2008
Nashville Area Aggregate Diabetes Report

Produced by
Nashville Area Diabetes Program/Tribal Epidemiology Center
Tribal Health Program Support Section
United South and Eastern Tribes, Inc. (USET)
in partnership with the
Indian Health Service Nashville Area Tribes

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EXECUTIVE SUMMARY

An analysis of 2003-2007 data revealed that the Indian Health System (IHS) Nashville Area AI/AN age-adjusted diabetes prevalence rate was approximately 1.4 times greater than the IHS wide rate and 3.9 times greater than the US All Races rate for the period 2003-2005. The IHS Nashville Area Diabetes Report (aggregate and site specific) presents an analysis of 2003-2007 data concerning AI/AN people with diabetes who receive care through the Indian health care delivery system. The IHS Nashville Area includes 28 federally recognized Tribes and three Urban Indian Health Care programs located in 14 states and encompasses approximately 112 counties totaling over 800,000 square miles. United South and Eastern Tribes, Inc. (USET) operates an IHS contracted Area Diabetes Program which provides consultative support to IHS/Tribal/Urban (I/T/U) health facilities in the Nashville Area. Twenty-two Nashville Area Tribal programs receive funding under the IHS Special Diabetes Program for Indians, and 20 of these programs participate in the IHS Diabetes Care and Outcome Audit (Diabetes Audit).

Two primary data sources were used to create this Diabetes Report: 1) 2003-2007 Nashville Area Diabetes Audit dataset 2) I/T/U health facility electronic patient management systems or I/T/U provided health data. Comparison statistics available through the Centers for Disease Control and Prevention (CDC) Division of Diabetes Translation and IHS were also used.

With the exception of the diabetes prevalence graphs (Figures 1a-1b), the findings section charts are based on an analysis of data from the 2003-2007 Diabetes Audits. Sites have the option of a manual audit or an electronic audit. Most sites generate a random sample of charts to audit; however, some sites choose to audit all patients on their diabetes registry.

Findings

- Diabetes Prevalence: The Nashville Area AI/AN age-adjusted diabetes prevalence has increased slightly since 2003, rising from 19.1% in 2003 to 20.4% in 2007. Age-adjusted diabetes prevalence rates calculated for the 23 Tribes included in the 2007 Nashville Area aggregate rate ranged from 8.7% to 34.0%, with a median of 19.1%. Since 2003, on average the Nashville Area age-adjusted diabetes prevalence rate has been approximately 1.4 times greater than the IHS wide rate. On average the Nashville Area AI/AN age-adjusted diabetes prevalence rate was approximately 3.9 times greater than the US All Races rate (2003-2005).
- Audit Sample Size: Sample size impacts how well Diabetes Audit analysis results represent the health status of persons on the diabetes registries of participating facilities and measurement of how well a diabetes program is following the IHS Standards of Care for persons with diabetes. In 2007, the Nashville Area audit sample (57.1%) was 1.3 times larger than the IHS wide sample (43.9%). Of the 20 Nashville Area I/T/Us that submitted data in 2007, audit sample sizes ranged from 6.3% to 100%, with a median of 80.4%.
- Missing Data: Knowing the level of missing data associated with a particular variable is important because as the percentage of missing data increases, so too does the concern that the analysis result may not be an adequate representation of the particular aspect of diabetic health status and/or measurement of how well a diabetes program is following the IHS Standards of Care for persons with diabetes. For the aggregated 2007 Nashville Area audit data, an analysis of missing data shows that the Cholesterol Category, LDL Category, HDL Category, Triglyceride Category, Number of Ideal Values (HbA1c, BP, LDL, BMI), and Tobacco Use variables were missing data for 30% to 50% of the records, and the Tobacco Cessation Counseling variable was missing data for more than 50% of the records.
- Duration of Diabetes: There was a statistically significant increase in the duration of diabetes >10 yrs.
- Glycemic Control & Drug Therapy: There was no significant change in the percentage of diabetic patients with A1c values <7.0; however, the hyperglycemia drug treatment therapy distribution has changed significantly over time.
- Blood Pressure Control and use of Hypertensive Medication: Although the percentage of change over time (2003-2007) appears to be small, audit data reflect a significant increase in blood pressure control (<130/80) among patients with diabetes; and a slight, but statistically significant increase over time in the percentage of ACE/ARB inhibitor use among diabetic patients with hypertension.
- Dyslipidemia & Lipid Management: Audit data reflect a statistically significant increase in the percentage of patients with good total cholesterol, LDL cholesterol (<100 mg/dL), and triglyceride results (<150 mg/dL). The percentage of patients with good high-density lipids (HDL =>40) has not changed significantly over time. Diabetes audit data reflect an overall decrease in the use of lipid-lowering agents among patients with high LDL >= 160 mg/d. This decrease is not statistically significant.
- Weight Status: The Diabetes audit data reflect very few diabetic patients with normal weight. In 2007 approximately 72% of the patients with diabetes were obese (BMI 30+).

- Combination of Ideal Values (HbA1c, BP, LDL, BMI): Diabetes audit data reflect a significant increase in the percentage of patients with a combination of three ideal values (HbA1c, Blood Pressure, LDL, BMI). Few patients have a combination of four ideal values.
- Nephropathy Assessment and Medication for Treatment: Audit data reflect that for this Area diabetic population, proteinuria, creatinine and GFR results did not change significantly over time. However, there was a statistically significant increase over time in the percentage of patients with a positive microalbuminuria result. Data also reflect that in 2007 approximately 22% of the diabetic patients have a calculated GFR <60 and therefore need follow-up. Data reflect a statistically significant increase over time in the use of an ACE/ARB inhibitor among patients with proteinuria/microalbuminuria.
- Depression Assessment: There was a significant increase over time in the percentage of patients with an active diagnosis of depression and in the percentage of patients screened for depression.
- Tobacco Use/Counseling: Audit data reflect a statistically significant increase over time in the percentage of patients using tobacco. Audit data reflect a decrease over time in tobacco counseling. There continues to be high percentage of missing data for this variable.
- Dental, Eye, Foot Exams: Audit data reflect no change in the percentage of completed dental and eye exams. There was a decrease in foot exams during this same time period.
- Diet Education: The percentage of patients receiving any diet education decreased significantly over time. There was no statistically significant change over time in the percentage of patients who had received diet education from an RD.
- Vaccines (Flu, Pneumovax, Tetanus-Diphtheria): There was a slight increase in the percentage of patients that received influenza or tetanus-diphtheria vaccination per diabetes standards of care between 2003 and 2007; however, there was no improvement over time in pneumovax vaccination coverage.
- PPD Status (Tuberculosis Skin Test) & Screening Rates: The percentage of patients with PPD status unknown increased significantly. The percentage of diabetic patients that received a PPD screening did not significantly change over time.

General Recommendations

- Continue to support the IHS Diabetes Care and Outcome Audit process.
- Develop and strengthen infrastructures necessary for the IHS Diabetes Audit including quality documentation, quality data entry and implementation of IHS Standards of Care for Adults with type 2 Diabetes.
- Use the data and recommendations in the Diabetes Reports to advocate for increased quality improvement efforts directed at diabetes treatment and prevention programs.
- Initiate the electronic diabetes audit process and implement “census” verses “sample” data collection.
- Initiate or continue efforts toward becoming recognized diabetes education programs. Sites can gain this recognition via the American Diabetes Association or IHS.
- Utilize the technical support of the Area Diabetes Consultant and USET Tribal Epidemiology Center staff, as well as IHS resources in the ongoing development of local diabetes programs.
- Continue to improve the quality of diabetes data that is available for analysis.
- Advocate for continued IHS Special Diabetes Program for Indians funding by using the Diabetes Reports.

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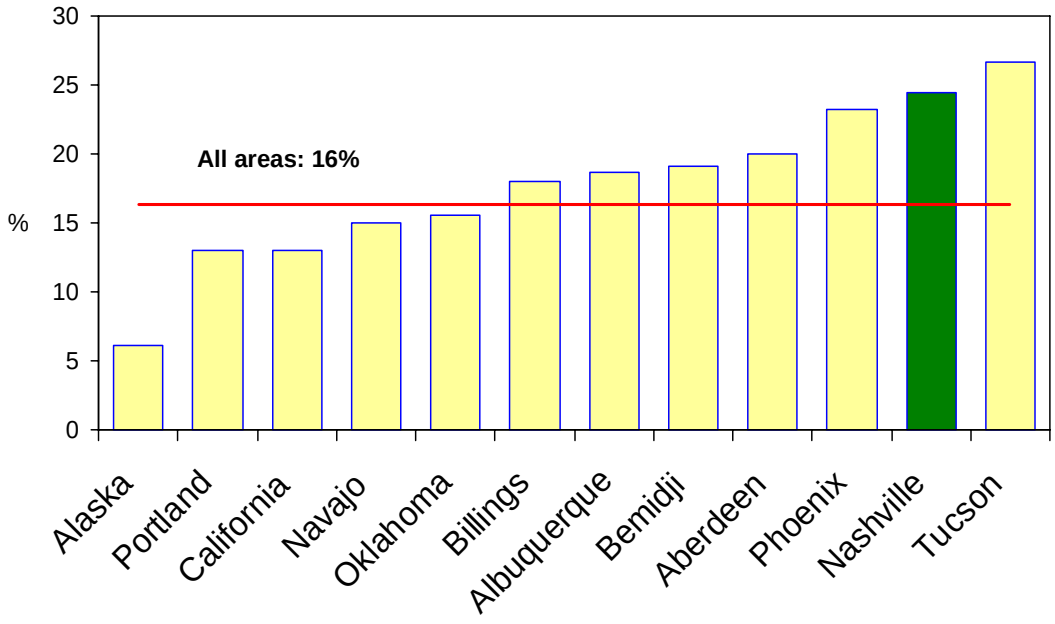
INTRODUCTION

A diabetes epidemic exists within Indian country and the Indian Health Service (IHS) Nashville Area American Indian/Alaskan Native (AI/AN) population suffers a disproportionate amount of this disease burden. In 2005, AI/ANs were 2.2 times more likely to have diabetes than non-Hispanic whites; 15.1% of AI/ANs aged twenty years and older who received care from the IHS had diabetes.[1] As shown in the figure below, in 2004 among the 12 IHS Areas, the IHS Nashville Area was identified as having the second highest age-adjusted prevalence of diabetes among AI/AN adults (24.4%).[2] An analysis of 2003-2007 data revealed that the IHS Nashville Area AI/AN age-adjusted diabetes prevalence rate was on average approximately 1.4 times greater than the IHS wide rate for the same period and 3.9 times greater than the US All Races rate for the period 2003-2005. The IHS Nashville Area Diabetes Report presents an analysis of 2003-2007 data concerning AI/AN people with diabetes who receive care through the Indian health care delivery system. The IHS Nashville Area Diabetes Report, which consists of an aggregate IHS Nashville Area report with accompanying Indian Health Service/Tribal/Urban (I/T/U) health facility specific sister reports, provides trends and comparisons that help describe the health status of IHS Nashville Area AI/ANs with diabetes. This information can assist Tribal leaders, health administrators and clinicians improve their diabetes programs, support those in the community with diabetes, and target the use of health care dollars to combat the diabetes epidemic.

2004 Age-adjusted* Prevalence of Diagnosed Diabetes Among AI/AN Adults by Indian Health Service Area



Source: 2004 IHS outpatient data. *Based on the 2000 U.S. standard population. **IHS Div. of Diabetes Treatment & Prevention & CDC Div. of Diabetes Translation report: Prevalence of diagnosed diabetes among AI/ANs, 2004. Burrows (2006)**

The Nashville Area IHS/Tribal/Urban (I/T/U) health care program network, the IHS Nashville Area Office, and the federally recognized tribal coalition organization called the United South and Eastern Tribes, Inc. (USET), work together to address AI/AN health needs. Together they serve approximately 60,000 rural and 75,000 urban AI/ANs in the southern and eastern United States who are members of federally recognized Tribes and eligible for Indian health care delivery system services. The Nashville Area includes 28 federally recognized Tribes and three Urban Indian Health Care Organizations, and encompasses approximately 112 counties totaling over 800,000 square miles dispersed across parts of Texas, Louisiana, Mississippi, Alabama, Florida, South Carolina, North Carolina, Maryland, Pennsylvania, New York, Connecticut, Massachusetts, Rhode Island, and Maine. In 2006, the Nashville Area Indian health care delivery system's network of I/T/Us included 2 hospitals, 25 clinics, 17 health stations, 10 alcohol/substance abuse programs, and 4 wellness centers or Contract Health Service only programs.

