ABSTRACT

Objectives. The Alaska Native Medical Center diabetes program analysed Diabetes Care and Outcomes Audit data from 1994–2004 to evaluate the impact of the Special Diabetes Program for Indians (SDPI) funding on process and intermediate outcomes.

Study Design. We conducted a retrospective analysis of data from standardized medical records reviews conducted between 1994 and 2004 from regional sites in Alaska.

Methods. We analysed 7,735 randomly selected records for trends over three time periods (pre-SDPI, transition and SDPI).

Results. Hemoglobin A1c, total and LDL cholesterol, triglycerides and blood pressure significantly improved from the pre-SDPI to the SDPI period. However, as the number of people with diabetes increased, the percentage of patients receiving foot, eye and dental exams decreased, as did the percentage receiving nutrition, exercise and diabetes education.

Conclusions. SDPI funding provided resources for interventions necessary to improve the effectiveness of diabetes care. This was associated with improved intermediate outcomes in American Indian/Alaska Native patients with diabetes. Further observations are needed to evaluate whether or not intermediate outcomes result in decreased cardiovascular disease, amputations, dialysis and retinopathy. (Int J Circumpolar Health 2008; 67(2-3):203-212)

Keywords: SDPI, American Indian/Alaska Native, diabetes care, lipids, blood pressure, hemoglobin A1c
INTRODUCTION

The prevalence of diabetes among American Indian people at 16.3% is one of the highest in the country. In addition to the high rates of diabetes, American Indian/Alaska Native (AI/AN) people have a three-fold higher risk of dying from diabetes (1). In Alaska specifically, the number of Native American people with diagnosed diabetes has increased from 1,259 at the end of 1994 to 3,264 at the end of 2004.

Recognizing the public health impact of the diabetes burden, the federal government funded the Special Diabetes Program for Indians (SDPI) in 1998. This program distributed funds among the AI/AN tribes. Between late 1998 and 2000, staff were hired and programs established and expanded. Diabetes teams with a dietitian and/or a diabetes educator were added or expanded. Access to blood glucose monitoring supplies and medications also increased. Regional diabetes registries were initiated and maintained as a component of the computerized medical records system.

Health care for Alaska Native people was historically provided by the Indian Health Service (IHS), a federal agency. By 1999 all Alaska Native health care facilities had transitioned to tribal management. Primary care for rural Alaska Native patients is provided in the village where trained community health aides/practitioners are the first-line providers (2). The second line of care is available at regional hospitals/subregional clinics, which are facilities located in larger communities. The Alaska Native Medical Center (ANMC) campus in Anchorage is the referral centre for tertiary care and provides primary care to AI/AN residents of the Anchorage region. The Alaska Native Medical Center’s Diabetes Program (ANMC DP) started in 1985 and provides diabetes specialty care within ANMC and in several regional facilities. A centralized clinical/epidemiological registry of AI/AN people with diabetes has been in existence in the ANMC DP since 1985. The Alaska Tribal Health System utilizes a combination of electronic and paper health records.

The Division of Diabetes Treatment and Prevention (DDTP), a division within the IHS, established guidelines for diabetes care in the mid-1980s and later developed an audit system to assess patient care over time through an annual evaluation of process of care and intermediate outcomes (3). The audit has been standardized and performed annually since 1994. Audit criteria are based on the IHS standards of care for adults with type 2 diabetes (4), which are similar to American Diabetes Association (ADA) criteria (5), and are set by DDTP. Audit criteria are reviewed annually to incorporate

| Age group | 1994 Male | 1994 Female | Total | 2004 Male | 2004 Female | Total |
|-----------|-----------|-------------|-------|-----------|-------------|-------|
| 0–14      | 6         | 4           | 10    | 13        | 11          | 24    |
| 15–24     | 9         | 11          | 20    | 20        | 33          | 53    |
| 25–34     | 28        | 31          | 69    | 61        | 114         | 175   |
| 35–44     | 44        | 77          | 121   | 184       | 223         | 407   |
| 45–54     | 119       | 161         | 280   | 295       | 400         | 695   |
| 55–64     | 136       | 190         | 326   | 351       | 440         | 791   |
| 65+       | 174       | 269         | 443   | 473       | 646         | 1,119 |
| Total     | 516       | 743         | 1,259 | 1,397     | 1,867       | 3,264 |

Table I. Number of patients with diabetes in 1994 and 2004.
new findings and improved clinical practices. The annual audit is performed at each regional health care facility.

