



Integrating Medication Management into the Electronic Patient Record

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"Change is easy, to improve is difficult."
Professor Porsche

ABSTRACT

Presented is an approach to consolidating patient medication data and integrating that data into the electronic patient record. True medication management involves more than just automated prescription writing, drug distribution and claims processing. It necessarily involves the consolidation of patient medication data across all healthcare providers, including: physicians, hospitals, pharmacies, health plans and pharmacy benefits managers (PBM's), as well as integrating that data with other patient record data in a seamless way. Whenever the same patient health data is required by more than one provider it should be shared. Patient medication data is rightfully an integral part of managed care, practice management and the patient record.

The consolidation of patient medication data across all healthcare providers and its integration with other patient record data addresses established industry objectives of: patient-focused care, optimal drug therapy, continuity of care and positive patient outcomes. It benefits everyone involved by assisting the various caregivers in making correct assessments and administering proper medication treatments. Adopting efficient and effective courses of action, or clinical pathways, for patients with similar diagnoses or procedures is critical to the planning, delivering and measuring of patient care. The establishment of treatment protocols and standards of care are becoming an important part of healthcare delivery. Determining proper medication treatments can only be achieved through the analysis of consolidated medication data.

The consolidation and integration of medication data helps managed care providers in evaluating physician activity, prescribing patterns and effectiveness for the establishment of recommended alternative medication treatments. Being able to compare the costs and outcomes of alternative treatments - pharmacoeconomics - provides the foundation needed to access the value of medication treatment. Consolidating patient medication data and integrating it with other patient record data is a prerequisite to analyzing outcomes and implementing more effective treatment protocols. This results in better management of healthcare delivery by promoting more efficient utilization of critical healthcare resources and quality of care.

One of the more important uses of consolidated medication data is for outcomes determination. Emphasis must change from the use of claims and financial data to include medication data. In addition, outcomes analysis must expand beyond individual clinical encounters to span all aspects of the patient record. Passive outcomes analysis based on profiles, history and trends may be used to set standards, benchmarks and courses of action, but active outcomes analysis is needed for proper intervention. Providers must be able to monitor medication therapy and the results in an expeditious, ongoing manner so they can be alerted to possible problems and to determine if the process needs modification. This presents new requirements for the availability of medication data, which requires the use of a new approach. Approaches based on "data warehousing", on- line analytical processing (OLAP) or other passive, read-only decision support technologies, do not provide the functionality and structure needed to support dynamic intervention and control.

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The linking of medication history data with other patient record data, such as disease progress and laboratory results, can provide insight into patient noncompliance. The lack of patient compliance is a major problem in the current use of medications. It often leads to uncontrolled chronic disease, prolonged illness, needless emergency room visits and hospital admissions, all of which contribute to the rising cost of healthcare. Physicians must be kept informed when prescriptions have not been filled and when the actual regimen followed varies from that ordered. As many as 20 percent of all prescriptions written are never filled and of those that are, many are never picked up. Of the prescriptions received, an estimated 50 percent are taken incorrectly. Noncompliance will become even more of an issue with the continued shift to outpatient care where patients are more responsible for their own medication treatment regimens.

BACKGROUND

Modern healthcare relies on decades old technology and forms of communication, which can no longer satisfy the collective needs of care givers. Patient health records largely remain as they were 40 years ago. The vast majority of physicians still utilize handwritten prescriptions and paper charts. Current patient records are subject to many flaws, such as missing and incomplete data entries, unavailability because of use and the general inability to be combined and manipulated. Very few physicians are electronically linked to pharmacies or other providers, even within the same organization or facility. Most medication data is not exchanged among providers, and when it is, it is usually in an electronic "document" format. The result is that no one provider has access to, or sees, the total medication picture and is never completely sure of the patient's medication history.

Because patient medication data is highly fragmented, it presents the potential for undesirable consequences. The reality is that medication data exists in various forms and resides in numerous places, including different physician offices, hospitals, pharmacies and PBM's. Even if obtained, the data is often difficult to use, and in many cases, is still in paper format. Data fragmentation occurs whenever a patient is seen by multiple physicians who independently prescribe. It further occurs when patients take prescriptions to different pharmacies, who keep different records. In addition, medication is often dispensed in the physician's office with little or no data disseminated.