USET represents 25 of the 28 Nashville Area Tribes. Although USET primarily focuses on providing services to its member Tribes, it also hosts several programs that benefit the entire Nashville Area I/T/U network. One such service is the technical assistance provided through the Nashville Area Diabetes Program that is funded by IHS, hosted by USET, and managed by the Nashville Area Diabetes Consultant. Under the Nashville Area Diabetes Program, 23 of the Nashville Area Tribes receive funding through the IHS Special Diabetes Program for Indians (SDPI) and 20 of these Tribes manage their diabetic population's clinical data and participate in the IHS Diabetes Care and Outcome Audit[3] (Diabetes Audit). The Diabetes Audit is a standardized method for assessing the diabetes care and the health status of diabetes patients seen at an I/T/U. Except for the diabetes prevalence charts, the charts in the Nashville Area Diabetes Report are based on an analysis of data collected from the population of persons with diabetes who receive care through the I/T/Us of the 20 Nashville Area Tribes that participate in the Diabetes Audit. These 20 Tribes are asterisked in the list below that includes all of the current Nashville Area Tribes and Urban Indian Health Organizations:

*Alabama-Coushatta Tribe of Texas
*Chitimacha Tribe of Louisiana
*Coushatta Tribe of Louisiana
Jena Band of Choctaw Indians
Tunica-Biloxi Indians of Louisiana
*Mississippi Band of Choctaw Indians
*Poarch Band of Creek Indians
*Miccosukee Tribe of Indians of Florida
*Seminole Tribe of Florida
*Catawba Indian Nation
*Eastern Band of Cherokee Indians
*Seneca Nation of Indians
*Oneida Indian Nation
*St. Regis Mohawk Tribe
Onondaga Nation
Cayuga Nation of New York
Towanda Band of Seneca
Tuscarora Nation
*Mashantucket Pequot Tribal Nation
Mohegan Tribe of Connecticut
*Narragansett Indian Tribe
*Wampanoag Tribe of Gay Head (Aquinnah)
Mashpee Wampanoag Tribe
*Aroostook Band of Micmac
*Houlton Band of Maliseet Indians
*Passamaquoddy Tribe- Indian Township
*Passamaquoddy Indian Tribe- Pleasant Point
*Penobscot Indian Nation
AI Community House of New York
North American Indian Center of Boston
Baltimore American Indian Center

The Diabetes Report includes the following components:

- An introduction section presenting a description of the purpose and components of the Nashville Area Diabetes Report and a description of the Nashville Area.
- A methods section describing calculation logic and data limitations.
- A findings section with diabetes related charts and narratives covering the period 2003-2007. First diabetes prevalence findings are provided. Then a series of analyses and charts based on the Diabetes Audit data are presented. For the aggregate report comparisons are made between the aggregate of the audit data from the participating I/T/Us across years. For the I/T/U specific reports audit comparisons include both comparisons of a particular I/T/U to itself and to the aggregate of the other Nashville Area I/T/Us across years. A summary of findings is provided at the end.
- A general recommendations section.
- Appendices that include a compendium of resources (Appendix A), a listing of participating I/T/Us by year (Appendix B), and the raw data used to create the diabetes audit charts presented in the findings section (Appendix C).

I/T/U specific reports are bound separately from the aggregate Nashville Area Diabetes Report. The aggregate report includes all of the aforementioned components. The I/T/U specific reports are limited to findings, recommendations, and an appendix with the data from a particular I/T/U's Diabetes Audit program. This is to avoid duplicating information already provided in the aggregate report and for each I/T/U to receive only its own data.

METHODOLOGY

Data Sources

Two data sources were used to create this Diabetes Report: 1) 2003-2007 Nashville Area IHS Diabetes Care and Outcome Audit (Diabetes Audit) dataset provided by the IHS Division of Diabetes Treatment and Prevention (DDTP) and 2) Indian Health Service/Tribal/Urban (I/T/U) health facility electronic patient management systems or I/T/U provided health data. Appendix B identifies the I/T/Us included in the Nashville Area aggregates by year. Comparison statistics are from the Centers for Disease Control and Prevention (CDC) Division of Diabetes Translation and IHS.

Methodology for Diabetes Prevalence Charts

To calculate Nashville Area and I/T/U specific age-adjusted diabetes prevalence rates (Figure 1a), the US Census 2000 All Race population was used as the standard. These rates represent what the crude percentage would have been if the population had the same age distribution as the standard. The crude rates are provided in the narrative and crude age specific diabetes prevalence rates are also shown in Figure1b. USET analysts either extracted data stored in electronic patient management systems or utilized I/T/U provided diabetes case data.

Nashville Area I/T/Us can opt to use the Resource and Patient Management System (RPMS) or a commercial product as their electronic patient management system. RPMS is the IHS provided patient management system and has been developed so that data can be used to evaluate clinical quality as well as public health.[4] For those I/T/Us that use RPMS, USET analysts extract age group specific population and diabetes case data using the Q-MAN data query application. For those I/T/Us that do not use RPMS, local staff extract similar data from their electronic patient management systems and provide these data to USET analysts.

The User Population definition was used for the denominator in the prevalence rate calculations:

- An individual had to be alive at the end of the report year
- An individual had to be classified as American Indian/Alaskan Native (AI/AN)
- An individual had to live within the Contract Health Service Delivery Area (CHSDA). An I/T/U's CHSDA is defined by those communities assigned to a particular Tribe by the IHS.
- An individual had to have had a health visit within three calendar years prior to the last day of the report year.
- All demo or "dummy" patients are excluded.

The numerator definition used to calculate the AI/AN diabetes prevalence rates is as follows:

- An individual had to be a member of the User Population denominator.
- An individual had to have at least one diagnosis of ICD-9 codes[5] 250.00-250.93 before or during the calendar year report period.

The IHS Division of Epidemiology and Disease Prevention provided 2003 to 2007 IHS-wide age-adjusted diabetes prevalence rates based on data from the IHS National Data Warehouse System.[6]

For non-AI/AN population diabetes prevalence comparisons, CDC National Diabetes Surveillance System All Races US and state population age-adjusted diabetes prevalence rates were used. Limitations of these data are that they are self-reported and use different age groups than the User Population method. The US All Races calculations are based on data collected on all ages through the CDC's National Health Interview Survey.[7] The State All Races calculations are based on data collected on persons 18 years and older through the Behavioral Risk Factor Surveillance System.[8]

Limitations for the diabetes prevalence rates include:

- An I/T/U's CHSDA is defined by those communities assigned to a particular Tribe by the IHS, and some of these communities have varied across years which can impact the denominator. In addition, the patient management systems record and store new residence information over previous residence information. Thus, patients that move into or out of the CHSDA between the report year end and the time of data extraction may be erroneously included or excluded from the denominators.
- The patient management system data are always changing because new information is constantly added, edited, and deleted.

- The diabetes prevalence rates represent those AI/ANs residing in the CHSDA who receive I/T/U services, not the entire AI/AN community residing in the CHSDA.
- In calculating the Nashville Area aggregate and I/T/U specific diabetes prevalence rates, only patient management system data are analyzed. Data from health care provided to patients outside of an I/T/U which have not been entered into the patient management system were not included in the analyses.
- Variability in medical provider documentation and data entry impacts the quantity and quality of the data in the patient management system.
- Comparison IHS wide diabetes prevalence rates are calculated based on IHS National Data Warehouse System data. Caution is warranted when comparing the Nashville Area and I/T/U specific rates to the IHS wide rates.
- Comparison US and State All Races diabetes prevalence rates are based on a different logic than the calculations used to produce the IHS wide, Nashville Area aggregate and I/T/U specific rates. Therefore, caution is warranted when comparing the IHS Wide, Nashville Area and I/T/U specific rates to the US and State All Races rates.

Methodology for Diabetes Audit Charts

With the exception of the diabetes prevalence graphs (Figures 1a-1b), the findings are based on an analysis of the 2003-2007 IHS Diabetes Audit data provided by participating I/T/Us. The IHS Diabetes Audit establishes a standardized method for assessing the IHS Standards of Care[9] and the health status of diabetes patients. This allows for valid comparisons between participating I/T/Us. Sites have the option to do a manual audit or an electronic audit. Data are collected by the Nashville Area Diabetes Consultant from participating I/T/Us, and sent to IHS DDTP. The IHS DDTP staff clean and organize the data so it can be aggregated at the Area and national levels. It is returned to the Area Diabetes Consultant and the I/T/Us Diabetes Coordinators for program planning and additional analyses. I/T/Us have the option of using a random sample of patients with diabetes or using the entire diabetes registry for the audit process. The random sample is drawn from the I/T/U's list of active diabetic patients in sufficient number to provide an estimate within 10% or more of the true rate (at a 90% or more level of certainty).

It is important to note that the time frame for each Nashville Area Diabetes Audit period has varied across years which impacts comparability. The period covered by the 2007 Diabetes Audit was from January 1, 2007 to December 31, 2007; the period covered by the 2006 audit was from June 1, 2005 to May 31, 2006; the period covered by the 2005 audit was from July 1, 2004 to June 30, 2005. The 2003 and 2004 audit periods were unknown at the time this report was created. In the future, the Nashville Area Diabetes Consultant plans to coordinate the use of calendar year to improve comparability.

It is also important to note that the number of participating I/T/Us has varied from year to year. This also impacts comparability across years. Between 2005 and 2007, 20 Nashville Area I/T/Us submitted audit data. In 2004, 18 Nashville Area I/T/Us submitted data and in 2003, 16 Nashville Area I/T/Us submitted data. See Appendix B for a list of participating I/T/Us by year.

In 2007, for the first time, IHS DDTP provided the Nashville Area Diabetes Consultant a Statistical Analysis Software (SAS) patient level dataset, allowing co-morbidity analyses, determinations of statistically significant differences, and yearly comparisons between an I/T/U and the aggregate of other participating I/T/Us. In the aggregate report, trends across time are analyzed. For the I/T/U specific reports trends across time are evaluated, and comparisons are made between an I/T/U and the aggregate. For the I/T/U specific report the aggregate audit data is represented as a series of dashes that coincide with the bars on each of the bar graphs.

For each chart, any missing data for the variable was excluded from the analysis (see Findings Section Table 2 - Missing Diabetes Audit Variable Value Percentages). This method of excluding records with missing values from the denominator differs from the IHS DDTP's current method of including missing data in the denominator. These methodological differences may impact the comparability of this report to DDTP provided audit analyses figures.

SAS computer programs were written to create the Diabetes Audit charts. Nashville Area aggregate level data were weighted according to the I/T/U ratio of sample size to registry size. This weighting procedure must be applied to calculate accurate Area level statistics so each I/T/U diabetic population is accounted for proportionate to the Nashville Area. This procedure increases how well the aggregate level results represent the population (the pool of patients from the combined diabetes registries of participating Nashville Area I/T/Us) from which the sample was selected. Accordingly, the results that are presented in the diabetes audit charts for the aggregate are adjusted, but I/T/U specific Diabetes Audit results are not

adjusted. Aggregate level percentages shown in a chart may not match the percentages presented in a chart's raw data table that is provided in the report appendix because the raw data are calculated from non-weighted data.

Three different statistical tests are applied to Diabetes Audit chart data. For each test, a p-value threshold of less than 5% is used to determine if an observed difference is believed true or due to chance. A summary of data used to create each chart and the results of the statistical significance tests are provided in Appendix C. Please note that statistical significance may not indicate clinical significance of diabetes care. The three statistical significance tests are as follows:

- Differences among years: This test examines whether the distribution of data for a particular chart variable change from year to year. If the test shows statistical significance (p-value < 0.05), one can conclude that at least two of the years have different distributions. Directionality cannot be determined from this test. .
- Trend across years: This test examines whether there is a directional change in the distribution of data across years. If the test shows statistical significance (p-value < 0.05), then one can conclude that there is has been a directional shift in the population. When the variable has only 2 or 3 categories, it is often easy to see how the trend manifests itself over the years. If the variable has many categories, it is usually more difficult to see. The results of this test are provided as a footnote in most of the charts. This test is only valid when the variable values are numeric. If the variable includes either "Refused", or "Unknown" then this test cannot be used.
- Difference between I/T/U and aggregate of other I/T/Us: This test examines whether the 2007 I/T/U data is distributed differently than the 2007 aggregate of the other I/T/U's. If the test shows statistical significance (p-value < 0.05) then one can conclude that a difference exists. The results of this test are provided as a footnote in most of the charts.

