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Analysis to Develop an Automated Denominator for the IHS Diabetes Audit

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Background

In 1986 the Indian Health Service (IHS) Diabetes Program developed the Diabetes Audit as a method to assess the diabetes care provided in the various systems delivering healthcare to American Indians and Alaska Natives (AI/AN). This assessment is a self-audit of medical records. The assessment standards were identified by the national program in conjunction with a group of practicing physicians serving as regional diabetes coordinators, and are based on preventive practices and key surrogate variables that could be measured to evaluate care and intermediate outcomes.[1-3] Participation in this audit has since grown from the initial four pilot facilities in 1986 to 190 facilities in 1999; in 1999 the review included 13,248 charts from the 80,827 "active" patients with diabetes.[1] This monitoring system has been widely regarded as one of the most successful and effective enterprise-wide assessments of diabetes care in any health care organization today.

To promote uniformity of this self-audit, written guidance has been provided for both identifying which patients should be included in the audit as well as the documentation that must be present in order to "count" a preventive service as "provided" or a key surrogate variable as having "occurred."[1] Despite the impressive success of this system, concern has been raised about the "variable quality of the diabetes registry maintained at each facility and variable adherence to the medical record review definitions."[2] Even with very specific and well-written guidelines and the best of intentions, it is not reasonable to expect that they will be consistently applied, without any significant bias, at hundreds of sites when the care that is being evaluated is the care that the reviewers, at least in part, are providing.

Furthermore the resources that facilities must commit to successfully perform this self-audit are not insignificant. There are ever increasing and justifiable initiatives and requirements to monitor other aspects care, care for other chronic conditions, etc. (e.g., Government Performance and Results Act, GPRA; ORYX; Health Plan Employer Data and Information Set, HEDIS; HP2010, Congressional directives; and others) and these are making even more demands on our limited resources. As Gohdes *et al* have noted "In the climate of decreasing health care resources, all primary health care systems such as the IHS must implement cost-effective feedback systems to monitor care practices,

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intermediate clinical variables, and, ultimately, long-term outcomes."[3]

Because of these concerns, the IHS Diabetes Program, in conjunction with the IHS Information Technology Support Center (ITSC), the Phoenix Indian Medical Center, the National Indian Council on Aging, Cimarron Medical Informatics, and others, undertook an initiative to see if it could design an automated assessment tool that would use data already existing within the clinical information systems utilized by the various systems providing healthcare to AI/ANs. As part of this initiative, the IHS Diabetes Program and the IHS ITSC have undertaken a project to see if they could design a logic that would allow them to select a valid, usable, understandable, and reproducible denominator of patients from the most widely used clinical information system among the various Indian healthcare delivery systems, the Patient Care Component (PCC), the major clinical component of the IHS's integrated healthcare management system, the Resource and Patient Management System (RPMS). We report the results of that project to develop an automated denominator for the IHS Diabetes Care Audit.

Methods

Five service units were identified for participation in this study. The service units were chosen to represent diverse sites, IHS and tribal, rural and urban, large medical centers and small outpatient facilities. A necessary criterion for service unit inclusion was that they used IHS's PCC clinical information system.

Patients to be evaluated in this analysis were chosen from those at each site who met two criteria: age 19 or older and having had at least one recorded encounter of any type for diabetes mellitus at the service unit in the preceding year. We used these very inclusive criteria in order to cast as broad a net as possible to identify patients who had received any care at all for diabetes at each service unit. We understood that many of these patients would not be considered primary care patients of this facility and so would be excluded in a manual audit.

Of those patients meeting these criteria, 80 were randomly selected for chart review and more detailed evaluation of their PCC (electronic) record at each of five service units, for a total of 400 patients. The chart review at each facility consisted of a review of the patient's chart (paper record) by a carefully selected local healthcare professional active in caring for diabetes patients. Each reviewer evaluated every patient for inclusion or exclusion according to the published standards for the IHS Diabetes Audit (Table 1). For the electronic record, one of us accessed data from each service unit's PCC clinical information system, abstracting data on factors we believed might help us identify the appropriate patients for inclusion in a diabetes review (Table 2). In order to carry out the analysis, the data from these two data sets were then matched on service unit and patient chart number. All data analysis was done using Epi Info v.6.04.

Our initial intention had been to use the manual review of the paper chart as the "gold standard" against which the electronic (PCC) record was compared. However, in several cases in which there were discrepancies between the manual and electronic records, the data in the electronic record appeared to contain more detailed, internally consistent information and either shed doubt on the accuracy or clarified some of the uncertainties of the manual review. In several of these instances we requested that the reviewers at these sites reexamine the paper charts. At least one such rexamination was conducted at each of the five sites. We only "corrected" the decision from the original manual audit if the second review provided additional information that would have, with certainty, changed the local auditor's decision. If the additional information just pointed out further uncertainties, then we left the manual auditor's decision as it originally was.

