The Electronic Patient Record (EPR) in South Africa

De Wet, L
B.Com., B.Com. (Hons), M.Sc., Ph.D.

McDonald, T
B.Sc., B.Sc. (Hons), M.Sc., Ph.D.
Department of Computer Science
and Informatics
University of the Free State
Bloemfontein, South Africa

Pistorius, GJ
MB, ChB, M (Med Dom), M.D. (Pret)
Department of Family Medicine
University of the Free State
Bloemfontein, South Africa

Address for Correspondence:
Dr. Lizette de Wet
Department of Computer Science
and Informatics
University of the Free State
P. O. Box 339
Bloemfontein, 9300
Tel: 051 401 3705
Fax: 051 401 3728
E-Mail: lizette@wwg3.uovs.ac.za

Abstract

Physicians drown in the amount of information engulfing their day-to-day tasks. The invention of the patient record was the first step towards bringing order to this situation. Worldwide, however, numerous problems are experienced with the paper medical records (PMRs) that have been in use in medical practices for the past few years. The obvious answer to these problems is an electronic patient record (EPR).

In South Africa (SA) the EPR is not generally used, despite its well-known potential advantages. Focusing on general practice, an EPR research project was therefore undertaken at the UFS. Despite some problems that were foreseen beforehand, a clear impression was gained that SA GPs believe in the concept of the EPR. Consequently two prototype EPR systems were developed and evaluated. The second prototype addressed the PMR and potential EPR problems and explored the majority of potential advantages of an EPR.

Introduction

Information drives the practice of medicine. Clinical information can be defined as "the commodity used to help make patient-care decisions".[1] Physicians must use it every time they see a patient, perform a procedure, or consult a colleague.[2] The sheer size of the medical knowledge base (existing and new medical facts, new research projects and results, etc.) poses a forbidding problem for the health-care practitioner. Physicians keep most of the information that is used when seeing patients in their heads. Unfortunately, some of the information in the physician's head is wrong and outdated. New information may not have penetrated and therefore may not be there to deal with patients with uncommon problems.[3]

Medical practitioners therefore desperately need assistance in order to stay informed, to be productive and to provide quality health care to their patients.[4] The latter implies that they do not only need to keep up with existing and new medical facts (external information explosion), but must also keep track of all the data created as part of day-to-day patient

consultations (internal information explosion). Examples of internal information include the personal details of every patient, the medical history of the patient, data resulting from the physical examination of each patient, and the subsequent diagnosis. This type of information is generated daily for every patient who consults a physician. Consequently physicians drown in the resultant medical facts of the *external* and the *internal* information explosion. The creation of the patient record was the first step towards bringing order to this internal information.

In this article the paper medical record (PMR) will first be defined. Its strengths and weaknesses will subsequently be outlined. The transition from paper to electronic patient record (EPR) will then be explained. The potential contents, strengths and problems of the EPR will be investigated. After exploring the status of the EPR in the rest of the world as well as in South Africa, a South African EPR initiative will be discussed. Specific mention will be made of how this initiative attempted to address the positive and negative aspects of the PMR and EPR.

Paper patient (medical) records

The patient record has probably existed ever since people with medical skills reported on a patient's course of disease and treatment. Physicians have always collected and stored data on their patients. This data served as a memory aid for ongoing diagnosis and management in the provision of continuing medical care.

What does a patient record (also referred to as a medical record) generally entail today? A patient record is a confidential record that is kept in respect of each patient by a health-care professional or organisation. It contains the patient's personal details (such as name, address, and date of birth), a summary of the patient's and his/her family's medical history, and documentation of every event (collection of the physician's notes), in-cluding symptoms, diagnosis, treatment and outcome (interpretation). Ins-urance information is also documented.[5] Relevant documents and correspondence are included, as well as images and graphs. Traditionally, every health-care provider involved in a patient's care has kept an independent record, usually paper-based – from whence the term *paper medical record (PMR)*. These PMRs are usually considered to be static, time-sequenced, and owned by the institution or practice where they are stored. The main purpose of the patient record is to provide a summary of a person's contact with a health-care provider and treatment provided to ensure appropriate health-care.[6]

