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*Position Paper* ■

# A Proposal for Electronic Medical Records in U.S. Primary Care

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**Abstract** Delivery of excellent primary care—central to overall medical care—demands that providers have the necessary information when they give care. This paper, developed by the National Alliance for Primary Care Informatics, a collaborative group sponsored by a number of primary care societies, argues that providers' and patients' information and decision support needs can be satisfied only if primary care providers use electronic medical records (EMRs). Although robust EMRs are now available, only about 5% of U.S. primary care providers use them. Recently, with only modest investments, Australia, New Zealand, and England have achieved major breakthroughs in implementing EMRs in primary care. Substantial benefits realizable through routine use of electronic medical records include improved quality, safety, and efficiency, along with increased ability to conduct education and research. Nevertheless, barriers to adoption exist and must be overcome. Implementing specific policies can accelerate utilization of EMRs in the U.S.

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> To provide all U.S. citizens with good quality, affordable health care, every primary care provider must be given the opportunity of using an electronic ambulatory information system, including a fully functional electronic medical record and with ability to access needed clinical information at the time and place of care.
>
> Vision statement of the National Alliance for Primary Care Informatics

Primary care is critical to the provision of excellent medical care.[1,2–4] A 1996 Institute of Medicine report defined primary care as the provision of integrated, accessible health care services by clinicians accountable for addressing most personal health care needs, developing a sustained partnership with patients,

