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Information Technology as a Tool to Improve the Quality of American Indian Health Care

| Thomas D. Sequist, MD, MPH, Theresa Cullen, MD, MS, and John Z. Ayanian, MD, MPP

The American Indian/ Alaska Native population experiences a disproportionate burden of disease across a spectrum of conditions. While the recent National Healthcare Disparities Report highlighted differences in quality of care among racial and ethnic groups, there was only very limited information available for American Indians. The Indian Health Service (IHS) is currently enhancing its information systems to improve the measurement of health care quality as well as to support quality improvement initiatives.

We summarize current knowledge regarding health care quality for American Indians, highlighting the variation in reported measures in the existing literature. We then discuss how the IHS is using information systems to produce standardized performance measures and present future directions for improving American Indian health care quality. (*Am J Public Health.* 2005;95:2173–2179. doi:10. 2105/AJPH.2004.052985)

THE AMERICAN INDIAN population is experiencing a growing chronic disease burden. While the epidemic of diabetes is widely publicized,[1–3] American Indians also suffer from an increased incidence of coronary heart disease, cancer, influenza, pneumonia, and infant mortality. This disproportionate disease burden contributes to the American Indian population's low median lifespan, which is 5 years shorter than among White Americans.[4]

While the base of scientific evidence about how to improve patient outcomes is large and growing, practice has lagged behind substantially. Only 79% of patients with newly diagnosed diabetes receive appropriate glycemic monitoring, and only 55% undergo appropriate eye examinations.[5] Similar findings of underuse exist for cancer screening, vaccination, and a wide spectrum of other conditions.[6] The measurement and improvement of health care quality is a relatively recent imperative,[7] and there is

currently limited information regarding quality of care for American Indians/Alaska Natives. The initial National Healthcare Disparities Report released in 2003, for example, was unable to provide reliable data for American Indians in many important areas, including receipt of influenza and pneumococcal vaccines and treatment of diabetes, coronary heart disease, and hypertension.[8]

Information systems have been cited by the Institute of Medicine as an important quality improvement tool.[9] Many large integrated health care organizations, including Kaiser-Permanente Northern California[10] and the Veterans Health Administration,[11] have adopted the use of electronic information systems to improve quality. When used in combination with other quality improvement strategies, these efforts have resulted in remarkable improvements in quality of care.[12] The Indian Health Service (IHS) is well positioned as an integrated health system to use information systems to pro-

vide data both on the current state of health care quality for American Indians and to direct quality improvement efforts.

In this article, we summarize the current state of health care quality for American Indians and describe ongoing efforts by the IHS to enhance its existing information technology infrastructure to support improved performance measurement. We then present case examples to illustrate how these systems can improve care and discuss barriers and future directions for quality improvement within the IHS.

THE INDIAN HEALTH SYSTEM

The IHS has functioned to fulfill the federal government's obligation to provide comprehensive health care to members of federally recognized American Indian tribes since 1955.[13] The IHS consists of 3 units: (1) the federally operated IHS direct care system, (2) tribally operated health

care facilities, and (3) urban health care services. The IHS direct care system, which is centrally administered through 12 area offices, is responsible for managing 36 hospitals and 110 outpatient centers.[14] The 1975 Indian Self-Determination and Education Assistance Act provided individual tribes with the option of using their allocated IHS funds to operate their own clinics. In recent years, tribes have increasingly exercised this option, which currently accounts for approximately 50% of the IHS budget.[15] Tribally operated programs currently manage 13 hospitals, 259 outpatient centers, and 176 Alaska village clinics. The Indian Health Care Improvement Act of 1976 allocated funding for urban Indian health organizations, which currently supports 41 programs in 34 cities.[16]

We focused on American Indians/Alaska Natives receiving care funded by the IHS. This system provides health care services to 1.5 million members of federally recognized tribes, a figure representing 60% of the 2.5 million people who reported only American Indian or Alaska Native race in the 2000 US Census and about 35% of the 4.1 million people who reported American Indian or Alaska Native race with or without another racial group.[17]