MATERIAL AND METHODS

Audits were performed in a total of 18 facilities (hospitals or clinics), including all that are hospital based and physician-staffed. Fourteen of the 18 facilities, all staffed by at least 1 physician/physician assistant or nurse practitioner, participated in the audit at least once in each time period. The 14 included all regional hospitals/referral facilities.

Patient selection
The patient sample for each facility was drawn from the centralized registry and included AI/AN patients residing in the region and receiving primary care in the regional facilities during the 12 months prior to the date on which the audit was performed. American Indian people not of Alaska origin and who were receiving health care in the Alaska Tribal Health System were included in the sample. The total Native (overall) population based on the 2000 census was 119,241 with 59,910 (50%) males and 59,331 (50%) females. Of these, 40,633 were under the age of 15 (51.6% were male and 48.4% were female) (Table II).

| Age group | Male    | Female  | Total  |
|-----------|---------|---------|--------|
| 0–14      | 20,951  | 19,682  | 40,633 |
| 15–24     | 10,438  | 9,839   | 20,277 |
| 25–34     | 7,767   | 7,946   | 15,713 |
| 35–44     | 8,625   | 8,927   | 17,552 |
| 45–54     | 5,994   | 6,102   | 12,096 |
| 55–64     | 3,301   | 3,315   | 6,616  |
| 65+       | 2,834   | 3,520   | 6,354  |
| Total     | 59,910  | 59,331  | 119,241|

Patients who missed appointments were still included in the audit if they met the residence and primary care criteria. Patients who died during the previous year, received primary care elsewhere or were non-Native were excluded from the audit analyses.

Patients were selected from the centralized registry for each facility’s audit based on a simple random sample so that there was at least 90% power to show that the true rate fell within 10% of the observed rate (90% reliability, 10% precision). DDTP provided the standardized form and instructions for the audit.

Audit methods
Trained health care professionals from the local region and/or ANMC DP performed the medical chart reviews for the audit. The electronic medical records system (Resource and Patient Management System or RPMS) contains key information such as active and inactive problems, diagnoses and lab results and hospital discharge summaries. RPMS also features a built-in diabetes audit component that draws information from several other clinical applications within RPMS. The chart review for the audit was completed from the electronic record or a combination of the electronic and paper records.

Process of care definitions and descriptions
The last value within the 12 months preceding the date of the audit was used for HbA1c, total cholesterol, HDL cholesterol, LDL cholesterol and triglycerides. An average of the most recent 3 blood pressure values from non-emergency visits was used to derive mean systolic and diastolic blood pressures. Lab values used in analysis came from laboratory assessments performed in the regional hospitals or at
contracted clinical laboratories. All lab assays were performed using standardized methods. We defined a foot exam to include sensory evaluation with a monofilament, a circulation check and a visual inspection of skin condition and foot deformities if present. We defined an eye exam as dilation of the pupil and examination of the eye, including the retina, by a trained eye professional.

**Data analysis**

Data was divided into 3 time periods: pre-SDPI, which was before the start of the grant period (1994–1998); transition, the period during which programs received funding and started recruiting staff (1999–2000); and SDPI, during which programs were actively implementing diabetes prevention and treatment strategies (2001–2004). As standards of care evolved, the parameters of the audit changed. The audit did not assess testing of LDL Cholesterol until 1998, thus the pre-SDPI period included data only from 1998. Assessment of HDL testing and lipid agent use began in 2000, hence the transition period data is limited to the year 2000.

Since facilities were responsible for widely varying numbers of patients with diabetes, the 90% reliability sampling method resulted in the inclusion of 5%–99% of patients in each facility. Data were weighted for each facility based on patient counts at the end of each calendar year. This weight was then applied to all the records from a facility for each year.