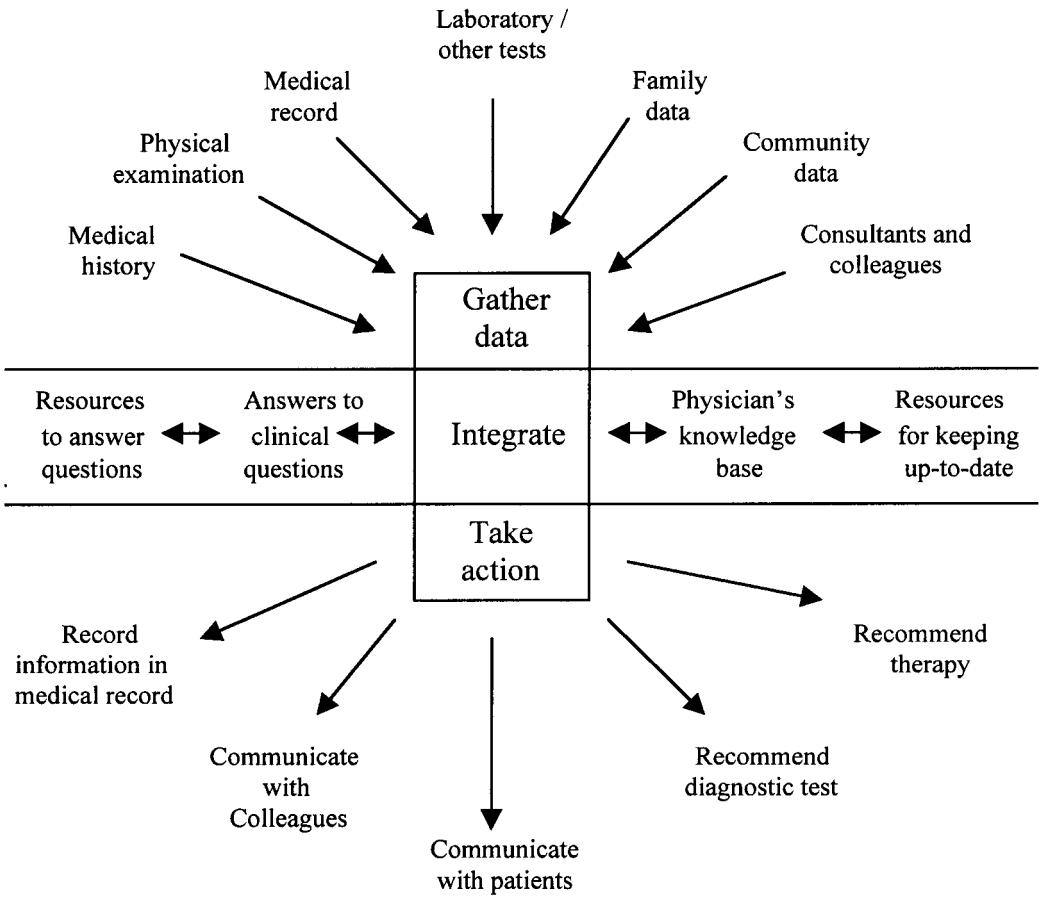


**Figure 1.** The flow of information in primary care practice. (Adapted with permission from MH Ebell and P Frame.)[65]

and practicing in the context of family and community.[4] More people receive care in primary care than in any other clinical setting.[5] In the U.S., the majority of office visits are to primary care providers[6] for care ranging from acute to chronic and preventive, including "priority" conditions such as heart disease, asthma, diabetes, and depression.[7]

Primary care providers manage information (from patients and other sources), integrate it with biomedical knowledge, and decide, with patients, on courses of action (Figure 1). Generally, this task is accomplished with pen and paper, despite the availability of many electronic medical record (EMR) systems (Table 1).[8,9] Currently, only about 5% of U.S. primary care providers use EMR systems.[10]

Even though U.S. medical care is the world's most costly, its outcomes are mediocre compared with other industrialized nations. A recent World Health Organization (WHO) report ranking the world's health systems placed the United States 37th.[11] The 2001 Institute of Medicine Report, "Crossing the Quality Chasm," characterized the U.S. system as fundamentally broken[12] and called for major federal investment in information technology as crucial to achieving necessary changes, such as "elimination of most handwritten clinical data by the end of the decade." Better use of information technology is essential to providing better care at lower cost.[12]

Despite its information-intensive nature, the health care industry invests only 2% of gross revenues in information technology, compared with 10% for other information-intensive industries.[13] Increased investment in health care information technology is clearly needed. We believe that the federal government, as the largest purchaser of American health care, should be integral in financing the adoption of electronic records. In the U.S., of $1.3 trillion spent on health care in 2000, public funds (including state sources) accounted for $589.4 billion, or 45%.[14] For health care providers, the federal government recently created unfunded mandates, including complex legislation like the Health Insurance Portability and Accountability Act of 1996 (HIPAA) and the Clinical Laboratory Improvement Amendments. Adopting

*Table 1* ■

Twenty-eight Outpatient Computerized Patient Record Systems[67]

| |
|---|
| Charting Plus |
| ChartWare |
| Clinical Works Module (ASP) |
| ComChart |
| DOCU*MENTOR |
| Dossier |
| Dr. Notes Program |
| ENTITY |
| EpicCare |
| HealthMatics |
| Health Probe Patient Information Manager |
| Logician |
| Logician Internet (ASP) |
| MedicWare EMR |
| NextGen |
| O-HEAP |
| Partner |
| PEARL |
| Physician Practice Solution |
| Physician Practice Solution (ASP) |
| PowerMed EMR |
| Practice Partner Patient Records |
| QD Clinical |
| SOAPware |
| TopsChart (ASP) |
| VersaForm CPR |
| Welford Chart Notes |

EMRs would alleviate some of the financial burden of these initiatives, and the federal government should participate financially in this solution.

We argue that the federal government should take the lead in financing an infrastructure to accelerate adoption of electronic records. A public-private partnership should be formed and charged with developing a strategic framework to facilitate EMR implementation, which would result in dividends to public and private health care, emergency preparedness, and the national community.

