Improving Drug Prescribing Practices in the Outpatient Setting:
A Market Analysis

Prepared for:
CALIFORNIA HEALTHCARE FOUNDATION

Author:
Melissa Buckley, M.P.P.

Improving Drug Prescribing Practices in the Outpatient Setting: A Market Analysis

October 2002

California HealthCare Foundation

UPDATE AT TIME OF RELEASE:

On October 30, 2002, following completion of this report, Medix Resources, a New York-based health care transaction software company, announced it has issued a letter of intent to purchase PocketScript, one of the companies profiled in this report. This action further underscores the volatility and change in the e-prescribing marketplace. For more information about this development and to follow other health technology news, please visit iHealthBeat, a free daily publication of the California HealthCare Foundation at **www.iHealthBeat.org**.

DISCLOSURES:

The information included in this report is provided as general information and is not intended as medical or legal advice. The California HealthCare Foundation does not, and does not intend to, whether through this publication or otherwise, endorse any product, entity, or person, and reserves the right to alter the content of this report at any time.

Consistent with the policies of the California HealthCare Foundation, no employee of the Foundation previously employed by a company included in this report has participated in the Foundation's work related to this report.

Acknowledgments

Contents

I. Introduction

THE HYPE AND PROMISE OF TECHNOLOGY AS A "magic bullet" has affected all sectors of the economy, including health care. As in other industries, over the last several years the health care industry has seen a wave of new technology companies and products come and go. Despite the shake-up, technology continues to hold promise in addressing problems related to health care costs, safety, and access.

One area in which technology has shown promise is improving drug prescribing practices. A number of companies offering point-of-care electronic prescribing products have sought to reduce medication errors, improve formulary compliance, and increase prescribing efficiency through the use of handheld/ personal digital assistant (PDA) devices. Unfortunately, slow adoption, unclear evidence of impact, and funding shortages have caused many of these vendors to fold. However, potential remains in those companies that have survived and in those that have more recently emerged.

Improving drug prescribing starts with an understanding of the weaknesses in the current prescribing process. The amount of pharmaceutical and prescription drug information physicians have to manage daily is staggering.

- According to the Institute for Safe Medication Practices, there are more than 17,000 pharmaceutical brands currently sold in North America, with 1,500 new products and indications slated for FDA approval over the next three years.[1]

- In 1995, more than 10,000 articles were published on randomized clinical trials, 100 times as many as in 1966.[2]

- The average physician group manages more than 16 managed care contracts, according to an annual membership census of the Medical Group Management Association.[3]

- According to the National Association of Chain Drug Stores, physicians wrote three billion prescriptions in 1999 and will write approximately four billion in 2005.[4,5]

An absence of accurate, easy-to-access drug reference and formulary information at the point of care and a reliance on handwritten prescriptions leads to prescribing problems in several areas:

- **Patient safety.** Lack of drug information (for example, drug-drug interactions, adverse reactions) or illegible, misinterpreted prescriptions can lead to subsequent adverse drug events. The Institute of Medicine reports that medication errors account for an estimated 7,000 deaths annually.[6] Medication errors generally occur for one of two reasons. Either the physician lacks drug reference or patient information and therefore prescribes inappropriately, or the physician's handwriting is misread by a nurse or pharmacist. Sixty-one percent of consumers fear being given the wrong medication.[7]

- **Prescribing efficiency**. Pharmacists make 150 million calls a year to physicians regarding non-formulary medications, potential drug interactions, incorrect dosages, and illegible handwriting, according to the Institute of Safe Medication Practices.[8] Having to clarify and correct prescriptions causes delays for the patient and extra work for pharmacists and physicians.

- **Drug costs.** Drug costs increased more than 17 percent to $154.5 billion in 2001, and they are expected to hit $243 billion by 2008.[9,10] Health plans and pharmacy benefit managers (PBMs) who pay these expenses have tried to control costs by encouraging use of generics and by negotiating lower prices from drug manufacturers in exchange for favorable formulary placement. But they have been consistently unable to deliver the high drug volumes that manufacturers require to lock in lower prices. At the same time, pharmaceutical companies attempt to influence physicians to prescribe their brands regardless of cost.

Despite the failure of many first-generation electronic prescribing companies, a range of technological solutions exists to improve drug prescribing practices, and new companies continue to enter the market.

This report describes four general approaches to using technology to improve drug prescribing. It presents information on the potential impact, the implementation challenges, and the vendors associated with each approach. In addition, the report provides detailed information on four companies that offer affordable, reasonably easy-to-implement, stand-alone prescribing technologies that can serve as a first step or longer-term solution to improving prescribing. Information for this report was gathered through an extensive literature review; review of industry reports and surveys related to electronic prescribing; and interviews with industry experts, software vendors, and customers. Please keep in mind that this is a fluid market, with companies entering, leaving, and merging. This report describes companies that are financially stable, already have electronic prescribing devices in the market, and demonstrate potential to achieve significant market penetration in the future.

II. Overview of Approaches to Improving Drug Prescribing

GIVEN THE IMPACT OF CURRENT PRESCRIBING practices on patient safety, prescribing efficiency, and drug costs, a range of technological approaches exists to improve prescribing practices. Approaches include the following.

Electronic drug references. Physicians download electronic drug *or* formulary information onto handheld devices to inform prescribing decisions at the point of care.

Integrated drug reference and formulary tools. Physicians download integrated drug *and* formulary information onto handheld devices and use the information at the point of care.

E-Prescribing solutions. Physicians use handheld or PC devices to review drug and formulary coverage and transmit prescriptions to a printer or local pharmacy. E-Prescribing software can be integrated into existing clinical information systems to allow the physician to access patient-specific information to screen for drug-drug and drug-allergy interactions.

Integrated electronic medical record and e-prescribing systems. Physicians access clinical and formulary information that is integrated with a patient's electronic medical record (EMR). Physicians review drug and formulary information, receive automatic prompts about drug-drug and drug-allergy interactions based on the patient's medication history, and transmit prescriptions to a printer or local pharmacy.

Major Benefits

Although the actual impacts differ by approach, technologies that support the prescribing process offer four major benefits.

Patient safety. Electronic prescribing can improve patient safety by reducing upstream adverse drug events and medical errors. These tools help physicians by screening for potential drug-drug and drug-allergy interactions, indicating appropriate drug dose, and by printing prescriptions in legible form. A 2002 Harris Interactive survey of 400 physicians found that 76 percent said e-prescribing technology enabled them to deliver better quality care.[11]

Prescribing efficiency. Electronic prescribing helps to increase physician office efficiency by reducing the number of callbacks from pharmacies. The software enables physicians to pre-check prescriptions for drug interactions and formulary coverage before the patient leaves the office. One study surveyed 939 physicians using an integrated drug and formulary product and found that 58 percent reported saving more than ten minutes a day due to fewer formulary callbacks. Sixty-four percent said they were then able to spend more time with patients.[12]

Improved customer service. Electronic prescribing devices with electronic prescription transmission capability have potential to save patients time and money. Physicians transmit prescription information directly to local pharmacies, so the medication is ready when the patient arrives. According to an August 2002 Harris Interactive survey of over 1,000 Americans, 61 percent valued having less waiting time at pharmacies.[13]

Cost savings. In addition to potential cost savings from improved efficiencies (such as eliminating the need for phone calls), electronic prescribing software can steer physicians to lower cost options by aggregating formulary information and making it easily available when physicians are choosing medications for their patients. Payers save through better formulary adherence and increased generic drug substitution. Harris Interactive reports that 81 percent of physicians surveyed say e-prescribing technologies improve formulary compliance.[14]

Major Obstacles

Despite widespread interest in handheld technologies that support prescription writing, physicians have been slow to adopt comprehensive, fully integrated solutions. According to a recent survey of 1,200 physicians by Fulcrum Analytics and Deloitte Research, 30 percent of all physicians own a personal digital assistant (PDA). Of those, 53 percent access drug information and 10 percent prescribe electronically.[15] Challenges to adoption vary by technological approach, but generally include the following.