The data were analysed using Statistical Analysis System (6) and Stata (7) software programs to evaluate whether process (education and exams) and intermediate outcomes (lab values and blood pressure) changed over the 3 time periods. Linear regressions were used for significance testing. Triglycerides and HbA1c values were transformed by taking their natural logarithm for a more constant variance for analysis. Data were adjusted for age (<45 years, 45–54 years, and >=55 years), gender and duration of diabetes.

**RESULTS**

We analysed data from 7,735 records on 2,587 AI/AN individuals with diabetes. Some patients were audited in more than one annual audit. Table III describes the characteristics of the audited population. Fewer than 4% of patients in any time period had type 1 diabetes. One percent or less of the audited population was under the age of 18 during any time period.

| Table III. Characteristics of the audited population at the time of each audit. |
|---------------------------------------------------------------|
| **Characteristics** | **Pre-SDPI (1994–1998)** | **Transition (1999–2000)** | **SDPI (2001–2004)** |
| Mean age (yrs) | 58 | 58 | 58 |
| Mean BMI (kg/m²) | 34 | 34 | 35 |
| Mean duration of diabetes (yrs) | 8.0 | 7.3 | 7.2 |
| Age <18 (%) | 0.4 | 0.5 | 0.7 |
| Females (%) | 60 | 56 | 58 |
| Males (%) | 40 | 44 | 42 |
| Records (n) | 3,552 | 1,361 | 2,822 |
| Patients (n) | 1,394 | 1,112 | 1,839 |

* Some patients were audited more than once.
Table IV shows that a higher percentage of patients received lipid tests over the 3 time periods. Table IV also shows that the percentage of patients treated with Angiotensin Converting Enzyme Inhibitors (ACE)/Angiotensin Receptor Blockers (ARB), aspirin and/or lipid-lowering agents increased over time. Only the increase in ACE/ARBs and aspirin was significant.

Except for dental exams, the percentage of patients receiving exams and education decreased. Although the overall percentage decreased, there was wide variation among the regional sites in terms of documented annual exams and education. Four had an increase in the percentage of patients receiving at least 1 of the exams or educational services audited (data not shown).

The percentage of patients meeting ADA treatment goals increased from pre-SDPI to the SDPI period.

| Table IV. Percentage of patients receiving recommended services or medications/meeting treatment goals. |
|-----------------------------------------------|
|                                              |
|                                               |
| Lipid tests                                   |
|                                              |
| Total cholesterol                             |
| %                                             |
| Pre-SDPI (1994–1998) %                        |
| Transition (1999–2000) %                      |
| SDPI (2000–2004) %                            |
| P Value**                                    |
| Adjusted P Value***                          |
| Percent                                      |
| Lipid tests                                   |
|                                              |
| Total cholesterol                             |
| 83                                            |
| 82                                            |
| 85                                            |
| 0.13                                         |
| 0.653                                        |
| LDL cholesterol                               |
| 59                                            |
| 71                                            |
| 77                                            |
| <0.001                                       |
| <0.001                                       |
| Triglycerides                                 |
| 79                                            |
| 81                                            |
| 84                                            |
| <0.001                                       |
| <0.001                                       |
| HDL cholesterol                               |
| NA*                                           |
| 78                                            |
| 83                                            |
| 0.003                                        |
| 0.022                                        |
| Medications                                   |
|                                              |
| Ace inhibitors/ARB                           |
| 46                                            |
| 63                                            |
| 68                                            |
| <0.001                                       |
| <0.001                                       |
| Aspirin                                       |
| NA*                                           |
| 50                                            |
| 68                                            |
| <0.001                                       |
| <0.001                                       |
| Lipid agents                                  |
| NA*                                           |
| 36                                            |
| 40                                            |
| 0.069                                        |
| 0.075                                        |
| Exams and education                           |
|                                              |
| Foot exam                                     |
| 75                                            |
| 71                                            |
| 67                                            |
| <0.001                                       |
| <0.001                                       |
| Eye exam                                      |
| 62                                            |
| 57                                            |
| 56                                            |
| <0.001                                       |
| <0.001                                       |
| Dental exam                                   |
| 22                                            |
| 37                                            |
| 35                                            |
| <0.001                                       |
| <0.001                                       |
| Nutrition education, any provider             |
| 76                                            |
| 69                                            |
| 60                                            |
| <0.001                                       |
| <0.001                                       |
| Exercise education                            |
| 68                                            |
| 66                                            |
| 55                                            |
| <0.001                                       |
| <0.001                                       |
| Other diabetes education                      |
| 77                                            |
| 76                                            |
| 64                                            |
| <0.001                                       |
| <0.001                                       |
| Treatment goals                               |
|                                              |
| HbA1C<7%                                      |
| 29                                            |
| 45                                            |
| 52                                            |
| <0.001                                       |
| <0.001                                       |
| LDL cholesterol <100 mg/dl                   |
| (<2.59 mmol/l)                                |
| 36                                            |
| 39                                            |
| 51                                            |
| <0.001                                       |
| <0.001                                       |
| HDL cholesterol >40 mg/dl                    |
| (<1.03 mmol/l)                                |
| NA*                                           |
| 65                                            |
| 73                                            |
| 0.005                                        |
| 0.006                                        |
| Triglycerides <150 mg/dl                     |
| (<1.68 mmol/l)                               |
| 33                                            |
| 34                                            |
| 37                                            |
| 0.003                                        |
| <0.001                                       |
| P<130/80‡ mm Hg                              |
| 28                                            |
| 32                                            |
| 37                                            |
| <0.001                                       |
| <0.001                                       |