## Primary Care in the U.S.

Family physicians, general internists, pediatricians, nurse practitioners, and physician assistants comprise the main work force delivering primary care in the U.S. Substantial evidence suggests that excellent primary care is important to health.[2,3,15,16] In one study, the quality of primary care physician-patient partnerships correlated with three key outcomes: adherence, satisfaction, and improved health status.[17] Patients value the first-contact and coordinating role of primary care physicians.[18]

Primary care providers also deliver important preventive services. In one large study of women, receiving primary care at their regular site strongly correlated with obtaining preventive services.[16] Primary care providers are effective in helping smokers to quit[19] and are central to the treatment of chronic conditions such as diabetes, asthma, and heart disease.[20] In addition to being complex and demanding to treat, these conditions also can be expensive.[21] A cohort study showed that improved glycemic control in a diabetic population was associated with lower costs within 1–2 years.[22] The primary health care system also serves essential national interests by providing an infrastructure for detecting unusual health events and a vehicle for rapidly disseminating information and care during a national emergency.[23]

Compared with specialists, primary care providers are reimbursed poorly for the care they give.[24] If viewed narrowly, primary care often loses money. As a result, health care organizations are often reluctant to invest in primary care. To generate investment in information technology for primary care, incentives will be required.

## Perspective on Traditional Paper-based Record-keeping

Historically, providers have documented and delivered care using paper records because of their simplicity, low implementation cost, and widespread acceptance. However, paper records have significant disadvantages: availability to only one person at a time; frequent illegibility; inability to be accessed remotely or at the time and place needed; growing so thick as to be unwieldy; low utility and large overhead as vehicles to evaluate quality; and segmentation with multiple volumes and multiple storage sites. The most serious problem with paper records is that they impede provision of clinical decision support; data stored in inaccessible formats cannot incorporate or trigger decision support tools.

## Definition of Electronic Ambulatory Medical Record

Ambulatory EMRs typically include a problem list, medication list, allergy list, notes, health maintenance information, and results retrieval (for laboratory, radiology, and other testing results). Most EMRs include a computerized prescribing tool, and many also include computerized ordering. These feature tools for both displaying and capturing data such as

notes. While having complete, legible, and organized information is advantageous, benefits can multiply when decision support is provided using electronic applications.

## Motivation for Electronic Medical Records in Primary Care

The unaided human mind simply cannot process the current volume of clinical data required for practice, especially relevant given the broad scope of primary care. Tolentino suggests that "voltage drops" occur in the transmission of medical knowledge.[25] As information becomes obsolete, it is not refreshed, and new knowledge cannot be integrated. Thus, physicians take "short cuts," using clinical experience and heuristics rather than pursuing organized investigations. The advent of genomics will only make this problem worse.

Primary care providers have many important information needs that are not being met.[26] Studies of these needs[27–29] suggest that physicians have about 8 unanswered questions for every 10 ambulatory visits. If physicians adopt EMRs, one benefit may be to improve access to electronic information resources.

Because of their integrating and coordinating function, electronic records are especially important for care of certain populations, such as rural residents, children, pregnant women, lactating mothers, and the elderly, who depend heavily on primary care physicians.[30] Poor and underserved populations may require different primary care services.

The dream of converting from paper to electronic charts has a long history.[31–33] Three recent developments make it time for this dream to become a reality. First, given the widely dispersed nature of primary care services, the Internet can now play a critical role in this transformation.[34] High-speed connections from physician offices can provide web-based clinical tools using an application services provider (ASP) model (see Table 1). Second, the speed and power of readily available computers are increasing and their costs decreasing. Third, computers and software are evolving rapidly, so that mobile devices can be easily linked to wireless medical networks.[35] Handheld computers can be useful sources of drug and other information[36] and in the near future will likely help to extend desktop networks.