Strengths and weaknesses of the PMR

The PMR has some special strengths and advantages associated with it. This is evident when one considers how long it was able to survive – it is still widely used today. The PMR is a familiar concept – everyone is familiar with pen and paper! It is portable (it is as simple as picking up a file and handing it to somebody else), it allows for flexible data recording (the physician can include anything according to his/her personal preferences), it can be browsed or scanned easily, and does not depend on technical requirements and computer "down-time".[7] Another important advantage is that PMRs do not require special training.[8]

About a quarter of a century ago researchers began to draw attention to the shortcomings of the paper medical record. Table I summarises some of the major weaknesses of the PMR.[9,10,11,12,13,7]

A distinguished American physician commented: "The (paper) medical record is an abomination ... it is a disgrace to the profession that created it. More often than not the chart is thick, tattered, disorganised, and illegible; progress notes, consultant's notes, radiology reports, and nurses' notes are all co-mingled in accession sequence. The charts confuse rather than enlighten; they provide a forbidding challenge to anyone who tries to understand what is happening to a patient".[14]

Table I: *Weaknesses of the PMR*

Poor organisation of documents and records
Incompleteness of information as a result of missing or misplaced files
Wasting of time when searching for missing or misplaced files
Inaccuracy
Ambiguity
Illegible handwriting
A paper record can only be in one location at a time
Duplication
Double entries necessitated by the need to record the same data many times on different documents
Paper-based data play a passive (in contrast to an active) role in the decision-making process

The electronic patient record (EPR)

As mentioned before, the need to improve the management of medical information is now critical as a result of the explosion of medical information, and also as a result of the need to provide extensive documentation of patient care to the ever-increasing list of interested parties.[8,15] This realisation has lead to the development of Medical Informatics, which can be defined as "the development, use, and evaluation of information technology in health care".[16] (Note that this is only one of many existing definitions that have been formulated.) Technological progress in the form of the tremendous potential of computer technology has led to great enthusiasm for, and high expectations of the application of computer technology to health care.[9] The price of personal computers is decreasing, while speed and storage capacity continue to increase. Hospitals and general practices are becoming more complex, and the computerisation of many administrative processes is vital to strategic planning and resource management.[17]

The foundation of health information cannot be laid by simply automating the existing paper medical record or by creating massive databases. A fundamental change in information collection, use, and access is necessary. This change is embodied in the concept of the electronic patient record.[18] An alternative term that is sometimes used is "computer-based patient record" (CPR). It is important to note that the term refers to a *computer-based* and not a *computerised* patient record. This re-emphasises the above-mentioned fact that true EPRs are more than automated versions of current paper patient records.[19] The term "electronic patient record" also implies that the record focuses on, and is integrated around the patient. The EPR is a complex multi-media record. The ultimate goal is that it will consist of all the clinical information on a single patient throughout his/her whole life. This will constitute a true life-long EPR.

According to Andreu and Dick[20], the purpose of EPR technology is threefold, namely to improve access to patient data, to improve quality of health services, and to reduce costs.

Potential contents of an EPR

It will be impractical to include all the possible EPR content alternatives in the limited scope of this article. However, the Institute of Medicine (IOM) Report published in the United States of America (USA)[21] in 1991, produced quite a representative list of contents of comprehensive EPRs. Logan and Blackman[22] added a list of functions (Table II). It should, however, be borne in mind that it will be virtually impossible to find a single system that will meet all of the requirements as listed in Table II.

Potential strenghts / advantages of the EPR

The potential benefits of the EPR are widely recognised. The evaluation of

Table II: Content and functions of comprehensive EPRs and EPR systems

Include a problem list
Support systematic measurement of health status and functional level
Document the clinical rationale for patient care decisions
Link to other clinical records across settings and across time to provide a longitudinal record
Provide comprehensive confidentiality safeguards
Offer easy access to authorised users
Allow selective retrieval and formatting of information
Link to local and remote knowledge, literature, bibliographic or administrative databases and systems
Assist in the clinical problem solving process
Support structured data collection and store data using a defined vocabulary as well as support direct data entry by practitioners
Aid in the management and evaluation of quality and costs of care
Be flexible and expandable
Include a medication list
Include an allergy list
Include a family history
Include a social history
Include referrals
Include an order entry and reporting function
Include a printing/fax facility
Include a billing/management function
Include scheduling

systems already in place and the analysis of the concept have led to a variety of positive findings concerning the EPR.