*Not assessed in pre-SDPI period; LDL assessed starting in 1998; HDL in 2000; aspirin in 1999; lipid agents in 2000.
**Logistic regression comparing pre-SDPI to SDPI; for items not assessed pre-SDPI, compares transition to SDPI.
***Adjusted for age, sex and duration of diabetes.
†IHS/ADA goals are defined based on standard units.
‡Systolic <130 and diastolic <80 mm/hg.
Table V shows that all lipids, blood pressures and HbA1c improved from the pre-SDPI to SDPI period. HDL Cholesterol showed a slight increase from transition to the SDPI period, but the change was not statistically significant when adjusted for age, sex and duration of diabetes.

**DISCUSSION**

Changes in health care systems have been shown to be associated with improved intermediate outcomes in diabetes (8–9). The improvements seen in our study coincided with major changes in the diabetes health care delivery system that resulted from increased funding. During the pre-SDPI period in Alaska, the ANMC Diabetes Program consisted of 4 staff

**Table V.** Mean laboratory values and blood pressure by time period.

|                        | Pre-SDPI (1994–1998) | Transition (1999–2000) | SDPI (2001–2004) | P Value *** Adjusted P value† |
|------------------------|----------------------|------------------------|------------------|-----------------------------|
| Total cholesterol mmol/l (mg/dl) | 5.46 (211)          | 5.17 (200)            | 4.91 (190)       | <0.001                      | <0.001                       |
| LDL cholesterol mmol/l (mg/dl)  | 2.97 (115)          | 2.85 (110)            | 2.66 (103)       | <0.001                      | <0.001                       |
| Triglycerides mmol/l (mg/dl)   | 2.63 (235)          | 2.52 (225)            | 2.34 (209)       | <0.001                      | <0.001                       |
| HDL cholesterol mmol/l (mg/dl) | NA*                 | 1.24 (48)             | 1.27 (49)        | 0.035                       | 0.068                        |
| Mean Sys BP mm Hg**          | 137                 | 135                   | 133              | <0.001                      | <0.001                       |
| Mean Dia BP mm Hg**         | 76                  | 74                    | 73               | <0.001                      | <0.001                       |
| HbA1C (%)                  | 8.4                 | 7.6                   | 7.4              | <0.001                      | <0.001                       |

*Not assessed.
**Average of most recent 3 systolic (sys BP) and diastolic (dia BP) blood pressure readings within the last 365 days.
***Logistic regression comparing pre-SDPI to SDPI, except for HDL cholesterol which compares transition to SDPI. P values were calculated on clinical measures using mg/dl.
†Adjusted for age, sex and duration of diabetes.