Table 1. Findings of manual audit of charts for 400 patients meeting the study criteria.

	Of 400 patients	
	n	%
Does not have Diabetes Mellitus	21	5.3
Gestational diabetes	1	0.3
Impaired Glucose Tolerance (IGT) [1]	2	0.5
Diabetes Mellitus not established[2]	19	4.8
Receives primary care elsewhere (or not in community) [3]	100	25.0
Other primary referral or contract care (paid by IHS)	4	1.0
Other primary care (non IHS funded)	14	3.5
Receives care at another IHS or tribal facility	69	17.3
In jail and receives care there	1	0.3
In nursing home and receives care there	0	0.0
Attends off-site dialysis unit and receives care there	7	1.8
Moved	2	0.5
Died	2	0.5
Unable to contact	1	0.3
No chart found	3	0.8

[1] One of the two patients with IGT was diagnosed as having gestational diabetes
[2] Does not include those with gestational diabetes or impaired glucose tolerance testing
[3] More than one reason for exclusion applied to 3 of the 100 patients

Results

Eighty patients at each of the five sites, for a total of 400 patients, were identified using the inclusion criteria noted above. In the manual chart reviews, 21 (5.3%) patients were considered not to have diabetes mellitus, and 103 (25.0%)

Table 2. Findings of PCC search for 400 patients meeting the study criteria

	Of 400 patients	
	n	%
Predictors of potentially not having Diabetes Mellitus		
Only 1 Diabetes Mellitus diagnosis ever*	22*	5.5
Only 1 or 2 Diabetes Mellitus diagnoses ever	36	9.0
Pregnancy related diagnosis in last year	7	1.8
Predictors of potentially receiving primary care elsewhere (or not being in community)		
Lives in community not in Service Delivery Area*	76*	19.0
No primary care provider visit in a primary care clinic coded for Diabetes Mellitus within 1 Year*	70*	17.5
No primary care provider visit within 1 Year	20	5.0
No primary care clinic visit within 1 Year	34	8.5
No primary care provider visit in a primary care clinic within 1 year	42	10.5
No primary care provider visit coded for Diabetes Mellitus within 1 year	38	9.5
No primary care clinic visit coded for Diabetes Mellitus within 1 year	64	16.0
Only 1 visit coded for Diabetes Mellitus diagnosis within 1 year	60	15.0
End-stage renal disease procedure (ever)	0	0.0
Ever had creatinine > 5.0 mg/dl*	6*	1.5

** 128 (32.0%) patients had at least one of the four exclusions that comprised the best predictor set.*

Table 3. Ability of PCC to identify those patients who have gestational diabetes using the criteria of a pregnancy-related diagnosis within the last year

	Gestational diabetes		
PCC pregnancy-related diagnosis	Yes	No	
Yes	1	6*	7
No	0	393	393
	1	399	400

** These are individuals with pre-existing diabetes who had become pregnant*

Table 4. Ability of PCC to identify those patients who are on dialysis using the criteria "creatinine > 5.0 mg/dl ever"

	On renal dialysis		
PCC creatinine ≥ 5.0 mg/dl ever	Yes	No	
Yes	6*	0	6
No	1	393	394
	7	393	400

** Initial manual chart reviews did not identify three of these patients on dialysis.*

patients, including three for whom charts could not be found, were determined to be not receiving their primary care at the study facility (Table 1). A total of 112 patients were identified by the manual reviews as meeting exclusion criteria within one of these two categories (12 patients met both criteria), leaving 288 patients who would have been included in a manual review as persons with diabetes mellitus who were receiving primary care for their diabetes at the study facility.

In the electronic PCC records, 22 (5.5%) patients had only one Diabetes Mellitus diagnosis ever, and seven (1.8%) patients had one or more pregnancy-related diagnoses; both of these were indicators we had hypothesized might reliably indicate the patient did not have Diabetes Mellitus. Using electronic criteria to identify patients likely to be receiving primary care elsewhere, we found 76 (19.0%) patients whose community of residence was not in the facility's Service Delivery Area, and 70 (17.5%) patients who had no primary care provider visit in a primary care clinic coded for Diabetes Mellitus within the prior one year. While no patients had an End Stage Renal Disease (ESRD) procedure in their electronic records, six (1.5%) did have at least one creatinine value ≥ 5.0 mg/dl.

