



Analysing the Scientific Publications of Peter Reichertz: Reflections from the Perspective of Medical Informatics Knowledge Today

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Abstract

Professor Peter L. Reichertz is one of the most significant pioneers in the field of medical informatics worldwide. In 1969, 50 years ago, he became Professor at the Hannover Medical School. On the occasion of this anniversary an attempt was made to report on the scientific work of Peter Reichertz and to reflect on this work in the light of medical informatics knowledge today. The aim of this study was to search publications listings in the Peter L. Reichertz Archive, in Pubmed/Medline, and in the Web of Science. As well as to analyse contents and communication approaches to help in classifying Peter Reichertz's scientific publications. Three comprehensive publication lists were identified: the Print Bibliography (384 publications), the Disc Bibliography (285 publications) and the Selected Publications Bibliography (111 publications). Based on the last bibliography, a classification was built along the semantic dimensions of (1) major topics, (2) fields of publication, and (3) publication languages. Major contents of Peter Reichertz's research in informatics were medical informatics as a field (including education), informatics applications in medicine and health care, and health information systems. Clear shifts over time were observed. To his research on informatics applications, in the 1970s health information systems was added as topic, which then became a major part of his research. While in the 1960s and earlier German was a major publication language, from the 1970s onwards this shifted to English as the major language. Peter Reichertz very early identified the potential of computers in medicine and health care. He did not just use information and communication technology and information processing methodology as if they were other technology, such as microscopes or ultrasonic devices, for improving diagnosis and therapy. He was visionary enough to very early see the revolutionary potential of informatics for biomedicine and health care, with consequential impact on research and education.

Keywords Medical informatics · Health informatics · Biomedical informatics · History

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Introduction

Professor Peter L. Reichertz (*September 20, 1930, †August 6, 1987) is one of the most significant pioneers in the field of medical informatics worldwide. In 1969 - exactly 50 years ago - Peter Reichertz became Professor at Hannover Medical School (MHH). Since Peter Reichertz passed away, there have been conferences and publications to his memory ([1, 2] as preface of volume 25, issue 2, of *Computer Methods and Programs in Biomedicine*, also containing his last publication [3, 4] with [5] as a memorial article, to mention just a few of them). No publication analysing and reflecting on his scientific work exists to date, as far as this author is aware. Between 1987 and 1988, when these books and journal issues appeared, might have been too soon for a reflective perspective. In addition, a comprehensive bibliography of his publications could not be found. Having been Executive Director of the Peter L. Reichertz Institute for Medical Informatics (PLRI, [6,

7]) for 10 years from 2007 until 2017, I am attempting such a perspective on the occasion of the 50th anniversary of Peter Reichertz's assuming his professorship at Hannover, including:

- (a) to report on the scientific work of Peter Reichertz and.
- (b) to reflect on this work in the light of medical informatics knowledge today.

The report in (a) is based on his scientific publications, and on the major topics in his publications, as well as on his communication approaches as reflected in fields of publication and publication languages. The reflections in (b) focus on the major questions that arose at the time, and lessons learned since then for medical informatics research, education and practice of today.

To better understand the results, presented here, a few key dates in Peter Reichertz's curriculum vitae [8] can be summarized here:

- High school graduation (German: Abitur) 1949 in Trier, Germany.
- Studies in medicine, mathematics, and physics. Final medical examination (German: Medizinisches Staatsexamen) and M.D. graduation (German: Dr. med) 1955 in Bonn, Germany.
- 1956-1966: worked as physician at the Department of Internal Medicine (German: Medizinische Poliklinik) of the University of Bonn. 1964: postdoctoral lecture qualification (German: Habilitation) in internal medicine, 1965-1966: head physician.
- 1967-1969: Associate Professor and Director, Radiology Computer Research at the University of Missouri, USA.
- 1969-1987: Professor (Associate Professor until 1972 and Full Professor thereafter) and Director at Hannover Medical School. In 1974, the field of his professorship was renamed to be Medical Informatics (earlier it had been Clinical Data Processing and Documentation). The institute he directed was then renamed the Institute for Medical Informatics.