Medication may be over or under-prescribed, not used in proper combination or otherwise cause an adverse drug event (ADE) unless patient medication records are carefully coordinated among all participants at the time of care. Therapeutic results may be inconsistent with expectations and the patient will not receive appropriate care. Without integrated data, it is difficult to know if medications are working. Consolidated medication data can show signs of increasing dosage or combination therapy, possibly indicating the progression of a disease.

NEED

Employers, consumers and government agencies are demanding lower healthcare costs, while expecting ever-greater quality. It is becoming increasingly important in an era of physician group mergers and managed care, that all patient record data become integrated to ensure the efficacy and quality of healthcare delivery. In fact, managed care depends on the comparison of clinical and financial data between the various providers and provider organizations. Data must be made available at the enterprise level and at the individual care giver level. Integrating patient record data not only promotes better management of healthcare delivery but improves the continuity of care, helps assure the proper course of treatment for diseases and conditions, reduces costs and promotes better management of healthcare delivery.

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With the growth of managed care has come an increased emphasis on managing patient pharmacy benefits. The inclusion of pharmacy benefits as part of managed care is becoming more widespread and is eroding the previously unchallenged authority of physicians to independently prescribe any medication. Decisions regarding patient medications are more and more being influenced by: pharmacy and therapeutics (P&T) committees, business partners, the government and other payers and overseers. The pharmaceutical companies are embracing this trend and the PBM's are expanding their product focus beyond cost savings toward the management of broader medication issues and high-risk patient groups.

A major concern is that as the population ages the demand placed upon healthcare delivery will increase dramatically as well as the number of concomitant medications. Patients over age 65 are the highest healthcare users and are at the highest risk of suffering serious medication related problems. A study reported in the Journal of the American Medical Association found that inappropriate and potentially hazardous prescribing for patient age 65 and older is prevalent. It identified the top systemic failure that leads to medication errors as the lack of sufficient patient information.

Although patient medication is one of the most automated segments of the healthcare industry, physicians and pharmacies do not routinely exchange patient medication data as part of the continuum of healthcare services. Pharmacists rarely participate in decisions involving the most appropriate medication therapy for the patient's medical condition. To be most effective in the future, disease management must be shared between physicians and pharmacists. The solution largely depends on the establishment of an interactive, electronic-link between the physicians' offices and the pharmacy so that pharmacists can prospectively influence medication treatment.

Traditional medication management systems cannot overcome the major obstacles at hand. Current medication management systems are not flexible enough to allow physicians, specialists and pharmacists to maintain and simultaneously use common patient medication data. To consolidate medication data and integrate it with other patient record data requires a medication management system capable of combining and using data in new and different ways. It requires a new type of system that can provide immediate direct access to consolidated patient medication data as part of the electronic patient record.

The longitudinal linking of all episodes of patient care in a meaningful way requires something other than the usual approach to systems development. Modern healthcare delivery utilizes networks of inpatient and outpatient facilities, including clinics, physician offices and even home-healthcare settings, which are usually spread throughout a large geographical area. Unless the various source data can be mapped to some universal scheme - medication data model - it cannot be used across the individual providers and physicians' offices. The creation and use of a medication data model as part of an all encompassing healthcare data model is destined to become the hallmark of future medication management systems.

Integrating medication data with patient record data is a very difficult endeavor. Much of the data and data coding schemes found in automated medication management systems and electronic patient record systems are organization or vendor specific. This situation is further complicated by extensive variations in the processing rules, such as those used for utilization review, formulary determination, medication selection and substitution, etc. The existing industry standards used for the electronic exchange of medication data, such as HL7 and NCPDP, still do not address true data integration. These are but a few of the difficult issues that currently stand in the way of comprehensive integrated use of medication data.

Central to medication management and the electronic patient record is an integrated patient-centric database -- one that is capable of supporting all medication and related patient record data in a common way. The database must be based on a comprehensive data model of industry medication data and other related



patient record data for use as a blueprint. It requires a medication management system capable of capturing and storing medication data across all healthcare delivery systems in an integrated way. The system also must support instant, around-the-clock access to the patient record data regardless of location, so that physicians and pharmacists do not have to search through paper records or make difficult, and often embarrassing, telephone calls to obtain medication information.

