Applying the Diabetes Quality Improvement Project Indicators in the Indian Health Service Primary Care Setting

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OBJECTIVE — With publication of the Diabetes Quality Improvement Project (DQIP) measures, the Indian Health Service National Diabetes Program applied the DQIP format to its IHS Diabetes Care and Outcomes Audit for comparison and benchmarks.

RESEARCH DESIGN AND METHODS — Since 1986 the IHS Diabetes Care and Outcomes Audit has been conducted by medical record review in >75% of IHS and tribal facilities. Each year systematic random sample of charts is drawn from local diabetes registries. Chart reviews are conducted by trained professionals according to standard definitions and instructions. Abstracted data are entered into a microcomputer-based epidemiologic software package. Local, regional, and national rates are constructed for each item. During the period 1995–1997, 150 facilities submitted data for compilation, representing participation from all 12 IHS administrative regions. The IHS Diabetes Care and Outcomes Audit collected virtually all of the DQIP measures, with the exception of LDL cholesterol (which was added to the record review in 1998).

RESULTS — In 1995, 1996, and 1997, a total of 9,557, 9,985, and 9,626 individuals, respectively, were included in the total IHS audit sample. The reviews for 1995, 1996, and 1997 revealed that of all subjects: 55, 65, and 80%, respectively, had more than one HbA_{1c} test during the year ($P < 0.001$); 42, 38, and 34%, respectively, had a high-risk HbA_{1c} (>9.5%) ($P < 0.001$); 83, 81, and 84%, respectively, were tested for macroproteinuria ($P < 0.11$) and 16, 17, and 23%, respectively, were tested for microproteinuria ($P < 0.001$); total cholesterol was assessed in 80, 81, and 85%, respectively ($P < 0.001$), and corresponding proportions of those with values <5.17 mmol/l were 48, 50, and 52%, respectively; triglyceride values were measured for 75,75, and 80%, respectively ($P < 0.001$), and the corresponding median triglyceride levels were 199, 198, and 193 mg/dl, respectively ($P < 0.001$); the proportion of clients with a blood pressure <140/90 mmHg was 64, 64, and 66%, respectively ($P < 0.05$); 55, 56, and 55%, respectively, had a dilated eye exam ($P < 0.053$); and the proportion of clients who had a comprehensive foot exam were 59, 59, and 61%, respectively ($P < 0.05$).

CONCLUSIONS — The DQIP accountability and quality improvement measures could be easily applied to the IHS Diabetes Care and Outcomes Audit, and the process can prove to be practical. However, data alone are not sufficient to effect change. Use of the measures to ensure that the quality of care improves must also be stressed, because measuring alone will not guarantee such improvement.

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Abbreviations: ADA, American Diabetes Association; BP, blood pressure; DQIP, Diabetes Quality Improvement Project; HCFA, Health Care Financing Administration; HEDIS, ; IHS, Indian Health Service; F/T/U, federal, tribally operated, or urban; NCQA, National Committee for Quality Assurance.

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A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

In recent years, U.S. health care organizations, from government agencies to managed care systems and accrediting boards, have been concerned with measuring and improving the quality of care for patients with diabetes (1–4). The American Diabetes Association (ADA), for example, developed measures for the Provider Recognition Program. The Health Care Financing Administration (HCFA), along with several peer-review organizations, organized a medical chart review in several states to measure the quality of care received by diabetic Medicare beneficiaries (5). Additionally, managed care organizations in Arizona, working through the peer-review organization, have expanded their measures of care beyond the yearly dilated eye examination to include 10 services along with 10 measures of diabetes care (6). Although most of the quality-of-care measures used by the various groups have been similar, there are enough differences to make comparisons confusing. Thus, in 1997, in response to the Balanced Budget Act, HCFA contracted with the National Committee for Quality Assurance (NCQA) to develop a unified set of performance and outcomes measures for diabetes called the Diabetes Quality Improvement Project (DQIP) (7). To formulate this set of measures, the DQIP steering committee, sponsored by the ADA, HCFA, NCQA, the American Academy of Family Physicians, the American College of Physicians, and the Department of Veterans Affairs, solicited input from many individuals and groups and considered a variety of indicators. DQIP then published a set of diabetes-specific performance and outcomes measures in August 1998 (Table 1) (7). The final DQIP recommendations included two sets of measures: an accountability set and a quality-improvement set. The accountability measures are evidence based; they have received consensus support from the scientific and medical community and have been field-tested. The measures were intended to be used to compare health plans or to compare providers and were chosen to avoid the need for case mix adjustments. The quality-improvement measures were recommended for internal performance information, but not, however,