During his studies in mathematics and physics he was very early introduced to computers and to the programming language FORTRAN.

From 1975 to 1977 Peter Reichertz was President of the German Association for Medical Informatics, Biometry and Epidemiology (GMDS). From 1977 to 1981 he was the first President of the European Federation for Medical Informatics (EFMI) and from 1983 to 1987 the first President of the German Medical Informatics Professional Association (BVMI). He was co-editor of the German book series *Medizinische Informatik und Statistik* (medical informatics and statistics), starting in 1976 (until 1985 with Siegfried Koller and Karl Überla, and later with Karl Überla and Norbert Victor), and of the book series *Lecture Notes in Medical Informatics*, starting in 1978 (jointly with Donald Lindberg), both published by Springer-Verlag. Having been a long-time editorial board

member of the journal *Methods of Information in Medicine* (since 1970) he became the journal's Associate Editor in 1987 ("European Editor", with the other being the "American Editor", Donald Lindberg, [9], p. 495) with the intention that he would succeed Gustav Wagner as the journal's Editor-in-Chief. Many other important roles might be added.

Finally, it should be noted that scientific communication in the 1960s, 1970s and 1980s, during which Professor Reichertz was most active, was very different from today's scientific communication. Since then information and communication technology and information processing methodology have continuously changed. The Internet and the web became important and highly visible factors. Through these changes, technologies for communicating scientific knowledge have changed, too, opening up substantially new opportunities for disseminating research results. During the time of Professor Reichertz's scientific activities, electronic publication and communication channels were more or less unavailable or not used at all. Publication metrics were practically non-existent and without impact on scientific careers and scientific reputations. Books, book chapters (often conference proceedings) and journal articles, *all in print*, were the usual way of communication. The percent of publications in an author's native language (for Peter Reichertz, in German) was, at least in the field of medical informatics, much higher than it is today.

Methods

To address (a), the author searched the Peter L. Reichertz Archive at PLRI for listings of Prof. Reichertz's scientific publications. In addition, he searched the term "Reichertz PL" in Pubmed/Medline (at February 27, 2019) and in the Web of Science Core Collection (at March 1, 2019). Based on the publications from one of the publication lists (details in the section results), and based on the PubMed/Medline and Web of Science searches, Peter Reichertz's publications were reviewed by the author, in particular with regard to their contents. Based on this review he constructed a classification for these publications, which should take into account Prof. Reichertz's major publication topics and communication approaches.

The reflections in (b) come from the author and is partly based on his editorial work in many journals and periodicals, in particular, as editor of the IMIA Yearbook of Medical Informatics and of *Methods of Information in Medicine* as well as on his research in analysing and commenting on medical informatics as scientific discipline [10-12].

Results (a): Reporting on the scientific work of Peter Reichertz

Publication lists and bibliographies

As mentioned before, it was intended that Peter Reichertz would succeed Gustav Wagner as Editor-in-Chief of *Methods of Information in Medicine*. After he passed away Gustav Wagner and Donald Lindberg published a manuscript “In memoriam Peter L. Reichertz” [1], which contained a comprehensive bibliography with selected publications of Prof. Reichertz, including 86 publications from 1965 to 1987, and were listed divided into original publications and books. This “Selected Bibliography” in [1], pp. 180–182, denoted here as the *Wagner-Lindberg Bibliography*, can be found in appendix 11.

From a Pubmed/Medline query on “Reichertz PL” from February 27, 2019, 44 publications of Prof. Reichertz from 1967 to 1987 were listed. The Pubmed/Medline search can be found in appendix 12. One manuscript appeared in 2006 [13] and was the written version of a keynote address given by Peter Reichertz at the Medical Informatics Europe 1984 conference in Brussels, Belgium. He did not publish this paper himself. When quoting it, he offered to send the manuscript upon request, and shared it directly. The author of this paper, among others, received a copy from him (Fig. 1). Although published in 2006, the manuscript ought to be dated to 1984 as the year of its composition and private dissemination.