Comparing the findings of the manual and electronic PCC reviews, we found that of the seven patients identified by electronic PCC criteria as potentially having gestational diabetes, on chart review six of them were determined to have had preexisting diabetes and so would have been included in a manual audit (Table 3). Four patients were initially identified by chart review as being on renal dialysis, three of these were identified by the electronic PCC criteria as having at least one creatinine ≥5.0 mg/dl. Interestingly, three additional patients were identified by this electronic criteria who had not initially been recognized as being on dialysis by chart reviewers. On reexamination of the charts of these three patients, the reviewers changed their determinations, agreeing that the patients were on renal dialysis and so should have been excluded (Table 4).

Using different combinations of the potential indicators that a patient either did not have diabetes or was receiving care elsewhere, and then comparing the findings with the those of the manual reviews, we found that the four best predictors for inclusion were having had: at least two Diabetes Mellitus diagnoses ever; a community of residence in the service unit delivery area; at least one diabetes-related visit with a primary care provider in a primary care clinic within the past year; and

never having had ever having had a creatinine ≥ 5.0 mg/dl (Table 7).

Using these "best criteria" identified 272 patients for inclusion based on electronic PCC criteria; of these 254 (93.4%) would also have been included by the manual review (Table 5). Despite substantial differences in site characteristics, the performance of this criteria set did not vary meaningfully from site to site (data not shown).

Sixteen patient's charts were rereviewed because the findings from the PCC indicated that the additional information the PCC provided might prompt the manual reviewer to change his/her decision. In eight rereviews, the manual reviewers found new information in the paper charts that changed the original decision (see Table 6). In these instances, we used this corrected decision in our comparison with the PCC rather than the original chart reviewer's decision. In six rereviews, the manual reviewers stood by their original decision. In two rereviews, the additional information provided by the PCC left the manual reviewer uncertain whether or not a patient should be included in an audit (e.g., a patient who appeared to sometimes use the study facility as their primary care provider but clearly chose to use an outside provider as their primary provider for much, if not most, of the study period). In these two instances, we did not change the original manual reviewer's decision in calculating our results and therefore they still were considered as discrepancies with the PCC.

Table 7. Elements of a PCC logic for inclusion in an automated diabetes audit denominator

- Age 19 years or older;
- At least two diabetes-related encounters ever (any clinic and any provider);
- At least one encounter at the given service unit/ tribal facility in a "primary care clinic" with a "primary care provider" with a "purpose of visit" of diabetes within the previous year;
- A current community of residence that is within the given service unit's "service delivery area" as defined in the standard code tables;
- Absence of a creatinine value of 5.0 mg/dl or greater.

Table 5. Comparing the best prediction of inclusion by PCC with the manual chart review determinations.

	Manual Review		
"Best" PCC criteria	Include	Exclude	
Include	254	18	272
Exclude	34	91	128
	288	112	400

Conclusions

Well-defined and widely-tested criteria for patient inclusion in the diabetes audit (Table 1) have been previously developed. The purpose of this study was to determine if electronic indicators for these criteria could be developed, and to evaluate whether this electronic approach might work as well in practice as skilled auditors trying to apply the criteria by manual chart review. We believe the results demonstrate that we were able to accomplish this at these five, highly diverse pilot sites.

In addition to identifying a valid set of criterion for use in an electronic selection of patients, this analysis supports our impression that even in the best of hands, with careful and well-written guidance, manual determinations of who should or should not be included in the diabetes audit were frequently difficult and variable. For example, when reviewers were given information from the electronic PCC after their manual review, the inclusion or exclusion of a number of patients was changed (Table 6). Because of these variations, we found that the manual audit method could not be considered the "true" gold standard for who should or should not be considered an active patient and therefore included in an audit.

Since manual reviews may not identify a consistent and reproducible set of patients to be audited, we concluded that the goal for an electronic determination cannot be to identify a group of patients who exactly matched any given manual auditor's determinations. Rather, we believe the goal for an automated audit tool should be that it provide a valid, understandable, and reproducible method for selecting a group of patients that can then be used to derive comparable information about the level of diabetes care provided by that facility.

Table 6. Changes in manual audit decisions following rereviews prompted by PCC information

Pt. #	Original Manual Audit Decision	Additional Information	Final Manual
1	Include	Died during study period.	Exclude
2	Include	Has arranged other primary care using private insurance.	Exclude
3	Include	Receives primary care elsewhere.	Exclude
4	Include	Receives primary care elsewhere.	Exclude
5	Exclude	Patient does receive primary care at study facility.	Include
6	Include	Attends an outside dialysis unit.	Exclude
7	Include	Attends an outside dialysis unit.	Exclude
8	Include	Attends an outside dialysis unit.	Exclude

A limitation of this analysis is that we only looked at these five sites, and so results at sites not analyzed might not match these. However, we attempted to mitigate this limitation by choosing widely diverse pilot sites (IHS and tribal, rural and urban, large medical centers and small outpatient facilities, etc.). As reported, we found that this logic worked well at all five sites despite their very different characteristics. We were also surprised that excluding seven patients with pregnancy diagnoses would have resulted in excluding six patients who had pre-existing diabetes. Because of this, we decided against using a pregnancy-related diagnosis as a reason to exclude patients

Based on the results of this analysis, we recommend that an appropriate set of patients upon whom a valid, usable, understandable, and reproducible audit could be conducted can be automatically selected from data existing in the RPMS based on the characteristics listed in Table 7. This logic appears to mirror the criteria originally developed for the manual audit.