Implementation can be difficult. The complexity of implementation varies, depending on the prescription tool. At a minimum, physicians are required to download drug reference and formulary information from the Web and onto a handheld device. More comprehensive e-prescription and EMR tools require integration with the physicians' existing systems, making them complex and costly to implement.

Connectivity presents challenges. An important way that physicians can improve quality and efficiency is by electronically transmitting prescriptions to printers and pharmacies. Some handheld devices still rely on cradle connections to exchange information with printers and servers. The need to synchronize can significantly disrupt a physician's workflow. Furthermore, no electronic data standard exists that allows physician and pharmacist software to exchange prescription information, so most orders must be faxed or delivered in hard copy. Even with these problems solved, as many as 19 states do not permit electronic transmissions from a physician's computer directly to a pharmacy computer.[16,17]

Technology can be expensive. Harris Interactive found that 31 percent of physicians who are not using e-prescribing technology said that "it costs too much and the benefits aren't clear."[18] Comprehensive EMR solutions can cost hundreds of thousands of dollars. Drug reference and formulary tools are inexpensive, but lack the ability to transmit prescriptions to printers or pharmacies. Typically, physicians pay these expenses. And while physicians generate some return through increased efficiency, most cost savings accrue to pharmacy benefit managers and health plans through increased formulary adherence and generic substitution.

Physicians are skeptical about the value of new technologies. According to a survey by Fulcrum Analytics and Deloitte Research, 95 percent of physicians reported using the Internet at least once in the past year and 21 percent regard the Internet as essential to their practices. Still, many do not see the time- and money-saving advantages of emerging technological tools, and are therefore more comfortable with existing paper-based processes. Rates of technology adoption vary, but overall adoption is slow.[19]

III. Prescription Writing Process and Supporting Players

Prescription Writing Process

THE ELECTRONIC PRESCRIPTION WRITING PROcess varies depending on the technology infrastructure of the physician's office and pharmacy, but generally it occurs in several steps.

1. The physician uses a handheld device at the point of care to review information and to select a medication. Depending on the capability, the physician may access drug, formulary, and/or patient-specific clinical information.

2. If electronic drug reference and integrated drug reference and formulary tools lack printing and transmission capabilities, the physician handwrites the prescription. Otherwise the physician generates and transmits the electronic prescription to a printer or local pharmacy via fax or email.

3. If necessary, the patient carries the printed or handwritten prescription to a local pharmacy.

4. The pharmacist obtains authorization for the prescription by communicating with the patient's PBM or health plan to verify the patient is covered and the prescribed drug is on formulary.

5. If necessary, the pharmacist calls or emails the physician to clarify and/or change the prescription because of issues related to formulary coverage, drug interactions, dosage, or allergies.

6. The pharmacist fills the prescription.

Supporting Players in the Prescription Writing Process

In addition to the physician and the patient, several other organizations/entities participate in the prescription writing process.

Electronic Data Interchange (EDI) Vendors

EDI companies have traditionally controlled the "pipes" that support electronic communications between payers, providers, and pharmacists. They facilitate electronic health care transactions like eligibility checks and claims processing. These vendors have taken two strategies to become more involved in electronic prescription writing:

■ *Add ASP-based e-prescribing capability to traditional services.* NDCHealth and Proxy-Med, for example, provide physicians and their staff access to online drug reference and formulary information, and support two-way messaging about prescriptions and renewal requests. ASP-based applications are cheaper than traditional client-server systems, but are generally desktop solutions (see Appendix C for more information).

■ *Build seamless integration between physician practice management software (PMS), electronic medical records, and EDI services.* WebMD, for example, owns substantial PMS, EMR, *and* EDI businesses. The company is positioned to leverage these assets to provide a comprehensive e-prescribing solution (see Appendix C for more information).

Health Plans and Pharmacy Benefit Managers (PBM)

Health plans, and the PBMs that often help them manage prescription drug expenses, would like to influence physicians' drug choices in order to reduce drug costs. These payers have formed alliances to help strengthen their influence. The two most noteworthy alliances are listed below:

■ **RxHub** was formed by the three leading PBMs—AdvancePCS, ExpressScripts, and Merck-Medco—in February 2001. The company is vying to receive prescriptions directly from physicians, to check for potential medical errors and formulary coverage itself, and then to send the information on to local pharmacies. By increasing its direct role in the prescription writing process, RxHub could increase PBMs' share of the profit and channel more prescriptions through mail-order pharmacy.

■ **MedUnite** was formed by seven leading health plans—Aetna, Anthem, CIGNA, Health Net, Oxford, PacifiCare, and WellPoint—and provides traditional EDI transaction services, like electronic claims processing. Recently, MedUnite has played a significant role in creating a free formulary database run by the Council for Affordable Quality Healthcare (CAQH).

Retail Pharmacies

Retail pharmacies profit from filling prescriptions and checking them for formulary compliance and medical errors. They also make money when patients buy retail items when they pick up prescriptions. Pharmacies need to prevent PBMs from assuming their role filling prescriptions, and from channeling prescriptions through mail-order pharmacy. In August 2001, the National Community Pharmacists Association and the National Association of Chain Drug Stores launched an industry initiative called SureScript to compete with RxHub. SureScript intends to create its own standardized transmission network to support e-prescribing traffic between physicians and pharmacies.

IV. Four Types of Drug Prescribing Technologies

THIS SECTION DIVIDES DRUG PRESCRIBING technologies into four categories for the purpose of providing information on benefits, challenges, and vendors.

Electronic Drug References

These companies provide electronic versions of medical information, which physicians then download over the Internet. A wide range of information is available, such as medical textbooks, continuing education material, and patient brochures on diseases and treatments. Typically, these different pieces of information are not integrated with one another or with formulary or patient information. Still, drug reference and formulary information are particularly helpful to physicians making prescription decisions at the point of care.

Efficiency: Low

Use of either drug reference or formulary information could lower prescription errors and callbacks. Without both pieces of the puzzle, however, physicians may be less likely to use the device. Without printing and pharmacy transmission, illegible handwriting is still a problem.

Cost Control: Low

Drug references have no measured impact on cost. Formulary tools give physicians aggregated information, but without integrated drug information, physicians are less likely to use the device.

Patient Safety: Low

Drug references give physicians general information about interactions and proper dosing, but impact on safety is less significant without patient-specific medication histories and allergy lists. Without printing and pharmacy transmission, illegible handwriting is still a problem.

Ease of Implementation: High

Physicians can access drug or formulary information without integrating new software into existing IT systems. They simply download content over the Web.

Affordability: High

Products cost less than $100 or are free to download.

Stability and Use in the Market: High

Fifty-three percent of physicians who own PDAs use them for drug reference.[20] Companies that supply electronic content are relatively stable. Thomas Medical Economics, for example, also publishes the hardcopy *Physicians Desk Reference* (PDR) to which, according to the company, 92 percent of physicians refer when making prescription decisions.