From a Web of Science Core Collection query on “Reichertz PL” on March 1, 2019, 24 publications of Prof. Reichertz from 1967 to 1987 were listed, including manuscript [13]. The Web of Science search can be found in appendix 13.

In the Peter L. Reichertz Archive at PLRI the author found a printout with another comprehensive bibliography of his publications, denoted here as the *Print Bibliography*. These

publications were listed in a printout of, probably, 1987 from the Hannover Medical School’s IBM mainframe computer at this time. In this Print Bibliography 384 publications were listed from 1957 to 1987. The Print Bibliography can be found in appendix 21.

In the Peter L. Reichertz Archive at PLRI the author also found a disc, which contained 34 Word documents. The printouts of these documents were used to structure the paper folders with publications (all on paper) of Prof. Reichertz. Merging his references all together in one document, resulted in a comprehensive bibliography of his publications, denoted here as the *Disc Bibliography*. In this Disc Bibliography 285 publications were listed from 1957 to 1987. The Disc Bibliography can be found in appendix 22.

A third comprehensive list of Prof. Reichertz’s publications resulted in merging the Wagner-Lindberg Bibliography with the publications, obtained from the PubMed/Medline and the Web of Science search. When comparing the Wagner-Lindberg Bibliography and the two searches, it turned out that most of the publications of the two searches were in the Wagner-Lindberg Bibliography. However some publications of Peter Reichertz, listed by PubMed/Medline as well as some listed by Web of Science, were not included. Among others, two important publications, published later, were not mentioned ([3, 13]). This merge of the Wagner-Lindberg Bibliography in [1] with the publications, obtained from the PubMed/Medline and from the Web of Science search, is denoted here as the *Selected Publications Bibliography*. In this Selected Publications Bibliography 111 publications are listed from 1965 to 1987. As mentioned above, one manuscript, which can be dated to 1984 was published in 2006. The Selected Publications Bibliography can be found in appendix 23.

A summary of these publication lists is presented in Table 1. The 285 publications listed in the Disc Bibliography were mostly, but not all, part of the larger Print

Fig. 1 Original manuscript of ‘hospital information systems – past, present, future’, later published in [13]. Excerpt of page 1

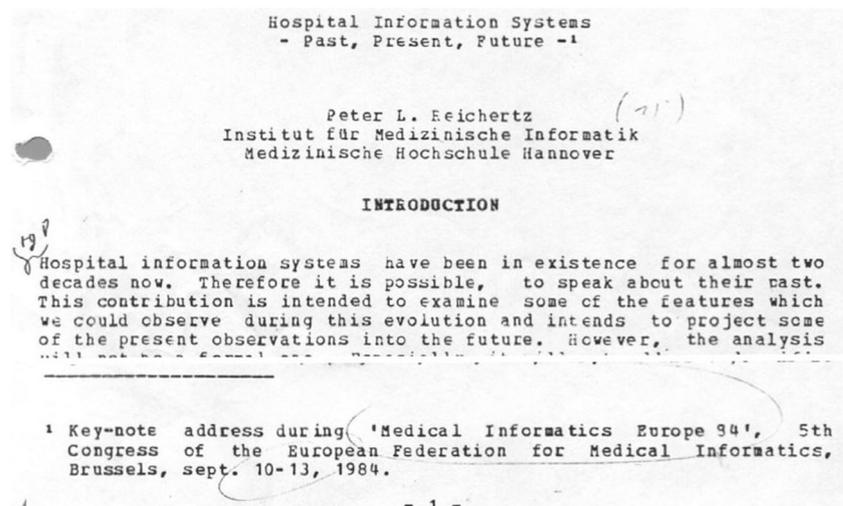


Table 1 The three comprehensive bibliographies with publications of Prof. Reichertz

