

From Papyrus to the Electronic Tablet: A Brief History of the Clinical Medical Record with Lessons for the Digital Age

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ABSTRACT

A major transition is underway in documentation of patient-related data in clinical settings with rapidly accelerating adoption of the electronic health record and electronic medical record. This article examines the history of the development of medical records in the West in order to suggest lessons applicable to the current transition. The first documented major transition in the evolution of the clinical medical record occurred in antiquity, with the development of written case history reports for didactic purposes. Benefiting from Classical and Hellenistic models earlier than physicians in the West, medieval Islamic physicians continued the development of case histories for didactic use. A forerunner of modern medical records first appeared in Paris and Berlin by the early 19th century. Development of the clinical record in America was pioneered in the 19th century in major teaching hospitals. However, a clinical medical record useful for direct patient care in hospital and ambulatory settings was not developed until the 20th century. Several lessons are drawn from the 4000-year history of the medical record that may help physicians improve patient care in the digital age.

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In the first decades of the 21st century, a major transition is underway in documentation of patient-related data in clinical settings with rapidly accelerating adoption of the electronic health record and electronic medical record.¹⁻³ Stimulated by financial incentives in the 2009 American Recovery and Reinvestment Act and the 2010 Affordable Care Act, the electronic health record/electronic medical record is expanding beyond governmental providers such as the Veterans Administration, health maintenance organizations such as Kaiser Permanente, and academic health systems such as Mayo Clinic, to small medical groups in the community, which are increasingly affiliating with hospital systems. This article examines the history of the development of medical records in the West. This history suggests lessons applicable to help physicians improve

patient care using electronic health records/electronic medical records.

The first documented major transition in the evolution of the clinical medical record occurred in antiquity with the development of written case history reports for didactic purposes. An early example of didactic recording is an Egyptian case report from a papyrus text on surgery dating to 1600 BC.⁴ Of great influence in the West were the case histories of Hippocrates of Cos (c. 460 BC -c. 370 BC) and the Hippocratic School, active in the 5th century BC.⁵ The Hippocratic Corpus and other Greek scientific texts were translated into Arabic in the medieval period.⁶ Benefiting from Classical and Hellenistic models earlier than physicians in the West, medieval Islamic physicians such as al-Razi (860-932) continued the development of case histories for didactic use (**Figure 1**).

In the 17th century, the rise of natural science, including human anatomy based on observation from dissection rather than classical authorities, and its increasing application to medicine, gave further stimulus to the impulse to systematically record case histories for didactic purposes and anatomical correlation.^{7,8} By the mid-18th century, not a few physicians in Western Europe kept case books, which

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have been transcribed and examined.⁹⁻¹¹ Trained in Edinburgh, the prominent American physician Benjamin Rush (1745-1813) kept detailed case books, which recorded his practice of bleeding and purging for most conditions.¹² Regarding hospital records in the US, the New York Hospital, which opened in 1791, first kept patient records in 1793, but these consisted only of line items in admission and discharge books.^{13,14}

Before 1800, diagnoses were based on subjective symptoms of the patient; physical examination played a minor role. The emergence of quantitative measurement in clinical medicine pioneered by the French Clinical School and German laboratory medicine gave an important stimulus to systematic recording of an ever-increasing volume of data.^{7,8} New research methods such as the numerical method of Pierre Louis (1787-1872) could be applied to series of case histories to test hypotheses about disease causation or therapeutic efficacy, increasing the value of archives of such histories in medical centers.⁸ A forerunner of modern medical records first appeared in the West in the form of loose paper files in major centers such as Paris and Berlin by the early 19th century.⁹

Development of the clinical record in America occurred first in major teaching hospitals. Before the late 19th and early 20th centuries, the hospital was a charitable institution for the poor staffed by volunteer physicians because little or no benefit was available there that the patient with means could not obtain at home. In 1808, the New York Hospital began copying selected case reports from physician notebooks into bound medical and surgical volumes for preservation in the library.^{13,14} Intended for didactic and archival purposes, data included “the history of the disease—the causes producing it—the remedies employed—and the result of the case...” Later they served as a resource for research (Figure 2). By the 1880s, concerns about the medical record as a legal document in insurance and malpractice cases motivated administrators of New York Hospital to attempt to supervise record content and quality.¹⁴ However, these records were not used for patient care, which was served by the physicians’ private notes. It was not until 1898 that the patient record originating at the bedside rather than an abstract or copy became the official hospital record.