CURRENT STATE OF QUALITY MEASUREMENT FOR AMERICAN INDIANS

Some data on the quality of care for American Indians are available from local[18,19] and state[20] studies. These studies highlight deficiencies in receipt of health care services among specific American Indian/Alaska

TABLE 1—Variation in Published Quality Measures for American Indians (AIs)

Quality Domain	AIs Receiving Service, % Range	Periodicity of Measure, y	Age Range, y	Settings[a]
Diabetes care				
HbA1c measurement	80–82	1	≥18–all ages	(1), (2)
Eye exam	55–65	1	≥18–all ages	(1), (2)
Adult Immunizations				
Influenza	38–70	1	≥50–≥65	(2), (4), (5)
Pneumococcal	31–67	Ever	≥50–≥65	(2), (4), (5)
Cancer screening				
Mammography	33–75	1–2	≥40–≥50	(2), (3), (4), (5), (6)
Papanicolaou test	57–86	1–3	≥18	(2), (3), (4), (6), (7)

Note. HbA1c = hemoglobin A1c.
[a]Settings are as follows. (1) Chart review from Indian Health Service (IHS) Diabetes Care and Outcomes Audit[21]; requires 1 outpatient visit to an IHS facility within the past 12 months. (2) Racial and Ethnic Approaches to Community Health (REACH) 2010 project involving survey of 2 American Indian communities.[22] (3) National Health Disparities Report.[8] Cancer screening data were obtained from the National Health Interview Survey. (4) Telephone survey of rural American Indians in New Mexico.[20] (5) Chart review of American Indians attending an urban clinic in Seattle, Wash.[19] (6) National telephone survey from Behavioral Risk Factor Surveillance System.[23] (7) National telephone survey from the National Survey of America's Families.[24]

Native populations; however, the findings vary on the basis of the age of the population included, the frequency of testing considered appropriate, and the clinical practice setting (Table 1). Annual influenza vaccination rates can be measured among those aged older than 50 years[20] or 65 years,[22] and in either rural[20] or urban settings,[19] resulting in screening rates ranging from 38% to 70%. Similarly, breast cancer screening can be assessed among females aged older than 40 years[8] or 50 years,[22] and on an annual[20] or biennial basis.[22] This variation results in reported breast cancer screening rates ranging from 33% to 75%. Even though local data are essential to implement quality improvement initiatives, it is difficult to extrapolate the findings of a single urban center or individual rural state to the national American Indian population. Most national databases, however, lack adequate sample sizes for American Indians,[8] have limited quality measures available for analysis,[24] or suffer

from potential misclassification of American Indians.[25,26]

Fortunately, standards for quality measurement do exist for large health care organizations. The Diabetes Quality Improvement Project (DQIP) measures were developed as part of a joint effort by the Centers for Medicare and Medicaid Services, the National Committee for Quality Assurance (NCQA), and the American Diabetes Association.[27] All health plans accredited by the NCQA have adopted a broader set of quality measures that the committee updates annually in the Health Plan Employer Data and Information Set (HEDIS).[28] These quality measures include a wide range of indicators for ambulatory care, including cancer screening, immunizations, diabetes care, and many other domains.

Building on the DQIP standards, the IHS National Diabetes Program conducts medical record reviews of a national sample of patients to collect quality indicators as part of the IHS diabetes audit program.[21] These data, col-

lected according to DQIP specifications, are generally comparable to data from other large health care organizations. This project has been a valuable asset for diabetes quality improvement within the IHS. However, data in other areas are needed.

INDIAN HEALTH SYSTEM INFORMATION SYSTEMS

The IHS is currently using its information systems to collect performance measures and direct quality improvement efforts across a broad spectrum of diseases. Large strides in quality improvement might be achieved through the effective use of information systems as part of an organizational commitment to improve patient care.[29–32] Therefore, the IHS is incorporating information systems in quality improvement efforts throughout the organization.