Bibliography		n. of publications listed	from [year]	to [year]
Print Bibliography		384	1957	1987
Disc Bibliography		285	1957	1987
Selected Publications Bibliography		111	1965	1987*
	Wagner-Lindberg Bibl. in [1]	86	1965	1987
merged from	PubMed/Medline search	44	1967	1987*
	Web of Science search	24	1967	1987*

*One manuscript ([13]), which has to be assigned to the year 1984, was published in 2006

Bibliography with its 384 publications. E.g., entries 52 and 58 of the Disc Bibliography could not be found in the Print Bibliography. The 86 publications, listed of the Wagner-Lindberg Bibliography, were all mentioned in the Print Bibliography. The Disc Bibliography did not mention all of them. For example, entries SB43 and SB48 of the Wagner-Lindberg Bibliography could not be found in the Disk Bibliography.

Reviewing Peter Reichertz's publications, in order to construct a classification of these publications, considering his major publication topics and communication approaches, the author decided to use the Selected Publications Bibliography. On one hand, this bibliography clearly contained Peter Reichertz's major publications in medical informatics, at least from the viewpoint of the author. On the other hand, the Print Bibliography and the Disc Bibliography would probably not produce other results, but could require significantly more effort in reviewing and classifying the documents.

Review and classification

After surveying the publications in the Selected Publications Bibliography, the author decided to build a three-dimensional classification for covering Prof. Reichertz's major publication topics as well as his communication approaches. The reason for building this classification was to be better able to report on the scientific work of Peter Reichertz, in particular with regard to its contents. It appeared appropriate to classify the publications by three dimensions. The three semantic dimensions of this classification comprise (1) major topics, (2) fields of publication, and (3) publication languages. The classes of this classification can be found in Table 2.

Classifying Peter Reichertz's publications

The classified publications of Prof. Reichertz, listed in the Selected Publications Bibliography, can be found in Table 3 and, with further details, in appendix 31.

Commenting on the results

Before commenting on Table 3 it has to be mentioned that the early scientific work of Peter Reichertz was in 'classical' medical areas, then mostly in internal medicine. One of his very first publications was, e.g., in 1957 on lung stretch receptors [14]. Rather early there was a certain focus on measuring and analyzing electric signals. In [15], e.g., he reported on research on measuring electric signals in the gastrointestinal tract by so-called gastrointestinograms. It took nearly ten years of publishing in 'classical' medical areas, before his first publications appeared, which were related to medical informatics.

Table 2 Three-dimensional classification for classifying the publications of Prof. Reichertz with respect to contents and communication approaches. The three semantic dimensions of this classification comprise major topics, fields of publication, and publication languages

major topics

medical informatics

i:introducing and reflecting on medical informatics as a new discipline

e:biomedical and health informatics education

informatics applications in medicine and health care

d:... for diagnosis and diagnostic decision support

a:all other applications

health information systems

h:hospital information systems, their architectures, functionalities, organization, incl. Patient databases

o:information systems for outpatient care, e.g. in medical offices

t:transinstitutional aspects of information systems for health, as in

'h: hospital information systems, ...', but beyond one institution (e.g. beyond one hospital)

s:*data protection*, comprising data privacy and security

.:others

fields of publication (discipline where a journal or book can be assigned to)

m:*medicine*, except medical informatics

i:*medical informatics*

c:*computer science* (German: Informatik), except medical informatics

.:others

publication languages

e:English

g:German

.:others

Table 3 Publications of Prof. Reichertz from the Selected Publications Bibliography (SPB), classified according to the semantic dimensions of (1) major topics, (2) fields of publication, and (3) publication languages