Table 1. Electronic Drug Reference Vendors

Company	Product	Rx Information	PDA Platform	Cost
Council for Affordable Quality Healthcare (CAHQ)	Formulary DataSource	Formulary information direct from 26 health plans, covering 100 million lives and contracted with 600,000 providers. Covers health plan name, product name, drug name, therapeutic class, drug category, coverage status, and program requirements (e.g., quantity limits, pre-authorization requirements). Currently no drug reference information included.	Online access*	Free to physicians; health plans pay $6,500 for set up, $100 for information updates†
ePocrates ‡	ePocrates Rx 4.0	Evidence-based medical content distilled from treatment guidelines and primary sources. Contains information on over 2,600 drugs and covers contraindications, adverse reactions, pricing, adult and pediatric dosing. Includes a messaging alert system on updates and new drug announcements for doctors.	Palm OS	Free
Franklin Electronic Publishers	PocketPDR§	Drug information from FDA-approved labels covering about 1,500 drugs. Covers manufacturer, class, indications, interactions, contraindications, adverse reactions, doses, and how drug is supplied.	Palm OS, Pocket PC	$60–$80
Handheld med.com	Physician's Drug Handbook	Drug information on 900 generics and 2,000 brands. Covers indications, interactions, contraindications, adverse reactions, doses, and how drug is supplied.	Palm OS, Pocket PC	$75
Skyscape.com	DrDrugs	Drug information on 4,000 brands and generics, as well as popular natural products. Covers indication, mechanism, interactions, adverse reactions, contraindications, and doses.	Palm OS, Pocket PC	$49.95
Thomson Medical Economics	mobilePDR	Drug information, direct from pharmaceutical manufacturers and approved by the FDA, on 1,500 brands and generics. Covers indications, interactions, contraindications, adverse reactions, doses, therapeutic class, black box warnings, and FDA announcements.	Palm OS, Pocket PC	Free

Source: Company interviews, Web sites, and marketing material.

* Planning to sell formulary content to third party vendors for use on handheld devices.

† CAHQ waives set-up fees for targeted states, including California.

‡ ePocrates offers a stand-alone drug reference product as well as an integrated reference and formulary product. ePocrates is therefore listed as both a drug reference and integrated drug reference and formulary tool vendor.

§ Franklin Electronic will gradually replace the sale of PocketPDR with mobilePDR software.

Integrated Drug Reference and Formulary Tools

Only one company, ePocrates, provides integrated formulary *and* drug reference information for use on a handheld device. The product includes drug reference information on 2,700 medications and formularies sourced directly from partner health plans and PBMs.

Efficiency: Low–Moderate

The combination of drug reference and formulary information has greater potential to lower prescription errors and pharmacy callbacks than nonintegrated drug reference and formulary systems described in the previous section. Without printing or pharmacy transmission, illegible handwriting remains a problem.

Cost Control: Moderate

Aggregated, easy-to-use formulary information helps physicians with compliance and can promote use of generics. Integrated drug references make physicians more likely to use the tool.

Patient Safety: Low–Moderate

Drug references give physicians general information about interactions and proper dosing, but impact on safety is less significant without patient-specific medication histories and allergy lists. Without printing or pharmacy transmission, illegible handwriting remains a problem.

Ease of Implementation: High

Product can be downloaded over the Web. There is no need to integrate the software into existing information systems.

Affordability: High

Product is free to physicians. Health plans and pharmacy benefit managers pay on a per-member basis, with expenses ranging between $30,000 and $200,000 annually, depending on the size of the plan.

Stability and Use in the Market: Moderate–High

The company estimates that almost all physicians who own a PDA have ePocrates's drug reference product on the device. As of July 2002, some 100,000 people have downloaded Rx Formulary.

Table 2. Integrated Drug Reference and Formulary Tool Vendors

Company/Statistics	Product	Rx Information	PDA Platform	Cost
ePocrates Private company founded in 1998, 75 employees, about 100,000 downloads of Rx Formulary.	Rx Formulary	Drug information on 2,700 drugs from package inserts, medical texts, and primary literature. Covers indications, interactions, adverse reactions, mechanism of action, dosages, tables and regimens, and how drug is supplied. Formulary information directly from PBM and health plan partners, covering about 65 million lives. Includes co-pay tiers, quantity limits, and prior authorization requirements.	Palm OS	Free to physicians; health plans pay on a per-member basis

Source: Company interviews, Web sites, and marketing material.

E-Prescribing Solutions

A handful of vendors provide access to integrated drug and formulary information, with the ability to transmit prescriptions to printers and pharmacies. Traditionally, these vendors have offered client-server applications. Newer entrants focus on Web-based applications, which are less expensive and less difficult to integrate.

Efficiency: High

Combination of drug reference and formulary information has potential to lower prescription errors. Although "electronic transmission" typically means automatic faxing rather than direct communication between physician and pharmacy computer systems, prescriptions are legible and therefore reduce callback from pharmacies.

Cost Control: High

Aggregated, easy-to-use formulary information helps physicians with compliance. Integrated drug references and electronic transmission make physicians more likely to use the tool and pharmacies more able to read the prescriptions.

Patient Safety: Moderate–High

Integration of drug and formulary information and legibility of prescriptions have potential to lower medical errors. Physicians have the option to integrate patient-specific information, which increases the software's ability to screen for problems.

Ease of Implementation: Moderate–Low

Software must be integrated into the physician's existing information systems to achieve basic functionality. At a minimum, patient demographic and formulary information must be exchanged through a one-time data capture from the physician's practice management system. Web-based applications are easier to implement.

Affordability: Moderate–Low

One advantage of e-prescribing products is that physicians do not have to implement a complete electronic medical record to gain benefit. However, they are more expensive than electronic references and integrated drug and formulary tools. Physicians pay a monthly subscription fee, purchase additional hardware, and incur expenses related to integrating the new system.

Stability and Use in the Market: Low

Many stand-alone e-prescribing companies have gone bankrupt and/or have been purchased by large PBMs or health plans (for example, iScribe, Parkstone Medical, LogonHealth). The remaining players have relatively low market penetration or may be on shaky financial ground.

Table 3. E-Prescribing Solution Vendors*

Company/Statistics	Product	Rx Capability	PDA Platform	Software Cost†
Allscripts‡ Founded 1986, $47 million, 365 employees, 2,000 physicians using Rx product.	TouchWorks: Rx+ (Version 8.1) for large medical groups; TouchScript for small group practices.	Provides integrated drug and formulary information through third-party vendors or partners. Provides detailed patient information when integrated with other IT systems. Offers wireless handheld devices and the ability to print or transmit to pharmacy.	Pocket PC	$100–$150 per month per physician
PocketScript Private company, founded in 1999, 16 employees, about 400 physicians using Rx product.	PocketScript	Provides integrated drug and formulary information from third-party vendors or partners, and access to patient demographic information. Offers wireless handheld devices and ability to print or transmit to pharmacy.	Pocket PC	$49–$79 per month per physician
Wellinx Private company, founded 1999, 70 employees, 300 physicians using Rx product.	Wellinx Clinical Information System	ASP-based application with handheld device. Supports clinical decisions with treatment guidelines and drug recommendations. Includes drug and formulary information from third-party vendors and the ability to print or transmit to pharmacy.	Pocket PC	$119 per month per physician

Source: Company interviews, Web sites, and marketing material.

* Other vendors—Medix's CyMedix and CyBear's @Rx—recently launched new Web-based applications that are free to physicians. To date, these products have very low penetration in the market.

† Excludes implementation and hardware costs, which can range significantly depending on the customer.

