronically integrate data from previous care stages into their systems. Almost all other respondents that didn't use a portal, answered that they scan in paper documents.

The experts pointed at comparably few deficits and more progress in Austria than in the other two countries, though structural barriers were reported in all three of them (Tab. 6).

"I think we're on the right track with this IT-infrastructure, which we're currently setting up in the course of introducing ELGA." one Austrian expert reported.

The modest adoption rates of HIE in Switzerland (see Tab. 5) were reflected by existing deficits and structural barriers as expressed by one Swiss expert:

"The possibilities for health information exchange across settings are still very limited and the patient record, i.e. the EPD, does not yet exist."

German hospitals were significantly poorer developed with regard to transferring discharge letters (Tab. 5) – a well-known drawback in Germany's eHealth landscape which was reiterated by many of our interviewees (Tab. 6). One expert stated:

"Even across sector boundaries, from hospitals to out-patient care. We are still, I don't know, 20 years behind."

Table 6 – Expert statements on HIE

Expert assessments	AT	CH	GER
Existing deficits in HIE	1	4	9
Structural barriers for HIE	4	4	7
Progress in HIE recognisable	4	1	1
Structural facilitators for HIE	1	3	2
Included interview statements in total*	10	12	19

*representing 41 out of 97 or 42.3% of all included expert statements

Key area c) Electronic communication with patients

Looking at IT-functions that allow for direct communication between patients and providers, all countries still operated on a rather low level (Tab. 7). Swiss hospitals reported the lowest adoption rates while rates in Austria and Germany were slightly, but not significantly, higher. This pattern was mostly in line with the experts' comments (Tab. 8). However, deficits were more often voiced by German experts. In total, this topic was not addressed all too often by the experts.

Table 7 – "Communication with patients" with 95% CI and test for group differences.

Item	Country	% of Hospitals indicating availability
Q4: Availability of IT function for communication with patients (e.g. via patient portals)*	AT (n=30)	17% (±13%)
	CH (n=40)	8% (±8%)
	GER (n=319)	19% (±4%)

*no significant group differences, GER as reference category

Table 8 – Expert statements on electronic communication with patients

Expert assessments	AT	CH	GER
Deficits present	1	3	5
Increasing expectations	1	1	2
Progress discernible	1	1	1
Included interview statements in total*	3	5	8

*representing 16 out of 97 or 16.5% of all included expert statements

Research question 2:

Can qualitative findings explain potential quantitative differences between the three countries?

Key area a) Hospital internal electronic patient records

The quantitative data pointed to a more advanced situation with regard to EPRs in Switzerland in comparison to the other countries. However, the Swiss experts did not offer a comprehensive explanation but rather pointed to the strengths of the Swiss hospitals, as one expert stated:

"And that is why in-patient structures, such as hospitals, are of course good carriers for ICT-innovations and for the promotion of the EPD, because with their central structures they have the necessary power (human and financial resources) to carry out such projects much better."

The qualitative interviews provided some background information on the mixed results among the Austrian hospitals. One participant indicated that ELGA initiated positive stimuli:

"I also think that such topics are very good drivers for innovation in a hospital. I see it this way: When you introduce a new system, when you deal with processes, then you always have the opportunity to clean up old things and think about how processes can be streamlined. From my point of view, the ELGA system has also brought us something positive."

However, criticism was also expressed particularly with regard to advanced functionalities:

"What is missing is a real innovation, like automatically creating summaries, displaying trends, abstracted from the concrete data. [...] What used to be known as a medical expert system or as clinical decision support is now completely lacking. We are currently at the level of medical raw data."

Reasons for the rather modest EPR adoption rates in Germany included the following explanation given by one expert:

"Of course, there are reasons for that, as I already mentioned, the financial situation: Half of the hospitals generate a deficit and they have to try to buy IT with the resources they have. There is only little support, financial funding in other words."

Key area b) Health information exchange

The Austrian hospitals showed the greatest progress in HIE in comparison to Switzerland and Germany based on the quantitative survey results. This progress was reflected in the interviews particularly in reference to ELGA:

"And ELGA has actually started to standardise all the documents in the hospital. This means that the doctor's summary looks the same throughout Austria: it has the same structure, the same layout, it is generated in the same way. From my point of view, this is something that will help the health care system to move forward."

However, as one expert expressed, implementation was not yet completed among all stakeholders and some unsolved problems remain:

"But what's still a problem for us, is the representation and integration into local information systems."

The survey results indicated limited HIE capabilities of Swiss hospitals. This could be related to the ongoing introduction of the EPD as the following statement illustrates:

"Due to the obligation of hospitals and other in-patient providers, it will inevitably happen within a time horizon of three to five years, all in-patient providers will become part of this system."

Despite similar HIE adoption rates in Switzerland and Germany, the German experts described the situation differently and expanded on the missing incentives for collaboration across care settings:

"Our health care system has a silo mentality. [...] One worries if something works in one's own system. As soon as it comes to cross-sectorial issues, it doesn't work because there is no incentive, no financial incentive, to do so."