The cornerstone of the information systems within the IHS is the internally developed Resource and Patient Management System (RPMS). The RPMS

includes over 50 software applications designed to provide comprehensive support of clinical and administrative functions within the IHS. This system can store clinical data on physical examination findings (e.g., blood pressure), laboratory and radiology results, medication prescriptions, and billing information.

The RPMS currently stores data on approximately 90% of clinical encounters occurring within IHS clinical facilities, including tribally administered and urban clinics. Each facility maintains an individual RPMS database that stores administrative data, but the level of clinical detail can vary because not all available software packages within the RPMS are used by all clinical sites. For example, a clinical site may not use the pharmacy software package if it does not have onsite pharmacy services.
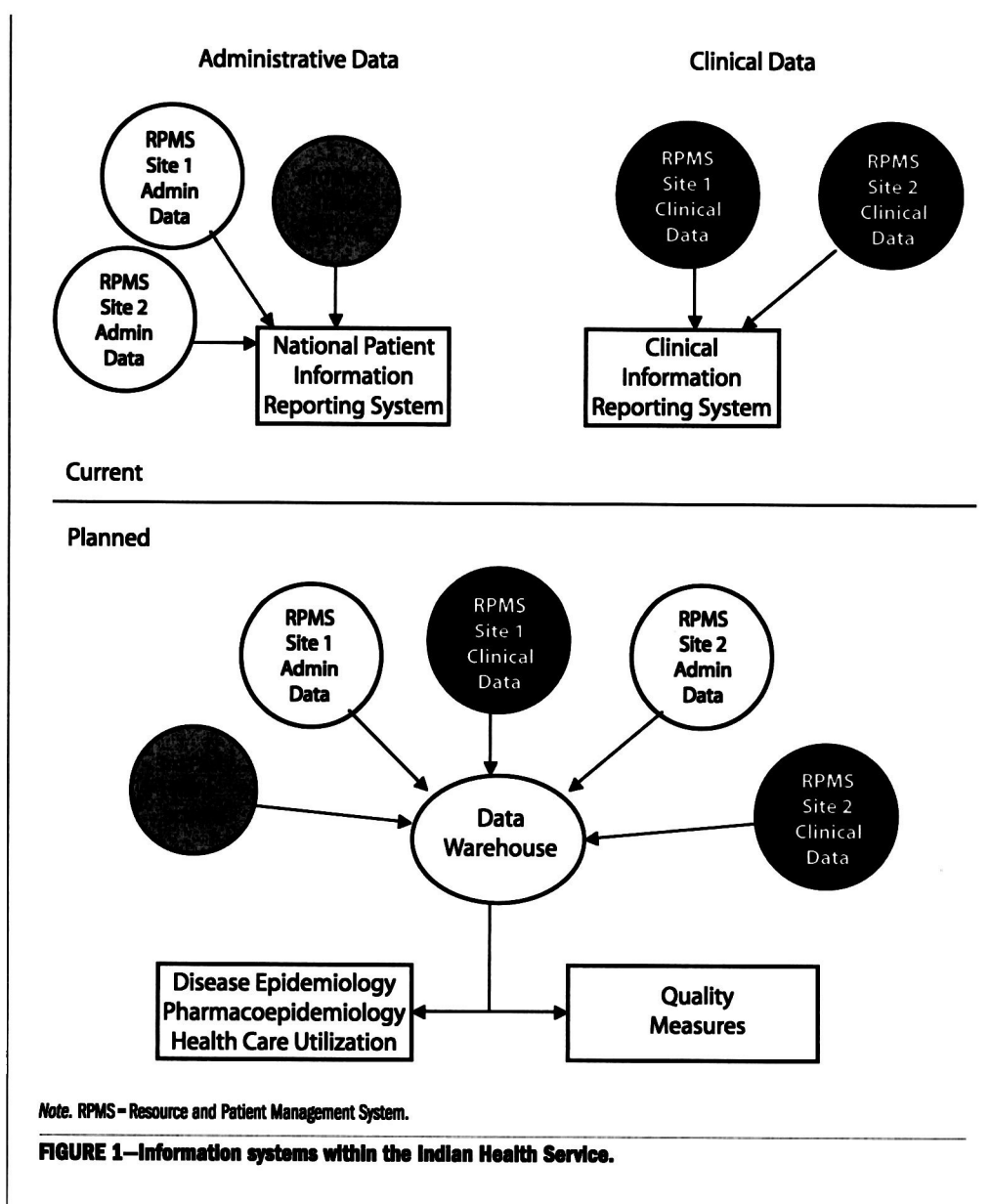
Limited data extracts from these facility-level databases are used to create a National Patient Information Reporting System (NPIRS). The NPIRS is a central repository with limited administrative and clinical data on all inpatient and outpatient encounters; it is used to track patient care statistics through the use of billing codes. This repository receives data via export files from local RPMS databases on a monthly basis. The NPIRS also includes similar data for contracted care that occurs outside of the IHS, including inpatient admissions to non-IHS facilities. The IHS uses this information to produce reports detailing the demographics of the user population, the volume of clinical activity per site, the leading causes of hospitalization, and the distribution of clinical diagnoses for ambulatory medical visits.[4] However, the NPIRS does not cur-