major topics		fields of publications			
		medicine, except medical informatics		medical informatics	
medical informatics	introduction & reflection	SB01-1965 SB06-1966	sb73-1975 sb74-1976	sb77-1978 SB46-1978	SB58-1980
		PM41-1968 SB18-1970	WS21-1971 SB22-1973	SB64-1983	
	PM26-1973 WS17-1975	WS07-1981			
		PM34-1968 PM08-1980	sb75-1977 SB40-1977	SB43-1977 SB45-1977	
			SB53-1979 sb79-1980	SB55-1980 sb83-1982	
			SB61-1982 SB62-1982	PM02-1987	
	education		sb82-1982 SB65-1983		
			SB32-1976 SB48-1978		
informatics applications in medicine and health care	... for diagnosis and decision support	SB02-1965 SB03-1966	SB12-1969	PM28-1972	
		SB05-1967 SB47-1978			
	SB04-1967 SB09-1968	SB39-1976			
	SB13-1970 SB14-1970				
	SB15-1970				
	all other applications		SB19-1971 PM29-1972	PM23-1974 SB30-1975	
		SB07-1967 SB11-1969	SB08-1968 SB10-1968	SB17-1970 SB23-1973	
		PM18-1977 PM16-1977	SB25-1974 SB33-1976	SB63-1982 SB69-1985	
health information systems	hospital information systems	PM24-1974	sb71-1972 PM30-1972	SB20-1972 SB21-1973	SB36-1976
			sb72-1975 SB28-1975	SB31-1976 PM13-1978	
		SB49-1979 sb84-1983			
		sb70-1971 SB24-1974	SB26-1974 SB29-1975	SB27-1975	
		SB34-1976 SB37-1976	SB50-1979 SB52-1979		
		SB56-1980 SB66-1983			
		PM01-2006			
	information systems for outpatient care	sb76-1978 sb78-1980			
		sb80-1981	SB16-1970 SB35-1976	SB42-1977 PM15-1978	
			SB51-1979 SB54-1980	SB57-1980 SB59-1980	
			SB60-1981 sb85-1986		
			sb86-1987		
	transinstitutional aspects				
			SB38-1976		
data protection in health		PM04-1984 PM03-1984	sb81-1982 SB68-1985		
			SB41-1977		

Numbers as in SBP (see appendix 31), followed by the year of publication. Non-italic: published in the German language (upper part of a class), italic: published in the English language (lower part of a class). Red: published in the 1960s, yellow: published in the 1970s, green: published in the 1980s. From the 111 publications in the SPB, 104 are listed in the table. The other 7 publications, which are classified as 'other' in one of the tree dimensions, are not listed there. These are the publications PM43–1967, PM42–1967, PM38–1968 (early clinical work), WS18–1975 (a conference report), SB44–1977, PM14–1978 (on the analysis of health care systems), and SB67–1984 (book published in a different field)

Let me mention here as early reports on informatics research his manuscript on diagnostics and automation ([16], SB01–1965 in Table 3) and on computer-diagnostics in ([17], SB06–1966 in Table 3). In diagnostics and information Peter Reichertz already in 1965 draw a visionary picture of the future, of what we are now calling era of digitization or information age, even referring to Teilhard de Chardin's place de l'homme dans la nature [18], viewing this development as part of Teilhard's philosophical-theological vision. An excerpt of this manuscript is shown in fig. 2. By the way, all publication mentioned were in German.

The major topics

In Table 3 we can see that major informatics topics, where Peter Reichertz reported ongoing research and research results, were on health information systems (mainly hospital information systems – with the Medical System Hannover as an important entity – and information systems in medical offices), on a variety of informatics applications in medicine and health care (mainly on diagnosis and on diagnostic decision support, but also on the reporting of findings as well as on coding and the representation of medical data), and on

Fig. 2 Reprint of ‘diagnostics and automation’, [16], Excerpt of pages 1 and 2



medical informatics as a discipline, first introducing and later reflecting on the field.

Whereas for the first two major topics he was usually one out of many co-authors, in the publications on medical informatics as a discipline, he was mostly the sole author.

Fewer publications of Peter Reichertz dealt with informatics education and with data protection.

When looking at the decades individually, where research has been published, we can observe clear changes in emphasis.