In a broader sense computerisation of health information provides many opportunities to improve a nation's health care, while simultaneously reducing costs. Informed decision-making will depend on improved access to the considerable amount of clinical information. Better clinical decisions will improve quality and lower costs. Clinical information, pooled in regional and national databases and available via networks, will be an important source of information on which national health policies can be based. The availability of this pool of information would be a direct result of having EPR systems in place. It could result in the following[20]:

- The undertaking of clinical studies on effectiveness and applicability
- Acceptable reimbursement policies
- Scientific hypotheses for further research.

The availability of patient data in electronic form already has important advantages compared to the paper predecessor. Patient records can be accessed at multiple locations. Patient data no longer needs to be scattered and the problem of illegible notes has been eliminated.[9]

The ability of computers to use single items in multiple ways is also of great help as far as the EPR is concerned. Double entry is eliminated, time is saved, and it obviates the tedium of writing referral letters or laboratory requests and reports. The increasing demands for data by members of the health-care team and requests by patients for access to their records can be met, and it enables quality control efforts to focus on the single point of data entry.[7]

Apart from being advantageous to the physicians and patients, the EPR can also serve groups such as pharmaceutical manufacturers, insurance companies, large company employers, health-care service firms, health-care consultants, and health-care service researchers.[20]

Potential problems regarding an EPR

Despite the above-mentioned potential advantages associated with an EPR system, it would be simplistic to assume that no problems will be encountered in venturing into this concept's application. Table III[23] summarises the major potential problems foreseen regarding the use/functioning of an EPR system and its introduction into general practice, Table IV[23] provides insight into the problems foreseen.

Table III: *Problems foreseen regarding the use / functioning of an EPR system*

Recording of work performed outside the consulting room, e.g. house calls
Problems in linking iformation (e.g. hand-written reports) with EPR system
Relationship of trust with the patient
Process of change from a manual system
Computer tasks interfering with existing normal tasks
Immediate recording of a visit
Lack of general standards regarding clinical vocabulary
Resistance on the part of the patients
Changed working method
Lack of general standards regarding patient identification
Not adaptable to changing circumstances
Power failures in the country side and viruses

Table IV: *Problems foreseen with / objections against EPRs in general practice*

Cost: Initial capital investment (software, hardware, facilities)
Cost: Operating cost
Time: Duration of patient encounter
Time: Training of physicians and supporting personnel
Personnel attitudes
Computer illiteracy
Security
Ethics
Quality of information
Lost information when linking with other institutions

The status of the EPR in the rest of the world and South Africa

EPR systems have been developed in many parts of the world. Some of the countries involved include Belgium (e.g. HEALTH *one*[24]), Canada (e.g. the FAMUS project[25]), Israel (e.g. CLINIC[26]), the Netherlands (e.g. Elias[27]), the UK (e.g. EMIS[28]), and the USA (e.g. EpicCare[29], the EPR at the Mayo Clinic[30], and Pathways Smart Medical Record[31]).

In South Africa (SA) a few initiatives have been taken. One such initiative was the MEDITECH system as used by AngloGold Health Services. However, as far as could be determined, the MEDITECH system does not meet the needs of private practice. In the Free State the major users of the system are the Universitas and Pelonomi Hospitals.

The only other recognised effort regarding the EPR was made by Brainware Health, the developers of Brainware98. Whereas existing medical systems in SA in the past mainly addressed the administrative and financial aspects of the medical practice, Brainware98 combines this information with a relatively extensive clinical facility. It appears to be a professional and comprehensive system. The clinical information is, however, spread across the whole system. Different clinical fields appear on different screens, sometimes combined with information not directly applicable to a clinical consultation. In order to be able to utilise the clinical section, an extensive knowledge of the system, as customised, is therefore required.

Therefore, although interest in the topic exists, EPR systems are not yet used widely in medical practices. With the exception of Brainware98, EPR systems directed at South African use are not yet available in the market for general practitioners (GPs) to choose from.