rently offer the level of clinical detail required to analyze quality of care in depth. In 2001, responding to the Government Performance and Results Act of 1993,[33] the IHS began combining data extracts from the more robust facility-level RPMS databases to produce reports for a series of national performance measures. This RPMS-based software program, known as the Clinical Reporting System (CRS),

includes measures on receipt of cancer screening services, adult immunizations, diabetes care, and well-child care.

The IHS plans to upgrade its information systems in the coming years to facilitate more comprehensive assessments of care (Figure 1). This plan includes the creation of a national data warehouse containing more detailed information from facility-level RPMS databases, including labo-

ratory results, radiology results, and pharmacy prescriptions. The data warehouse, scheduled to become operational by fiscal year 2006, will provide a central location for all data collected on the IHS patient population to facilitate new insights into disease epidemiology and health care use. While this project is still under development, the reporting of quality measures will continue through the CRS.

Note. RPMS = Resource and Patient Management System.

FIGURE 1—Information systems within the Indian Health Service.

THE CLINICAL REPORTING SYSTEM

The IHS designed a quality measurement system to provide reproducible data that are consistent with recognized performance measures such as HEDIS or DQIP indicators. The creation of a quality measure involves the definition of an eligible population (the "denominator"), as well as reliable identification of those patients who have received appropriate health care within the specified time frame (the "numerator"). As part of this process, the patient population actively using the IHS for primary care is defined as those with at least 2 visits to outpatient primary care clinics within the past 3 years. These visit data are currently recorded in the NPIRS and will become a part of the national data warehouse. Once this active user population is fully specified, subsets of patients can be assessed for adherence to treatment guidelines for various health care services.

Diabetes Quality Measurement—A Case Example

Eligible population. For all diabetes measurements using the CRS, patients who are actively being followed for their diabetes management within the IHS must be identified (Figure 2). Diabetes is first defined by the presence of an *International Classification of Diseases, Ninth Revision*[34] diagnosis of diabetes (codes 250.00–250.93) in at least 2 previous outpatient visits, consistent with the definition employed by the Medicare Quality Improvement Organizations.[35] All of the diabetes measures are assessed annually, so the first diagnosis of diabetes must have occurred at least 12 months prior to the current reporting cycle. As some patients may choose to seek care outside the IHS for diabetes management, the population is restricted to those having at least 2 outpatient visits within the past year, similar to definitions employed by the Veterans Health Administration.[12]

Outcome identification. Dates and values of laboratory testing such as hemoglobin A1c are identified through outpatient Current Procedure Terminology codes available within the RPMS until the IHS changes to the Logical Observation Identifiers Names and Codes (LOINC) system for laboratory tests.[36] Procedures including dilated eye examinations are identified by Current Procedure Terminology codes. The CRS also uses internal IHS codes, as well as local laboratory test taxonomies and clinical codes to ensure that all laboratory tests, results, and screening examinations are recognized by the CRS application.