‡ Allscripts takes a "modular" approach to selling a comprehensive EMR solution. Physicians can purchase the entire EMR or the e-prescribing module. Therefore, Allscripts is listed as both an e-prescribing solution and an integrated EMR vendor.

Integrated EMR and E-Prescribing Systems

Electronic medical record software supports clinical decision making and information management processes, including capturing medical notes, ordering lab tests, and reviewing clinical guidelines. Most EMR systems include prescription writing capability. Physicians can review drug information, screen for drug and allergy interactions using the patient's medical record, and transmit prescriptions to printers or pharmacies. Many systems lack integrated formulary information or handheld devices.

Efficiency: Moderate–High

Access to drug information and legible prescriptions can reduce clinical errors and callbacks from pharmacies. Some systems lack formulary information and handheld devices, which could limit impact on efficiency.

Cost Control: Moderate–High

Some systems lack formulary information, and physicians do not use handheld (point-of-care) devices, which could limit impact on cost control.

Patient Safety: High–Moderate

Platforms offer the advantage of working in an integrated system and having access to sophisticated clinical information. Safety checks are patient specific. New prescription information flows back into the electronic medical record. Some systems lack handheld devices, which could limit use at the point-of-care and therefore impact on patient safety.

Ease of Implementation: Low

Systems are comprehensive software packages. They require extensive integration into the physician's workflow and existing practice management system, which can take weeks or months.

Affordability: Low

Physicians pay monthly subscription fees, purchase additional hardware, and incur expenses related to integrating the new system. Total expenses start at $15,000 and easily top $200,000.

Stability and Use in the Market: Low

Most physicians have a practice management system to support administrative processes like scheduling, registration, and billing. Relatively few practices have electronic medical records. According to a survey by Deloitte Research and Fulcrum Analytics, 12 percent of physicians use an EMR and 4 percent use one with Internet access.[21]

Table 4. Integrated EMR and E-Prescribing Systems Vendors

Company/Statistics	EMR Product	Rx Capability
Allscripts* Founded 1986, $47 million, 365 employees	TouchWorks: Rx+	Automates processes, including prescribing, charge capture, dictating, lab orders and results, and clinical note writing. Physicians can purchase comprehensive EMR solution or individual capabilities. Includes formulary information and handheld device.
Cerner Corp. Founded 1979, $543 million, 4,190 employees	PowerChart	Clinical office features prescription writing along with documentation, orders management, and decision support tools. Includes drug reference and formulary information.
Companion Technologies Founded in 1973, $84 million	MedicWare	Enables physicians to use handheld to search drug reference, check current medications, generate prescriptions, and transmit to pharmacy. No built in formulary information.
Epic Systems Founded 1979, $76.5 million, 650 employees	EpicCare, Epic OnHand (handheld device)	Enables physicians to prescribe medications, enter notes, indicate diagnoses, and create orders at the point of care. Includes drug reference and formulary information.
GE Medical Systems Information Technologies Founded 2000, $1.6 billion, 4,400 employees	Centricity, Logician	Logician enables physicians to search drug reference, check current medications and formularies, and print or fax prescriptions to pharmacy. No handheld device currently available.
Health Care Data Systems Founded in 1995, $9.6 million, 100 employees	Entity†	Enables physicians to use handheld to search drug reference; check interactions, allergies, and doses; and print or fax prescriptions to pharmacy. No built-in formulary information.
Misys Health Care Founded 1982, $400 million in revenue, 2,400 employees	Misys EMR	Enables physicians to use handheld to search drug reference, check interactions, current medications, and doses, and print or fax prescriptions to pharmacy. No built in formulary information.
NDCHealth Founded 1967, $350 million in revenue, 1,400 employees	Concept,† Lytec,† MediSoft†	Prescription writing capabilities provided through EDI services (see Appendix C).
NextGen Founded 1974, $40 million in revenue, 223 employees	NextGen EMR	Enables physicians to use handheld to search drug database, check current medications and allergies, and generate prescriptions for printing and transmission to pharmacy. No built-in formulary information.
VitalWorks Founded in 1997, $106 million, 660 employees	ChartStation	Contains handheld prescription writing capability.
WebMD Founded in 1996, $706 million in revenue, 4,300 employees	OmniChart, Medical Manager†, Ultia (handheld device)	OmniChart and Ultia enable physicians to select drugs and print prescriptions. With Medical Manager Network Services, physicians can also check DUR and formularies, and transmit prescriptions to pharmacy.

Source: Healthcare Informatics June 2002; company interviews, Web sites, and marketing material.

* Allscripts takes a "modular" approach to selling a comprehensive EMR solution. Physicians can purchase the entire EMR or the standalone e-prescribing module. Therefore, Allscripts is listed as both an e-prescribing solution and an integrated EMR vendor.

† This is a practice management software application and is the foundation of the company's prescription writing capability.

V. Detailed Company Profiles

IN LIGHT OF THE SIGNIFICANT BARRIERS TO adoption of integrated EMR e-prescribing solutions and the relatively low impact of electronic drug reference tools, this concluding chapter focuses on four companies that offer stand-alone prescribing products. These products have some degree of impact on efficiency, cost, and quality, and are *relatively* inexpensive and easy to integrate. They offer practical interim alternatives to more costly and complex integrated prescription writing programs.

Table 5. Vendor Comparison

	Product/Platform	Penetration	E-Prescribing Capability	Ease of Use	Cost to Physician (per mo/per doc)
Allscripts	TouchScript, Rx+ (Pocket PC)	2,000 physicians w/ handheld prescription writing software ●●○○	Full functionality; integrated patient information ●●●●	Flexible integration; robust design can make tasks more difficult ●○○○	$100–$150, with medium to significant integration costs ●○○○
ePocrates	Rx Formulary (Palm OS)	100,000 downloads ●●●○	Drug and formulary content; limited expandability of Palm platform ●○○○	No integration; familiar device (Palm); straightforward application ●●●○	Free ●●●●
PocketScript	PocketScript (Pocket PC)	400 physicians ●○○○	Full functionality; limited patient information ●●○○	Simple integration; straightforward application ●●○○	$49-$79, with low integration costs ●●○○
Wellinx	Wellinx (Pocket PC)	300 physicians ●○○○	Full functionality; limited patient information ●●○○	ASP-based application means limited integration ●●●○	$119, with low–medium integration costs ●●○○

●●●● *Superior*　　●●●○ *Above Average*　　●●○○ *Average*　　●○○○ *Below Average*　　○○○○ *Low*

Allscripts

Allscripts is a publicly traded company with 365 employees headquartered in Libertyville, Illinois. The company was founded in 1986 and originally focused on dispensing prepackaged medications within physician offices. In 1998, the company changed its business model to include the sale of electronic prescribing systems. Through a series of acquisitions over the last three years, Allscripts now offers a comprehensive EMR solution, called TouchWorks, that automates processes including prescribing, charge capture, dictating, lab orders and results, patient education information, and clinical note writing.

Strategic Focus

Allscripts' strategy is to take a modular approach to providing comprehensive EMR solutions. Physicians purchase individual pieces of software, representing pieces of the EMR capability, one at a time and according to their need.

Because the company ultimately supports large software packages, Allscripts targets large group practices and health care organizations as its customers. Allscripts is particularly focused on sales to customers of IDX Systems Corporation. IDX supports practice management systems for approximately 25 percent of U.S. physicians, with greater than 50 percent penetration of large physician groups, health systems, and academic medical centers. In July 2000, Allscripts entered a ten-year strategic alliance with IDX to serve as the company's exclusive provider of Internet and point-of-care clinical applications.

