Association for Information Systems
AIS Electronic Library (AISeL)

AMCIS 1998 Proceedings

Americas Conference on Information Systems (AMCIS)

December 1998

Using Electronic Commerce to Improve Health Care Management

Guisseppi Forgionne
University of Maryland Baltimore County

Jo-Ann Klein
University of Maryland Baltimore County

Robert Eckhardt
University of Maryland Baltimore County

Using Electronic Commerce to Improve Health Care Management

Guisseppi Forgionne
Aryya Gangopadhyay
Jo Ann Klein
Robert Eckhardt
Information Systems Department
University of Maryland Baltimore County

Abstract

While some health claims are processed electronically, many others are not. In addition, the electronic transactions rarely capture data that would be very useful to provider and payer decision makers. As a result, clinical, administrative, and policy decisions often are made with incomplete and outdated information. This paper presents an integrated information system that can alleviate these shortcomings and promote effective electronic commerce in health care.

Introduction

Consumers generate many transactions when seeking and obtaining health care. These transactions are processed by the providers into patient records, administrative accounts, payment claims, and other relevant data. Typically, the payment claims are forwarded, in some manner, to a variety of organizations for settlement.

The providers seeking payment can include: (a) physicians, (b) hospitals, (c) psychiatrists, (d) psychologists, (e) dentists, (f) nurse practitioners, (g) physical and other therapists, (h) chiropractors, (i) private and public clinics, (j) group practices, and (k) physician assistants (PAs). While claims can be submitted on a physical form through postal mail, electronic commerce would take either a semi-automated or fully-automated form. In the semi-automated form, specialized intermediaries or billing offices would act as an electronic intermediary between providers and payers. In the full form, stand-alone or integrated (claims processing plus administrative and/or clinical support) software would provide a direct electronic link between providers and payers. Payers can include: (a) government programs, such as Medicare, Medicaid, and state and local welfare, (b) prepaid health plans, such as HMOs, PPOs, and POSs, (c) insurance companies, such as Aetna, Prudential, and Blue Cross, Blue Shield, and (d) employers providing self-insurance or purchasing group plans for employees (Haimowitz *et al* 1995). In this paper we present a general architecture of an integrated system for storing clinical and administrative data, modeling and simulating financial and claims performance outcomes, and analyzing historical data for management decisions. The system in currently at the planning stage for future design and implementation.

Claims Processing Operations

Electronic commerce commences when the provider fills out the claims form. Typically, this form will contain patient demographics, the provider's identification and administrative characteristics (volume, specialty, location, tax identification number, referring doctor's identification number), diagnostic codes (ICD), service codes (DRG, CPT), service fees, and claim age. The completed form is submitted to the payer for settlement.

If a pre-defined linkage has been negotiated and established, the claim submission may be made directly, in paper or electronic form, to the payer. Otherwise, the submission will be made through available software for common and routine transactions. For elaborate and complex submissions, intermediaries are used to check transactions for errors, convert the data into the format required by the payer, proffer the converted claim to the payer, receive payment, deduct a fee, and then forward the net compensation to the provider.

Problems and Shortcomings

Direct and indirect electronic processing can save considerable time over physical submissions via postal mail. Still, there may be a processing delay, perhaps 2 weeks, before the provider receives payment. Moreover, the processing cost can be high, especially when transactions are complicated and require many data conversions to format the information properly. Even with the move toward a common payment format, delays will persist and costs will be high (Haimowitz *et al* 1995, Hutchison *et al* 1996).

Current and proposed electronic commerce approaches do not capture much useful information. For the provider, the lost information includes: (a) service utilization patterns, (b) financial statistics (co-payment, deductible, and payment method), (c) the relationship between patient demographics, service selection, and payment mechanisms, and (d) the effects of program restrictions on feature and payment selection. The same information is lost to the payer in addition to: (a) statistics to measure

and document potential fraud, (b) provider output rates, and (c) the relationships between provider characteristics, output, patient demographics, service utilization, and payment selection.

Although some of the lost information can be captured after claims processing, such a process yields several shortcomings: (a) post-claims collection requires a special effort, and the process, along with any subsequent information analysis and results dissemination, will be time-consuming and costly; (b)there is no guarantee that the affected parties will receive the analysis and results in a timely manner where it can be effectively utilized; and (c) this approach is reactive, rather than proactive, as a result of detecting key patterns and recognizing problems after they have occurred. Only then may corrective action be taken to resolve the problems. In the interim, opportunities may be lost, and patient health may suffer.

Post-claims collection will not capture all relevant lost information. Indeed, many of the affected parties may be unaware of the availability and importance of such information resulting in inefficient and ineffective coordination of plan design and financing decisions.