We believe that these characteristics allow the selection of a comparable group of patients at sites using clinical information systems other than PCC as long as those systems also allow the collection and storage of the required information, that information is reliably and accurately entered into that system and coded in a form that uses standard terminologies, and the system allows selection of patients based on these criteria or the export of its data into another database that does.

Finally, while automating the selection of patients (who make up the denominator) for participation is important in standardizing the selection and ensuring a fair comparison across facilities, it is also a first step towards a larger goal, a fully automated diabetes audit for which numerator data also come from automated analyses and no chart review is necessary. Based on work we have done recently, we believe that for limited clinical parameters routinely entered into the PCC, computerized audits are already feasible.[6] For other parameters, for which capture into the PCC is inconsistent or not currently feasible, manual charts reviews will continue to be necessary until the quality of those data components is improved. For the near future, we believe that a mixed system of automated and manual audits would most likely provide the best information on diabetes practices. For a subset of diabetes care measures, automated audits would accurately and more frequently (perhaps on a quarterly basis) provide information on all a facility's patients. Annual manual audits would validate those findings on a sample of patients with diabetes and provide information on diabetes care measures for which the quality of electronic data does not yet make automated audits a viable methodology.

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References

1. Acton K, Valway S, Helgerson S, Huy JB, Smith K, Chapman V, et al. Improving diabetes care for American Indians. *Diabetes Care*. 1993;16(Supplement):372-5
2. Mayfield JA, Rith-Najarian SJ, Acton KA, Schraer CD, Stahn RM, Johnson MH, et al. Assessment of diabetes care by medical record review. The Indian Health Service Model. *Diabetes Care*. 1994;17:918-23
3. Gohdes D, Rith-Najarian S, Acton K, Shields R. Improving diabetes care in the primary health setting. The Indian Health Service Experience. *Annals of Internal Medicine*. 1996;124:149-52
4. Personal communication. Ray Shields. October 30, 2000
5. IHS Diabetes Program. AUDIT2K. Indian Health Diabetes Chart Audit for Quality Assurance and Quality Improvement. February 2000
6. Peterson DE, Wilson C, Novak C. Comparing RPMS-PCC and the Diabetes Audit as data sources for calculating diabetes-related performance measures. Available on request

The e-Audit: Improvements in the RPMS Diabetes Audit Tool

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Introduction

In 1986, the Indian Health Service (IHS) developed diabetes care standards and an assessment process using a manual chart review to evaluate adherence to those standards.[1] The Diabetes Audit is now a common procedure for assessing organizational delivery of diabetes care by many IHS and tribal programs and has been credited with systematic improvements in diabetes care.[1,2] Interest in developing an automated procedure to mimic or replace the labor intensive manual chart audit procedure has been present for several years.

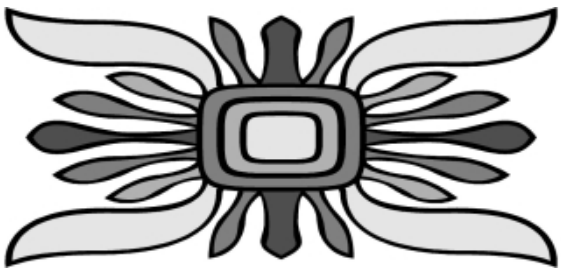
In 1996 a Resource and Patient Management System (RPMS)-based audit program was created by the IHS to extract clinical and laboratory data from Patient Care Component (PCC) and related packages and report the data in the format of an audit. In 1999 the Phoenix Indian Medical Center (PIMC) systematically evaluated the use of this automated audit and designed modifications to make the audit more useful. These modifications have resulted in an updated RPMS diabetes audit package that is now available to RPMS users anywhere. In this paper, we report on selected aspects of the evaluation and modification process and on procedures for implementing what we now call the diabetes *e-Audit*.