Similarly, from 1821 the house physician at the Massachusetts General Hospital, founded in 1821, recorded his admission findings and notes dictated by the attending physician in his journal and copied information to the hospital case book, to which the attending referred as needed.¹⁵ However, data recorded were scanty until the late 19th

century. Modeled on the use of the case history at Harvard Law School, Walter Cannon pioneered its greater use in teaching at Harvard Medical School⁸ (Figure 3). By the late 19th century, these medical records consisted of sections for family history, patient habits, previous illnesses, present illness, physical examination, admission urine and blood

analyses, terse daily or less frequent progress notes, and discharge diagnosis and instructions. Records were kept serially in bound volumes, and separate volumes were kept by medical and surgical inpatient services and the outpatient service. Hence, a patient’s data were widely scattered and hard to retrieve, and data could be incomplete. In the US and Canada, the casebook, daybook, and diary were among the forms commonly used by private physicians in the 19th century.^{16,17}

In the US, a clinical medical record useful for direct patient care in hospital and ambulatory settings was not developed until the 20th century. In the late 19th and early 20th centuries, an acceleration of the evolution of hospitals towards their modern

form in the US and Europe coincided with professionalization and specialization of medicine and reforms of medical education beginning at leading institutions. Reforms in medical education were stimulated by the Flexner Report of 1910 and follow-on activities of the Rockefeller Foundation and others.¹² However, hospital records from the service of William Osler (1849-1919) at the Johns Hopkins Hospital were scanty and seldom signed.¹⁸

To address the problem of scattered, disorganized data, a major innovation to further education and patient care based on models from business and industry was introduced in 1907 at St Mary’s Hospital and the Mayo Clinic by Henry S. Plummer (1874-1937) (Figure 4).¹⁹ Each new patient was assigned a clinic number, and all data for that patient were combined in a single record. An analysis of the first 100 clinic numbers found that the charts consistently listed chief complaint, objective symptoms, subjective symptoms, and diagnosis, but data on medical treatment provided were scanty; an operative note was a mere sentence; a pathology report was a diagnosis; and a dismissal summary was lacking.¹⁹ The unit medical record was developed further after 1916 at Presbyterian Hospital in New York. To address the problem of failure to record relevant data in the hospital record, a second major innovation was that of requiring basic clinical data to be recorded in a standard format.^{14,19} In 1918, the American College of Surgery launched a program to require hospitals to keep records on all patients, including a summary of care and outcomes, which could be used for quality improvement. Less than a fifth of physician offices

CLINICAL SIGNIFICANCE

- A major transition is underway in documentation of patient-related data in clinical settings with adoption of the electronic health record/electronic medical record.
- This article examines the history of the development medical records in the West from antiquity to the 21st century.
- This history suggests lessons applicable to the current transition; for example, physicians must play a vital role in medical practice redesign to effectively use and benefit from this new technology.



Rhazes of Bagdad Used Harp Strings for Sutures

RHAZES, the Arabian surgeon who practiced in Bagdad in the ninth century, reported the suturing of abdominal wounds with strings of

Figure 1 Drawing of al Razi (Rhazes of Baghdad) who preserved and enhanced the Hippocratic practice of didactic case histories. Source Images in the *History of Medicine*, National Library of Medicine.



Figure 3 Walter Cannon encouraged the expanded use of case histories for teaching students at Harvard Medical School. Source Images in the *History of Medicine*, National Library of Medicine.

kept adequate records.¹⁵ As increasing numbers of hospitals attempted implementation of these reforms, hospital records grew in volume and complexity and, although much

improved, suffered from problems of unreliable availability, illegibility, and lack of ready availability of records from other hospitals or physician offices.

Developments in science and medicine following World War II were reflected in rapid improvements in the hospital record.^{7,12} However, the number of citations with “medical records” in the title changed little (41 in 1945-1949 and 42 in 1950-1954, 43 in 1955-1959) until a rapid increase in varied journals after 1960 (in title/in all fields 60/687 in 1960-1964; 113/1763 in 1965-1969; 171/3098 in 1970-1974; 260/3737 in 1975-1979, compared with 414/37,950 in 2005-2009). The problem-oriented medical information system for reorganizing and summarizing content was introduced by Weed in the 1960s.²⁰