Although the full range of EMR benefits will not become clear until more systems are implemented and more processes computerized,[37] EMR systems can already improve efficiency and quality. The costs of "chart pulls" can be eliminated, and dictation costs can be substantially reduced. Providers can also receive decision support regarding the costs and selection of drugs, laboratory tests, and radiographic studies. By making a number of changes identified by EMR data, such as identifying the least expensive drug within a class, providers were able to reduce drug costs by 18% (personal communication, J. M. Overhage, September 2001). Several studies showed that displaying charges for tests,[38] the last test result of that type,[39] and prediction whether a specific future result would be abnormal given prior results[40] independently reduced laboratory test use by 10–15%. The EMR is available 24 hours daily, 7 days a week; can be viewed by more than one user at a time; is available from remote locations; can nearly always be found; and is legible. A covering physician can rapidly get a sense of a patient's problems by quickly reviewing those problems, medications, and recent notes in the EMR.

Even more than improving efficiency, quality may be the greatest benefit of computerization. Computerization of reminders and prevention guidelines benefits patients.[41] Reminders are also effective in care of chronic conditions, such as diabetes (Figure 2).[42] Computerization of medication prescribing improves safety; in one study of inpatients, the medication error rate was reduced by more than 80%.[43] Communication between patients and providers appears to represent a particular problem in outpatient care,[44] and computerization may be helpful in this domain. Another quality improvement benefit will likely come from monitoring and tracking abnormal results and ensuring that appropriate follow-up occurs. Moreover, electronic records can be linked with public health surveillance, which may be extremely important in emergencies such as a bioterrorism attack or an epidemic.[23]

To deliver the same or better care at similar or lower costs, we need to measure quality routinely. The public and payers are increasingly demanding quality measurement,[45] which becomes vastly easier when using EMRs, since aspects of chart reviews can be automated.[46] EMRs facilitate sharing medical information between patients and providers.[12] A related variety of patient-centered and community-based EMR experiments are ongoing.[46]

Electronic medical records will also have important benefits for specialty care. For example, poor communication plagues the current referral process[47] and