The 1960's decade

In the 1960s publications were either on informatics applications (mainly on diagnosis and decision support) and on introducing medical informatics. At this time the computer was a new tool. It was mainly used in medicine like other tools – such as microscopes or ultrasonic devices – for improving diagnosis and therapy.

The majority of publications were in medical publication organs, not specialized in medical informatics, as this specialized area of publication barely existed then. The only specialized international journal in this field during this decade was *Methods of Information in Medicine*, which was launched in 1962, and which had a predecessor journal with publications only in the German language, followed in 1968 by *Computers and Biomedical Research*, now called the *Journal of Biomedical Informatics* ([9], p. 493). All other leading international informatics journals started later. There were also book series such as the Springer series *Medizinische Informatik und Statistik* and *Lecture Notes in Medical Informatics*, starting in 1976 and in 1978. Another observation is that half of his publications were in German and the other half in the English language. Considering all his publications, not only those of the Wagner-Lindberg Bibliography, the amount of German publications would be even higher.

The 1970's decade

In the 1970s there was a clear change. In his new position at Hannover Medical School Peter Reichertz could invest in significant computer equipment (an IBM 360 computer) and he could take on important responsibilities for the Medical School's hospital information system, in particular its

computer-supported part. Having accepted this opportunity, which was also a hard challenge for him and for his team, he saw the chance and brought in a new topic – health information systems – into medical informatics, which was on the one hand decisive, and on the other hand unusual or even strange at least for the clinical disciplines in medicine. Also based on the contents of his publications it can be seen that in addition to traditional research subjects like improving diagnosis and therapy, he also did research on medical processes and infrastructures and with it on new views on health care systems.

This can be seen in his publications during the 1970s. A strong additional topic now was on health information systems, concentrating on hospital information systems with its many computer-supported facets (focused on MHH's Medical System Hannover) and on information systems in medical offices.

Two publications, not mentioned in the Selected Publications Bibliography, need to be mentioned here, since they were, in my opinion, outstanding for the time. From 1975 Peter Reichertz was giving lectures to computer science students at TU Braunschweig on their minor subject of medicine which he also organized. For his introductory course to medical informatics he wrote a script on ‘concepts of medicine and informatics – an introduction to medical informatics’ [19]. There he introduced medical informatics through reporting and reflecting on concepts of health care, health care systems and its entities with various roles (e.g. his view on medicine as a ‘subject-object system’). Appropriate education, including continuing education and postgraduate certification for a variety of students and graduates, in particular in medicine and in computer science, was regarded as important to him. In 1973 he coordinated a conference where German leaders from medical informatics and also from other areas of medicine and of computer science met at Reisenburg Castle, Germany, in order to elaborate recommendations on education in medical informatics [20]. Having been for many years only available in German and as an unpublished manuscript, it is now, thanks to Jochen Moehr, broadly available as a publication in the IMIA Yearbook of Medical Informatics in English [21, 22].

In the 1970s most of the manuscripts could now be published in journals and books specializing in medical informatics. More publications on informatics research were now in English, except papers introducing informatics, mainly in medical journals.

The 1980's decade

The relative number of Peter Reichertz's publications, reflecting on medical informatics and providing visions for the field's future increased, as did his responsibilities as editor of books on medical informatics. What is probably the most comprehensive and visionary paper on hospital information systems written is [13]. With the continuing penetration of information and communication technology and with the progress of informatics applications in health care, additional questions arose, which had to be solved. In particular those working on health information systems could see new challenges of privacy and security coming up. Probably because of this, Peter Reichertz also worked and published on questions of data protection.

The major publication language had become English at this time. As already in the 1970s most of the manuscripts were now published in journals and books specialized in medical informatics.