A South African EPR in general practice research project

Twenty-five years after the inception of the EPR concept, there is still no EPR in widespread use that fully replaces the paper chart (with a few exceptions in the case of primary care). Apparently physicians believe that the potential benefits of the EPR do not yet outweigh the strengths of the PMR.[9]

In order to assess the EPR issue in SA (specifically in general practice), a joint research project was undertaken by the Department of Computer Science and Informatics and the Department of Family Medicine at the University of the Free State (UFS). In order to ascertain whether a need for EPR systems exists, identify problems associated with current PMRs, and identify the requirements, expectations, and needs regarding EPR systems, a questionnaire was sent to 150 randomly selected GPs. Despite some problems that were foreseen beforehand, the results of the questionnaires[23] left the researchers with a clear impression that GPs believe in the concept of the EPR, that they definitely feel a need for it and that they would use it should it become available. This triggered the next phase of the research project, namely the designing of EPR prototype systems aimed at meeting the needs of GPs in SA.

Two prototype systems were developed. After completion of the second prototype, an extensive usability evaluation (which included query techniques, heuristic evaluation and empirical usability tests) was performed to test the viability of the EPR in general practices in SA and to test design principles. Despite the fact that some minor adjustments were suggested, the evaluation results indicated that the second prototype appeared to be a vast improvement on the first. (Refer to Figure 1 and 2 for screen examples of the second prototype). It also appears that the majority of weaknesses of the PMR (Table I) were largely overcome.

In order to determine whether the potential strengths of an EPR were explored in the second prototype, it may be meaningful to refer to Table II for the list of contents and functions of comprehensive EPRs. Although the second prototype addresses the majority of the content and function requirements listed in Table II, it does not address all the potential strengths of the EPR. One of the reasons is that SA is not yet geared to provide links from the EPR to other clinical records across settings and across time in order to provide a longitudinal record. A conscious decision was made not to include an extensive dispensing

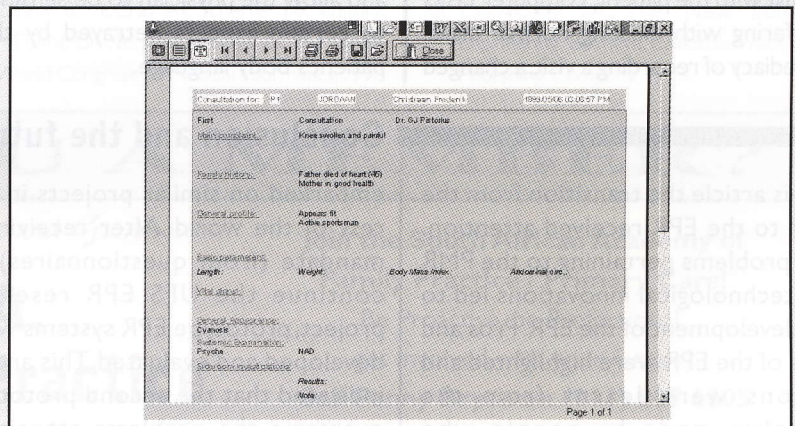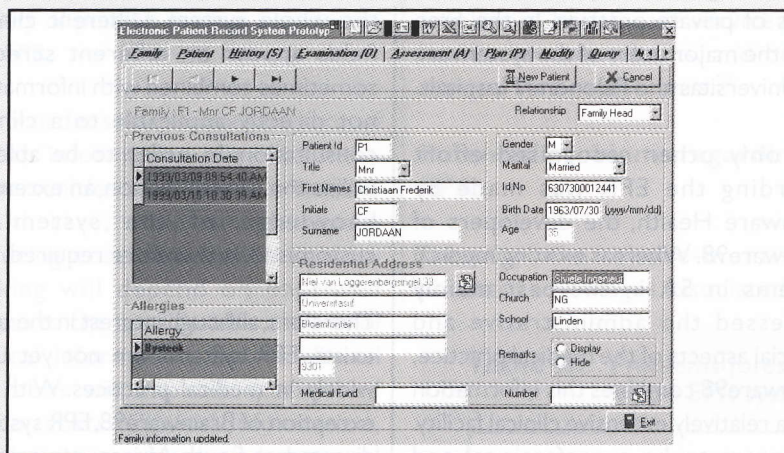**Figure I:** *An example of a clinical note on the screen in the second prototype*

Figure II: *The patient screen in the second prototype*

function in the prototype, the reason being the many existing dispensing programs already in use in medical practices — there is no need to re-invent the wheel. (For those physicians who do not have access to these types of programs, the second prototype provides a limited dispensing function where the physician is required to add his/her medication list). The re-inventing argument applies to the inclusion of order entry and billing/management functions. In future the EPR should, however, be able to link with these existing systems. Scheduling is a useful function that has not yet been addressed in the second prototype.