Revenue Model

Allscripts charges physicians for its software, hardware, and implementation services. PBMs pay transaction fees for prescriptions written through Allscripts' systems. The company diversifies its revenue base through a program called FirstFill, which enables physicians to dispense prepackaged medications out of their offices.

Allscripts software costs vary, depending on the size of the medical group and the software modules purchased, but e-prescribing may cost between $100 and $150 per month per physician. Hardware, integration, and implementation costs vary significantly. Costs for hardware and one-time data capture to implement TouchWorks Rx+ Version 7.6 may start at $5,000, while implementation of TouchWorks Rx+ Version 8.1 can easily exceed $50,000.

Market Penetration

Allscripts supports more than 20,000 physicians nationally with its EMR and e-prescribing solutions. Approximately 2,000 physicians use Allscripts' handheld e-prescribing solution. The company reports that over 280,000 new prescriptions are written every month, and more than 88,000 were written in California in the second quarter of 2002.

Prescription Software

Allscripts has two e-prescribing products, one for large medical groups and another for smaller physician practices.

■ TouchWorks Rx+ Version 8.1 was designed to be the prescription-writing module within Allscripts' comprehensive EMR. If physicians choose to buy this version as a stand-alone module, they must also purchase "WorkFlow," which is the foundation of the entire EMR solution. Rx+ Version 8.1 and WorkFlow require significant integration, which can be expensive, but which support continuous, bidirectional exchange of patient information.

■ TouchWorks Rx+ Version 7.6 (also Touch-Script) predates Allscripts' EMR solution. While essentially a stand-alone product, the system can be integrated for continuous information exchange into an existing PMS system, but operates well using basic patient demographic information exchanged periodically or downloaded once at the time of installation. New e-prescribing products are being developed, including an integrated hardware/software product optimized for individual physicians and small group practices. The product should work like Version 7.6 and is due to launch in fall 2002.

The e-prescribing process using these two products is basically the same. Using a PDA, the physician selects a patient's name, selects a diagnosis from a list of standard ICD-9 codes, selects a drug from a list of medications associated with that diagnosis, and selects a dosage for that drug. During the process, the physician sees warnings about drug-drug and drug-allergy interactions, and can look up the appropriate doses for adult and pediatric patients. The patient-specific formulary information for each medication is listed next to each drug name. After the physician has selected the appropriate medication, the system automatically generates a prescription, prints it and/or transmits the prescription to a local pharmacy.

Hardware

Allscripts software runs on desktop workstations or wireless handheld devices. Allscripts supports handheld PDAs using the Pocket PC operating system, including the Compaq iPAQ and HP Jornada. Allscripts plans to incorporate Microsoft's Windows XP Tablet PC into its product line for advanced mobile health care solutions by the end of 2002. To operate Allscripts' e-prescribing systems, physicians need a handheld device with wireless capability ($700–800) or a desktop PC, a server ($1,000–5,000), a printer ($300–400), and possibly additional wireless access points ($500–700), depending on the configuration of the office.

Evidence of Impact

Allscripts has demonstrated cost savings through a number of pilot studies with clinics and hospital systems. In one independent study, Cap Gemini Ernest & Young examined 682,000 prescriptions from 1,200 doctors and found that generic utilization increased 12 percent, from 43 to 55 percent.[22] Other documented case studies with specific medical groups have demonstrated similar positive impact on prescription utilization and costs (for example, Temple University, San Jose Medical Group, Quantum Medical Group, Joliet Medical Group). Allscripts also works with managed care organizations to accelerate physician adoption of e-prescribing. For example, the Hawaii Medical Services Association (HMSA) helps subsidize the costs of hardware and software for physicians in Hawaii. Their pilot program was recently expanded from 150 physicians to more than 500 physicians.

Allscripts has launched, but not completed, a study with a large academic medical center to evaluate impact on quality of care. Meanwhile, the company points to partner Temple University Health System, which managed to negotiate a 10-percent reduction in its annual malpractice insurance based on the assumption that medical errors would decrease.

ePocrates

ePocrates is a private company with 75 employees, founded in 1998 and headquartered in San Mateo, California. Originally, the company focused on selling drug reference information preloaded on Palm Pilot devices, and distributing those devices through pharmaceutical sales representatives. ePocrates stopped selling hardware in 2001 and now relies on physicians to download the software over the Internet rather than receive it via pharmaceutical sales representatives.

Strategic Focus

ePocrates focuses on achieving large-scale physician penetration by providing limited, easy-to-use functionality. The company has chosen not to provide more complex e-prescribing capabilities, such as prescription generation, printing, and transmission to pharmacy. ePocrates maintains the ability to add these and other applications if and when the infrastructure and standards exist to support the development of a technology that physicians will incorporate into their everyday workflow.

Revenue Model

ePocrates provides its products free to physicians. The company charges health plans and pharmacy benefit managers on a per-member basis to incorporate their formularies into Rx Formulary, ePocrates's formulary and drug reference product. The total annual investment for a health plan is between $30,000 and $200,000, depending on the size of the plan. The company also generates revenue from pharmaceutical companies, which pay for the right to send drug alerts and promotions to ePocrates physicians, and from market research companies, which pay to solicit physicians to participate in various marketing surveys.

Market Penetration

Nationally, ePocrates's drug reference information has been downloaded by 640,000 individuals, including doctors, pharmacists, and other health care professionals; 43 percent of downloads are by practicing physicians. ePocrates's formulary product, Rx Formulary, was launched in January 2002, and has been downloaded by 100,000 individuals, 45 percent of whom are practicing physicians.

Prescription Software

ePocrates combines proprietary drug reference and formulary information from partner health plans and pharmacy benefit managers into one product, Rx Formulary. Physicians download the information from ePocrates's Web site to their desktop PCs, and then hotsync the information onto their handheld PDAs.

Physicians can view lists of branded or generic drugs and check for interactions among up to 30 medications simultaneously. By tapping on the "Formulary Status Code" to the right of each drug name, physicians can view pop-up displays with detailed formulary information. Physicians can switch from formulary to formulary, depending on a patient's coverage, by opening a pull-down menu and selecting a specific plan.

ePocrates's drug information—which is drawn from package inserts, drug information compendia, medical texts, specialty references, consensus guidelines, primary literature, and clinical experts—is similar to drug reference material purchased by most e-prescribers from First Databank or Multum Information Service. The primary difference is that the information has been formatted expressly for use on a handheld device—there is less extraneous information, so the screen is uncluttered and the memory "footprint" is small (1.5 MB). The information includes adult and pediatric dosing, drug interactions, adverse reactions and contraindications, mechanism of action, packaging information, tables and regimens, off-label indications, and retail price.

Unlike most e-prescription vendors, ePocrates partners directly with PBMs and health plans to make their formularies available through Rx Formulary, rather than purchasing the information from a third-party vendor. Nationally, ePocrates estimates that their formulary information covers 65 million individuals, or 30 percent of the 220 million people with pharmacy benefits. The company's partners include ExpressScripts, Aetna, CareMark, and Cigna, but exclude AdvancePCS and Merck-Medco (although ePocrates works with several of Merck-Medco's largest clients, including UnitedHealthcare). The formulary information includes co-pay tier, prior authorization requirements, quantity limits, and step therapy guidelines.