Resonance of Reichertz's publications in the scientific community

The resonance of Prof. Reichertz's scientific publications in the scientific community was high. This could be seen in his many responsibilities, when he took leadership positions (President of GMDS, President of EFMI, and others) and in the many keynote lectures he was invited to give at leading conferences. Publication metrics, as they are used today, could, however, hardly be applied to measure specific resonances. The five most cited publications in the Web of Science Core Collection (but recall that there are only 24 publications of Peter Reichertz listed there), are, in descending order, "hospital information systems – past present future" ([13], PM02–1987 in Table 3), "RADIATE – updated and redesigned for multiple cathode-ray tube terminals" ([23], SB11–1969 in Table 3), "preparing for change: concepts and education in medical informatics" ([3], PM02–1987 in Table 3), "medical informatics – fiction or reality?" ([24], SB55–1980 in Table 3), and "towards systematization" ([25], SB40–1977 in Table 3).

Results (b): Reflecting on Peter Reichertz's work in the light of today's medical informatics knowledge

My reflections will try to consider international developments. To a certain extent they will, however, focus on Germany, in order to better be able to reflect specifically on Peter Reichertz's research and its impact.

Medical informatics as a field is no longer new. In many countries it is well established. IMIA, the International

Medical Informatics Association, now comprises 59 member societies [26]. With 6 regional medical informatics societies, APAMI (Asia and Pacific), EFMI (Europe), HELINA (Africa), IMIA LAC (Latin America), IMIA North America, and MENAHIA (Middle East) all parts of the world are covered. In Germany during the time of Peter Reichertz medical informatics was primarily a field to be found within the medical faculties of universities, whereas now it is has also become a field within the faculties of computer science (in German: Informatik).

Educational programs in medical informatics or medical informatics courses in programs at the time of Peter Reichertz rarely existed. This has changed dramatically because of the needs of medical informatics specialists. In [27] we see listed 24 dedicated bachelor programs and 18 dedicated master programs in medical informatics and related disciplines in Germany, Austria and Switzerland, and there is a clear demand to establish more of them. Official international recommendations on informatics education exist for a variety of programs and levels since 1999 [28, 29], currently being updated by IMIA in a 2nd revision.

Discussions on the contents of medical informatics research is continuing (e.g. [30]). As the field grew significantly, a broader diversification was necessary [31–36]. Together with the growth of computer-based information processing, this diversity was also a factor, causing an increasing separation of practises of medical informatics and research in this field, even in universities with their medical faculties and university hospitals. A recent publication on research subjects in medical informatics listed as main subjects "biomedical data analysis", "clinical informatics", "EHR - knowledge representation", "mobile health", and "organisational aspects of HIS" ([37], EHR: electronic health records, HIS: health information systems). Topics like artificial intelligence, frequently raised by Peter Reichertz, now more in the context of collaboration and synergy of human and machine entities, are now enjoying a notable boom in our era of digitization.

The breadth of informatics applications in medicine and health care has grown considerably. The contents of the IMIA Yearbooks of Medical Informatics (published annually since 1992) can serve as good overviews [26].

Research on information systems in health was, during Peter Reichertz's lifetime, institution-centered and focused on supporting processes of patient care and administration through the newly introduced computer-based application systems. Major institutions were hospitals and medical practises. The persons to be supported were mainly physicians and administrative staff. This has also changed dramatically. Besides health care professionals (now also including nurses and other professionals), the patients themselves are supported in a variety of ways. Also, patient-centered care (not institution-centered care) with all its consequences for health information systems architectures and information

management strategies came within the focus of informatics research and practice [38–41], including even patients personal environment such as their homes [42, 43]. Functionalities now also consider the support of biomedical research, comprising appropriate forms of data representation and data analysis, in Germany now mainly in research activities within the German Medical Informatics Initiative [44, 45] with its four research consortia DIFUTURE [46], HiGHmed [47], MIRACUM [48], and SMITH [49].