Background and Purposes

Auditing is a systematic process to measure performance, whether performed on a single patient or a group of patients.[3,4] A comparison of the process of reviewing the medical records of a group of patients for an aggregate audit of the performance of an organization, and the review of a single medical record for an individual audit, shows both differences and similarities. For an example of a difference, a medical record audit uses only available clinical information and documentation as the proof of the delivery of care. The findings from such audits are then used to make assumptions and guide programs. In clinical care, the documentation procedures help direct patient care but would never override clinical judgement.

For example, if a facility did an audit to identify patients with drug allergies, and 12% of patients had documentation of allergy to penicillin, the audit could correctly report that approximately 12% of patients do and 88% of patients do not have documentation of allergy to penicillin. The local administrator could use this information to help plan the pharmacy budget for drugs for patients with penicillin allergies, or design education materials. However, for an individual patient it would be risky to not ask the patient about drug allergies before dispensing penicillin simply because there was no notation in the chart or because the audit reported that most people do not have an allergy.

Even aggregate audit procedures require some form of interpretation and judgement of the available data. Audits of clinical records in several types of facilities have shown that because of the multiple possible methods of documentation, acceptable



audit results often require use of a broad timeframe or even surrogate conditions to identify all possible conditions. Using the previous example, to identify all patients with penicillin allergies one might have to look for patients with allergies to (or events with) a number of different B-lactam antibiotics over a long period of time to identify all 12% of patients with documentation of an allergic reaction to penicillin.

Audits are thus highly dependent on the procedures used to gather information. Audits vary according to the reliability and training of the reviewer, by accuracy of the information in the chart, and timeframe examined in the review. The procedures used to record data also affect audit performance. For example, transcription errors can occur even when the chart abstraction is accurate. Multiple investigations of auditing procedures suggest that audit procedures have variable accuracy and may include their own biases.[5-8] Because of the potential effect of bias, audits must be designed with the end use in mind. Because our interest was in describing aggregate performance of an individual or groups of individuals in the delivery of diabetes care, our efforts for this evaluation and modification focused on the goal of most accurately reflecting care given to a population of patients. We will revisit the issue of the purpose of an audit, and the use of data for individuals versus populations, in a later section.

Table 1. Selected comparison of the 1996 version of RPMS DM audit to an audit performed manually (N=95)

Diabetes Care Standard	Manual Audit Results	RPMS Audit Results	Sensitivity (%)
Flu Vaccine	39%	43%	110%
Diet Instruction	29%	20%	69%
ACE Inhibitor Use	41%	25%	60%
Foot Exam	62%	0%	0%
Eye Exam	53%	0%	0%

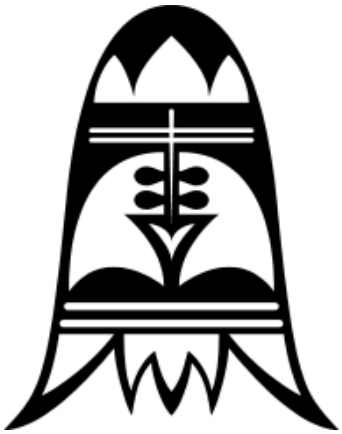
Evaluation

The 1996 version of the Diabetes Audit is a reporting application in the PCC Management Reports component of RPMS. To evaluate the usefulness of the audit, we created a head-to-head comparison of a manual and an automated audit. To do this, we used the prior year's manual audit and created a template of patients who were used in that audit to run the 1996 audit package. We used the manual chart audit results as the gold standard against which we compared the results of the RPMS audit program (see Table 1). As shown, compared to the manual review, the sensitivity of the audit package was highly variable.

We reviewed the procedures used by the audit for identifying elements of the care. We found the procedures to be highly detailed, but very different than the documentation procedures commonly used in clinical practice. For example, a complete diabetes foot exam required a notation of a foot check in one of the procedural boxes (small boxes to the right side of a PCC encounter form). While such a procedure should be highly specific for a foot exam, we did not find anyone who was aware of this documentation procedure. We did find that diabetic foot exams were frequently written as a purpose of visit and frequently occurred during podiatry clinic visits. Thus, the lack of sensitivity of the automated audit was a function of the specific, but very narrowly defined documentation requirement.

Modification and Reevaluation

While very specific and detailed documentation procedures are certainly laudable, we felt that we could reflect organizational performance equally well by modification of the automated audit program to reflect common documentation practices. We systematically worked through each of the elements of the audit by looking at the common purpose of visit codes, common clinic locations and typical personnel (i.e., codes for foot examinations, podiatry clinics, or providers) associated with the elements of the standards. Using this, we created a set of conditions that we felt would best reflect the typical provision of care. We awarded a contract to Cimarron Informatics to modify the audit package to meet the purpose of developing a totally electronic diabetes audit.