Hardware

ePocrates requires a handheld device using the Palm OS operating system and a desktop PC with Internet capabilities. Palm-OS-based devices include the Palm series, Handspring, Sony, HandEra/TRGpro, and Kyocera. The Rx Formulary content requires 1.5 MB-2.0 MB of free memory on the handheld, and 20 MB of available hard disk space on the desktop PC. ePocrates software is not compatible with Pocket-PC-based devices such as HP Jornada, Compaq iPAQ, and Cassiopeia. The Rx Formulary product does not run on Macintosh computers.

Evidence of Impact

Three studies point to ePocrates's impact on cost, quality, and efficiency.

- AdvancePCS followed 90 physicians over a four-month period. The study found that utilization of generics and preferred brands increased 1.7 percent and 3.9 percent respectively, while multi-source and non-preferred single-source brands decreased by 4.1 percent and 1.5 percent respectively. Sixty-five percent of participating physicians rated high or very high ePocrates's impact on quality of care. Sixty-four percent reported a reduction in formulary-related phone calls.

- A Brigham & Women's study, published in the May/June 2002 *Journal of the American Medical Informatics Association*, surveyed 2,250 ePocrates physicians. Fifty percent said ePocrates prevented one to two errors per week. Almost 79 percent said that using the product contributed to improved drug-related decision making.[23]

- ePocrates surveyed 939 of their own customers in June 2002. Fifty-eight percent reported that they or their staff saved more than ten minutes a day due to fewer formulary callbacks, and 64 percent of those said they were then able to spend more time with patients.

PocketScript

PocketScript was founded in Mason, Ohio, in 1999 by Dr. Thaddeus Bort, a family practitioner with a large practice in the Cincinnati area, and Steven Burns, an electrical engineer with experience in software and medical connectivity applications. In March of 2002, their senior management team and some former investors purchased the PocketScript assets out of bankruptcy and formed PocketScript LLC. Since March, the company has transactional revenue agreements with the three largest PBMs and is one of the lead vendors in the RxHub rollout. PocketScript has approximately 16 employees and focuses exclusively on providing electronic prescribing capabilities.

Strategic Focus

PocketScript is known by customers as providing electronic prescribing capabilities that are easy to use and easy to integrate. The company's established product is a handheld PDA, used for traditional wireless electronic prescribing. The company is in the process of introducing a Web-based product that can be used from virtually any computer with Internet access, and a smart-phone PDA model that can be used as an electronic prescriber and as a cell phone and pager.

Revenue Model

PocketScript's approach to funding is that "everybody should pay something because everybody shares the value." In line with that philosophy, PocketScript generates revenue from physicians, pharmacy benefit managers, pharmaceutical companies, and pharmacies. Physician cost is generally between $49 and $79 per month per physician, excluding hardware and installation. Installation costs for the software supporting the handheld PDA depend on the customer, but range from no charge to approximately $1,500.

Market Penetration

PocketScript has placed devices with 400 physicians, the majority of which use the product everyday to write new prescriptions as well as renewals.

Prescription Software

Physicians use the PocketScript handheld device at the point of care to transmit electronic prescriptions directly from the exam room to the patient's pharmacy of choice. The physician taps on the patient's name, selects a drug, and chooses the appropriate dose for the patient. Before the prescription is transmitted, PocketScript flags possible drug interactions and supplies patient-specific formulary information, enabling the physician to select the most appropriate pharmaceutical product for the patient.

In addition to the wireless handheld version, PocketScript's Web-based version can be used by front-office staff to queue up renewal requests for physician approval. Once approved by the physician, the prescriptions are sent electronically to the pharmacy of the patient's choice. The Web-based version is designed to be a low-cost entry point into electronic prescribing with the ability to add optional handheld versions or the new e-prescribing smart-phones for the physician.

PocketScript software offers access to detailed formulary information and patient medication histories through its partnership with RxHub. Merck-Medco, AdvancePCS, and ExpressScripts are the three largest PBMs in the country and provide their formulary information to Pocket-Script to incorporate into their software.

PocketScript buys drug reference information from Multum Information Services. The information includes drug interactions, adverse reactions and contraindications, adult and pediatric dosing, packaging information, tables and regimens, and adult and pediatric doses.

Hardware

PocketScript supports handheld PDA and smart-phone devices using the Microsoft Pocket PC operating system. The Web-based version of PocketScript requires Microsoft IE browser version 5.5 or higher. To operate the wireless handheld system, physicians need a device with wireless capability ($700–800), a server with wireless capability ($1,000–5,000), a printer ($300–400), and possibly additional wireless access points ($500–700), depending on the configuration of the office.

Evidence of Impact

In August 2002, Tufts Health Plan and Advance-PCS released results of an electronic prescribing study using PocketScript technology. The effort involved 100 Massachusetts physicians who work for Tufts Health Plan and was designed to measure the value and impact of e-prescribing. The study showed:

- Up to two hours less spent on the prescription process per day per prescriber.
- Thirty percent fewer calls between physicians and pharmacists.
- Savings of nearly one hour per pharmacist in a typical day.
- Increased quality of care reported by 35 percent of prescribers due to the ability to check drug interactions and prescription accuracy.
- Increased adherence to Tufts Health Plan preferred drugs reported by 50 percent of prescribers.

Wellinx

Founded in 1999, Wellinx is located in St. Louis, Missouri, and employs 70 people. Wellinx software was originally developed by an independent 75-physician group practice of internists, pediatricians, and family practitioners. The system links critical patient and clinical information with decision support and e-prescribing capabilities.

Strategic Focus

Wellinx is physician focused and clinically based. Physicians receive clinical support for diagnosing patients, recommended treatment guidelines, and lists of appropriate drug therapies. Wellinx does not partner with pharmaceutical companies or PBMs as a way of generating income. The system presents formulary information but does not push physicians toward particular drugs in accordance with any corporate agreement.

Wellinx delivers its application through an Internet ASP-based system rather than a traditional client server, and it is therefore different from most e-prescribing solutions. ASP-based applications—the software, hardware and implementation—generally cost less than traditional solutions. These systems store data remotely on a centralized database, which means patient prescription and diagnosis history are aggregated and can be accessed by multiple people from different locations.

Revenue Model

Wellinx charges physician clients for its services. Expenses include a one-time implementation fee of $5,000 per site, a monthly subscription fee of $119 per practitioner, and a monthly equipment cost fee of $50–$75. Wellinx also generates revenue through DRx, a wholly owned subsidiary that supplies pre-packaged prescription medications to medical and dental clinics and offices throughout the United States.

Market Penetration

Approximately 300 physicians currently use Wellinx's electronic prescribing system. The majority is located in Missouri, Kentucky, Wisconsin, and Florida.

Prescription Software

Using a wireless handheld device (or wired computers already in the clinic), physicians generate diagnosis codes for their patients by stepping through a series of prompts about the condition. Physicians may also skip directly to a specialty-specific diagnosis list, a physician-specific diagnosis list, or a list of 3,000 ICD-9 codes.

Once an accurate diagnosis code is created, the software presents information about recommended therapies. Physicians have constant access to explicit assessments about the quantity and quality of information that leads to the system's conclusions and recommendations, and can access summaries of the primary data behind them. The system also supplies printable diagnosis- and treatment-related education material for physicians to give to their patients.

After generating a diagnosis code, physicians can write prescriptions. Prescribing support includes drug-drug interactions, drug-allergy alerts, and formulary status information. Wellinx utilizes the industry standard First DataBank for drug-drug and drug-allergy interaction checking, and buys formulary information from Infoscan. The system automatically faxes prescriptions to pharmacies, and prescriptions can be printed in the physician's office.