In Europe, national governments played an important role in development of the medical record because of the early adoption of public health insurance. For example, in the UK, the National Insurance Act of 1911 mandated compulsory insurance for working men aged 16 to 70 years and required that participating general practitioners keep record cards in a format specified.²¹ This system of color-coded cards and envelopes was retained by the new National Health Service created in 1948. Attempts to reform the general practitioner record system began in the 1970s.^{21,22}

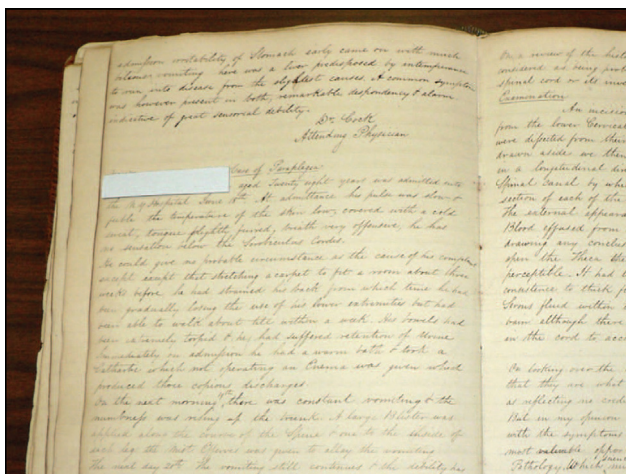


Figure 2 A case and explanation from the first casebook of New York Hospital, 1818. (Source: Dr E. Siegler, Weill Cornell Medical College, and the Archives of NewYork-Presbyterian/Weill Cornell Medical Center; Annals of Internal Medicine by permission).



Figure 4 Henry S. Plummer created and implemented the first unit medical record system at Mayo Clinic St. Mary's Hospital in Rochester, Minnesota in 1907. Source Images in the History of Medicine, National Library of Medicine.

Conceived as a solution to problems inherent in paper records, the development of the electronic health record and electronic medical record has been rapid compared with that of the modern medical record itself, as described extensively elsewhere.^{1-3,23-28} Stimulated in Europe by national health insurance systems and in the US by demands of Medicare/Medicaid, health maintenance organizations, quality review, and Institute of Medicine panels, great strides have been made since the pioneering work of the 1960s.^{1-3,15,23-25} In 2011, over 50% of physicians reported having an electronic health record system.²⁴ In light of projected major benefits, the actual performance of leading commercial electronic health record systems has been the subject of much criticism in the literature and by practitioners.^{2,3,26-28} A recent systematic review of studies of the impact of the electronic health record in the clinical setting found that only about half the studies reported a positive impact while a fifth showed negative impact and the rest no impact.³ Critics complain that vendors have produced electronic health records that are not innovative as compared with systems used by other industries or by consumers, are not user friendly, are not interoperative, and are excessively costly.^{2,28} Other information technology applications in business and

industry of the Internet age can provide models for further innovation in the electronic health record/electronic medical record, just as law school and business practices suggested improved medical school practices to Walter Cannon and Henry Plummer a century ago. Clinicians want to better understand the disease mix, outcomes, and treatments of patients under their care. Unfortunately, the reporting and data analysis tools in most current electronic health records are not nearly as convenient and user friendly as they should be.

What lessons can be drawn from the 4000-year history of the case history and medical record that may be useful in the digital age? First, physicians must not allow technology to devalue the doctor-patient relationship and a continuity of care in which the patient as person maintains a place in the memory of a clinician, not merely a computer. The electronic health record/electronic medical record must enable this relationship, not interfere with it as when the physician faces a computer screen with back towards the patient.

Second, physicians may expect that progress in implementing the electronic health record/electronic medical record widely and documenting a positive impact on population health, patient experience, and cost will likely be slower than hoped for, as was the case with medical record reform efforts in the early 20th century. Physicians must play a vital role in medical practice redesign to effectively use and benefit from this new technology.

Third, the ability to capture and utilize the overwhelming volume of medical data, both patient-specific and from medical science, should be a criterion for physicians in selecting a clinical record system.

Fourth, physicians must expect that the incorporation of more extensive behavioral health and social determinants information in the medical record will require changes in structural, organizational, and privacy standards for the traditional physiologically oriented clinical record.

Fifth, physicians must insist that didactic applications for the electronic health record/electronic medical record should be actively sought. It should become a tool for self-evaluation and learning for physicians as well as for teaching in graduate and postgraduate medical education.

Finally, electronic health record/electronic medical record developers and global health agencies and physicians must attempt to adapt this technology to serve the hundreds of millions in the poor nations of the world who still lack basic primary care services.

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