**Table VI.** Comparison of changes in intermediate outcomes among 3 groups.

| Clinical and biological measures | NHANES and BRFSS 1990s/2000s†† | IHS 1995/2001⁹ | Alaska (1994–1998)/ (2001–2004) |
|----------------------------------|---------------------------------|----------------|----------------------------------|
| Mean HbA1C%                      | 7.8/7.7                         | 8.9/7.9        | 8.4/7.4                          |
| Mean total cholesterol mmol/l (mg/dl) | 5.77/5.40 (223/209)           | 5.38/4.99 (208/193) | 5.46/4.91 (211/190)              |
| Mean triglycerides mmol/l (mg/dl) | 2.09/1.80 (187/161)            | 2.88/2.63 (257/235) | 2.63/2.34 (235/209)              |
| Mean systolic blood pressure mm Hg | 132/132                         | 134/132        | 137/133                          |
| Mean diastolic blood pressure mm Hg | 74/72                            | 79/76          | 76/73                            |

**Table VII.** Percentage of patients meeting goals compared with an MCO and NHANES/BRFSS.

|                                  | Alaska SDPI (2001–2004) | U.S. MCO (1999–2000)⁻² | NHANES and BRFSS (2000s)²¹ |
|----------------------------------|-------------------------|-------------------------|---------------------------|
| HbA1C <7%                        | 52                      | 37                      | 42                        |
| LDL cholesterol <100 mg/dl (< 2.59mmol/l) | 51                      | 23                      | 34                        |
| Triglycerides <150 mg/dl (< 1.70 mmol/l) | 37                      | 34                      | 47                        |
| Systolic BP <130 mm Hg           | 45                      | 41                      | 48                        |
| Diastolic BP <80 mm Hg           | 79                      | 54                      | 74                        |
members – a physician, nurse practitioner (NP), a registered dietitian (RD) and an administrative assistant. This team provided specialty clinic services to some of the rural and remote field sites.

SDPI funding introduced additional staff and an expanded infrastructure throughout Alaska. This resulted in all the regional sites maintaining local diabetes registries and acquiring a team that included a nurse, a dietitian and/or a certified diabetes educator to provide education and follow-up for diabetes patients. The funding also increased access to specialty diabetes providers by funding travel for diabetes teams to visit villages and for patients to travel to regional facilities. Funding was also used to add necessary and current diabetes medications to the formularies. As part of SDPI, culturally appropriate patient education materials were developed. SDPI funded an annual conference that provided diabetes-related medical education and focused providers’ attention on revised and updated diabetes standards of care. Flow sheets in paper or electronic formats were developed and may have helped providers to be vigilant about specific individual patient needs at each clinic encounter. A study in the American Veterans’ Administration found that the availability of a “champion” for use of clinical guidelines and the distribution of audit results to primary providers were associated with better processes of care. They also found that feedback to providers and grand rounds presentations were associated with improved patient intermediate outcomes (10). As a result of SDPI funding, diabetes coordinators and teams at each facility act as “champions” and facilitate distribution of audit results to clinical providers.

Networking with other diabetes teams around the state every year may have fostered improved morale and a sense of support and team work among care providers. This may have contributed to the ability of teams to assist patients in achieving diet, exercise or other life-style modifications thereby contributing to the improvements in intermediate outcomes. SDPI funding provided for activities such as educational talks on lifestyle issues and diabetes in the community, regularly scheduled fun runs/walks/exercise/weight management classes, diabetes support groups, health fairs and diabetes screening throughout the year. Increased community awareness and involvement in SDPI activities may also have assisted patients in being actively involved in their own diabetes management. The audit did not measure patients’ or providers’ attitudes and changes in behaviour. Further studies are needed to determine more specifically which changes resulted in the improvements noted.