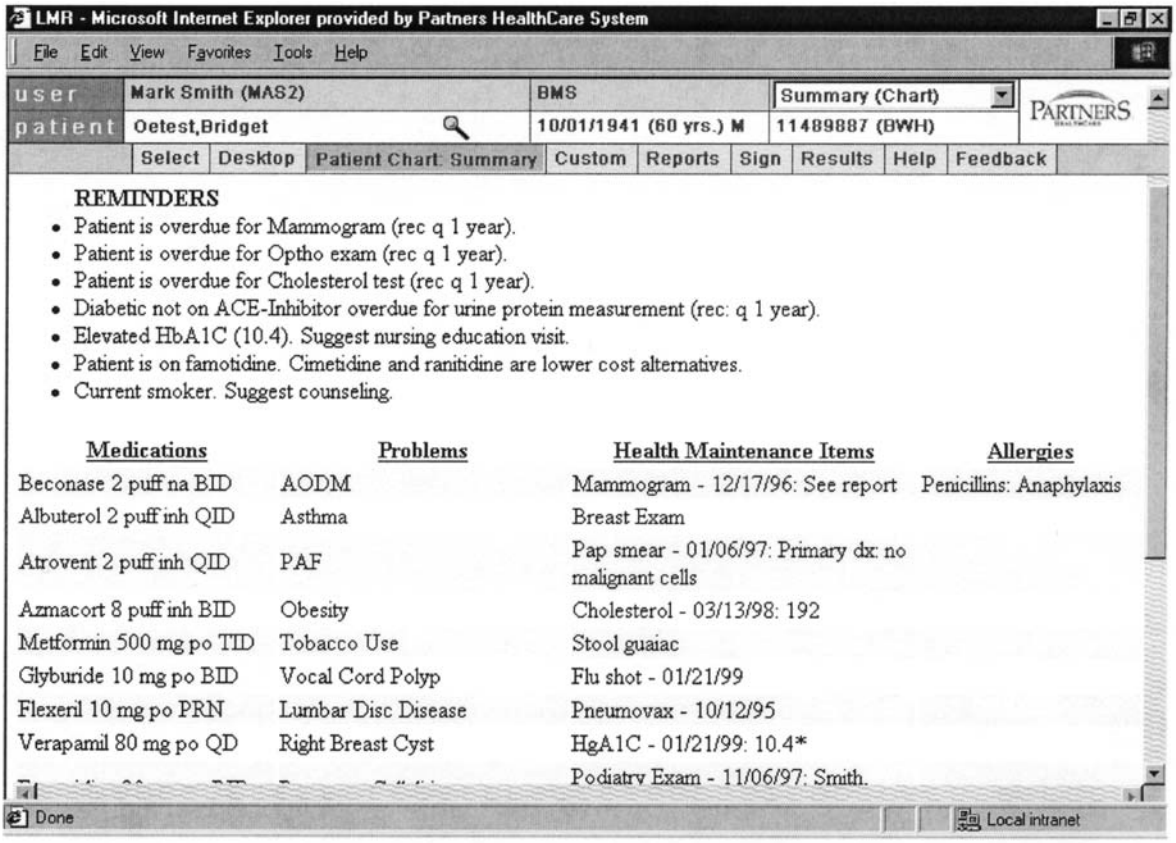


**Figure 2.** "Face Sheet" for a typical patient. When a primary care provider sees a patient, the EMR typically provides a snapshot of key information, including but not limited to the patient's demographics, problem list, medications, and health maintenance information. These and other data can be used to generate a set of reminders, which improve the likelihood that a patient will actually receive needed care.[66] Without such decision support, it is extremely hard to rapidly determine what actions are due.

could be ameliorated through computerization. Poorly coordinated care can lead to adverse drug events, unnecessary tests and treatments, and higher costs. Critical linkages between specialty services and primary care cannot be established until the EMR is developed sufficiently to interface across a spectrum of settings.

## Return on the EMR Investment

The overall return on investment for introducing electronic medical records into primary care remains to be determined. Few studies have been performed, most by system vendors; thus, the results must be viewed with caution. Nevertheless, the limited available data suggest that this return is excellent.[37,48] For example, Renner evaluated the costs and benefits of implementing an electronic medical record for a 40-physician primary care group and found that its net present value was $279,670 in 1996 dollars based on a 5-year model.[37] Reducing drug costs and preventing adverse drug events appear to be areas of greatest benefit in primary care.[48] Further independent analyses are clearly needed.

The degree of benefit of EMRs to a health care organization depends on the reimbursement system, with return being lower in a fee-for-service environment and higher with capitation. In a fee-for-service system, third-party payers will realize many of the benefits. For example, unless providers are at financial risk for medications, savings in drug costs accrue to payers. However, from the societal perspective, return on investment is high. Thus, it is critical that the costs of EMRs must be borne in part by payers, including the federal government.[37,49]

## Models of Successful EMR Implementation in Primary Care

Both Australia and England have implemented highly successful national programs to promote the use of

electronic medical records in primary care.[50–52] Other countries, including New Zealand and the Netherlands, have also achieved substantial success.[53] In terms of speed, Australia's results have been most dramatic. In May 2000, 70% of general practices stated that the majority of physicians in their practice were using a computer in their consulting room to generate most of their prescriptions, compared with only 15% of general practitioners reporting computer use for any purpose in October 1997.[50] Australia achieved this remarkable transition by providing general practitioners with financial support to help purchase a computer, supporting system implementation for those who needed it, and offering incentives for providers to submit claims electronically.

England has made greater progress, albeit more slowly. Currently, 98% of general practitioners have access to an EMR on their desktop. Nearly all use it for prescription refills, and 30% report that their practices are paperless (personal communication, Michael Bainbridge, November 4, 2001). Just three vendors supply these records; accreditation is required for the sale of systems. An application called Prodigy interacts with these applications and provides evidence-based decision support; the plan is to distribute this application to all primary care clinicians.[54]

Each of these countries made a national investment in a coordinating group to develop a strategic framework and identify standards. Development of the actual records has been carried out by private vendors, who have benefited from having a common set of goals and standards. In addition, each country developed incentives for providers to make the transition from paper to electronic records.