Limitations of the Nashville Area Diabetes Audit analysis include:

- The audit process reviews only individuals on the active diabetes registry. Thus individuals who are not actively seeking care are not included in the audit.
- The lack of Diabetes Audit report period consistency and I/T/U participation variations across years impacts comparability.
- Skills and degree of accuracy of the person performing the Diabetes Audit process and/or entering the data can impact data quality.
- Sample size impacts how well Diabetes Audit analysis results represent the health status of persons on the diabetes registries of participating facilities and measurement of how well a diabetes program is following the IHS Standards of Care for persons with diabetes.
- Missing data impacts the results of analysis and ultimately the representation of diabetic health and program status.

FINDINGS

Diabetes Prevalence

Figure 1a
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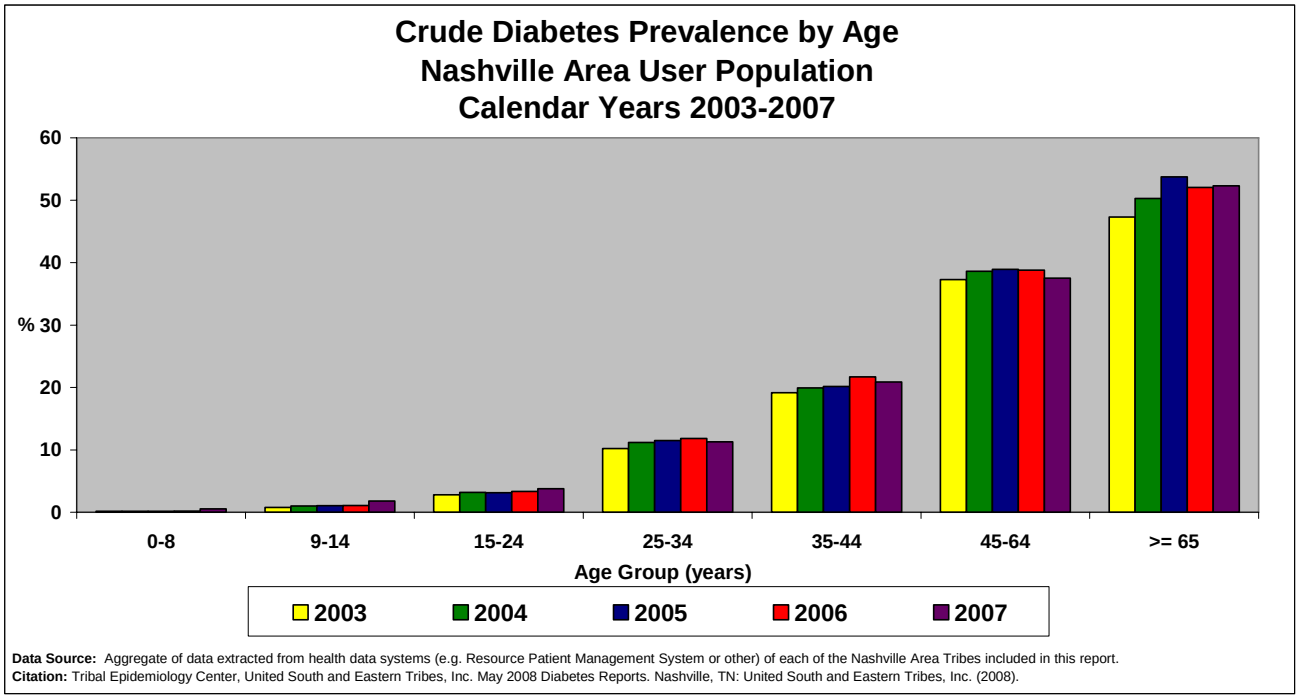
Figure 1b



Diabetes prevalence was calculated based on data collected on 23 Nashville Area Tribes (see Appendix B) following the User Population definition (see Methodology Section). To calculate age-adjusted diabetes prevalence rates (Figure 1a), the US Census 2000 All Race population was used as the standard. These rates represent what the crude percentage would have been if the population had the same age distribution as the standard. Figure 1a shows that the Nashville Area AI/AN age-adjusted diabetes prevalence increased slightly since 2003, rising from 19.1% in 2003 to 20.4% in 2007. Age-adjusted diabetes prevalence rates calculated for the 23 Tribes included in the Nashville Area aggregate rate showed a wide range; in 2007, I/T/U specific age-adjusted diabetes prevalence ranged from 34.0% to 8.7%. Since 2003, on average the Nashville Area age-adjusted diabetes prevalence rate has been approximately 1.4 times greater than the IHS Wide rate. For the three years (2003-2005) that US All Race[7] age-adjusted rates were available for comparison, the Nashville Area AI/AN age-adjusted diabetes prevalence rate on average was approximately 3.9 times greater than the US All Races rate. Having an age-adjusted diabetes prevalence rate that is approximately four times greater than the US All Races rate reflects the existing large and disproportionate burden of diabetes in the Nashville Area AI/AN population.

The actual (crude) diabetes prevalence rates for the Nashville Area aggregate were as follows: for 2003, 13.8% (6,302/45,825); for 2004, 14.0% (6,513/46,481); for 2005, 15.1% (7,020/46,463); for 2006, 15.5% (7,416/47,839); and for 2007, 15.7% (8,062/51,256). Figure 1b shows crude diabetes prevalence rates by age group.

IHS Diabetes Care and Outcome Audit Data Analysis Results

The information presented in the series of tables and graphs that follow reflects an analysis of the IHS Diabetes Care and Outcome Audit (here after referred to as Diabetes Audit) data.[3] Data are generated from audits performed on the records of selected patients on the diabetes registries of participating Nashville Area I/T/Us from 2003 to 2007. The Diabetes Audit (electronic or manual) captures data for each patient record audited on numerous health variables consistent with IHS Standards of Care for adults with type 2 diabetes.[9] For some of the graphs statistical significance tests are applied to determine if an observed difference is believed true or due to chance (see Aggregate Report Methodology Section). For this report, statistical tests were used to evaluate whether there had been a change in this I/T/U's data between the earliest year and the most recent year (years vary for some I/T/Us, 2003 and 2007 are the standard) and whether in 2007 the I/T/U data was different than the Nashville Area data. In the footnote of each graph, the "Statistical Significance (<=.05)" refers to the level at which the test was applied. The "Trend over Time" refers to whether the data changed in one direction over time; if a "Yes" is indicated this means that with 95% confidence, a real trend is being seen over time. The "Difference between I/T/U & Other Nashville Area I/T/Us" refers to whether the data for this I/T/U was different than the other Nashville Area I/T/Us aggregated in 2007; if a "Yes" is indicated this means that with 95% confidence a real difference exists between this I/T/U's data and the Nashville Area data in 2007. Please note that statistical significance may not indicate clinical significance of diabetes care. There may be a statistically significant change or difference in the data; however, that change or difference

may be so small that it may not be clinically important, thus it is up to clinician to determine what changes or differences will be clinically significant. It is also important to note that while overall population data may show improvements that is not necessarily reflective of a particular individual. A summary of data used to create each graph, perform the statistical significance tests, and the results of the test are provided in Appendix A (available as an electronic file).

Audit Sample Size

Sample size impacts how well Diabetes Audit analysis results represent the health status of persons on the diabetes registries of participating facilities and measurement of how well a diabetes program is following the IHS Standards of Care for persons with diabetes. Table 1 below provides a comparison of the I/T/U's Diabetes Audit sample size to the Nashville Area and IHS wide samples. For 2007, the Nashville Area audit sample (57.1%) was 1.3 times larger than the IHS wide sample (43.9%). Of the 20 Nashville Area I/T/Us that submitted data in 2007, audit sample sizes ranged from 6.3% to 100%, with a median of 80.4%. For the Nashville Area, in 2007 ten I/T/Us submitted sample sizes of 100%, four between 75-99%, three between 50-75%, two between 20-25%, and one of 6.3%.

Table 1. Comparison of Diabetes Audit Sample Sizes

Year	Audit Level	Registry Total	Sample Total	%
2003	Nashville Area	4590	1042	22.7
	IHS Wide	110305	30192	27.4
2004	Nashville Area	5357	1766	33
	IHS Wide	117225	33769	28.8
2005	Nashville Area	5930	2713	45.8
	IHS Wide	115710	40627	35.1
2006	Nashville Area	5689	3215	56.5
	IHS Wide	122885	48524	39.5
2007	Nashville Area	5775	3296	57.1
	IHS Wide	123979	54415	43.9

Missing Data

Prior to beginning a review of Diabetes Audit data analysis interpretations it is important to examine the level of missing data associated with each of the variables under study. Knowing the level of missing data associated with a particular variable is important because as the percentage of missing data increases, so too does the concern that the analysis result may not be an adequate representation of the particular aspect of diabetic health status and/or measurement of how well a diabetes program is following the IHS Standards of Care for persons with diabetes. For the Nashville Area aggregate, Table 2 below shows the amount of missing data for a particular variable by year. For the aggregated 2007 Nashville Area audit data, an analysis of missing data shows that the Cholesterol Category, LDL Category, HDL Category, Triglyceride Category, Number of Ideal Values (HbA1c, BP, LDL, BMI), and Tobacco Use variables were missing data for 30% to 50% of the records, and the Tobacco Cessation Counseling variable was missing data for more than 50% of the records.

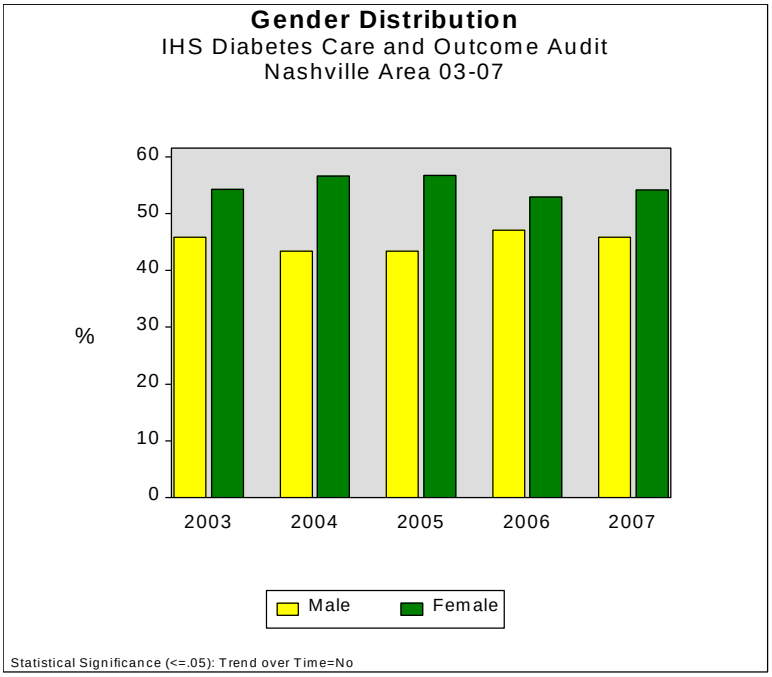
Table 2. Missing Diabetes Audit Variable Value Percentages

	Percent Missing				
	2003	2004	2005	2006	2007
Variable					
Sex	0.0%	0.0%	0.0%	0.0%	0.0%
Age Category	0.1%	0.0%	0.0%	0.0%	0.0%
Duration of DM Category (10 Year)	3.5%	7.0%	15.3%	15.7%	17.0%
HbA1c	9.3%	14.8%	18.0%	15.1%	21.0%
Treatment Category	3.2%	1.3%	3.6%	1.1%	0.5%
Blood Pressure Category	9.8%	16.3%	20.5%	16.4%	17.8%
Hypertension Present & ACE Use	0.0%	0.0%	0.0%	0.0%	0.0%
Cholesterol Category	25.6%	25.7%	38.5%	29.3%	32.0%
LDL Category	29.2%	27.5%	40.5%	28.8%	31.9%
HDL Category	27.2%	26.6%	39.0%	30.0%	32.8%