Performance assessment. Quality reports are generated on the basis of the eligible population and the receipt of defined services (Table 2). For diabetes care, the proportion of patients receiving appropriate glycemic monitoring and eye examinations within the IHS is lower than rates reported for the US population in the recent National Healthcare Disparities Report. When a quality problem such as low national screening rates for diabetic retinopathy is detected through the CRS, further regional analyses can be conducted to determine whether quality improvement initiatives should be directed to individual clinical centers or larger regional areas. In addition, high-performing sites may provide insight into methods that can be used to increase screening rates at lower performing sites to close the "quality chasm."[37]

Quality improvement initiative. The low screening rates for eye examinations were found to be partially related to lack of access to direct ophthalmologic services. In response to this problem, the IHS partnered with the Joslin Vision Network in Boston, Mass, to provide several pilot clinics with remote access to retinal examinations through the use of telemedicine technology. This technology is an effective method of improving screening rates for diabetic retinopathy and identifying retinal conditions requiring intervention to prevent
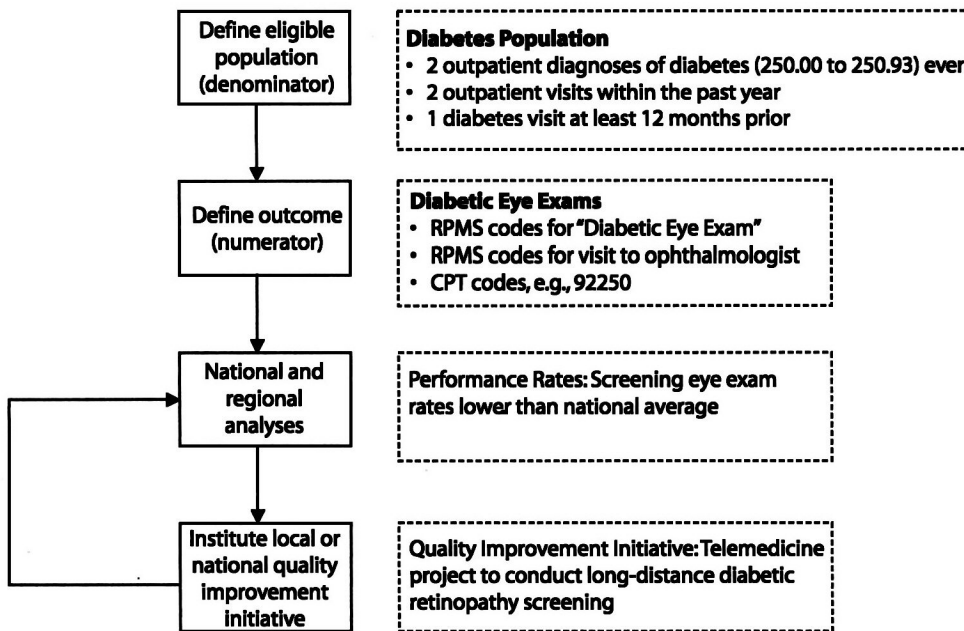
Note. RPMS = Resource and Patient Management System; CPT = Current Procedure Terminology.

FIGURE 2—Example of a current quality measurement and improvement project within the Indian Health Service.

TABLE 2—Comparison of Quality of Care Within the Indian Health Service and the General US Population

Quality Domain	Receiving Quality Indicator, %	
	Indian Health Service	US Population
Diabetes care		
HbA1c measurement, annual (all ages)	75	90
Dilated eye exam, annual (all ages)	58	67
Adult immunizations		
Influenza, annual (≥65 y)	51	65
Pneumococcal, ever (≥65 y)	65	53
Cancer screening		
Mammography, within past 2 y[a]	40	70
Papanicolaou test, within past 3 y (18–65 y)	61	85
Maternal and child health: receipt of vaccines, 19–35 mo	80	75