Table III lists some problems foreseen regarding the use/functioning of the EPR. The second prototype offers solutions to the problem of recording work performed outside the consulting room. The problems related to the relationship of trust with the patient, computer tasks interfering with existing normal tasks, immediacy of recording a visit, a changed

working method, the duration of the patient encounter, and resistance on the part of the patients will largely depend on the manner in which the physician handles the consultation. It is true that the introduction of an EPR system into a practice will necessitate changes, especially in the mindset of the physician. When the physician takes the patient into his/her confidence concerning the changes brought about by the introduction of a computer, the patient should theoretically trust the physician with his/her clinical information in the same way as he/she trusted him/her with a paper version thereof. Just as the physician would, for example, look the patient straight in the eye while listening to the main complaints before starting to write the note, he/she should refrain from using the computer during this stage of the consultation. This will build confidence and allow the physician to be sensitive to certain aspects betrayed by the patient's body language.

Power failures (especially in the countryside) and viruses do pose a problem. A stringent backup policy would, however, minimise the impact of any lost information. In case of power failures, the physician should provide for a paper form on which information can be recorded manually for the duration of the power failure. This information can then be transferred to the computer at a later stage.

Issues regarding the EPR that still need to be researched, include standards, ethics, privacy, security, and legal aspects. This is true worldwide. In SA a first step regarding standards has been taken with the establishment of a subcommittee which will be responsible for all national standardisation in the field of Health Care Informatics. All the above-mentioned aspects become particularly important when one considers the idea of presenting an EPR system via the Internet.

With regards to problems foreseen with EPRs in general practice (Table IV), it is understandable that the initial capital investment might pose a problem. In future, however, no private practice will be able to survive without computer technology.

When an EPR is introduced, personnel should be briefed regarding the future advantages. They should be sent on computer literacy courses (an asset to the practice) to make this transition as easy as possible. This would facilitate use of the system as far as, for example, handling the mouse is concerned.

Conclusion and the future

In this article the transition from the PMR to the EPR received attention. The problems pertaining to the PMR and technological innovations led to the development of the EPR. Pros and cons of the EPR were highlighted and lessons were learnt from the mistakes made by people who

embarked on similar projects in the rest of the world. After receiving a mandate (from questionnaires) to continue the UFS EPR research project, prototype EPR systems were developed and evaluated. This article indicated that the second prototype overcame the problems associated
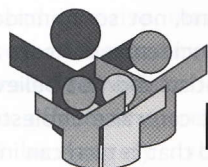
with the PMR and the EPR, and explored the potential strengths of the EPR as well. The next step will be to present a model of a proposed EPR system specifically designed with the assistance of GPs in SA and according to their requirements and needs.