	Percent Missing				
	2003	2004	2005	2006	2007
Chol=>240 & Lipid Agent Use	0.0%	0.0%	0.0%	0.0%	0.0%
LDL=>160 & Lipid Agent Use	0.0%	0.0%	0.0%	0.0%	0.0%
Triglyceride Category	26.4%	26.6%	39.1%	30.2%	33.5%
BMI Category	6.7%	3.1%	2.3%	3.8%	2.6%
Number of Ideal Values (HbA1c, BP, LDL, BMI)	35.9%	37.9%	50.9%	39.9%	41.6%
Number of Ideal Values (HbA1c, BP, LDL)	33.1%	36.2%	49.9%	38.7%	40.8%
EKG Done Last 5 Years	0.0%	0.0%	0.0%	0.0%	0.0%
Urinalysis Past Year	1.4%	0.9%	0.7%	0.7%	0.4%
Proteinuria Present	0.0%	0.0%	0.0%	0.0%	0.0%
Microalbuminuria Present	0.0%	0.0%	0.0%	0.0%	0.0%
Creatinine Category	18.1%	28.5%	23.5%	20.3%	21.1%
GFR Category	18.2%	28.5%	23.5%	20.3%	21.1%
Proteinuria/Microalbuminuria Present & ACE Use	0.0%	0.0%	0.0%	0.0%	0.0%
Depression Active Diagnosis	0.0%	0.0%	0.2%	0.5%	0.1%
No Active Depression Dx - Depression Screen	.	.	0.0%	0.0%	0.0%
Tobacco Use	14.9%	19.0%	12.3%	40.9%	38.1%
Tobacco Cessation Counseling	77.4%	75.8%	78.6%	70.9%	69.9%
Foot Exam Past Year	1.3%	0.2%	0.1%	0.4%	0.2%
Eye Exam Past Year	1.5%	0.1%	1.0%	0.3%	0.4%
Dental Exam Past Year	4.1%	0.4%	0.2%	0.5%	0.3%
Any Diet Education Provided	2.7%	0.2%	0.1%	0.3%	0.1%
Diet Education by Registered Dietician	2.7%	0.2%	0.1%	0.3%	0.1%
Flu Vaccine Past Year	0.8%	0.3%	0.2%	0.4%	0.1%
Pneumovax Ever	2.0%	0.5%	0.4%	0.5%	0.2%
Tetanus-Diphtheria Past 10 Years	1.7%	0.5%	0.7%	0.5%	0.2%
PPD Positive	2.7%	0.3%	0.1%	1.0%	0.6%
PPD Positive & Tx Complete	0.0%	0.0%	0.0%	0.0%	0.0%
PPD Negative & Last PPD After DM Dx	0.0%	0.0%	0.0%	0.0%	0.0%

Gender Distribution

Figure 2.

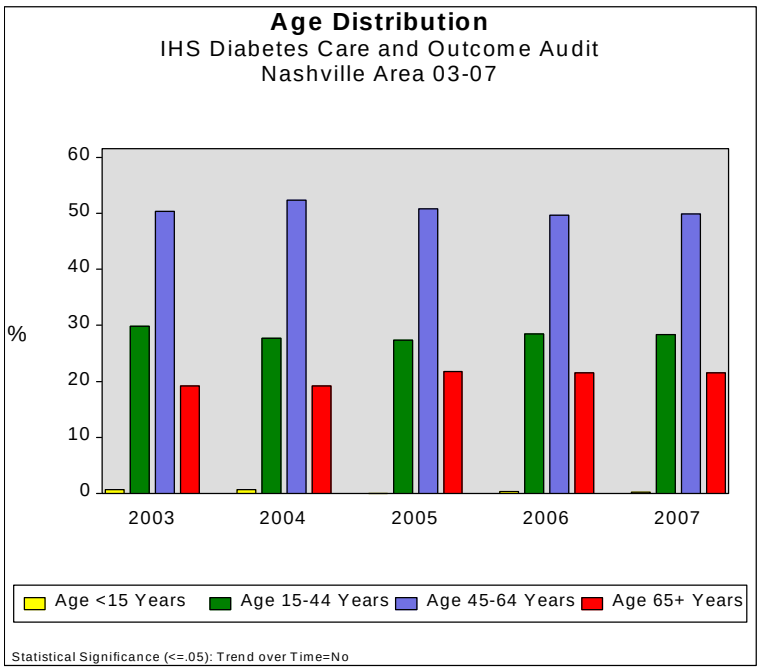


Diabetes audit data reflect a higher percentage of women with diabetes, which mirrors national AI/AN statistics.

Age Distribution

Age is a risk factor for type 2 diabetes. In the past type 2 diabetes was diagnosed predominately in patients age 40 and older. Young adults are the fastest growing age group developing type 2 diabetes within Indian country.

Figure 3.

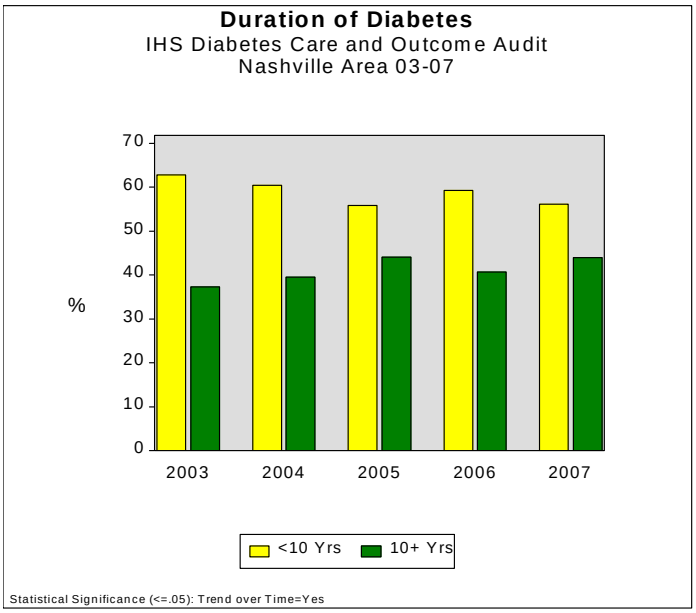


The age distribution of patients with diabetes has not changed significantly over time (2003-2007).

Duration of Diabetes

The duration of diabetes is related to complications such as kidney disease, cardiovascular disease and amputation. Intensive treatment and patient compliance with a regimen of recommended care can reduce the risk of diabetes complications.

Figure 4.

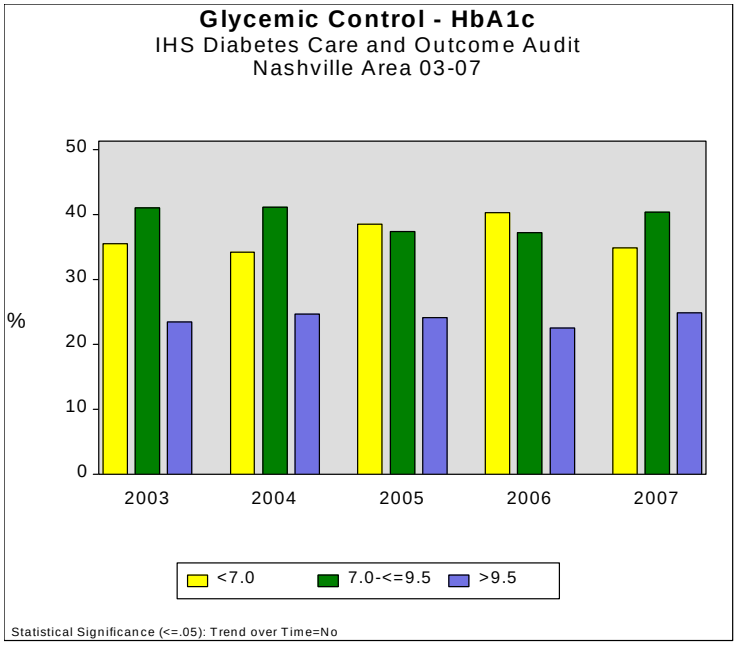


For the Nashville Area, there was a statistically significant increase in the duration of diabetes for 10+ years.

Glycemic Control

Hemoglobin A1c (HbA1c) is a weighted measure, which is used to estimate glycemic control for the previous 3 months. The A1c value goal is less than 7%; however, some clinical groups advocate for a goal of less than 6.5%. This lab test is recommended in all patients with diabetes to monitor progress toward clinical glucose targets and facilitate decision making. As a goal, a HbA1c lab test is recommended every 3-4 months.

Figure 5.

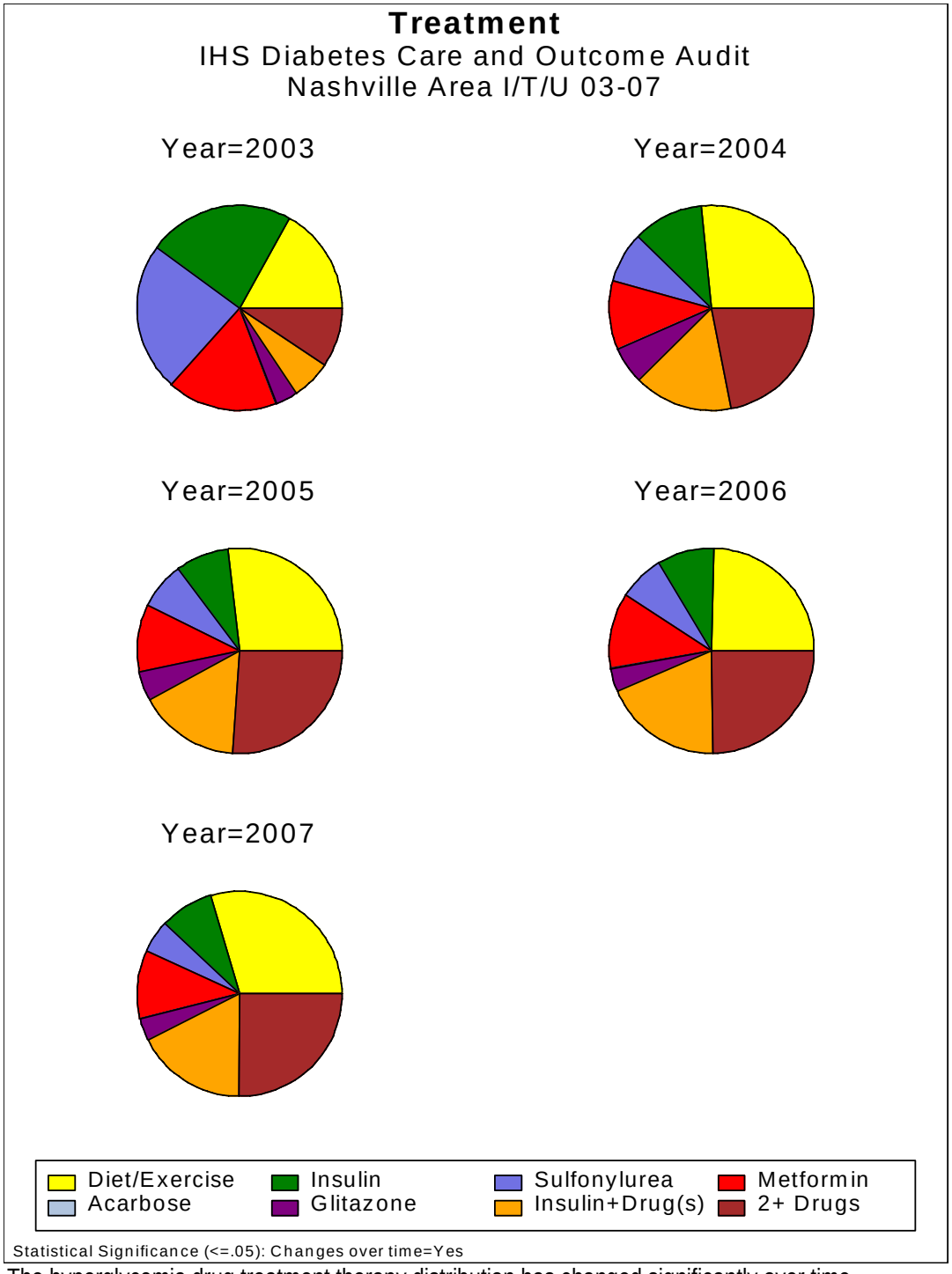


There was no significant change over time in the percentage of diabetic patients with A1c values <7.0.

Hyperglycemia Treatment Distribution – Multi-Drug Therapy

There is an increase in the percentage of providers prescribing multi-drug therapy as treatment for individuals with diabetes. Many individuals are seeing increased benefit in improved glycemic control with the use of multiple diabetes drug therapy.