Hardware

The Wellinx system requires a high-speed Internet connection and a networked printer to perform prescription writing. The company provides a wireless handheld device that operates on a Pocket PC platform and accesses information through secure Internet communications. Physicians are not required to purchase a server to support the technology. A remote computer center operates around the clock to execute the Wellinx software, and is backed by a duplicate center. Wellinx builds an interface between the physician's practice management system and its ASP application in order to integrate patient demographic and scheduling information into the e-prescription program.

Evidence of Impact

Studies of claims data from two health plans comparing Wellinx users to control groups showed the following results:

- Users have significantly lower prescription drug costs, measured per member per month ($8.59, or 11.7 percent, less per member per month for Medicare plan members and $5.87, or 23.5 percent, less PMPM for commercial plan members).

- The average generic prescribing rate for Wellinx users is 63 percent, versus 48 percent for controls.

- Wellinx eliminates nearly all pharmacy-related phone calls to physicians, as well as chart pulls and rework associated with most calls.

Appendix A:
Product Comparison

	Allscripts		ePocrates	PocketScript	Wellinx
Product	TouchWorks: Rx+ 8.1	TouchScript: Rx+ 7.6	Formulary Rx	PocketScript	Wellinx Clinical Information System
Penetration	200 physicians	1,800 physicians	100,000 downloads	400 physicians	300 physicians
PDA platform	Pocket PC	Pocket PC	Palm OS	Pocket PC	Pocket PC
Functionality	Full e-prescribing, extensive patient information	Full e-prescribing, limited patient information	Drug and formulary content only	Full e-prescribing, limited patient information	Clinical support for diagnoses, full e-prescribing, range of patient information
Drug content	MediSpan*	MediSpan*	Proprietary database	Multum*	First Data Bank*
Integration	Extensive	Flexible	No capacity or need to integrate	Minimal	Minimal
Formulary content	InfoScan† and PBM partners	InfoScan† and PBM partners	PBM and Health Plan partners	PBM partners	InfoScan†
Connectivity	Wireless to printer and pharmacy via fax	Wireless to printer and pharmacy via fax	None	Wireless to printer and pharmacy via fax	Wireless to printer and pharmacy via Internet and Wellinx server
Hardware requirements	PDA, PC, Internet, server, printer, wireless connection	PDA, PC, Internet, server, printer, wireless connection	Palm OS-based PDA, PC, Internet	PDA, PC, Internet, server, printer, wireless connection	PDA, PC, Internet, printer, wireless connection, VPN for remote access
Software cost to physician (per physician per month)	$120-$150 ‡	$100 ‡	None to physicians, health plans pay an annual fee	$49-$79	$119
Additional costs	Integration and hardware costs likely to exceed $50,000‡	Integration between $1,000 and $10,000, excluding hardware‡	None, aside from Palm and Internet-ready PC	Integration cost between $0 and $1,500, excluding hardware	$5,000 set up fee, $50-75 per month per physician for additional hardware

* First DataBank, Multum Information Services, and MediSpan are third-party vendors for electronic drug information, including drug name; dosing; pharmacokinetics; drug-drug, drug-allergy, and drug-food interactions; side effects; pharmacology; warnings and contraindications; therapeutic categories; and article citations.

† InfoScan Formulary Database integrates formulary information from 2,800 managed care organizations, PBMs, HMOs, PPOs, self-insured employers, and other health care plans. Information includes drug status, relative price, and prior authorization requirements.

‡ Costs range significantly depending on the kind of e-prescribing/EMR capability the customer is interested in purchasing and the size of the practice. Allscripts plans to launch an additional product for small practices and charge a lower, one-time flat fee for the software, hardware, and implementation services.

Appendix B:
Comparing Palm OS and Pocket PC[24]

PALM OS AND POCKET PC MACHINES WERE designed for two entirely different functions. Palm OS was optimized to support small personal productivity programs and run on specific hardware designed by Palm Computing. Pocket PC was designed as a general-purpose operating system to run on a much wider range of hardware—different screens, keyboards, modems, and peripheral devices. The advantages of Palm devices include cost, size, ease of use, and battery life. Pocket PC's fast processor and large memory allow it to handle larger programs than Palm OS.

Generally speaking, Palm OS devices are good for physicians interested in using a PDA for drug references, medical texts, and personal information management. Pocket PC devices are better for physicians looking to automate their office operations. According to Forrester Research, 45 percent of physicians who use sophisticated health care applications favor Windows-based devices, and most PMS vendors have moved toward Pocket PCs.

Table B-1. Comparison of Key Features

	Palm OS	Pocket PC
Overview		
Device manufacturers	Palm, Handspring, Sony	Compaq, HP, Casio, NEC
Retail price	$199–$500	$300–$650
Market share	approx. 85%	approx. 15%
Form Factors		
Weight	4.0–5.9 oz.	6.3–6.7 oz.
Typical dimensions	4.7 by 3.1 inches	5.1 by 3.3 inches
Interface	Easy to use, but lower image and color quality	High image and color quality
Power		
Memory	8 MB–16MG	16MB–64MB
Speed	33–66 MHz	206 MHz
Battery	Days to weeks	8–14 hours
Multimedia	More limited audio/visual support	Sound and video support
Connectivity		
Compatibility	Microsoft Office with interface	Microsoft Office
Wireless	Built into Palm VII, but others use cradle	Requires modem accessory

Source: Manufacturer Web sites; *NPD TechWorld* retail data; customer interviews.

Appendix C:
Select Electronic Data Interchange Vendors

Table C-1. Select Electronic Data Interchange Vendors

Company/Statistics	EDI Services	E-Prescribing Initiatives
NDCHealth Founded 1967, $350 million in revenue, 1,400 employees	Broad range of products for physicians, pharmacies, and pharmaceutical companies, including eligibility, referrals, claims, payments, and data-gathering services.	Electronic Prescription Services is a Web-based service that uses standardize messages (e.g., request for a new prescription, cancel prescription previously sent) to facilitate electronic prescription writing and refills between physicians and pharmacies.
ProxyMed Founded in 1989, $43 million in revenue, 284 employees	ProxyNet connects providers, payers, pharmacies, and labs through a proprietary network. Transactions include claims, eligibility, and prescribing processing.	PreScribe, launched February 2002, enables nurses and physicians to authorize refills using a Web-based desktop system. Also working with pharmacy software vendors to develop standard for electronic prescriptions.
WebMD Founded 1996, $706 million in revenue, 4,300 employees	Envoy is a clearinghouse for batch and real-time transactions between payers, providers, pharmacies, and labs, including eligibility, referrals, claims and payments.	E-prescribing capabilities provided through PMS and EMR software, not EDI services (see Table 4).