On completion of the reprogramming modifications, we used 295 manually reviewed charts and a template of the same 295 patients to create a head-to-head comparison of the manual and modified RPMS audit program (see Table 2). We manually entered the chart review results and used the RPMS to export the electronic audit directly to an Epi-Info REC files (Epi-Info Statistical package, Stone Mountain GA). The two REC files created by the two different procedures allowed us to then directly compare individual and group results and to apply more sophisticated statistical evaluation techniques. After modifications, we found much higher sensitivity without significant loss of specificity. The observed agreement between the two procedures was high and the kappa value, a measure of the agreement between the two methods that is independent of chance, ranged from 0.21 to 0.99. Kappa values above 0.5 demonstrate high levels of agreement. For example, a kappa value of 0.7 is often found in comparison of two radiological reports of the same x-ray.[9]

Table 2 Selected comparison of the RPMS *e-Audit* to an audit performed manually (N= 295)

Diabetes Care Standard	Manual Audit Results	RPMS *e-Audit* Results	Sensitivity (%)	Kappa
Flu Vaccine	42%	37%	88%	0.82
Diet Instruction	49%	17%	34%	0.21
ACE Inhibitor Use	75%	80%	106%	0.76
Foot Exam	38%	37%	96%	0.83
Eye Exam	44%	48%	109%	0.84

Relation to Other RPMS Packages

The modifications were then scrutinized during a January 2000 meeting in Phoenix that was attended by many experts from throughout the IHS. A consensus methodology was used to slightly modify the procedures by removing questionable assumptions, to improve applicability at other sites, and to help define the purposes and appropriate uses of the new automated audit. The purposes and uses of the automated audit were specifically compared to the purposes of use of the Diabetes Patient Care Supplement package ("Implementing a New Case Management Tool: The Diabetes Patient Care Summary," *The IHS Provider*, Volume 25, Number 2, Pages 17-19, February 2000). The main differences between the purposes and design of the two programs is summarized in Table 3.

Table 3. Key comparison points between two new RPMS diabetes tools

- Both tools use data supplied by the RPMS Laboratory, Pharmacy, Radiology, Immunization, and Dental Systems as well as by the PCC Data Entry process.
- The *e-Audit* Program was designed to do an IHS Diabetes Program audit on a group of patients, was created to report as much data as possible, and uses assumptions that are accurate for groups of patients; however it may not be accurate for an individual patient.
- The Diabetes Patient Care Supplement was designed to help prompt appropriate care for an individual patient, was created to report data on individual patients that had been accurately entered in the computer system, uses assumptions that avoid misinformation, but may miss some information that is available in the paper chart.

The primary purpose of the *e-Audit* is to evaluate the delivery of services to a population of patients. Therefore, the *e-Audit* design still contains some assumptions that are accurate for groups of patients but may not be accurate for any individual patient. An example is the yearly diabetic foot exam. In addition to diabetic foot exam as a purpose of visit, the *e-Audit* program accepts any visit to podiatry or a podiatrist as evidence of a complete exam. This is because it is highly likely (> 80% probability in our analysis) that a complete exam occurred. Our evaluations show that use of such assumptions results in a more accurate reflection of the performance of the organization. Using a podiatry visit alone, though, could result in slightly less than 20% of patients receiving credit for, but not actually receiving a detailed foot examination. If used without proper clinical questioning for an individual patient, the *e-Audit* could perhaps result in underutilization of services for some patients.

However, because the design of the program is written so that the first option is documentation of a complete foot exam, if an organization uses uniform documentation and data entry procedures, the audit could be used for individual care as accurately as for a population of patients. Similarly, if uniform documentation practices occurred, the results obtained by chart review, *e-Audit*, or Diabetes Patient Care Supplement would be equivalent. Similarly, such consistency in documentation would also support many of the other electronic auditing activities that are independently occurring in the IHS, such as those of the Diabetes Tracker, the National Indian Council on Aging (NICOA), Government Performance and Results Act (GPRA), and ORYX. We support organizational efforts to achieve uniform documentation practices.

We also feel that the *e-Audit* has demonstrated the ability to accurately mimic audit results for a population of patients with equivalence to, and in some cases superior results to, those of a manual chart review, without additional staff training and ongoing retraining efforts. We believe that the procedures and assumptions used to create the Diabetes Patient Care Summary may be easier to use and better suited to instruct providers in the care of individual patients. Finally, we believe that any use of RPMS data will likely lead to improvements in data quality across

all RPMS applications, and that this, in turn, offers the best hope for uniformity of data collection and use.