They also criticized the *E-Health-Gesetz* for its one-sided focus on the out-patient sector and for its missing strategic approach.

Overall, experts from all three countries addressed similar barriers and facilitators for hospitals (Tab. 6):

- missing, insufficient, or inadequate funding,
- lack of interoperability,
- lack of willingness to cooperate across sectors,
- resistance of physicians,
- less technically advanced out-patient sector.

In total, more barriers than facilitators were mentioned in this context. Only Austrian and Swiss experts stated that the national eHealth laws serve as facilitators.

Key area c) Electronic communication with patients

The quantitative survey results suggested that the capabilities to communicate with patients were equally poor in all three countries. The interviews provided some background information on this issue. For instance, interviewees stressed that citizens did not yet make use of the power they possess – there was a clearly lacking demand on the patients' end. One Austrian expert commented on the role of citizens within the ELGA initiatives as follows:

"I think it's true that many people may not even know that they have access to ELGA, they don't care about it."

Similarly, a Swiss hospital representative stated:

"On the other hand, we have not had a single request from a patient in recent years: Can I access my data? In this respect, interest in effective access to the data: zero. Really, zero. And that also tells me, how active are we there as a hospital at the moment? And the answer is: not at all. Because there would be no balance between effort and yield."

However, according to one German expert patients and health policy makers actually are desirable facilitators of electronic data exchange with patients:

"If you follow the treatment process and realise that hospitals send their documents via mail to the GP or that you yourself are walking around with a letter, then that is very absurd. In my opinion, the driver can only be the citizen or policy by changing certain laws."

The lacking demand and the resulting unwillingness to offer an electronic communication service was summarised by another German expert as follows:

"Well, I think there's going to be a lot of adjustments. [...] Because there are a lot of patients who are ignorant of this; or patients who don't want it and don't request it at all. Then, the hospitals notice: Oh, we don't necessarily have to provide this service, people don't want to have it anyway, and there is no one who keeps track if we are providing these things."

This statement highlighted the need of health policy to get involved and to set up mechanisms of informing the citizens.

Discussion

This study offered unique insights into key eHealth areas by combining cross-country surveys with qualitative expert interviews from the countries involved. To our knowledge, it is the first study of this kind. Many of the interview statements corroborated the survey findings and thus contributed to their validation. There is some support from other studies as well [4,7,10] that overlap in parts.

Overall, adoption rates were the highest for EPRs, followed by HIE, and electronic patient communication ranking lowest. This finding largely matched the patterns of statements on deficiencies, progress and advanced status provided by the experts. Background information provided by the experts shed light into the "whys". Among the most salient reasons given were increased expectations towards the rather new legislative frameworks in Austria as well as Switzerland that might have sparked some advances of hospital EPRs. Moreover, particularly Switzerland spends more on secondary care, thus allowing more operational flexibility. In contrast, missing incentives in Germany could have dulled the motivation of hospitals to invest in EPR systems. A clear story of the benefits can work as a strong motivator. ELGA is seen as an important lever for HIE in Austria. Due to the fact that the Swiss eHealth act, the EPDG, is a rather young law, the technical developments for HIE are still in their infancy and effects do not materialise yet. In Germany, where HIE exists only in few places, lack of real incentives and a preponderance of the out-

patient sector in the eHealth law seem to function as strong barriers. In general, wherever funding, willingness to cooperate and interoperability are missing, the odds are rather low to have HIE in place. Electronic communication with patients is not well developed in all three countries. Experts spoke about the chicken or egg problem in this context: Because patients do not voice a strong demand hospitals do not offer it. Because there are no offers from providers, patients do not know about them and do not ask for it.

Policy recommendations

Based on results of this study, some messages might be of interest for health policy considerations: All three countries are facing similar structural barriers for HIE when it comes to funding, interoperability, and willingness for collaboration across settings. Despite these communalities eHealth took a different path in Austria and Switzerland than in Germany that could be due to the design of eHealth legislation that better integrates hospitals in Austria and Switzerland. Large healthcare organisations are well known for being able to drive and spread IT innovation [4,8]. Although patient centred approaches are claimed to be pursued in all three, the citizen is not really part of the digital agenda yet, raising efforts by health policy. Effects of pertinent new laws that are under way, e.g. in Germany, need to be observed.

Findings from other countries

Especially many Nordic countries such as Finland, Norway and Denmark, that compare to Austria and Switzerland at least in terms of population, have made noticeably greater progress towards national eHealth infrastructures. Following early political commitment, all three countries approached market saturation of hospital EPR's about 5-10 years ago [11–13] and policy makers have since moved on to establish HIE capabilities across sectors and connect all citizens. Other, larger OECD countries, like the United Kingdom made some more troublesome experiences. Despite early advances through the “National Programme for Information Technology” (NPfIT) in 2004, aiming (amongst others) at digitizing secondary care, the program was terminated unsuccessfully in 2011 – essentially due to inadequate management [14]. However, in contrast to Germany, the UK has and still does acknowledge secondary care to be a crucial determinant for fostering eHealth and is thus launching new funding initiatives [15]. In essence, the different approaches seen internationally show that it is not only about doing it but also about doing it right.