Table 1—*DQIP initial indicators and comparable IHS measures*

DQIP accountability measure	DQIP quality-improvement measure	IHS Diabetes Care and Outcomes Measure*
1. Percentage of patients receiving ≥1 HbA_{1c} test per year	1. HbA_{1c} levels of all patients reported in six categories (i.e., <7.0%, 7.0–7.9%, 8.0–8.9%, 9.0–9.9%, ≥10%, none documented)	Most recent HbA_{1c} in past year or mean value of three blood glucoses in past year if no HbA_{1c}
2. Percentage of patients with the highest-risk HbA_{1c} level (i.e., HbA_{1c} >9.5%)		Mean blood glucoses are calculated to estimate HbA_{1c} when HbA_{1c} unavailable (12)
3. Percentage of patients assessed for nephropathy		Urinalysis in past year—proteinuria positive; microalbumin screen in (–) urinalysis for negative/unknown proteinuria
4. Percentage of patients receiving a lipid profile once in 2 years		Annual cholesterol determination
5. Percentage of patients with LDL† <3.35 mmol/l	2. Distribution of LDL values† (i.e., <2.60, 2.60–3.35, 3.36–4.10, >4.10 mmol/l, no value documented)	Yearly cholesterol and triglyceride values Total cholesterol distribution
6. Percentage of patients with BP† <140/90 mmHg	3. Distribution of BP values† (i.e., <140, 140–159, 160–179, 180–209, >209 mmHg systolic; <90, 90–99, 100–109, 110–119, >119 mmHg, no value documented)	Mean of last three BPs in the past year
7. Percentage of patients receiving a dilated eye examination (see description for frequency)		Yearly dilated eye examination by experienced provider
	4. Proportion of patients receiving a well-documented foot examination to include a risk assessment	Yearly foot risk assessment to include neuropathy and vascular status

*Some of the measures have exclusions based on comorbidity or based on the results from a previous examination. All measures apply to people with diabetes between 18 and 75 years of age, regardless of type of diabetes, and measures 1, 2, and 7 can be applied to children 10–17 years of age as well. †For all measures requiring a value (e.g., LDL cholesterol and BP), the most recent test result is used.

for comparing plans or providers because of methodological or feasibility concerns. All measures were intended to be practical and immediately feasible (7).

The DQIP accountability and performance measures are very similar to measures that the Indian Health Service (IHS) has been using for years. The IHS is an agency of the U.S. Public Health Service that is responsible, in cooperation with its tribal partners, for elevating the health status of more than 1.4 million American Indians and Alaska Natives. The IHS National Diabetes Program, established in 1979, is charged with addressing the epidemic of diabetes in Native American communities through medical, public health, and community-based approaches to diabetes care and prevention. As part of its public health approach to diabetes, the IHS National Diabetes Program created guidelines to improve the process of diabetes care and the outcomes for patients with diabetes seen in the federal, tribally operated, or urban (F/T/U) facilities. Primary care providers from various hospitals and clinics within the system identified preventive care practices that could be incorporated into the treatment of diabetes in Native American patients (8). Along with these care practices, the IHS National Diabetes Program identified key variables to measure to evaluate patient care, to track intermediate clinical outcomes, and to provide ongoing surveillance of care practices. In 1986, these recommendations became the IHS Standards of Care for Diabetes. An annual medical record audit process measuring key variables at local facilities was created simultaneously with the standards of care; this IHS Diabetes Care and Outcomes Audit has been described in a previous publication (9). Both the IHS Standards of Care for Diabetes and the audit measures have been revised periodically to reflect new scientific findings and our own experience. The standards have been promoted on an ongoing basis by regional diabetes coordinators throughout the F/T/U health care system, and significant improvements in care have been measured (8–10). When the specific DQIP measures were published, the IHS National Diabetes Program took the opportunity to compare DQIP measures with recent data from the IHS Diabetes Care and Outcomes Audit. This article offers the benchmarks from an application of the DQIP format to the IHS-established diabetes improvement data set and shares the IHS experience of establishing benchmarks and improving diabetes care within the context of the continuing evolution of the scientific framework for diabetes care.