Note. HbA1c = hemoglobin A1c.
Source. Indian Health Service data are from the 2002 Clinical Reporting System. Data on US population are from the National Healthcare Disparities Report.[8]
[a]Age range is 50 years and older for Indian Health Service data and 40 years and older for the US population.

blindness.[38–40] The telemedicine program has resulted in the evaluation of over 1500 patients within the IHS and increased screening rates at one clinical site from 47% to 70%. An advantage of the automated IHS performance measurement system is that the impact of such quality improvement interventions can be evaluated in a timely and efficient manner. With the merging of clinical and administrative information in the upcoming national data warehouse, the IHS will also be able to evaluate the cost-effectiveness of such interventions.

Additional performance measures. The example of diabetes quality improvement is readily extrapolated to other performance measures (Table 2). Whereas the rate of pneumococcal vaccinations is higher among users of IHS health services than among the general US population, the rate of influenza vaccinations is

lower (51% for IHS clients vs 65% for US population). Studies can be conducted to determine the causes of low influenza vaccination rates in specific areas, such as inadequate tracking mechanisms or limited vaccine supply, which may have very different implications for quality improvement. Similarly, cancer screening rates are generally low for the IHS population compared with the US population, which may relate to regional variation in access to screening services such as onsite mammography. Although we have highlighted only process measures, this system also generates data on intermediate outcomes, such as rates of appropriate hemoglobin A1c control. In addition to standard performance measures, the CRS can be used to produce performance measures focused on the specific needs of the American Indian population, such as monitoring annual rates of obesity, a growing epidemic.[41]

FUTURE DIRECTIONS AND POTENTIAL BARRIERS

The information systems available within the IHS create a vast potential for quality improvement. Because the performance measures reported by the IHS are developed through the use of standard definitions, they are directly comparable to data from other health care settings, allowing the IHS to benchmark its care against other health care systems, such as the Veterans Health Administration and Medicare managed care plans.

The IHS is also in the process of implementing a graphical user interface for the RPMS that will support electronic entry of physicians' orders, retrieval of results, documentation of encounters, and support of clinical decisions.[42] This electronic health record will be installed in at least 20 sites by the end of 2005 and will be fully installed at all sites that desire this additional functionality by 2008. The new graphical user interface will expand the current scope of health information technology in American Indian communities and contribute to the adoption of electronic records in rural and medically underserved areas.

An electronic health record is a powerful tool that can be implemented to address a more complete range of quality improvements. Interactive decision support tools in the form of electronic reminders can be implemented within this system to provide patient-specific screening or treatment recommendations on the basis of the most recent available data within the RPMS. In multiple health care settings, these tools have been shown to improve adherence to recommended practice guidelines.[43,44]

The IHS will be able to monitor the effect of these tools on quality of care through automated data extracts similar to those described previously. The IHS electronic health record will also increase patient safety, as computerized entry of physicians' orders can reduce the occurrence of adverse events by providing dosage recommendations and checking for drug interactions.[45]

The RPMS and the future data warehouse will also support the review and evaluation of population health information through expanded patient registries. Current patient registries have been developed for diabetes, high-risk pediatric diseases, and asthma. Future registries will be expanded to include other high-risk conditions such as coronary artery disease, with up-to-date information on individual patients to support more efficient and effective care management programs.[32,46] For example, individual clinical sites will receive an electronic list of patients with coronary artery disease who are overdue for specific health services. Specific outreach efforts can be directed to these patients, such as placement of orders for overdue screening laboratory testing through computerized order entry.

Similarly, population health information is currently used to monitor larger trends in health, including the incidence and prevalence of diabetes, or the number of hospitalizations for asthma exacerbations in individual communities. However, expansion into the fully functional electronic health record will allow for more detailed analyses, such as monitoring trends in prescribing patterns for specific conditions to determine if overuse

or underuse of specific medications is occurring.[47]

Potential barriers to the adoption of electronic health records include resistance by physicians, high costs of implementation, suboptimal design of products and user interfaces, maintenance of the validity and confidentiality of data, and inadequate technical support.[48] The IHS benefits from a centralized leadership structure that provides strong support for the adoption of information systems, which is an effective method of overcoming clinicians' resistance to adopting new technology.[48,49] However, it continues to experience the standard barriers to adoption of information technology solutions, as well as additional barriers unique to a rural health care system providing care to multiple sovereign tribes across large distances.