Figure 6.

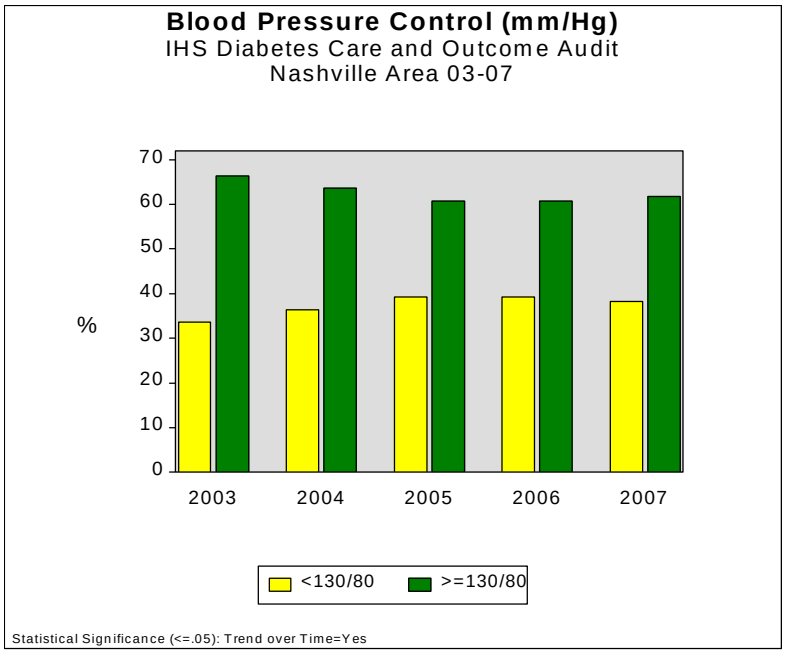


The hyperglycemia drug treatment therapy distribution has changed significantly over time.

Blood Pressure Management

The target blood pressure (BP) for patients with diabetes is <130/80 mmHg and there is additional protection against renal disease by lowering BP to 120/70 mmHg. High blood pressure increases the risk of heart disease and renal failure in type 2 diabetes.

Figure 7.

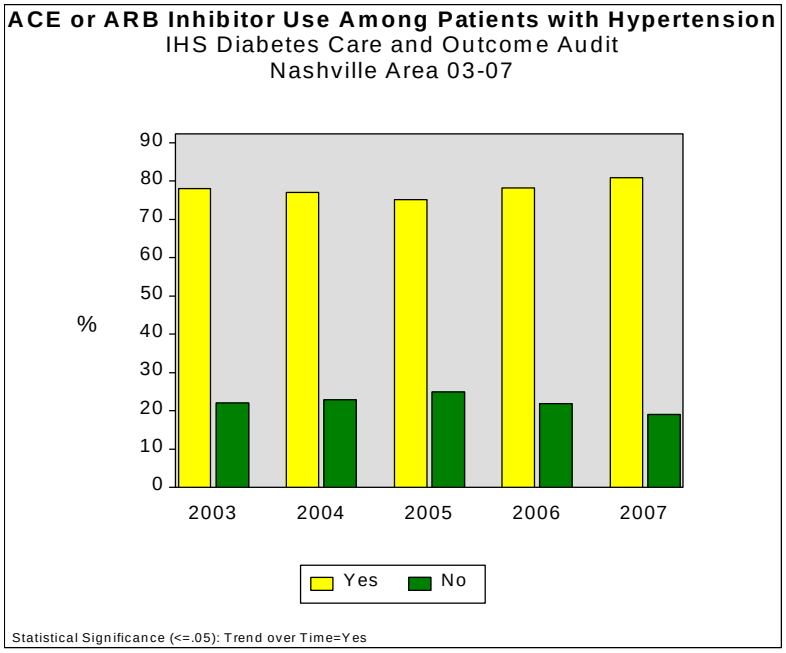


Although the percentage of change over time (2003-2007) appears to be small, audit data reflect a statistically significant increase in blood pressure control (<130/80) among patients with diabetes.

Treatments for Co-occurring Disorders - ACE Inhibitor/ARB Use in Hypertension

Angiotensin Converting Enzyme (ACE) Inhibitors and Angiotensin II Receptor Blockers (ARB) are used for controlling blood pressure, treating heart failure and preventing kidney damage in people with hypertension or diabetes.

Figure 8.



Audit data reflect a slight but statistically significant increase in the percentage of ACE/ARB inhibitor use among diabetic patients with hypertension over time (2003-2007).

Lipid Results and Treatment

A lipid panel should be performed annually for all individuals with diabetes. A lipid panel includes total cholesterol, low-density lipoprotein (LDL), high-density lipoprotein (HDL) and triglycerides. The risk factors for atherosclerosis include: total cholesterol >200 mg/dL, LDL>100 mg/dL, HDL<40 mg/dL, and triglyceride >150 mg/dL.

Figure 9.

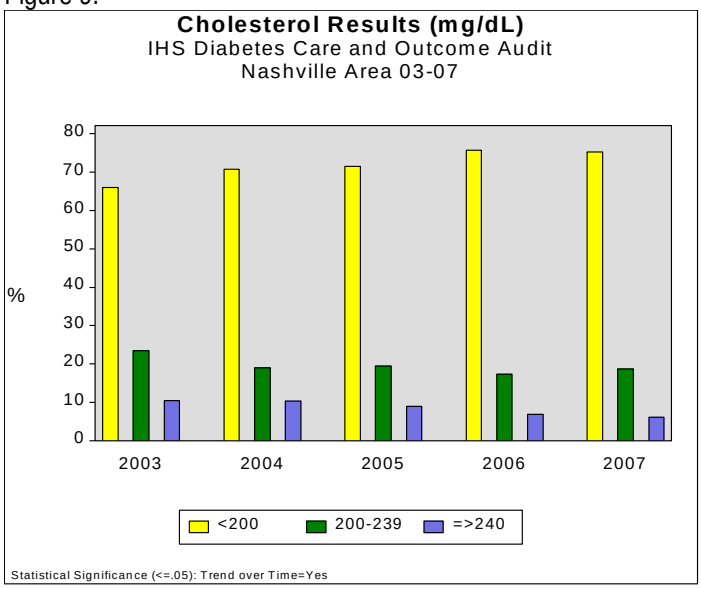


Figure 10.

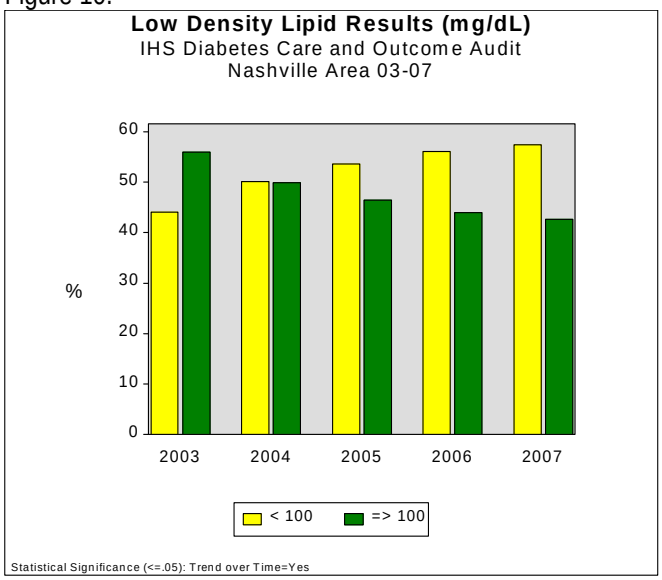


Figure 11.

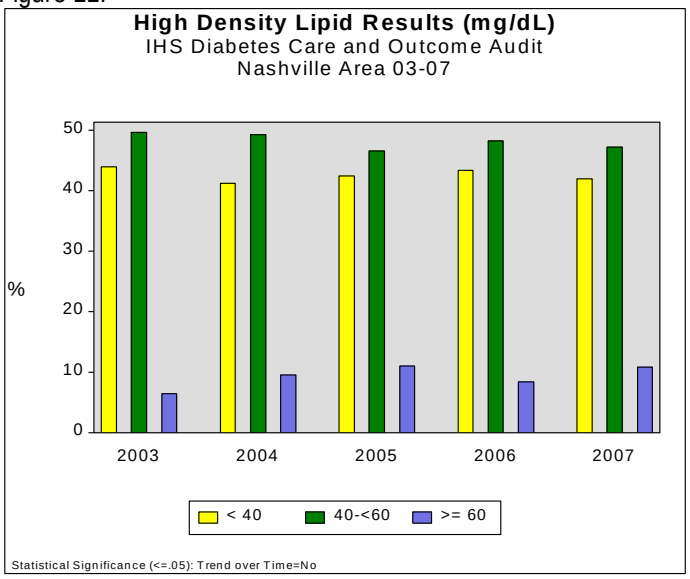
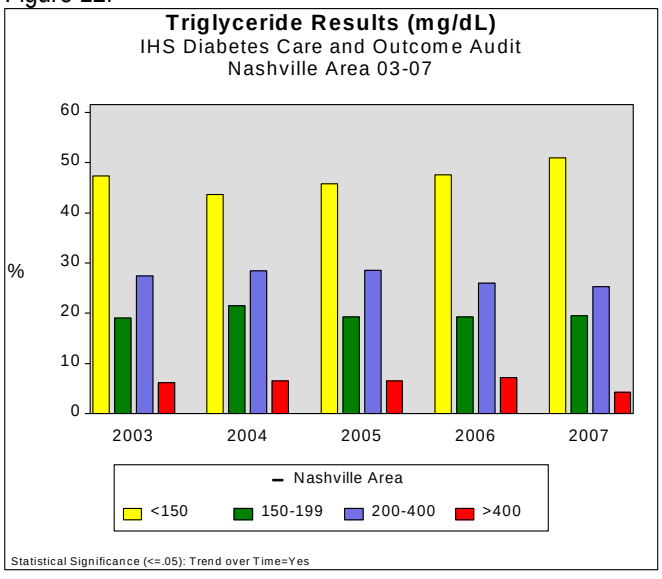


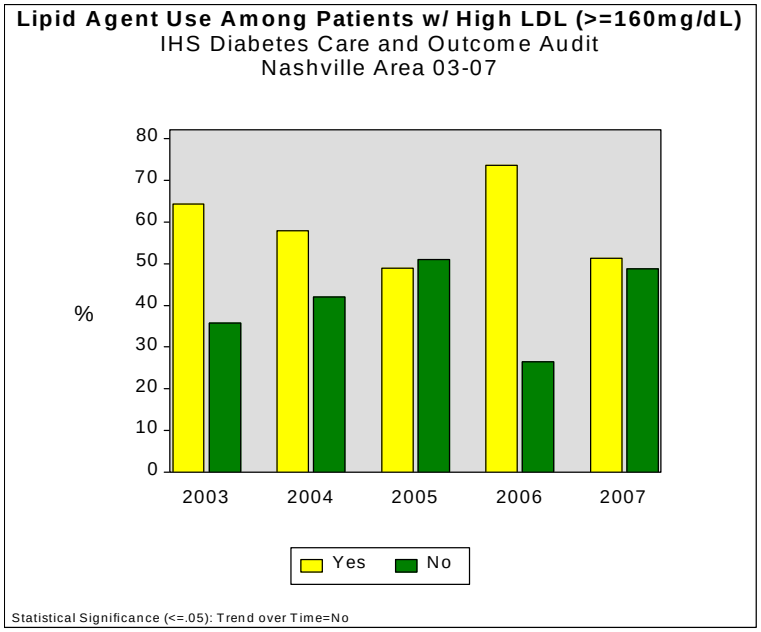
Figure 12.



Audit data reflect a statistically significant increase over time (2003-2007) in the percentage of patients with good total cholesterol, good LDL cholesterol (<100 mg/dL), and good triglyceride results (<150 mg/dL); however, the percentage of patients with good high-density lipids (HDL =>40) has not changed significantly over time.

Lipid Agent Use

Figure 13.