RESEARCH DESIGN AND METHODS

— Since 1986, the IHS Diabetes Care and Outcomes Audit has been conducted by annual medical record reviews in >75% of the IHS and tribal facilities. At present, these facilities provide care to over 80,000 American Indians and Alaska Natives with diabetes (9). These reviews were organized locally, and participating facilities received a packet of instructions to enable them to draw a random sample of charts from the local administrative data. Each year, a systematic random sample was drawn from each facility's list of diagnosed diabetic patients who had been seen at least once during the past year. The instructions explained to the facilities' staff members how to calculate the local sample size so that the width of the 90% CI for the true rate would be the estimated rate ±10% for measures performed at a level of 60%.

Actual chart reviews were conducted by area diabetes consultants and other professional staff trained by them, in accordance with written instructions and definitions provided by the IHS National Diabetes Program.

Table 2—*Categories of glycemic control by measured and calculated HbA_{1c} in IHS clients with diabetes, 1995–1997*

	1995	1996	1997
Measured/calculated* HbA_{1c} levels (%)	5,265/3,437	6,527/2,735	7,662/1,407
<7.0	18.9/28.2	19.9/27.9	23.5/31.7
7.0–7.9	15.3/15.6	16.0/16.5	18.1/13.7
8.0–8.9	15.4/15.7	16.9/14.8	15.7/14.2
9.0–9.9	14.7/14.6	14.8/13.6	14.1/12.4
>10.0	35.7/25.9	32.4/27.1	28.6/28.0
No HbA_{1c} or three blood glucoses documented	855/9,557 (9.0%)	723/9,985 (7.2%)	557/9,626 (5.8%)
Proportion of patients with measured HbA_{1c} performed	5,265/9,557 (55.1%)	6,527/9,985 (65.4%)	7,662/9,626 (79.6%)

Data are *n* unless otherwise indicated. Mantel-Haenzel χ^2 test comparing metabolic control over the 3-year period: measured HbA_{1c} $\chi^2 = 116.12$ ($P < 0.001$) and calculated HbA_{1c} $\chi^2 = 0.36$ ($P = 0.55$). *Calculated HbA_{1c} consists of values calculated from the last three blood glucose measurements using the formula mean blood glucose = $30.9 \times HbA_{1c} - 60.16$ (12, and as amended by R.Little, personal communication).

These instructions specified selected clinical interventions, performance measures, and intermediate outcomes reflected in the medical record and provided a uniform set of definition for reviewers. Where facilities had the ability to abstract variables from the IHS electronic management information system, they were encouraged to do so and to supplement the data by chart review as necessary. All abstracted data were entered into a microcomputer-based epidemiological software program (11). Summary reports were printed for immediate use by facility staff in their quality-improvement and program planning activities. Regional and national rates were subsequently constructed for each item using aggregate data from all participating sites. During the period of 1995–1997, 150 F/T/U facilities submitted data to be compiled for the IHS total. Participation from each of the 12 IHS administrative regions varied by year and by federal or tribal management. All regions were represented in each year, and approximately two-thirds of all facilities contributed data in a given year. Although participation was not mandated, local facilities providing primary care have always been strongly encouraged to participate, and technical assistance was provided regionally.

Results for discrete variables for the 3 years were compared using the Mantel-Haenzel χ^2 statistic. Triglyceride values were analyzed as a continuous variable using the Kruskal-Wallis test, since the triglyceride frequency distributions for each year are skewed. All analyses were done using SAS version 6.12.