APPROACH

The approach presented involves the use of the Meta-Script System, which is based on The Metadata® Company's technology. This includes a high-level data model - Metamodel - that can be used to commonly define and structure data across multiple diverse sources and systems; a universal database management system (UDBMS) based on the Metamodel that can accommodate all types and forms of data using a common database design; an integrated repository that can maintain any system documentation and metadata in a structured uniform way; and a utility that can interface with existing systems and migrate databases without programming. The Metadata® Company technology has a significant impact on the way the healthcare data is viewed, stored and processed. It is designed to support the anticipated medication management and electronic patient record needs into the next century.

Important to the approach is the way in which the various providers interact with each other. All providers are connected to pharmacies and each other via the Meta-Script System and its supporting patient-centric database. Leased and dial-up telephone lines and existing networks may be used and all system communication takes place in real-time. Links to other external healthcare systems such as health insurance plans, PBM's and hospitals are possible using standard industry protocols or specially created interfaces in both real-time or batch mode.

The key prerequisite to the consolidation of healthcare data and its integration with other patient record data is the development of a comprehensive medication data model. Unfortunately, there is no current industry standard data model of medication data or of other patient record data. The Meta-Script System is based on a medication data model developed using the Metamodel. An industry survey of medication data was conducted resulting in a data model of more than 500 different data elements. The data model covers data in such areas of activity as eligibility, referrals, claims and laboratory results. It also includes the data needed to identify, describe and interrelate patients and healthcare providers in such a way as to enable future system expansion and interoperability. Besides directly supporting the Meta-Script System, the medication data model contains the necessary linkages for inclusion of the electronic patient record.

Several commercial sources of "standard" medication data exist. In addition, a number of medication management system developers have even created their own medication data. Unfortunately there are significant differences in the scope, coded forms and logical structures of the different source data. Different procedures are required for the identification and structuring of: therapeutic and generic classes, diseases, products, dosages, drug interaction checking, etc. The use of different medication data has resulted in different patient medication records that are very difficult to integrate. To "normalize" and consolidate patient medication data from disparate sources requires the use of a common medication data model and a database structure that reflects that model. Because the Meta-Script System database is structured using the Metamodel, it can automatically accommodate medication data from any source.

Standard medication data as well as specialized application data was loaded into the Meta- Script System. This included: prescription history data, patient eligibility data, formulary data, medical claims history data, provider data, drug-of-choice data and therapeutic treatment data. The resulting database supports patient physician assignment; benefits eligibility; drug utilization review; patient medication, disease and allergy



profiles; medical claims history; claims processing; medication substitution; prescription writing; as well as other medication management activities.

The consolidation of patient medication data across pharmacies, physicians, health plans, PBM's, etc., is necessary to its meaningful integration into the electronic patient record. Consolidating medication data helps reduce errors by providing information from a central source about medications that have or have not been effective for a particular patient. It also allows different treatment outcomes to be analyzed to determine which are the most efficacious and cost-effective. Large quantities of medication data can be assessed as a unit to determine the most effective treatments for various illnesses or conditions and adopt them as standards. It also can be used to show the least effective medications so they can be eliminated from the formulary. Medication treatment plans can be developed for common disorders and unhealthy conditions can be identified early to prevent disease.

To integrate medication data with other healthcare data requires the establishment of common patientcentric database that can be shared by all healthcare providers. Medication data must be identified and structured using standard healthcare identifiers such as for providers, patients and diseases so that it can be linked to other patient record data. The Meta-Script System database is capable of accommodating all healthcare data in such a way. All medication data is stored such that it is extendable and available for further use.

META-SCRIPT SYSTEM

The Meta-Script System is a comprehensive medication management system designed to satisfy the current and expected needs of: physicians, pharmacies, benefits managers, health insurance plans and other providers. It has specific application to any individual, healthcare provider or organization involved with the use of medication. The system is designed to accommodate any: physician, patient, medication, pharmacy, location, healthcare delivery method or related area of medication activity. In addition, the Meta- Script System directly addresses important healthcare concerns, including: quality of care, patient satisfaction, cost, system integration, continuity of care, provider communication and outcomes. The Meta-Script System is the result of a cooperative effort between physicians, pharmacists and computer specialists. It is the first of a planned set of integrated healthcare systems and is packaged in such a way as to integrate with other patient record systems.