The costs of implementing new information systems will pose substantial challenges to quality improvement within the IHS. In fiscal year 2003, the IHS received approximately $2.5 billion in federal support to deliver health care to approximately 1.5 million American Indians and Alaska Natives. This funding represents only 60% of the amount that would be needed to provide access to the same services provided by the Federal Employees Health Benefits Program.[50] Current funding sources for new information systems within the IHS include both the centrally administered IHS direct care system and funds contributed by tribally operated health centers. External funds from the US Congress and the Agency for Healthcare Research and Quality are also being used to support the implementation of the electronic health record. However, additional federal funding will be needed to ensure the timely adoption of effective quality improvement strategies. This funding should ideally be secured as part of a long-term plan to support the adoption of health technology solutions in the IHS, thereby eliminating some of the yearly unpredictability in IHS funding. This funding may be more achievable when additional information becomes available on the cost effectiveness of information technology solutions for improving health care.[51]

The IHS provides care to a large rural population; therefore, adequate technical support is an ongoing concern. The IHS has experienced significant turnover among local information technology managers, resulting in difficulty maintaining a pool of adequately trained support staff. One solution implemented by the IHS is to maintain data on regional servers instead of at each local site, allowing centrally located staff to provide technical support to individual locations.

The deployment of an electronic health record within the IHS also presents special challenges related to tribal sovereignty. Prior studies have demonstrated that successful implementation of computerized medical records is critically dependent on obtaining local support for such initiatives.[48,49] As noted earlier, the IHS is organized into a centrally administered direct care system and multiple independent tribally operated health centers. These individual tribal clinics are not required to adopt the full functionality of the RPMS and the electronic health record, or to share health information collected by these systems. However, most tribal health centers have adopted these systems and provide the IHS with the relevant health information, for 2 main reasons. First, the systems have had relatively low marginal costs for the tribes to maintain as part of the overall IHS information infrastructure. Second, the IHS has used these data as a national advocate for the tribes, promoting increased funding and attention to improving American Indian health care. The RPMS can also be used to produce reports that some tribes are required to submit to the Health Resources and Services Administration Bureau of Primary Health Care to receive funding through this federal program.

The measurement and improvement of quality within the IHS rely on the validity of the data within these information systems. The IHS has conducted site visits by personnel trained in data quality control, where routine processes are reviewed to ensure data accuracy, including validation of the active user population and of the diagnosis of chronic diseases such as diabetes. Of equal concern is the maintenance of data confidentiality at the individual and tribal level. Individual-level confidentiality is maintained through privacy training for all employees and the maintenance of a password-protected electronic environment. Health-related data are protected at the tribal level because the tribes own the data, and tribal permission is required to use the data.

As the practice of medicine grows increasingly complex, concerns about the quality of care have risen to the forefront of large health care systems. The IHS is in the unique position of providing integrated health care to a predominantly rural, underserved population. By expanding the use of information technology, the IHS has the potential to improve substantially the quality of care for this population and to provide important lessons for other large health care organizations and federal health care programs seeking to implement comparable information systems. ∎

About the Authors
Thomas D. Sequist and John Z. Ayanian are with the Department of Health Care Policy, Harvard Medical School, and the Division of General Medicine, Brigham and Women's Hospital, Boston, Mass. Theresa Cullen is with the Office of Information Technology, Indian Health Service, Tucson, Ariz.

Requests for reprints should be sent to Thomas D. Sequist, MD, MPH, Brigham and Women's Hospital, Division of General Medicine, 1620 Tremont St, Boston, MA 02120 (e-mail: tsequist@partners. org).

This essay was accepted January 26, 2005.

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