Implementation

As might be expected, development of a sophisticated electronic audit package has required significant effort and resources. Implementation of the e-*Audit* will also require resources. Full implementation of the *e-Audit* requires use of the RPMS Laboratory, Pharmacy, Immunization, and Dental packages, as well as appropriate PCC data entry processes. Site specific laboratory and pharmacy taxonomies need to be set up. The export function used to create an Epi-Info REC file requires understanding of file transfer procedures. Use of the *e-Audit* requires an epidemiologic understanding of methods used to identify appropriate patients for creation of the proper denominator. Use of the REC file for statistical analysis requires knowledge of Epi-Info and statistics.

For a large facility like the Phoenix Indian Medical Center, the efforts put into this procedure allow us to do total, sampled, site specific, and provider specific audits that were never possible in a manual chart review process. Once the epidemiologic and statistical framework had been done, organization-wide profiles could be created within minutes by one person. This is a significant savings over the nearly one to two man-hours per chart needed to pull, manually abstract, transcribe, and replace a single manual chart for review. While requesting a predetermined audit may take minutes, actual computer processing time make take many hours, and such larger runs are usually left to take place overnight.

Therefore, for PIMC, not only does the *e-Audit* improve the capacity to gather data for organizational performance improvement projects, but the process also saves auditing resources by reducing the manpower required to create an audit. While the expected benefit to effort ratio of the *e-Audit*, which is dependent on the resources and size of the facility, is likely to be most favorable for large facilities, this does not prevent the use of this package by smaller facilities. Smaller facilities with less RPMS support could use a partial *e-Audit* that is supplemented by a manual chart review. The process for implementation at any given facility would require an independent assessment of the capabilities of that facility.

Summary

An electronic diabetes audit process, the *e-Audit* is now available to users of RPMS. Under the proper conditions, the *e-Audit* results in an audit that is statistically equivalent to, and perhaps even better than, a manual chart review. The creation of this process has required significant investment of resources to date, and new users of the process will also need to invest time and effort in developing the capacity to properly apply the *e-Audit* process at their facility. However, once the procedures are established, significant improvements in data gathering performance and in manpower savings may occur. With wider use, experience, and feedback from other Indian health system facilities that use RPMS, improvements and easier implementation will likely become available.

References

1. Gohdes D, Rith-Najarian S, Acton K, Shields R. Improving diabetes care in the primary health setting. The Indian Health Service experience. *Ann Intern Med*. 1996;124(1 Pt 2):149-52
2. Acton K, Valway S, Helgerson S, Huy JB, Smith K, Chapman V, Gohdes. Improving Diabetes care for American Indians. *Diabetes Care*. 1993;16(1):372-5
3. Wyatt J. Acquisition and use of clinical data for audit and research. *J Eval Clin Pract*. 1995;1(1):15-27
4. Nelson EC, Splaine ME, Batalden PB, Plume SK. Building measurement and data collection into medical practice. *Ann Intern Med*. 1998;128:460-466
5. Wu L, Ashton CM. Chart review. A need for reappraisal. *Eval Health Prof*. 1997;20(2):146-63
6. Stange KC, Zyzanski SJ, Smith TF, Kelly R, Langa DM, Flocke SA, Jaen CR. How valid are medical records and patient questionnaires for physician profiling and health services research? A comparison with direct observation of patients visits. *Med Care*. 1998;36(6):851-67
7. Dresser MV, Feingold L, Rosenkranz SL, Coltin KL. Clinical quality measurement. Comparing chart review and automated methodologies. *Med Care*. 1997;35(6):539-52
8. Robinson JR, Young TK, Roos LL, Gelskey DE. Estimating the burden of disease. Comparing administrative data and self reports. *Med care*. 1997;35:932-47
9. Berry CC. The kappa statistic. *JAMA*. 1992;268(18):2513-4

Acknowledgments

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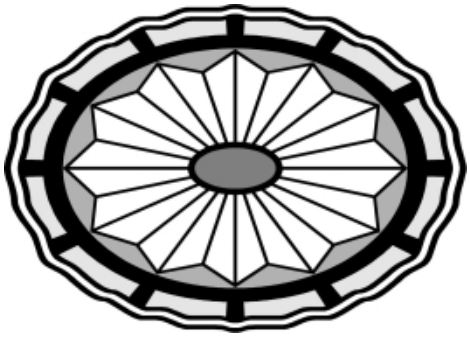


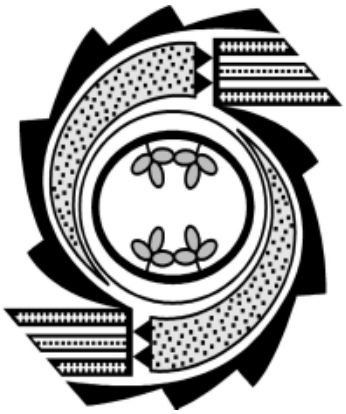
Standards and the Computerized Patient Record

Theresa Cullen, MD, Medical Informatics Consultant, Division of Information Resources, Indian Health Service, Tucson, Arizona

Overview

How do you collect and share electronic information in health care? How do you query for patient information in your computerized patient record? Do you enter first name and last, just last name, or last name followed by first name? Does it matter? Once you obtain the patient's information, how do you know that the information is accurate and reliable? How do you know that the random blood glucose that appears on the computerized health summary is not a fasting blood glucose? How do you know that the diabetes that appears on the health summary as a purpose of visit is really diabetes mellitus (entered as "DM"), and not otitis media (entered as "OM")? Oh, those nasty abbreviations that we all use!