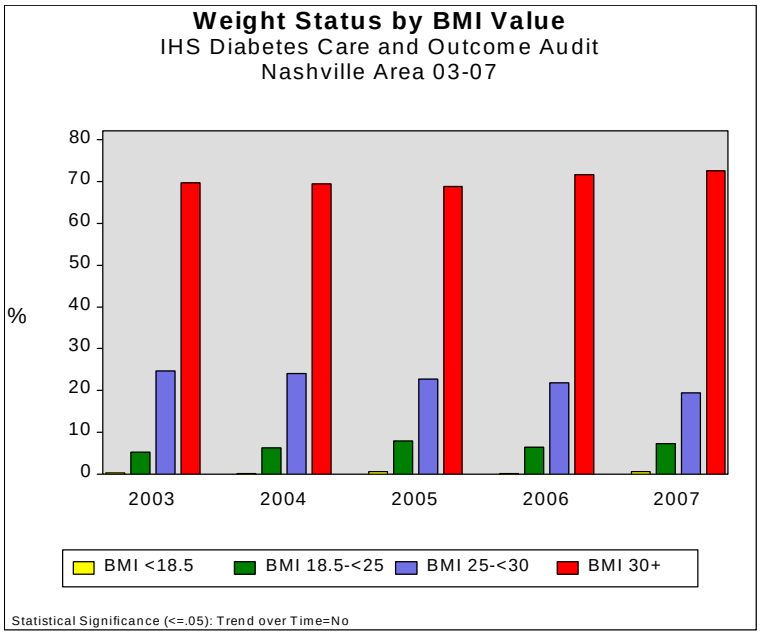


Diabetes audit data reflect an overall decrease in the use of lipid-lowering agent among patients with high LDL >= 160 mg/d. This decrease is not considered statistically significant.

Overweight and Obesity

Obesity and physical inactivity are risk factors associated with the development of type 2 diabetes. The Diabetes Prevention Project (DPP) demonstrated that weight loss, low fat eating, and regular physical activity can decrease the risk of developing diabetes by 58%.

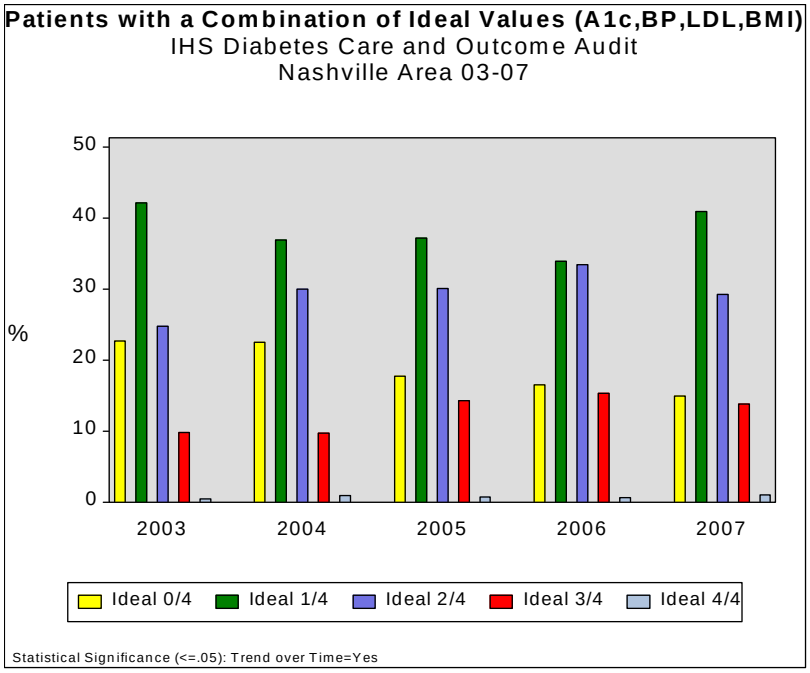
Figure 14.



The Diabetes audit data reflect very few diabetic patients with normal weight. Being overweight or obese is also a risk factor for hypertension and cardiovascular disease. In 2007, approximately 72% of the patients with diabetes were obese (BMI 30+).

Combination of Ideal Values (HbA1c, Blood Pressure, LDL, BMI)

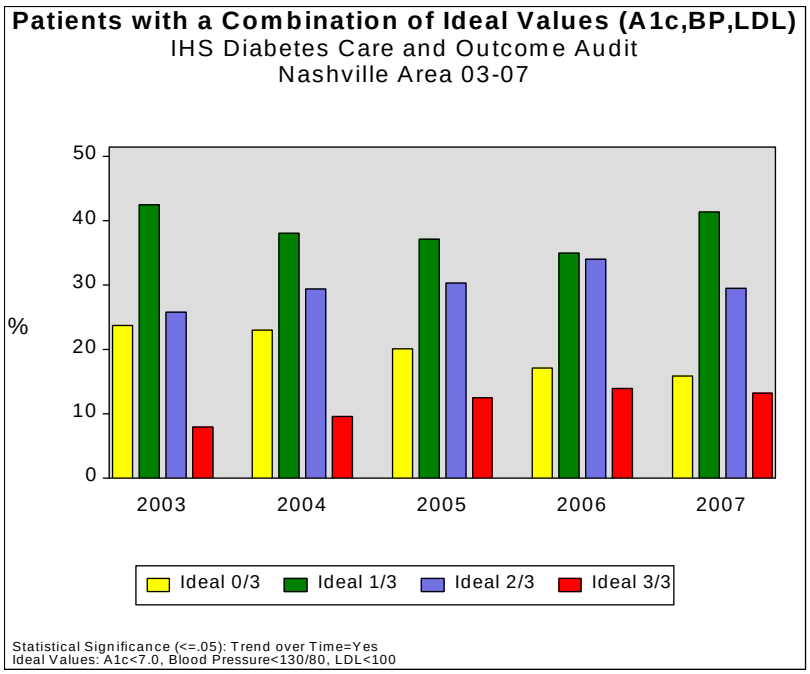
Figure 15.



Diabetes audit data reflect a significant increase in the percentage of patients with a combination of three ideal values (HbA1c, Blood Pressure, LDL, BMI). Few patients have a combination of four ideal values.

Combination of Ideal Values (HbA1c, Blood Pressure, LDL)

Figure 16.

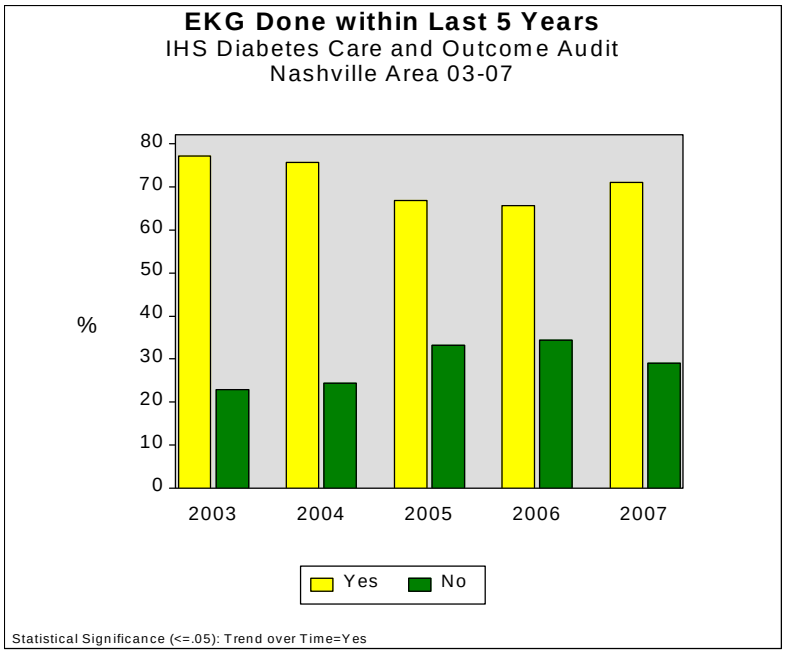


Diabetes audit data reflect a significant increase in the percentage of patients with a combination of ideal values (HbA1c, Blood Pressure, LDL).

EKG

A baseline electrocardiogram (EKG) is obtained after diagnosis of diabetes and this is repeated every 1-5 years as clinically indicated.

Figure 17.

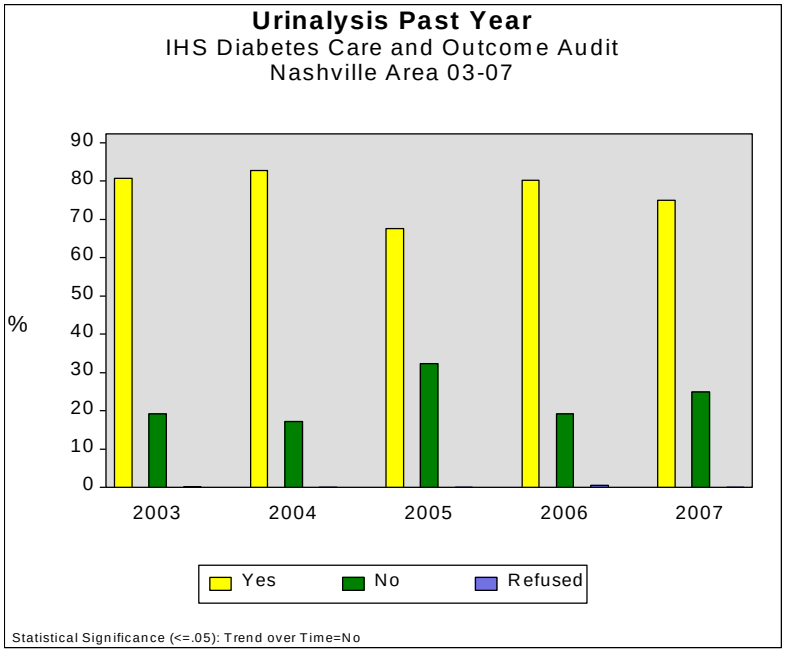


Audit data reflect a significant decrease over time (2003-2007) in the percentage of patients that had an EKG done, per diabetes standards of care.

Chronic Kidney Disease Assessment

Screening includes an assessment of glomerular filtration rate (GFR) and measurement of urinary protein excretion. These tests should be done at diagnosis and be repeated at least annually.

Figure 18.



In 2007, 75% of patients received a urinalysis per the diabetes standards of care.

Kidney Disease Assessment: Nephropathy – Proteinuria, Microalbuminuria, Creatinine, and Glomerular Filtration Rate

Figure 19.

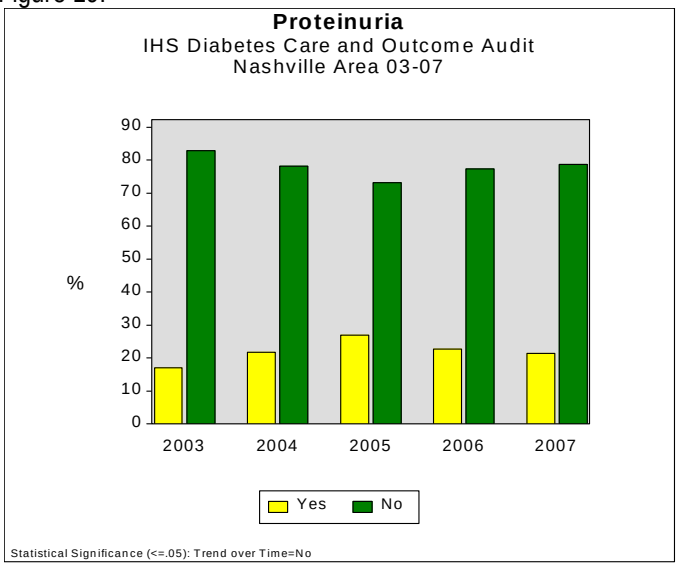


Figure 20.

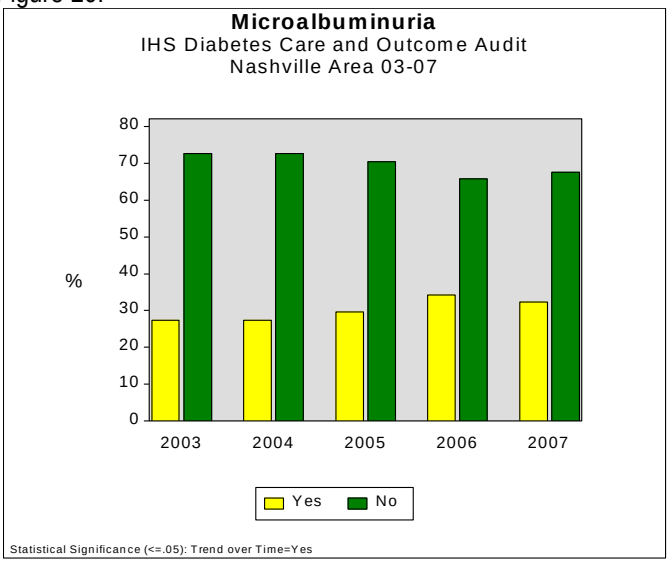


Figure 21.