The Meta-Script System database has interactive and passive components. Medication data from physicians and pharmacists is interactively maintained, while other related patient record data is loaded from history files. Patient profiles are created both concurrently and retrospectively as new medications are prescribed and prescription and medical claims history data is loaded. Patient medication, disease and allergy profiles are provided that cut across: physicians, pharmacies, claims processors, benefit plans, managed care contracts, etc. The patient profiles include both active and resolved problems, together with: related event dates obtained from prescriptions, claim/encounters, laboratory tests and other medication management systems. This includes a summary-level list of all drugs taken and supporting detail prescription data.

The Meta-Script System provides the crucial physician-pharmacy linkage. It can be used to link all healthcare providers via a common database, which serves as the universal patient index and data repository for all patient records data. All parties interact directly with the database in a "neutral" environment. The flow of data is always to and from the Meta-Script System database, not between individual scattered electronic mailboxes. The ability to interact directly with a common medication database in an "open" environment greatly facilitates the integration and exchange of patient data. The Meta-Script System permits: physicians, pharmacists, PBM's, health insurance plans, hospitals, etc., to share patient medication data interactively,



thus eliminating the flow-of-information problem caused by the "systems interface" approach. Medication review, authorization and precertification can be performed on-line at the time of prescribing.

The technical approach used in developing the Meta-Script System is considerably different from those used in other systems. The Meta-Script System is not a typical database or data warehouse. All data is intermixed including historical patient records as well as active data. This means that all data contained within the Meta-Script System database is capable of real-time access and update. In addition, the MetaScript System database is capable of expansion to support other healthcare applications without redesign.

The Meta-Script System provides the following functionality

Security/Sign-On

Security provisions are provided to prevent improper system use and to insure the confidentiality of patient data. Each user is assigned a unique ID and personal password for system sign-on and use. The passwords are tied to all medication activities for authorization and traceability and can be delegated using aliases.

Provider Selection

Any healthcare provider entered into the database can be selected either by name, license or DEA number, or by any other known identification. The system does not require that any one provider ID be used. The provider who signed on is initially displayed. If an existing prescription is selected, the prescribing physician is shown.

Patient Selection

Patient profiles of known diseases, allergies and medications are displayed. These profiles are created as a routine part of system use, but may be augmented using external data. If a drug or disease is selected from the profile, only related drugs are shown on the patient's history.

Medication Selection

Any medication may be selected from a complete medication database, using either drug name, NDC, mnemonic code, generic class or therapeutic class. Generic substitution is automatically performed at the time of medication selection unless overridden.

Dosage Checking

Dosage checking is automatically performed at the time of medication selection. Both individual and daily doses are checked for out-of-range conditions by age group and disease. Body surface area may also be calculated.

Drug-Of-Choice

A ranked list of medication alternatives (drug-of-choice) is automatically displayed for desired therapeutic classes or diseases at the time of drug selection. There can be different lists displayed for different health



plans, IPA's, etc. The medication lists are disease step/phase sensitive and can be used in conjunction with established treatment protocols.

Patient Disease/Problem Identification

A list of all diseases commonly treated with a given medication is displayed for selection. Diseases may be selected by name or any level of ICD-9-CM code. Selected diseases automatically show on the patient's disease profile. Known patient diseases obtained from medical claims history are also included.

Drug Utilization Review (DUR)

A complete DUR may be performed to guide the prescriber in making the most appropriate medication decision, and prior to the patient's arrival in the pharmacy. It is designed to show potentially hazardous prescribing practices and includes checks for duplicate therapy, drug-drug and drug-food interaction, disease contraindication, allergy and drug sensitivity, age and pregnancy.

Formulary/Health Plan Restrictions

Drug formulary and precertification restrictions may be checked at the time of medication selection, eliminating dispensing problems in the pharmacy which include provider- pharmacy communications and patient dissatisfaction from drug substitution. Any number of different formularies may be used.

