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Commentary

Medical and Health Information Systems; the Boundaries are Still Fading

Reflections on M.F. Collen's paper:
General Requirements for a Medical Information System

1. Introduction

The advice, offered Morris Collen's visionary paper on medical information systems [1], published in 1970, remains valid today. We want to comment on this paper by discussing the following questions:

- What are the most important aspects of this paper that have influenced on the field of medical informatics?
- What early views expressed in this paper are no longer valid? Where have insights changed?

However, first of all and to better understand the significance of Collen's article at the time it was published, let us recall:

- What happened in 1970?

2. What Happened in 1970?

1970, it was the time of the iron curtain between West and East and student movements for peace and democracy had started to change society. Solzhenitsyn received the Nobel prize for literature, the USSR refused to let him travel to Stockholm; Pablo Picasso painted the "Femme au Fauteuil"; the song "Let it Be" from The Beatles became an international hit.
The very few computers at that time were mainframes, usually operating in batch mode, and punch cards and printers were the common input/output devices. Edgar Codd contributed to a paradigmatic change in database theory and practice with his paper on a "Relational model for large shared data banks". He argued that "future users of large databanks must be protected from having to know how the data is organized in the machine" ([2], p. 377). In medical informatics, pioneers made early attempts to change and improve health care. For instance, Carl Theo Ehlers introduced computer-based recording of patient data at the University Hospital of Tübingen. Fortunately, he was able to use at that time an exceptionally powerful computer (an IBM 360/30 with 32k magnetic main memory). In his book on "Computers, Tools for Medicine", Ehlers strongly advocated patient centered integrated data processing in hospitals, with benefits for both physicians and administrators [3]. Chris Rümke from Amsterdam drew attention to the "danger of wrong inferences from medical record data", caused by Berkson's fallacy [4]. In 1969, Gustav Wagner, Heidelberg, reported on experience with the "in-patient records face sheet of the Heidelberg clinics" and argued why it was necessary to decide on a minimum basic data set for an in-patient, which fits on one punch card and which could be analyzed on punch card sorting machines as well as on computers [5]. One year after 1970, the then future IMIA president Marion Ball, Philadelphia, provided one of the first surveys on functionality, costs, and vendors of hard- and software for integrated, computer-supported "total hospital information systems" [6].

In 1970, the informatics world was completely different from today. Taking today's view it was underdeveloped regarding information technology and methodology. For instance, no personal computers existed, no Internet and no Medline. Nowadays, more personal computers are sold worldwide than cars. The annual turnover of the world market on information technology in 1995 has been estimated at approximately 3 trillion US dollars, with an increasing growth rate. Jan van Bemmel reported in 1993 on studies on the amount of investments in both hardware and software in the health-care market ([7], p.2). He argued that it was estimated that the USA expended over 5 billion US$ annually on information systems, that the European market in this area in 1993 was about 3.5 billion ECU, expected to grow to 15 billion ECU in the year 2000, and that the worldwide market for hospital information systems was estimated to

be about 100 billion US$ around the turn of the century (taken from [8], pp. 9-10).

3. What Are the Most Important Aspects?

The most important aspects of Morris Collen's paper that have influenced on medical informatics are, in our opinion, his visionary view on:
- The benefit of computer-supported information processing in health care regions.
- The functionality of, as he called it, "medical information systems".
- Necessary organizational aspects in information systems management.

Although Collen, in 1970, could hardly foresee the speed of the revolutionary developments in information technology and methodology, he did not restrict his views of computer support in health care to one health care institution only, e.g., to hospitals. His view on information processing comprised "electronic data processing and communications equipment" ... "for patient data within one or more general medical centers, including both hospitals and outpatient services" ([1], p. 94). Hospital information systems formed parts of his medical information system, and were not an isolated, independent system with "boundaries" to information systems of other health-care institutions. Although he defended on the benefits of such a system not only for physicians and nurses, but also for health-care managers, his primary view was to center on the patient. Obviously, patients will usually be treated not in only one, but in several health-care institutions.

The functionality of information processing, as Collen described, still applies to a very large extent to present health-care institutions. This is remarkable, because diagnostic and therapeutic possibilities in health care changed considerably since 1970. For instance, MRI systems were not known at that time; it took nine years before Allan M. Cormack and Godfrey N. Hounsfield were awarded the Nobel prize for medicine and physiology for the progress in diagnostics by computerized tomography. The need was felt to on-line access patient data, including progress reports (described on pages 394-6) and to use these data for multiple purposes: for patient care, for administrative and management purposes, and last but not least, for clinical and epidemiological research. All health professionals should be users of computer-supported medical information systems, not only physicians or hospital administrators.

Besides the need for sufficient computing and storage capacity, Collen described in great detail the necessity of well-educated professionals in health care for managing and operating such an information system, also taking into consideration project management or information systems analysis. At that time, to our knowledge, only the Ph.D. program at the University of Utah existed as dedicated program in medical informatics. The medical informatics program at the University of Heidelberg/School of Technology Heilbronn started two years afterwards in 1972, the Health Information Systems Program of the University of Minnesota in 1973 ([9], pp. 255-6). Today, management boards of health-care institutions still have to be convinced that for good information processing practice not only investments in appropriate information technology are necessary, but also in well-educated staff and well-trained users.

4. Where have Insights Changed?

What early views expressed in Collen's paper are no longer valid? Where have insights changed?

Insights certainly have changed in the technology and methodology for information processing; the reasons have been outlined in the first section of this commentary.

In our opinion it turned out that the complexity of information systems management is more difficult than expected. The main reason is that we are still concerned with problems Collen mentioned in his article. There still is a lack of integrated, patient centered information processing. The majority of computer-supported hospital information systems, for instance, is still focused on supporting administrative and diagnostic service departments. In many countries and in many health-care institutions, boundaries for fast and comprehensive information exchange for patient care still exist, although technically there are no major problems anymore. For instance, most countries still do not have a unique patient identification, as was requested by Collen ([1], p. 398). Of course, there are exceptions. However, there still is a long way to go before we will have fulfilled the requirements, Collen phrased in 1970. In addition to the technology of information processing we certainly have to focus on a more efficient organization of health care, and especially, its information management.

Insights have also changed with respect to the persons who need information. In the 1970s it was clear that computer systems had to provide information and had to support decision making for health-care professionals. Nowadays, also patients request better information, in addition to the care provided by the health professionals. This trend, caused by increasing self-awareness of patients in many countries and by new technological possibilities, such as Internet access to medical knowledge sources, will continue to increase. Owing to the achievements of modern medicine, particularly in the area of acute diseases,

chronic diseases and multimorbidity caused by age, this need for more information will grow. In societies where the average age of the population increases, the need for "patient directed information systems", supporting diagnosis and therapy will grow.

5. Medical and Health Information Systems; Still with Boundaries

In an excellent special topic issue of the International Journal of Biomedical Computing on "hospital information systems with fading boundaries", summarizing a conference on hospital information systems in 1994, one of the main messages was: "Whereas the preceding" ... conferences considered the scope of the Hospital Information Systems (HIS) to be restricted to the information systems within the borders of the institution, this conference was of the opinion that functions outside the hospital also need to be included in the definition, i.e., HIS broad-

ens its meaning to Health Information Systems" ([10], p. 11).

We have to recognize that, despite a remarkable progress in health care through information technology and methodology, boundaries in information exchange between health-care institutions still exist otherwise they could not fade. Let us continue the work of Morris Collen on patient-centered, computer-supported health or medical information systems.

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