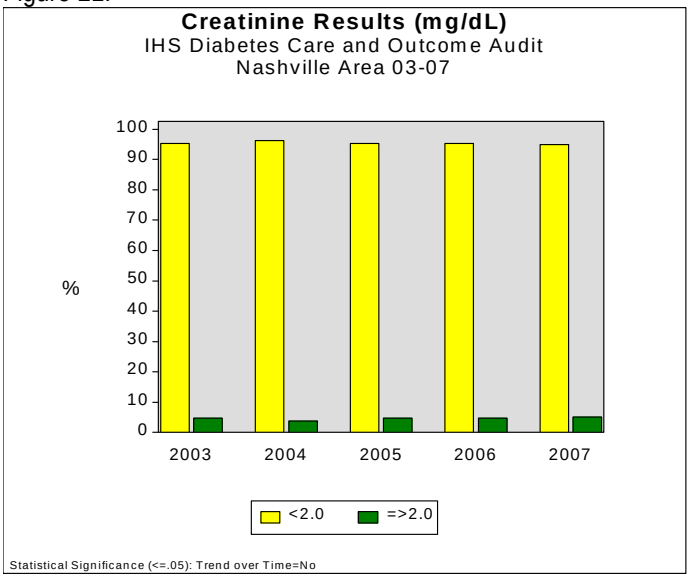
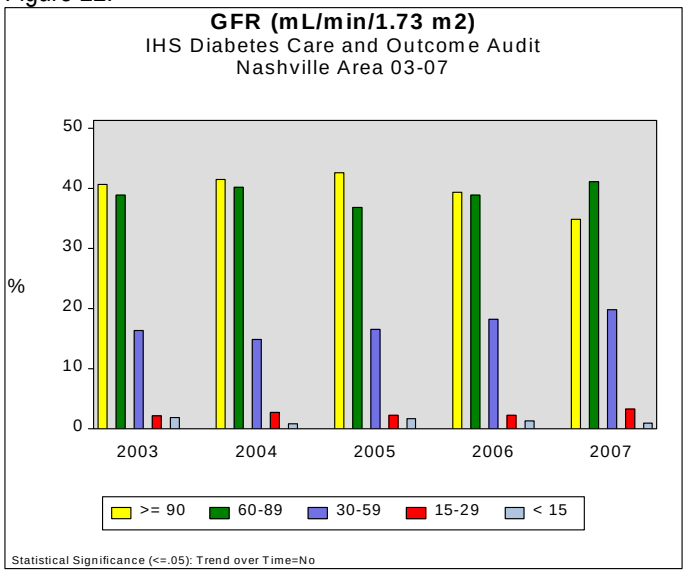


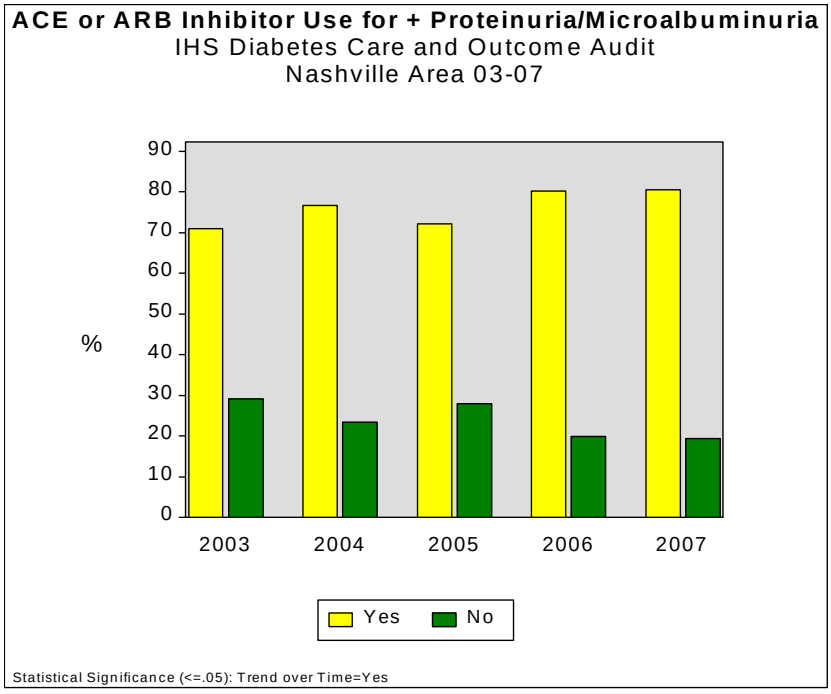
Figure 22.



Audit data reflect that for this Area's diabetic population, proteinuria, creatinine and GFR results did not change significantly over time (2003-2007). However, there was a statistically significant increase over time in the percentage of patients with a positive microalbuminuria result. Data also reflect that in 2007 approximately 22% of the diabetic patients have a calculated GFR <60 and therefore need follow-up.

Kidney Disease Treatment – ACE/ARB Inhibitor Use by Proteinuria or Microalbuminuria Positive Patients

Figure 23.



Data reflect a statistically significant increase over time in the use of an ACE/ARB inhibitor among patients with proteinuria/microalbuminuria.

Depression Screen

Studies have shown that many people with diabetes also have depression, and that depression may affect the control of diabetes.[5, 6] This indicator was added in 2005 and will continue to be trended in upcoming years.

Figure 24.

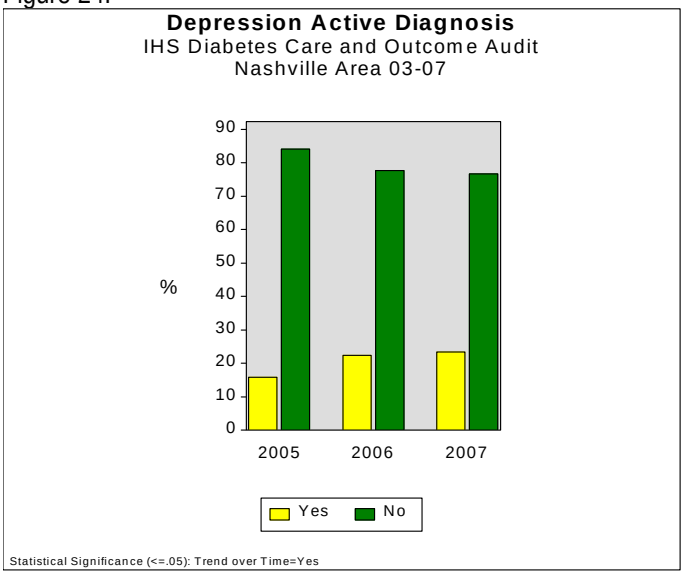
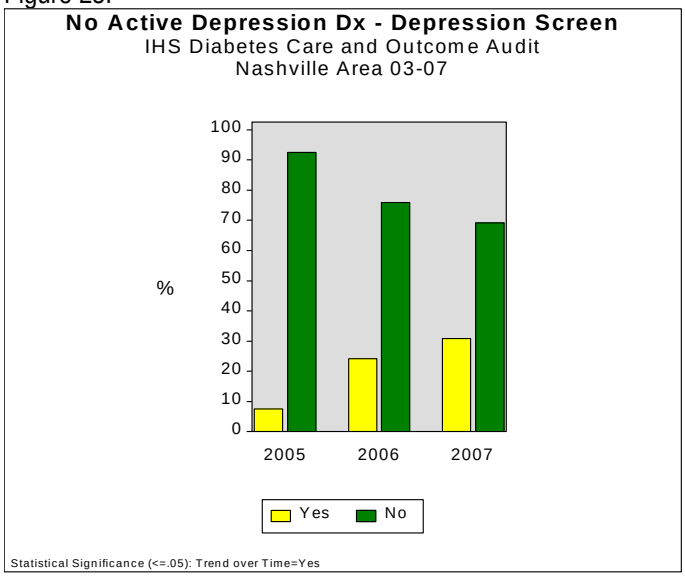


Figure 25.

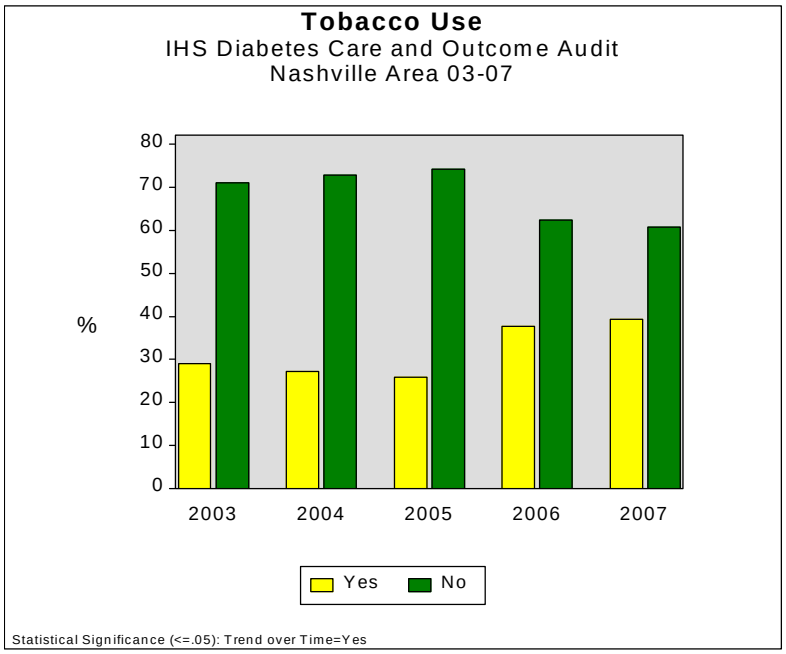


There was a significant increase in the percentage of patients with an active diagnosis of depression and in the percentage of patients being screened for depression over time (2005-2007).

Tobacco Use/Counseling

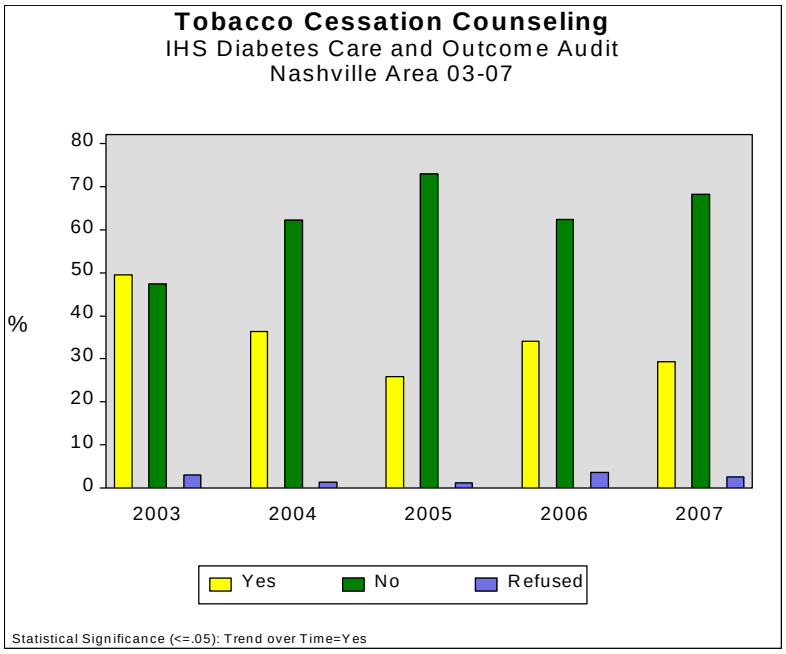
Tobacco use is the primary preventable risk factor for cardiovascular disease, which is the leading cause of death among patients with diabetes.

Figure 26.



2007 audit data reflect a statistically significant increase over time (2003-2007) in the percentage of patients using tobacco.

Figure 27.