Eligibility Checking

Patient eligibility, which includes patient-provider assignment, is shown for any number of coverages and health plans. Eligibility information is used for determining formulary restrictions, pricing prescriptions and reporting claims. Patients without coverage can be treated accordingly, including determining the lowest cost medication source.

Automated Prescription Writing

Prescriptions are created by entering a bare minimum of data. A standard prescription, which can be altered, is automatically displayed for the medication selected based on patient age and disease. The prescription may be printed in the physician's office or sent to a pharmacy (on-line or FAX) or held in the database for later selection by a pharmacy.

Refill Processing

Existing prescriptions can be accessed by prescription number or from the patient medication profile for refill processing. All related provider, patient and medication data are displayed. Inter-pharmacy prescription refill requests can be handled/transferred on- line without requiring telephone contact.

Medication Authorization

Requests for prescription authorization (new or refill) are automatically displayed on the physician's authorization log for disposition. Whenever a request is approved or denied, the results are automatically displayed on the drug order log in the pharmacy. Authorization requests may originate at the pharmacy or in the physician's office.



Office Dispensing

Medications can be dispensed within the physician's office by identifying the medication sample. In addition, a prescription can be written that is filled (partially or full) in the office. Office dispensed medications are recorded as any other prescription and show up on the patient's medication profile. Addition medication dispensing by the pharmacy may be ordered.

Medication Order Status

A log is maintained of all prescriptions for pharmacy and physician use. It shows the date/time, priority, status and delivery instructions for each item, along with the medication data. The log can be filtered for provider, patient, date and status, providing complete visibility of the medication order process.

Standard Reports

Reports are provided that compare prescribing behavior across specialties for select, high- volume and high-cost therapeutic classes. In addition, reports are provided that show system activity so that all steps of the medication process can be monitored as they occur. Physicians receive daily activity reports showing all patient medication ordered, authorized and received, as well as printed labels for the patient's chart. All reports are available on- line and printed.

SUMMARY

It is time to move beyond the approach of trying to interface disparate healthcare systems to one of creating integrated patient records. Prescriptions and other patient records can no longer be considered just clinical tools and historical documents for independent use by pharmacies and physicians. Patient record data, including medication data, must be managed as a whole and made uniformly available to a wide range of users. This requires setting up relationships and trust between individuals and organizations that may have conflicting business objectives and reimbursement schemes. The incentives to tie medication data together with other patient record data in a coherent, uniform and centrally accessible way, must come from outside physicians, pharmacies and the patients receiving treatment.

The complexity of the healthcare environment can only increase in the future and systems must be built in such a way that vertical and horizontal expansion can be accomplished without disruption, and in a nonintrusive way. The technical feasibility of creating a commonly-held, patient-centric database capable of supporting present and future requirements for the electronic patient record has been demonstrated using the Meta-Script System. The goal is to expand the current application area and obtain greater collaboration and data-sharing with the various healthcare providers.

Integrated healthcare data has long been a goal, but the electronic patient record as currently envisioned is a long way off. There are important steps however, that can be taken now. The most important step being the establishment of the healthcare data model and communication links between physicians, pharmacies and other healthcare providers. This will allow pharmaceutical services and medication management to be reoriented from that of distribution to managed care, which assumes vastly greater importance than just the dispensing of medications. There currently exists a tremendous opportunity for pharmacists to help redefine pharmaceutical care as an integral part of the electronic patient record. Outcome studies have shown the



beneficial impact that integrated pharmaceutical care can have on other treatment areas and the value of allocating additional dollars to help bring it about.

BIOGRAPHY

Steve Kelso has over 25 years experience in pharmacy management, including 10 years as Director of Pharmacy for a 345 bed hospital. He currently manages Triple Option Pharmacy Services (TOPS), a PBM, claims and drug repackaging enterprise; and Med Express, a capitated pharmacy. Steve serves as consultant for the Meta-Script System.

Jack Myers has over 35 years experience in data processing, including 10 years related to healthcare systems. He is currently President of The Metadata® Company and a past vice-president of Partners National Health Plan and Megadyne Information Systems. Jack is the inventor of the Metamodel and architect of the Meta-Script System.