Healthcare Electronic Commerce DTS

An information system can be developed and implemented to alleviate many of the problems and shortcomings with current healthcare electronic commerce. We call this system the Healthcare Electronic Commerce Decision Technology System (HEDTS).

The HEDTS is an integrated system of computer hardware and software. The system has a database that captures and stores joined patient, clinical, and administrative data (including insurance and payer program). A modelbase captures and stores economic and accounting constructs to describe and simulate financial outcomes, management science models to evaluate claims performance, and network methodologies to schedule claims actions. In addition, there is a knowledgebase that captures and stores linked patient data, treatment/care issues, and historical management actions (more detailed information may be found in Forgionne *et al* 1998).

Interested clinicians and administrators use the HEDTS interactively to: (a) organize data into parameters needed for the provider and payer phases of concurrent claims processing, (b) structure models that represent provider and payer claims processing in an integrated and complete manner, (c) simulate performance outcomes from proposed claims policies under specified internal and external conditions, (d) solve specified models for the most preferable claims policies.

Many transactions, in a variety of formats, are generated between providers and payers. All transactions are captured by HEDTS and automatically reformatted, according to predefined rules, to form a data warehouse of pertinent electronic commerce data. By interactively quizzing HEDTS', the user can access the warehoused data, extract appropriate information, and display the called information in concise reports.

In addition to the components described above, HEDTS consists of a data warehouse for analyzing and reporting relevant patterns in data. The design of the data warehouse is based on the KEFIR system (Matheus *et al* 1996). Several business indicators, called measures, are defined in the system. If the current measures change significantly from previous or normative values, it may indicate a pattern worth investigating further. This analysis is based on the data collected from previous transactions, normative values of measures, and domain knowledge. The system computes the deviations, finds explanations for the deviations, and generates reports. For each organizational unit and geographical region, the measure is obtained for each study area. Next, the measure is drilled down into smaller subcategories of the study area. For example, the top level study area could be inpatient, which, in turn, can have subcategories such as surgical, medical, mental, and pregnancy. Deviations are computed from normative and trend values. The explanations of a deviation are derived by decomposing the measure into sub-measures and the drivers that are used in their computations. For example, the total payment for a specific unit may be derived from total payment per day and total number of days, or total payment per case and the number of cases. An additional capability is to generate reports on the key findings, their explanations, and recommendations.

Conclusion

This paper presents a general architecture of an integrated Healthcare Electronic Commerce Decision Technology System (HEDTS). The system overcomes some of the limitations in current healthcare systems. Such limitations include the loss of information needed by both service providers such as physicians and hospitals, and payers such as government programs, health plans, and insurance companies. By providing an integrated platform for capturing electronic transactions for claims processing, billing, service selection, and providing patient care, HEDTS can support modeling and simulation of activities that would support managerial decision making for all trading partners in the healthcare industry. The system we propose consists of a database for capturing the relevant data, model base for modeling and simulation of financial outcomes, and a knowledge base for analyses and evaluation of various reports, forecasts, and actions. A data warehouse is designed to provide decision support based on historical data. While this paper provides a conceptual framework for the HEDTS system, it currently at the planning stage for future design and implementation.

References

Forgionne, G., Gangopadhyay, A., Klein, J. A., and Eckhardt, R."Electronic Commerce in the Health Care Industry", Working paper, IFSM Department, University of Maryland Baltimore County, January 1998.

Forgionne, G., Gangopadhyay, A., Klein, J. A., and Eckhardt, R. "Facilitating Electronic Commerce in the Health care Industry through Decision Technology System", Working paper, IFSM Department, University of Maryland Baltimore County, May 1998.

Haimowitz, I. J., Farley, J., Fields, G. S., Stillman, J., Vivier, B. “Temporal Reasoning for Automated Workflow in Healthcare Enterprises”, in *Electronic Commerce*, N. Adam and Y, Yesha (Eds), 1995, pp. 87-113.

Hutchison, A., Kaiserwerth, M., Moser, M., and Schade, A. "Electronic Data Interchange for Health Care", *IEEE Communications Magazine*, July 1996, pp. 28-32.

Keegan, A. J. and Baldwin, J. "EIS: A Better Way to View Hospital Trends", *Healthcare Financial Management*, Vol. 46, No. 11, 1992, p. 58.

Matheus, C. J., Piatetsky-Shapiro, G. and McNeill, D. "Selecting and reporting What is Interesting: The KEFIR Application to Healthcare Data", in Fayyad, U. M. Piatetsky-Shapiro, G., Smyth, P., and Uthurusamy, R. (Eds.) *Advances in Knowledge Discovery and Data Mining*, AAAI/MIT Press 1996.