Other studies have shown similar decreases in lipids, blood glucose and blood pressure. The magnitude of decreases in HbA1c, total cholesterol, triglycerides, systolic and diastolic blood pressure is similar to decreases seen in IHS-wide data between 1995 and 2001 (Table VI) (9). It is also similar to the decreases observed for total cholesterol, triglycerides and diastolic blood pressure in the National Health and Nutrition Examination Survey (NHANES) and Behavioral Risk Factor Surveillance System (BRFSS) data (11). Beginning in the 1990s, there was increased attention given to diabetes prevalence and the fact that intensive control of HbA1c, blood pressure and cholesterol reduced complications of diabetes. This could have had a role in
the improvements seen in the NHANES and BRFSS study populations and in our population. However, compared with the above NHANES data and a managed care organization (MCO), a higher percentage of AI/AN patients met treatment goals for HbA1c, LDL cholesterol and diastolic blood pressure (Table VII) (11,12). This suggests that SDPI may have had a beneficial effect beyond that of the general increased attention given to diabetes at the national level. Although less than 100% of our patients received lab tests each year, we have no reason to believe that they differ from those who did.

Evidence from other studies suggests that our changes may be clinically as well as statistically significant. The Diabetes Control and Complications Trial (DCCT) provided convincing evidence that lower HbA1c levels reduced the risk of microvascular complications of diabetes (13). A 1 percentage point reduction in HbA1c, as was observed in our patient population, has been shown to reduce any diabetes-related end point (microvascular disease, amputation, heart attack, stroke) or death by 21% (14).

A decrease of 10 mm Hg in systolic blood pressure was shown to reduce the risk of any diabetes related complication by 12% and mortality by 15% in the United Kingdom Prospective Diabetes Study (15). In the Hypertension Optimized Treatment trial, a 4-point reduction in diastolic blood pressure from 85–81 resulted in a 50% reduction in risk for cardiovascular events in patients with diabetes (16). While the diastolic pressures have decreased by 3 mm Hg from pre-SDPI to SDPI periods in our report, they were lower than 80 mm Hg to begin with. Amputation rates and dialysis/transplant rates among Alaska Native people with diabetes have been lower than in other Native American diabetic populations (17–19). It is possible that the lower levels of blood pressure among Alaska Native people with diabetes have resulted in the comparatively lower rates of amputation/dialysis.

Accurate identification of patients with diabetes, use of well maintained and current registries, application of standard guidelines for care and audits of diabetes care with regular feedback to clinicians have been shown to be associated with improved intermediate outcomes (20). In the Alaska Tribal Health System, we selected patients for the audit from the ANMC DP diabetes registry. Patients were added to the registry only after thorough case investigations verified that they met criteria for diabetes. Diabetes teams at most regional facilities use an electronic diabetes flow sheet to identify needs for the provider before each patient encounter. The data elements in the flow sheet are determined by the IHS standards of care. The standards of care for patients with diabetes have been updated regularly during the last 2 decades in keeping with modifications to recommended diabetes treatment. For example, blood pressure goals have changed from less than 130/85 to less than 130/80. The triglyceride goal has been lowered to less than 150mg/dl from less than 200mg/dl (4).

The percentage of patients receiving annual exams and education decreased from the pre-SDPI to the SDPI period. IHS-wide, though the number of patients receiving exams has increased, the percentages have not increased (personal communication from C. Wilson, April 2007). Compared with ordering lab tests or medications, performing
an exam or providing an education session and documenting them properly can be more time consuming. It is possible that the increase in staffing was not sufficient to meet the needs of the increasing diabetes population for these time-consuming services. Turnover and a shortage of staff are challenges in remote areas of Alaska. It is possible that temporary duty staff were not trained adequately in documenting both exams and education because priority was given to provision of clinical services. Eye exams provided to many AI/AN patients in the private sector would not necessarily be available in the patient chart used for the audit. Dental records in most regional facilities are kept separate from the medical record.

In summary, our findings suggest that an enhanced health care infrastructure, an accurate registry, standardized guidelines for care and annual evaluation and feedback to clinicians have resulted in positive changes in intermediate outcomes for AI/AN people with diabetes. Community awareness and involvement in diabetes prevention activities may also have improved intermediate outcomes. Future program evaluations are needed to determine whether long-term outcomes such as cardiovascular disease, amputations, end-stage renal disease and retinopathy reflect the positive changes in laboratory measures and blood pressure readings.