## Research and Education

While primary care electronic medical records and clinical decision support are useful, additional fundamental research is required. Early research in informatics took place in the outpatient setting; many exemplary EMRs were ambulatory systems, including Costar, the Regenstrief Medical Record, and The Medical Record.[33,55] More recently, research has focused on hospital settings. While electronically generated clinician reminders have proved effective in multiple clinical settings, only limited information exists about why clinicians often fail to follow computer-generated advice. Questions exist regarding the most effective ways to deliver reminders and decision support advice. Additional research is needed to begin to consider how information should be organized and delivered, how patients can become involved, what role patient-managed records should play, and how communication between providers and patients can be improved. Research investment is essential if we want to improve the way evidence is provided at the point of care.

Electronic media will become central to the delivery of medical education. As recognized many years ago, electronic records have the potential to provide information at the "teachable moment."[31] Yet few data are available regarding how physicians and other clinicians learn from such records, how information and knowledge can best be delivered, and what the impact of making it available would be. Testing and evaluating alternative strategies are desperately needed. Training opportunities in primary care informatics are limited, typically involving only enrollment in existing "generic" medical informatics programs.

## Barriers to Adoption of EMRs

Several barriers exist to adoption of EMRs, but none are insurmountable. A major impediment is the initial cost of EMR systems. Identifying who will make the investment is difficult. The 1991 Institute of Medicine report on the Computerized Patient Record (CPR) suggested that "the cost of CPR systems should be shared by those who benefit from the value of the CPR."[56] However, a 1997 update on progress related to the 1991 recommendations by Detmer and Steen[57] concluded that "no progress can be reported" in this area and that "this remains a significant hurdle." Many financial benefits of EMR usage accrue to third-party payers and purchasers of health care rather than to the provider groups and networks who invest in them. An exception is large integrated delivery systems such as Kaiser and Group Health, which have gained from making large EMR investments. The Leapfrog Group, a consortium of the nation's largest employers, may soon recommend adoption of physician-office–based clinical information systems, which could promote higher reimbursement for providers using EMRs (personal communication, Arnold Milstein, November 12, 2001).

Another barrier has been the transience of vendors; many early EMR developers are in precarious financial positions or even defunct. Consequently, primary care practices see implementing EMRs from current vendors as risky. The risk could be reduced if vendors adopted common data standards.[58] Transferring of legacy data to a new system would then be more practical, even though the significant overhead of

workflow disruption due to system changeover would remain.

Physician resistance to use of EMR systems is another issue. The authors believe that this resistance stems from physicians' perceptions that EMR usage negatively affects their workflows. For example, data entry may take extra time, and time is the most precious commodity to physicians.[59,60] Even though the learning curve for system usage may be steep, a recent study demonstrated that by using a well-developed and properly refined primary care electronic record, clinician ordering can become faster than with use of a paper record.[61] With proficient use, EMRs can reduce the overall time spent by clinicians on related activities.[61] Improved speed and efficiency may not be realized with all systems; thus, this criterion should be a key issue in vendor selection. As physicians become more adept with computers, resistance based on lack of familiarity or facility will diminish.

Concern about security and confidentiality of electronic information is an important issue,[62] and to develop and assess security strategies much work remains. However, the basic technology to ensure data safety is available today.[63]

## Risks of Failure to Adopt EMRs

Several risks may ensue by not pursuing EMR implementation. The United States is falling behind other countries because of its failure to computerize information related to common, important problems managed in the primary care setting. Many people may benefit from new drugs and devices that depend on computerized information. Failure to computerize will lead to missed opportunities in public health care delivery and preventative services, and efforts to deal with bioterrorism may suffer. Without a national plan or standards, each insurer could promote its own EMR that is incompatible with others, resulting in an automated Tower of Babel.