Appendix D:
Contact Information

Allscripts Healthcare Solutions
Libertyville, IL
1-800-654-0889
www.allscripts.com

Cerner Corporation
Kansas City, MO
(816) 201-1024
www.cerner.com

Companion Technologies
Columbia, SC
1-800-999-0788
www.companion
technologies.com

Council for Affordable Quality Healthcare
Washington, DC
(202) 861-1492
www.caqh.org

Cybear
Boca Raton, FL
(877) 999-3500
www.cybear.com

Epic Systems Corp.
Madison, WI
(608) 271-9000
www.epicsystems.com

ePocrates
San Mateo, CA
(650) 650-227-1700
www.epocrates.com

Franklin Electronic Publishers
Burlington, NJ
1-800-266-5626
www.franklin.com

GE Medical Systems
Waukesha, WI
1-800-558-5120
www.gemedicalsystems.com

Handheldmed Inc.
Springboro, OH
(770) 261-5087
www.handheldmed.com

Health Care Data Systems
DeWitt, NY
(315) 446-7111
www.hcds.com

Medix Resources (Cymedix)
Agoura Hills, CA
(877) 996-3349
www.cymedix.com

MedUnite
San Diego, CA
(800) 586-6870
www.medunite.com

Misys Health Care
Raleigh, NC
(866) 647-9787
www.misyshealthcare.com

NDCHealth
Atlanta, GA
(404) 728-2000
www.ndchealth.com

NextGen Healthcare Information Systems
Horsham, PA
(215) 657-7010
www.nextgen.com

PocketScript
Mason, OH
(513) 701-6024
www.pocketscript.com

ProxyMed
Fort Lauderdale, FL
(800) 997-7699
www.proxymed.com

RxHub
St. Paul, MN
(651) 855-3000
www.rxhub.net

Skyscape.com
Hudson, MA
(978) 562-5555
www.skyscape.com

SureScript Systems
Alexandria, VA
(703) 683-8868
www.surescript.com

Thomson Medical Economics
Montvale, NJ
(201) 358-7200
www.medec.com

Vital Works
Ridgefield, CT
800-278-0037
www.vitalworks.com

WebMD
Elmwood Park, NJ
(201) 703-3400
www.webmd.com

Wellinx
St. Louis, MO
(866) 935-5469
www.wellinx.com

Appendix E: Resources

RESEARCH FOR THIS REPORT WAS CONDUCTED through an extensive review of articles, industry reports, and surveys related to electronic prescribing, and interviews with several industry experts, software vendor representatives, and key customers. Notable resources include:

Barrett, Michael J. "Making E-Prescribing Pay Off." Forrester Research, April 2002.

California HealthCare Foundation. "A Primer on Physician Order Entry." First Consulting Group, September 2000.

California HealthCare Foundation. "Innovations in Physician Prescribing." Protocare Sciences, October 2001.

California HealthCare Foundation. "E-Prescribing." First Consulting Group, November 2001.

Institute for Safe Medication Practices, "Electronic Prescribing Can Reduce Medication Errors." 2000

Fulcrum Analytics and Deloitte Research. "Taking the Pulse: Physicians and Emerging Information Technologies." Survey, January 29, 2002.

Harris Interactive and Boston Consulting Group. "Vital Signs Update: Doctors Say eHealth Delivers." *Health Care News* 1:31, November 13, 2001.

Holmes, Bradford J. "Doctors Connect with Handhelds." Forrester Research, June 2001.

Kohn, L. T., J. M. Corrigan, and **M. S. Donaldson, eds.** *To Err Is Human: Building a Safer Health System.* Washington, D.C.: National Academy Press, 1999.

Appendix F: Glossary

Adverse drug event (ADE)—An injury resulting from medical intervention related to a drug.

Bandwidth—The width of the range of frequencies that an electronic signal occupies on a given transmission medium; the amount of data that can be transmitted in a fixed amount of time.

Client server systems/software—Typically, a "client" is an application that runs on a personal computer or work station and relies on a server to perform some operations, such as sending email.

Electronic medical record (EMR)—Multifunctional software packages that support administrative and clinical operations of physician practices and typically include scheduling, registration, billing, managed care, and patient care modules.

Application service provider (ASP)—A vendor that deploys, hosts, and manages access to a packaged application for multiple parties from a central facility, charging a subscription use fee.

Electronic data interchange (EDI)—A direct exchange of data files between two computers. Generally, EDI transmission is faster than electronic faxing and offers more security than email transmission of prescriptions.

Formulary—A list of medications (both generic and brand names) that are covered by a specific health insurance plan or PBM.

Handheld PC or Pocket PC—A more powerful handheld than a PDA, the pocket PC has many of the functions and capabilities of desktop and laptop computers.

Medical error—The failure of a planned action to be completed as intended or the use of a wrong plan to achieve an aim in the health care delivery process.

Medication error—A mistake made at any stage in the provision of a pharmaceutical product to a patient.

Palm Operating System (Palm OS)—Handheld computer operating system developed by 3Com and characterized by operating simplicity and extensive information storage capacity.

Pharmacy benefit manager (PBM)—An organization contracted by health insurance plans to manage prescription medication benefits.

Personal digital assistant (PDA)—A handheld portable organizer; some with Internet access and email functions.

Wireless local area network (WLAN)—A computer network that spans a relatively large geographic area. Typically a WLAN consists of two or more Local Area Networks (LANs).

Endnotes

1. Institute for Safe Medication Practices. 2000. "Electronic Prescribing Can Reduce Medication Errors." (http://www.ismp.org/MSAarticles/Whitepaper.html)

2. Chassin, M. R. "Is Health Care Ready for Six Sigma Quality?" *Milbank Quarterly* 76: 565-591, 510 (1998).

3. Medical Group Management Association, Annual membership census (1996).

4. National Association of Chain Drug Stores, "2001 Community Pharmacy Results" (http://www.nacds.org/wmspage.cfm?parm1=505).

5. Institute for Safe Medication Practices, 2000.

6. Kohn, L. T., J. M. Corrigan, and M. S. Donaldson, eds., *To Err Is Human: Building a Safer Health System* (Washington, DC: National Academy Press, 1999).

7. International Communications Research, "ASHP Patient Concerns National Survey Report" (issued by American Society of Health-Systems Pharmacists, September 1999).

8. Institute for Safe Medication Practices, 2000.

9. "Inflation Spurs Health Spending in 2000," *Health Affairs* (January/February 2002), 179.

10. Mehl, B. and J. P. Santell, "Projecting future drug expenditures—2001." *American Journal of Health System Pharmacology* 58 (2001).

11. Harris Interactive and Boston Consulting Group Survey, "Vital Signs Update: Doctors Say eHealth Delivers," *Health Care News* 1:31 (November 13, 2001).

12. ePocrates customer survey (June 2002).

13. Harris Interactive Survey, released at the National Association of Chain Drug Stores' Annual Pharmacy & Technology Conference (August 12, 2002).

14. Harris Interactive and Boston Consulting Group Survey, "Vital Signs Update: Doctors Say eHealth Delivers." *Health Care News* 1:31 (November 13, 2001).

15. Fulcrum Analytics and Deloitte Research, "Taking the Pulse: Physicians and Emerging Information Technologies" (January 29, 2002).

16. National Association of Boards of Pharmacy, *Survey of Pharmacy Law* (2000) 60-61.

17. Chesanow, N. "Electronic Prescribing: What does your state allow?" *Medical Economics Online* (January 30, 2001).

18. Harris Interactive and Boston Consulting Group Survey, "Vital Signs Update: Doctors Say eHealth Delivers," *Health Care News* 1:31 (November 13, 2001).

19. Fulcrum Analytics and Deloitte Research, "Taking the Pulse: Physicians and Emerging Information Technologies" (January 29, 2002).

20. Ibid.

21. Ibid.

22. Cap Gemini Ernst & Young US LLC. "Financial Impact Analysis on Pharmacy Risk Pools." October 2000 (http://www.allscripts.com/ahcs/epres/page1.asp).

23. Rothschild, J.M., T. H. Lee, T. Bae, and D. W. Bates. "Clinician Use of a Palmtop Drug Reference Guide." *Journal of the American Medical Informatics Association* 9:223-229, 2002 (http://www.jamia.org/cgi/content/abstract/9/3/223).

24. Terry, K. "Palm, Pocket PC, or pen tablet? Hard facts about hardware," *Medical Economics* (2002) (http://www.pdr.net/articles/article1.jsp).