The IHS Diabetes Care and Outcomes Audit collected virtually all of the DQIP measures—with the exception of LDL cholesterol (which was added to the record review in 1998)—on the medical record review, as shown in Table 1. During the period under study, total cholesterol was used to assess cardiac risk. As publications from the Strong Heart Study of cardiovascular disease in American Indians emerged, triglyceride and subsequently LDL and HDL were added (12,13). Although the majority of IHS facilities used HbA_{1c} to assess metabolic control during the 3 years, for some sites, use of HbA_{1c} was not available or was considered too expensive. In these cases, the mean of the three most recent blood glucose values during the previous year was calculated. Estimates of comparable HbA_{1c} were generated from one of the published formulas comparing HbA_{1c} levels with multiple blood glucose determinations in the same individual (10,14–16; R. Little, personal communication). Unlike the Health Plan Employer Data and Information Set (HEDIS) specifications for DQIP's nephropathy screening measure, assessment for nephropathy was considered adequate in those whose urinalysis did not reveal proteinuria (defined as fixed protein excretion at trace levels or above) only if microalbuminuria screening was also completed (5). No attempt was made to assess methods for microalbuminura screening, although F/T/U facilities were encouraged to use albumin-to-creatinine ratios. A dilated eye examination by an experienced provider (optometrist or ophthalmologist) or fundus photo was considered necessary for a screening eye examination. A complete foot examination consisted of inspection, assessment of pulses, and monofilament testing. Cholesterol and triglyceride determinations as well as foot and eye examinations were categorized as not done if documentation was lacking.

RESULTS — In 1995, 1996, and 1997, a total of 9,557, 9,985, and 9,626 individuals, respectively, were included in the total IHS audit sample. The first DQIP accountability measure is the percentage of patients receiving one or more HbA_{1c} tests per year. The IHS medical record reviews for 1995, 1996, and 1997 revealed that of all subjects, 55, 65, and 80%, respectively, received one or more HbA_{1c} tests during the year ($P < 0.001$ for trend). Metabolic control was assessed yearly by HbA_{1c} or alternatively by the mean of three blood glucose values in 92, 94, and 95% of clients for 1995, 1996, and 1997, respectively. The proportion of IHS patients with diabetes whose measured and calculated (10,14–16) HbA_{1c} values fell into each DQIP quality-improvement category is shown in Table 2 by year.

The second DQIP accountability measure specifies the percentage of patients with the highest-risk HbA_{1c} level, defined as HbA_{1c} >9.5%. The proportions of IHS patients with diabetes with HbA_{1c} in this category actually decreased from 42% in 1995,

Table 3—*Assessment of macroalbuminuria and microalbuminuria in IHS patients with diabetes, 1995–1997*

	1995	1996	1997	χ^2 (*P*)
n	9,557	9,985	9,626	—
Urinalysis done	82.8%	81.0%	83.7%	2.55 (0.11)
Proteinuria among those tested	38.2%	28.6%	29.9%	125.87 (<0.001)
Microalbuminuria tested in clients "negative" or "unknown" for protein	16.3%	17.4%	23.0%	80.57 (<0.001)

Table 4—*Yearly distribution of mean BP values in IHS patients with diabetes, 1995–1997*

	1995	1996	1997
n	8,896	9,357	9,207
Systolic BP (mmHg)			
<130	42.4	42.2	42.8
131–139	23.9	24.2	24.7
140–159	27.1	26.8	26.4
160–179	5.7	5.9	5.2
>179	0.9	0.9	0.9
Diastolic BP (mmHg)			
<85	80.6	81.0	82.6
85–89	11.1	10.4	10.0
90–99	7.4	7.6	6.6
100–109	0.8	0.9	0.8
>109	0.1	0.1	0.0

Systolic BP: Mantel-Haenzel $\chi^2 = 2.04$ ($P = 0.15$); diastolic BP: Mantel-Haenzel $\chi^2 = 11.48$ ($P < 0.01$).