Limitations

Due to the study design, some limitations need to be considered: Selection bias might occur in the survey data in light of the modest response rates (volunteer bias) and in the qualitative data (purposive sampling). Furthermore, this study provided a point in time analysis only. Follow-ups are planned and an in-depth analysis of the qualitative data is currently in progress. However, we tried to mitigate these limitations by pooling the two data sets, thereby mutually validating the findings and by blending a broad scope with contextual information.

Conclusions

The mixed methods study offered a new approach, contributed to a validation of the findings per country and provided a better insight into the overall context than with a single method alone. Hospitals and large care providing organisations must be well integrated into a national eHealth strategy before all sectors can benefit. The patients' awareness of the potential of eHealth still needs to be developed by health policy in conjunction with providers offering tangible solutions. Cross-national studies

yield a good and rich basis to leverage the science-politics dialogue.

Acknowledgements

This study is funded by Lower Saxony, Germany (ZN 3062).

References

- [1] A.K. Jha, D. Doolan, D. Grandt, T. Scott, D.W. Bates The use of health information technology in seven nations. *Int J Med Inform* **77**, 2008, 848–854.
- [2] J. Adler-Milstein, C.E. Green, D.W. Bates A survey analysis suggests that electronic health records will yield revenue gains for some practices and losses for many. *Health Aff (Millwood)* **32**, 2013, 562–570.
- [3] J.D. Halamka, M. Tripathi The HITECH Era in Retrospect. *N Engl J Med* **377**, 2017, 907–909.
- [4] J. Hüßers, U. Hübner, M. Esdar, E. Ammenwerth, W.O. Hackl, L. Naumann, J.-D. Liebe Innovative Power of Health Care Organisations Affects IT Adoption: A bi-National Health IT Benchmark Comparing Austria and Germany. *J Med Syst* **41**, 2017, 33.
- [5] U. Hübner, M. Esdar, J. Hüßers, J.D. Liebe, J. Rauch, J. Thye, J.-P. Weiß *IT-Report Gesundheitswesen: Wie reif ist die IT in deutschen Krankenhäusern?*. Schriftenreihe Nds. Ministerium für Wirtschaft, Arbeit, Verkehr und Digitalisierung., Hannover, 2017.
- [6] W. Gall, A.-F. Aly, R. Sojer, S. Spahn, E. Ammenwerth The national e-medication approaches in Germany, Switzerland and Austria: A structured comparison. *Int J Med Inform* **93**, 2016, 14–25.
- [7] R. Haux, E. Ammenwerth, S. Koch, C.U. Lehmann, H.-A. Park, K. Saranto, C.P. Wong A Brief Survey on Six Basic and Reduced eHealth Indicators in Seven Countries in 2017. *Appl Clin Inform* **9**, 2018, 704–713.
- [8] D.E. Leidner, D. Preston, D. Chen An examination of the antecedents and consequences of organizational IT innovation in hospitals. *The Journal of Strategic Information Systems* **19**, 2010, 154–170.
- [9] J.W. Creswell, V.L. Plano Clark *Designing and conducting mixed methods research*. Sage, Los Angeles, 2011.
- [10] J. Zelmer, E. Ronchi, H. Hyppönen, F. Lupiáñez-Villanueva, C. Codagnone, C. Nøhr, U. Huebner, A. Fazzalari, J. Adler-Milstein International health IT benchmarking: learning from cross-country comparisons. *J Am Med Inform Assoc* **24**, 2017, 371–379.
- [11] I. Winblad, P. Hämäläinen, J. Reponen What is found positive in healthcare information and communication technology implementation?—the results of a nationwide survey in Finland. *Telemed J E Health* **17**, 2011, 118–123.
- [12] P. Kierkegaard eHealth in Denmark: a case study. *J Med Syst* **37**, 2013, 9991.
- [13] V. Heimly, A. Grimsmo, A. Faxvaag Diffusion of Electronic Health Records and electronic communication in Norway. *Appl Clin Inform* **2**, 2011, 355–364.
- [14] T. Justinia The UK's National Programme for IT: Why was it dismantled? *Health Serv Manage Res* **30**, 2017, 2–9.
- [15] H.S. Sood, K. McNeil How is health information technology changing the way we deliver NHS hospital care? *Future Healthcare Journal* **4**, 2017, 117–120.

Address for correspondence

Prof. Dr. Ursula Hübner, Health Informatics Research Group, University AS Osnabrück, u.huebner@hs-osnabrueck.de