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REFERENCES

1. Department of Health and Human Services, Indian Health Service Division of Diabetes Treatment and Prevention. Diabetes in American Indians and Alaska Natives: facts at-a-glance; June 2007 [cited 2007 Sep 13]. Available from: http://www.ihs.gov/MedicalPro-grams/Diabetes/FactSheets/Diabetes_in_AIAN_ Facts_200706.pdf.
2. Peabody SM, McMahon P, Rounds-Riley J, Pickering K. CHAP overview. In: O’ Neil K, Brainerd H, Burgess R, Curda LG editors. Alaska Community Health Aide/Practitioner Manual. Anchorage: Alaska Native Health Board and Alaska Native Tribal Health Consortium; 2006. 31–35.
3. Mayfield JA, Rith-Najarian S, Acton KJ, Schraer CD, Stahn RM, Johnson MH, Gohdes D. Assessment of diabetes care by medical record review. Diabetes Care 1994;17(8):918–923.
4. Indian Health Service Standards of Care for adults with type 2 diabetes [cited 2007 Aug 9] Available from: http://www.ihs.gov/MedicalPrograms/diabetes/IHSDiabetesStandardsofCare2006.pdf.
5. American Diabetes Association. Standards of medical care in diabetes 2007. Diabetes Care 2007;30(Suppl 1):S4–S41.
6. SAS Institute Inc., SAS 9.1.3, Cary, NC: SAS Institute Inc., 2002-2004.
7. StataCorp. 2005. Stata Statistical Software: Version 5.0. College Station, TX: StataCorp LP.
8. Jha AK, Perlin JB, Kizer KW, Dudley RA. Effect of the transformation of the Veterans Affairs health care system on the quality of care. N Engl J Med 2003;348; (22):2218–2227.
9. Wilson C, Gilliland S, Cullen T, et al. Diabetes outcomes in the Indian Health System during the era of the Special Diabetes Program for Indians and the Government Performance and Results Act. Am J Public Health 2005;95(9):1518–1522.
10. Ward MM, Yankey JW, Vaughn TE, et al. Physician process and patient outcome measures for diabetes care – relationships to organizational characteristics. Med Care 2004;42(9):840–850.
11. Saaddine JB, Cadwell B, Gregg EW, et al. Improvements in diabetes processes of care and intermediate Outcomes: United States, 1988–2002. Ann Intern Med 2006;144:465–474.
12. Beaton SJ, Nag SS, Gunter MJ. Adequacy of glycemic, Lipid, and blood pressure management for patients with diabetes in a managed care setting. Diabetes Care 2004;27(3):694–698.
Diabetes care and control in Alaska Native people

13. The Diabetes Control and Complications Trial Research Group. The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. N Engl J Med. 1993;329:977–986.

14. Stratton IM, Adler AI, Neil HA, Matthews DR, Manley SE, Cull CA et al. Association of glycaemia with macrovascular and microvascular complications of type 2 diabetes (UKPDS): prospective observational study. BMJ 2000;321:405–412.

15. Adler AI, Stratton IM, Neil AW, et al. Association of systolic blood pressure with macrovascular and microvascular complications of type 2 diabetes (UKPDS 36): prospective observational study. BMJ 2000;321:412–419.

16. Hansson L, Zanchetti A, Carruthers SG, et al. Effects of intensive blood-pressure lowering and low-dose aspirin in patients with hypertension: principal results of the Hypertension Optimal Treatment (HOT) randomized trial. Lancet 1998;351:1755–1762.

17. Schraer CD, Adler AI, Mayer AM, Halderson KR, Trimble BA. Diabetes complications and mortality among Alaska Natives: 8 years of observation. Diabetes Care 1997;20(3):314–321.

18. Schraer CD, Mayer AM, Vogt AM, Naylor J, Brown TL, Hastie J, et al. The Alaska Native Diabetes Program. Int J Circumpolar Health 2001;60:487–494.

19. Schraer CD, Weaver D, Naylor J, Provost E, Mayer AM. Reduction of amputation rates among Alaska Natives with diabetes following the development of a high-risk foot program. Int J Circumpolar Health 2004;63(Suppl 2):114–119.

20. Russell KG, Rosenzweig J. Improving outcomes for patients with diabetes using Joslin Diabetes Center’s registry and risk stratification system. J Healthc Inf Manag 2007;21(2):26–33.

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