## Recommendations

A joint effort by stakeholders in primary care is needed to handle issues related to adopting EMRs. Without a central organizing group to coordinate efforts, many desired benefits will not be realized. For example, widespread implementation of messaging and other types of standards is critical to enabling information exchange among providers, hospitals, ancillary groups (such as laboratories and radiology departments), and payers. Good standards exist for many domains. For clinical messaging, the National Center for Vital and Health Statistics has recommended HL7 as the core standard to the secretary of Health and Human Services.[58] Endorsement of this recommendation by HHS, followed by mandating HL7 use—especially by the Center for Medicare and Medicaid Services—would be a major step forward.

Other prior efforts to form a central organizing group around EMRs have been made. In 1992, following a recommendation of the Institute of Medicine, the Computer-Based Record Institute (CPRI) was incorporated.[56] The CPRI has produced a range of white papers and programs: functional descriptions of the computer-based patient record (CPR); promotion of EMR-related standards; the Davies Recognition Award program for Excellence in CPR Implementation; and others. In 2000, CPRI and Healthcare Open Systems and Trials (HOST) were consolidated to form CPRI-HOST.

To advocate for the steps needed to increase the likelihood that electronic records will be adopted in primary care, we have established a centralized coordinating group, the National Alliance for Primary Care Informatics. This group includes key stakeholders (see Table 2) interested in strategic planning and activities that can rapidly incorporate EMRs into American primary care. Given the present financial climate in health care, individual organizations are unlikely to be able to provide adequate financial backing.

We believe it imperative that the federal government proffer funds to coordinate infrastructure development for and implementation of EMR systems in primary care. The "Crossing the Quality Chasm" report recommended $1 billion for developing a National Information Infrastructure.[12] Part of this investment should support a primary care group that would convene key working groups, develop the strategic framework, and undertake specific projects. The coordinating group would represent a public-private partnership and should be located within the federal Department of Health and Human Services. The Agency for Healthcare Research and Quality (AHRQ) or the National Library of Medicine (NLM) should be home for the center. The existing locus of national efforts to improve patient safety, AHRQ has a track record of highly successful interagency collaboration and cooperation.[64] The NLM also should be involved, as it has supported relevant informatics research for decades and has successfully distributed biomedical data and bibliographic databases worldwide.

*Table 2* ■

Organizational Endorsements

This document was developed over 4 years and represents a collaborative effort of organizations representing over 300,000 primary care practitioners. The following organizations have officially endorsed the vision statement leading to the establishment of the National Alliance for Primary Care Informatics:

- The Primary Care Informatics Working Group of the American Medical Informatics Association
- Ambulatory Pediatric Association
- American Academy of Family Practice
- American Academy of Pediatrics
- American Medical Informatics Association
- International Medical Informatics Association (Working Group V-General Practice)
- North American Primary Care Research Group
- Society of General Internal Medicine
- Society of Teachers of Family Medicine

Specifically, we recommend the following:

- To facilitate adoption of EMRs in primary care, a coordinating infrastructure should be established, with $20,000,000 initial funding.
- This group should be multidisciplinary and include representation from providers, payers, vendors, government, employers, and consumers.
- This group should work to promote selection of standards for specific content areas and should work closely with existing standards-setting groups such as HL7.
- The group should foster large national pilot studies of specific strategies to accelerate EMR adoption.
- The group should recommend specific practices and policies, such as zero-interest loans and increased reimbursement, for users of electronic medical records, electronic prescribing, and electronic decision support, which would require additional investment beyond that described above.

## Conclusions

Electronic medical records provide many benefits, especially to primary care. EMRs will eventually become the standard of care. However, the initiatives and investments recommended in this paper can lower the costs of and accelerate EMR adoption as well as facilitate achievement of benefits such as common national standards for clinical data. Because this effort would benefit the entire population and favorably affect the large health care portion of the federal budget, the government should act to facilitate development of a public-private partnership to encourage adoption of electronic medical records in primary care.

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