In an attempt to increase accuracy, reliability, and reproducibility, electronic patient records increasingly rely on standards developed throughout the electronic medical data industry. This article will help explain standards and their role in improving health data accuracy and reliability.



What are some things that a CPR can do?

An adequate computerized patient record (CPR) can and should improve our understanding and management of medical information. Computerized patient records are designed to increase data accuracy and reliability, and improve health outcomes. However, achieving these goals is dependent upon adequate data, knowledge, and tools. This information can then, in the right context, be used to make appropriate medical decisions. However, the "right" decisions are dependent upon obtaining the "right" information. For instance, do I get different information depending upon how I query our medical information system for a specific patient? How do I indicate exercise induced asthma since ICD-9 codes don't include this diagnosis? Does the specificity of this diagnosis matter? Are the lab values that I see on a health summary entered in a common format? Can I really compare lab values done on different days?

What is a medical informatics standard?

The concept of "standards" for electronic medical information has arisen in response to these types of questions. Standards are the "rule of the road." They help explain how individuals as well as systems use specific information and data. Standards allow, and encourage, medical information to be structured and entered into an electronic format in an accepted and well-defined manner. Commonly accepted and well-defined standards can allow for improved electronic sharing between providers and information systems.

A standard is a collection of specifications that has been developed, agreed upon, and then endorsed by a recognized group. Once again, the goal of standards is to ensure that shared data are reliable, accurate, and easily interpretable. There are many categories of standards in medical information sharing. These include:

1. standards that describe the way information is exchanged between health care information systems. These standards are designed to allow electronic information to 'make sense' when it is moved from one information system to another. HL7 messaging is an example of this type of standard.
2. standards for ideas/diagnoses/values that represent medical concepts. These standards, such as ICD-9 codes, can help ensure that "otitis media" is a standard representation of the same disease, independent of the electronic information system.

As medical providers, we continually collect clinical data and evaluate them. In order to be useful, the data must be

collected in a reproducible manner. Data that are more detailed, reliable, and comparable allow for better evaluation and medical decision making. Performance benchmarking, interpreting outcomes, and allocating scarce resources require comparable data and a standardized approach to the collected information. Standardization of information is dependent upon the acceptance of standard words for the same meaning. For instance, male and man usually mean the same thing, but an electronic system may not know that. It must have some "knowledge" to figure this out. Standard terminology is this knowledge.

Current ICD and CPT medical terminology (examples of standard vocabularies) are limited, not only in scope, but in their ability to handle differing degrees of disease severity and/or other qualifying details. Quality and medical decisions may be hampered when they are dependent upon a patient record that is unable to adequately capture patient conditions and important qualifiers to those conditions (for example, unspecified pneumonia, versus right upper lobe pneumococcal pneumonia). The development of more robust and comprehensive terminologies (standard languages) allows health systems to generate increasingly reliable and reproducible data. In addition, common terminologies support the creation of comparable databases in health care delivery, allowing for common guideline development, as well as shared decision support rules and tools.

The previous article on the use of LOINC ("When is a Glucose not a Glucose? An Overview of Logical Observation Identifier Names and Codes (LOINC), The Next Generation of Laboratory and Clinical Standards," *The IHS Primary Care Provider*, Volume 25, Number 10, pages 160-161, October 2000) as a standard terminology for lab values helped illustrate these concepts. The Division of Information Resources within the Indian Health Service is currently poised to modify the lab package to utilize LOINC. This evolution should help ensure that our laboratory software application remains at the forefront of laboratory standard terminology. This effort will help ensure that our laboratory data gain increasing reliability and accuracy, resulting in improved abilities to monitor and evaluate the health status of American Indians aand Alaska Natives.

Additional standards terminology initiatives within the Division of Information Resources are forthcoming, and are designed to address these 21st Century issues. We recognize that data availability and quality hinge on our ability to integrate standards terminology into our systems.

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THE PROVIDER will no longer publish citations from the current National Library of Medicine MEDLINE database. The reasons for this change are twofold.

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The second reason for this decision is economic. Last year's printing costs for this feature were over $2,000.

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