References

1. WYATT JC. Medical Informatics: Artefacts or Science? Methods Inf Med 1996;35:314-7.
2. TONKS A, SMITH R. Information in Practice: Make it work for patients. BMJ 1996;313:438.
3. SMITH R. Information in Practice: What Clinical Information do Doctors Need? BMJ 1996;313:1062-8.
4. ORNSTEIN SM. Electronic Medical Records in Family Practice: The Time is Now. J Fam Pract 1997;44(1):45-8.
5. OLSEN K. Computerised Patient Records. http:// snad.ncsl.nist. gov/snad-staff/ olsen/pubs/ titledb/ node3.html. Aug 18, 1995.
6. NEAME RLB. Electronic Medical Records. http:// www.health.govt.nz /NZHIS/EMR.html. Jul 16, 1996.
7. LIAW ST. The Computer-Based Patient Record – An Historical Perspective. Published in HISA HOME Magazine Back Issues, Nov 1993. http://www.hisavic. aus.net/ hisa/mag/nov93/the.htm. Jun 18, 1996.
8. DICK RS, STEEN EB. The Computer-based Patient Record: An Essential Technology for Health Care. In: Dick RS, Steen EB, editors. Committee on Improving the Patient record Division of Health Care Services – Institute of Medicine. Washington, D. C.: National Academy Press; 1991.
9. VAN GINNEKEN AM. The Structure of Data in Medical Records [Review Paper]. Yearbook of Medical Informatics 1995: The Computer-based Patient Record 1995:61-70.
10. BARNETT GO. The Application of Computer-based Medical-record Systems in Ambulatory Practice. N Engl J Med 1984;310:1643-50.
11. BURNUM JF. The Misinformation Era: The Fall of the Medical Record. Ann Intern Med 1989;110:482-4.
12. MOORMAN PW, VAN GINNEKEN AM, VAN DER LEI J, SIERSEMA PD, VAN BLANKENSTEIN M, WILSON JHP. The Contents of Free-text Endoscopy Reports: An Inventory and Evaluation by Peers. Endoscopy 1994;26:531-8.
13. WYATT JC. Clinical Data Systems, Part 1: Data and Medical Records. Lancet 1994;344:1543-7.
14. BLEICH H. Computer-based Medical Records. Computing 1993;10(2):70.
15. BARNETT GO, JENDERS RA, CHUEH HC. The Computer-based Clinical Record – Where do we stand? Ann Intern Med 1993;119:1046-8.
16. HERSCH WR, LUNIN LF. Perspectives on Medical Informatics: Information Technology in Health Care. Introduction and Overview. Journal of the American Society of Information Sciences 1995;46:726-7.
17. KALRA D. Electronic Health Records: the European Scene. BMJ 1994;309(6965):1358-61.
18. COMPUTER-BASED PATIENT RECORD INSTITUTE. Standards for Computer-based Patient Records. http://www.cpri.org/conf .html. Jul 16, 1996.
19. DETMER DE, STEEN EB. Countdown to 2001: The Computer-based Patient Record After the Institute of Medicine Report [Review Paper]. Yearbook of Medical Informatics 1995: The Computer-based Patient Record: 1995:55-60.
20. ANDREU WF, DICK RS. Applied Information Technology: A Clinical Perspective Feature Focus: The Computer-based patient Record (Part 1). Comput Nurs 1995;13(2):80-4.
21. INSTITUTE OF MEDICINE. (US). The Computer-Based Patient Record: An Essential Technology for Health Care. Washington: National Academy Press; 1991.
22. LOGAN JR, BLACKMAN JA. The Choice of Outpatient CPR's: Questions to Ask. http:// www.informatics-review.com/thoughts/ askcpr.html. Jan 13, 2000.
23. DE WET L, McDONALD T, PISTORIUS GJ. The Electronic Patient Record in General Practice – A South African Perspective. In: Cesnik B, McCray AT, Scherrer J-R, editors. MEDINFO 98. Proceedings of the Ninth World Congress on Medical Informatics; 1998 Aug; Seoul, Korea. Amsterdam: IOS Press; 1998;1:9-13.
24. HEALTH DATA MANAGEMENT PARTNERS. Health one. http:// www.hdmp.com. Feb 9, 1999.
25. GRANT A, DELISLE E, DUBOIS S, NIYONSENGA T, BERNIER, R. Implementation of a Province-Wide Computerised Network in Quebec: The FAMUS project. Clinical Computing 1995; 12(1):45-9.
26. WARSHAWSKY SS, PLISKIN JS, URKIN J, COHEN N, SHARON A, BINZTOK M, MARGOLIS CZ. Physician use of a Computerized Medical Record System during the patient Encounter: A Descriptive Study. Comput Methods Programs Biomed 1994;43:269-73.
27. VAN DER LEI J, DUISTERHOUT JS, WESTERHOF HP, VAN DER DOES E, CROMME PVM, BOON WM, VAN BEMMEL, JH. The Introduction of Computer-based Patient Records in the Netherlands. Ann Intern Med 1993;119(10):1036-41.
28. PRINGLE M, WARD P, CHILVERS C. Assessment of the Completeness and Accuracy of Computer Medical Records in Four Practices Committed to Recording Data on Computer. British Journal of General Practice 1995; 45:537-41.
29. CHURGIN PG. Introduction of an Automated Medical Record at an HMO clinic. MD Computing 1994;11(5):293-300.
30. CARPENTER PC. The Electronic Medical Record: Perspective of the Mayo Clinic. International Journal of Bio-Medical Computing 1994;34:159-71.
31. TURBO GUIDE. Home page. Pathways Smart Medical Record. http:// medical.software-directory.com/cdprod1/ swhrec/021/624.shtml. Jul 3, 1999.
32. CONGER SA. The New Software Engineering. Belmont, California: Wadsworth Publishing Company; 1994.