38% in 1996, and 34% in 1997 ($P < 0.001$). When metabolic control for all patients was measured by HbA_{1c} or calculated from the mean of the last three blood glucose values for the year, the proportions of clients decreased similarly from 38, 37, and 34%, respectively, for each year ($P < 0.001$). Interestingly, when we divided into quartiles the individuals who did not have an HbA_{1c} measurement taken during the 3-year period by mean glucose, the mean of the three blood glucose measurements for those in the lowest quartile was <8.3 mmol/l.

The third DQIP accountability measure is the percentage of patients who are assessed for nephropathy. Comparable measures from IHS, using the frequency of testing for macroalbuminuria and microalbuminuria, are shown in Table 3. In 1997, almost one-third of the individuals with diabetes were known to have overt proteinuria. Of those not known to have proteinuria, 23% were tested for microalbumnuria.

The fourth DQIP accountability measure is the percentage of patients receiving a lipid profile once in 2 years, and the fifth measure is the percentage of patients with an LDL cholesterol level <3.36 mmol/l. The second DQIP quality-improvement measure specifies a distribution of the LDL values. The IHS medical record review assessed whether total cholesterol and triglyceride were measured in the past year and values were recorded when available. Total cholesterol was assessed within the last year on 80, 81, and 85% of individuals in 1995, 1996, and 1997, respectively ($P < 0.001$), and the corresponding proportions of those with total cholesterol values <5.17 mmol/l were 48, 50, and 52%, respectively ($P < 0.001$). Triglyceride values were measured for 75, 75, and 80% of patients in 1995, 1996, and 1997, respectively ($P < 0.001$), and the corresponding median triglyceride values were 199, 198, and 193 mg/dl, respectively ($P < 0.05$ by Kruskal-Wallis test).

The sixth DQIP accountability measure is the percentage of patients with a blood pressure (BP) <140/90 mmHg, and the corresponding third quality-improvement measure specifies a distribution of BP values. The proportions of clients with BP <140/90 mmHg in the IHS medical record review, using the mean of the last three recorded BPs, were 64% in 1995, 64% in 1996, and 66% in 1997 ($P < 0.05$).

The seventh DQIP accountability measure is the percentage of patients with a dilated eye examination in the past year. The proportions of IHS patients with a dilated eye examination recorded in the chart in 1995, 1996, and 1997 remained essentially stable over the 3 years at 55, 56, and 55%, respectively ($P = 0.053$).

The fourth DQIP quality-improvement measure is the percentage of patients with a complete foot examination documented in the past year. The proportions of IHS patients who had a comprehensive foot examination in 1995, 1996, and 1997 were 59, 59, and 61%, respectively ($P < 0.05$).

CONCLUSIONS — The IHS was able to generate the DQIP measures with the data from the IHS Diabetes Care and Outcomes Audit. Although the measures were not precisely the same, this process proved to be practical. However, other concerns with the IHS experience emerged. The DQIP quality-improvement set specifies many ranges for glycemic and BP control. In the IHS, however, we have never chosen to use such detailed ranges because the number of categories is overwhelming and clinically unnecessary. The data from IHS shown in Table 4 show that BPs for very few individuals fall into the higher DQIP categories. From a practical clinical standpoint, diastolic values between 110 and 119 mmHg and ≥119 mmHg clearly need urgent attention, and the distinction between the two would not be useful in our settings. In view of the recent U.K. Prospective Diabetes Study data, it may be appropriate to consider a lower diastolic category as a meaningful reflection of BP control in patients with diabetes (17). Although these ranges may have been the best compromise for the many opinions on where to define cutoffs for BP control during the development of DQIP, we have chosen to use a simpler classification of well-controlled, moderately controlled, and poorly controlled BP for everyday clinical use. It is also interesting to note that individuals who have not had an HbA_{1c} evaluation in the past year are assumed to be in poor control, according the HEDIS specifications for DQIP (18). One-quarter of the IHS patients who had not had an actual HbA_{1c} test within the year had mean blood glucose levels of 8.3 mmol/l or less, indicating the likelihood of excellent metabolic control.