Discussion and Concluding Remarks

It needs to be re-emphasized that Peter Reichertz's times were very different than today's. Existing information and communication technologies (PCs just became available in the 1970s, the Internet started slowly in the 1980s) as well as ways of communicating research (paper-based) were very different then than now. Limitations resulting from shifting technological environments also changed. For limitations existing in today's technological environment let me refer to [10, 12, 30, 40, 43, 46–49]. Also, as mentioned before, journals (except *Methods of Information in Medicine*) and book series needed to be established first, and this was partially done by Peter Reichertz himself.

Peter Reichertz very early identified the potential of computers for medicine and health care. Unlike many others, he did not only use information and communication technology and information processing methodology as if they were like other technologies such as microscopes or ultrasonic devices, for improving diagnosis and therapy. He was visionary enough to very early see the revolutionary potential of informatics for all aspects of biomedicine and health care, with consequences for research agendas and education. In other words: He was by no means just an internist, who could write FORTRAN (and, later, PL/1) programs, using this skill for writing programs on improving diagnosis and therapy, as important as this might have been.

His appointment as professor at MHH gave him an outstanding chance to implement his visions. In this context I would like to mention Professor Berthold Schneider. In 1965 at MHH he was appointed to the position of Full Professor for biometry and documentation. It was he who made it possible to have a professorship in medical informatics at MHH.

Systems, like the Medical System Hannover, are never built by just one person. Peter Reichertz had an excellent team. Without this team, the work on hospital information systems, would not have been possible. An incomplete list of some of the outstanding team members include: Rolf Engelbrecht, Jochen Möhr, Otto Rienhoff, Karl Sauter, Friedrich Wingert, and Enno Wolters. All of them became Professors. Other departments of MHH also carried out important informatics

work at the time of Peter Reichertz, contributing to his success and that of his institute. Outstanding colleagues included Albert Porth and Dietrich-Peter Pretschner. Many more need to be added here.

Various limitations of this article need to be mentioned. The reflections in the section on results, part (b), will remain to some extent subjective. Some subjectivity remains as well in part (a) concerning the selection of the publication lists, the clustering of publications into major topics and communication approaches, the construction of the classification and the classifying of publications itself. The reflections, presented here, would likely be different coming from others. On the one hand the author knew Peter Reichertz in person, and since the 1970's was aware of his work by hearing him speak and by reading his publications, but on the other hand he was never a member of his research team nor co-authored publications with him, so the present paper could be considered to provide a relatively independent perspective.

Let me conclude on a personal note. Professor Reichertz was an external reviewer of my habilitation thesis on expert systems in medicine, which I had submitted in 1987 to RWTH Aachen's Medical Faculty. The last letter I received from him, was dated June 10, 1987, less than two months before he passed away. Still today I am thankful that Arie Hasman, who in 2006 was Editor-in-Chief of the International journal of Medical Informatics, agreed with my proposal that Peter Reichertz's still unpublished manuscript on hospital information systems – past, present, future, could finally be published [13], and that this coincided with the publication of my paper on health information systems – past, present, future [40]. For both authors these papers have become the most cited ones. And I am glad that in 2006 my suggestion, to give the joint Medical Informatics Institute of TU Braunschweig and Hannover Medical School, launched in 2007, the name of Peter L. Reichertz Institute for Medical Informatics, was accepted and supported by the then-Presidents of TU Braunschweig, Prof. Hesselbach, and Hannover Medical School, Prof. Bitter-Suermann.

Recommended three 'must reads' of Peter Reichertz's publications

Last, but not least, here are my recommended 3 'must reads' of Peter Reichertz's publications (in order of publication):

- *Konzepte der Medizin und Informatik. Eine Einführung in die Medizinische Informatik* ([concepts of medicine and computer science. An introduction to medical informatics], [19] from 1981).
- *Hospital information systems - past, present, future* ([13] from 1984).
- *Preparing for change: concepts and education in medical informatics.* ([3] from 1987).

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Compliance with Ethical Standards

Conflict of Interest The author declares that he has no conflicts of interest.

Ethical Approval This article does not contain any studies with human participants or animals performed by the authors.

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