Reports describing the IHS process to improve care practices and outcomes in different regions of the U.S. have been published and attest to the value of measuring diabetes care over time and feeding the data back to local sites for quality-improvement activities (8–10). If the DQIP process is to lead to a sustained increase in the performance and documentation of quality diabetes care over a number of years in a variety of settings in the U.S., the IHS experience suggests that there will have to be a mechanism to update and to change the particular measures. In the course of the IHS's ongoing efforts to improve clinical outcomes, the parameters measured in the actual data collection have changed as the quality-improvement efforts have stimulated improved charting and patient care. For example, in the first few years (1986–1989), the reviews measured only the percentage of charts that reflected the date of diabetes diagnosis in a prominent place. More recently, the actual date of diagnosis has been abstracted and duration of diabetes reflected in standard reports. The majority (92%) of charts now reflect the date of diagnosis, but it took several years of process feedback to providers to change the recording patterns. In regard to

adult heights, it again took several years for the actual heights to become routinely recorded so that BMI profiles for groups of patients could be calculated. IHS changed from measuring simple visual foot checks at each visit to measuring a yearly foot risk assessment when accumulated data showed that amputation rates could be effectively reduced by targeting identified high-risk patients (19). In our experience, the ongoing accumulation of data has enabled us to refine the measures used. To refine measures of quality, it may be necessary to emphasize the recording of key information as a first step. More complete recording of the date of diagnosis, for example, would allow providers to measure how long it takes for newly diagnosed patients to attain and maintain acceptable levels of metabolic control. This measure may be one of the best overall measures of quality. In addition, as scientific research documents new preventive strategies, DQIP must respond by adopting new measures to reflect these advances. The performance of microalbuminuria screening in American Indian health care settings, for example, has been measured for only the last 3 years. Although screening rates are increasing, there remains confusion at the local level about the various methods available to screen for microalbuminuria and the criteria to be used for a diagnosis of microalbuminuria after several positive screening tests. Greater standardization of the process for screening and diagnosis will undoubtedly facilitate more refined measures of how well health care providers screen for and diagnose microalbuminuria. This increased standardization will also facilitate measuring and improving compliance with current treatment standards.

In conclusion, the DQIP accountability and quality-improvement measures could be easily applied to the IHS Diabetes Care and Outcomes Audit—a set of diabetes care measures that has been collected for more than a decade. The IHS process has proven successful in stimulating efforts to improve care and outcomes at the local level (8,10, 14). Quality improvement is data driven, but data alone are not sufficient to effect change. Some parameters like eye examination rates have not improved in recent years. This lack of improvement may reflect the constrained resources and diminished infrastructure experienced by the Indian health care system.

Like any health maintenance organization with a defined patient population, the Indian health care system is "at risk" for the complications of diabetes. Indian health care dollars have been severely limited for years. In 1996, the IHS received $1,578 per capita to care for its population compared with $3,920 per capita expended for the U.S. civilian population (19). Because health expenditures for diabetic patients are estimated to be at least three times the rates for nondiabetic individuals, the F/T/U system with its relatively large number of diabetic patients is severely constrained (19). Thus, as diabetes rates increased, F/T/U facilities were forced to track the use of preventive services before many other organizations developed disease management programs and clinical pathways. IHS adapted the public health surveillance methods that had been used successfully for tuberculosis control. These methods included carefully considered standards of care as well as surveillance about the implementation of these standards, including feedback and suggested improvement at the local level. All health care delivery systems with finite resources—including the IHS—are faced with the same problems, and many have developed similar solutions. Development of the DQIP measures was a considerable accomplishment, but it will be important to revisit the measures periodically to keep them vital and current. Use of the measures to ensure that the quality of care improves must also be stressed, because measuring alone will not guarantee such improvement. Attention to the evaluation and application of these measures must be a priority as health systems improve their performance in response to the initial DQIP measures and as the science underlying diabetes care changes and the measures evolve.

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