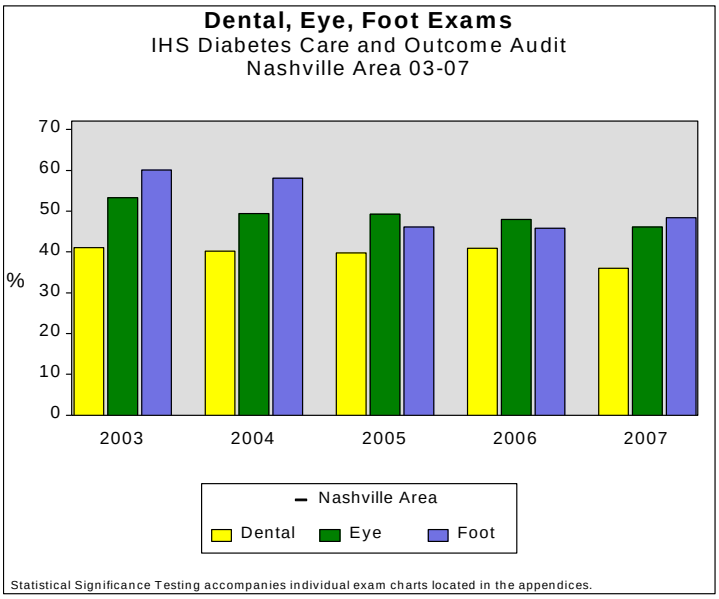


Audit data reflect a decrease in tobacco counseling over time (2003-2007). Because this variable includes non-numeric categorical values, the trend over time statistical significance test is not valid.

Preventive Care Measures – Dental, Eye and Foot Exams

Annual screening exams are important aspects of diabetes care. IHS standards recommend annual foot, dilated eye and dental exams.

Figure 28.

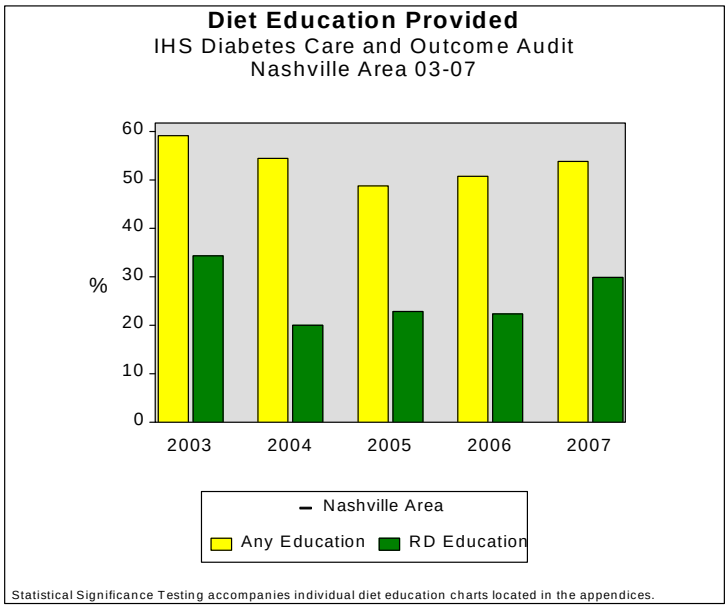


Audit data reflect no change in the percentage of completed dental and eye exams between 2003 and 2007. There was a decrease in foot exams during this same time period. Because these variables include non-numeric categorical values, the trend over time statistical significance test is not valid.

Education – General and Provided by Registered Dietician

Nutrition and exercise education are integral aspects of treatment for the individual with diabetes.

Figure 29.



The percentage of patients receiving any diet education decreased significantly over time (2003-2007). There was no statistically significant change over time in the percentage of patients who had received diet education from an RD.

Immunizations

All persons with diabetes should have flu and pneumovax vaccines. Yearly re-vaccination for flu is recommended to provide up-to-date protection. The pneumovax vaccine is necessary at least once and a booster may be needed according to the physician's advice.

Figure 30.

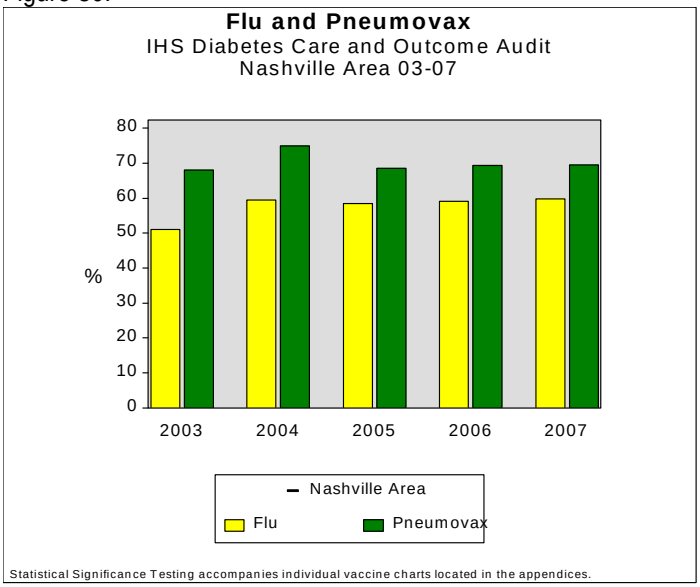
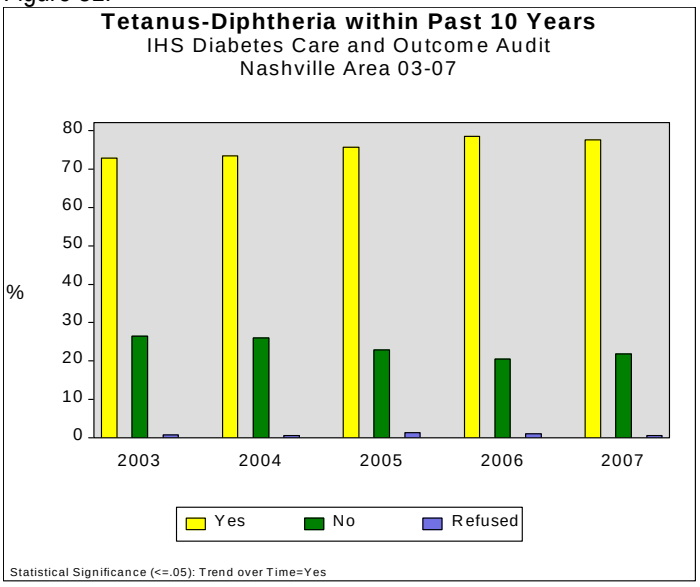


Figure 31.



There was a slight increase in the percentage of patients that received a flu and tetanus-diphtheria vaccination per diabetes standards of care between 2003 and 2007; however, there was no improvement over time in pneumovax vaccination coverage. Because these variables include non-numeric categorical values, the trend over time statistical significance test is not valid.

Tuberculosis Skin Test (also know as PPD) Screening and Treatment

Adults with diabetes and latent tuberculosis infection (LTBI) are at high risk of progressing to active TB if they are not treated for LTBI.

Figure 32.

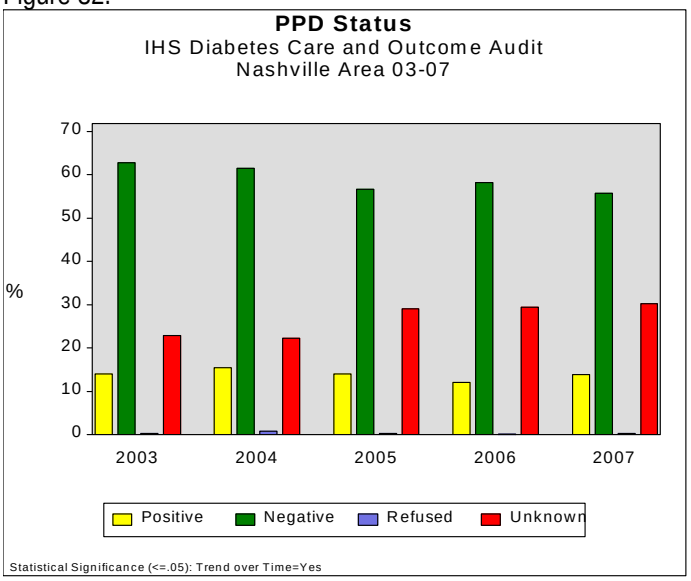
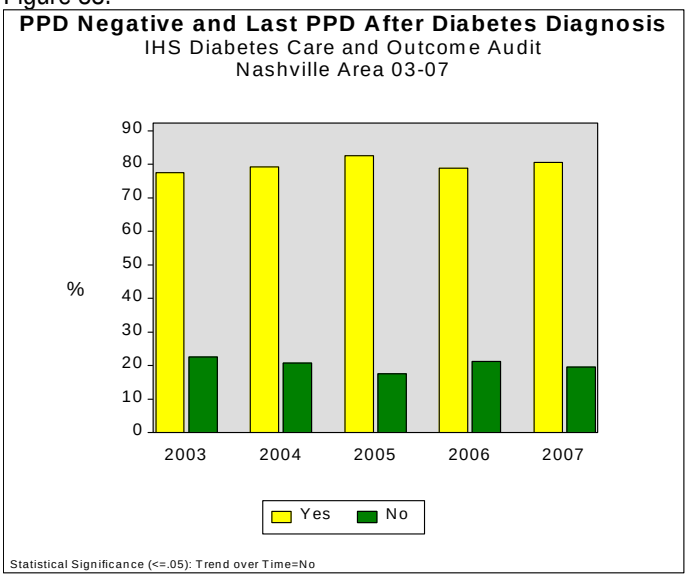


Figure 33.



The percentage of patients with PPD Status unknown increased significantly between 2003 and 2007. The percentage of diabetic patients receiving a PPD screening has not significantly changed over time.

Summary

Diabetes data analysis findings are summarized as follows:

Category	Summary of Findings
Diabetes Prevalence	Diabetes prevalence was calculated based on data collected on 23 Nashville Area tribes. The Nashville Area AI/AN age-adjusted diabetes prevalence increased slightly since 2003, rising from 19.1% in 2003 to 20.4% in 2007. Age-adjusted diabetes prevalence rates calculated for the 23 Tribes included in the 2007 Nashville Area aggregate rate showed a wide range; in 2007, I/T/U specific age-adjusted diabetes prevalence ranged from 34.0% to 8.7%, with a median of 19.1%. Since 2003, on average the Nashville Area age-adjusted diabetes prevalence rate has been approximately 1.4 times greater than the IHS Wide rate. For the three years (2003-2005) that US All Race[8] age-adjusted rates were available for comparison, the Nashville Area AI/AN age-adjusted diabetes prevalence rate on average was approximately 3.9 times greater than the US All Races rate. The actual (crude) diabetes prevalence rates for the Nashville Area aggregate were as follows: for 2003, 13.8% (6,302/45,825); for 2004, 14.0% (6,513/46,481); for 2005, 15.1% (7,020/46,463); for 2006, 15.5% (7,416/47,839); and for 2007, 15.7% (8,062/51,256). These figures reflect the existing large and disproportionate burden of diabetes in the Nashville Area AI/AN population.
Audit Sample Size	Sample size impacts how well Diabetes Audit analysis results represent the health status of persons on the diabetes registries of participating facilities and measurement of how well a diabetes program is following the IHS Standards of Care for persons with diabetes. For 2007, the Nashville Area audit sample (57.1%) was 1.3 times larger than the IHS wide sample (43.9%). Of the 20 Nashville Area I/T/Us that submitted data in 2007, audit sample sizes ranged from 6.3% to 100%, with a median of 80.4%. For the Nashville Area, in 2007 ten I/T/Us submitted sample sizes of 100%, four between 75-99%, three between 50-75%, two between 20-25%, and one of 6.3%.
Missing Data	Knowing the level of missing data associated with a particular variable is important because as the percentage of missing data increases, so too does the concern that the analysis result may not be an adequate representation of the particular aspect of diabetic health status and/or measurement of how well a diabetes program is following the IHS Standards of Care for persons with diabetes. For the aggregated 2007 Nashville Area audit data, an analysis of missing data shows that the Cholesterol Category, LDL Category, HDL Category, Triglyceride Category, Number of Ideal Values (HbA1c, BP, LDL, BMI), and Tobacco Use variables were missing data for 30% to 50% of the records, and the Tobacco Cessation Counseling variable was missing data for more than 50% of the records.
Duration of Diabetes	For the Nashville Area, there was a statistically significant increase in the duration of diabetes for 10+ years.
Glycemic Control & Drug Therapy	There was no significant change in the percentage of diabetic patients with A1c values <7.0. The hyperglycemia drug treatment therapy distribution has changed significantly over time.
Blood Pressure Control and use of Hypertensive Medication	Although the percentage of change over time (2003-2007) appears to be small, audit data reflect a significant increase in blood pressure control (<130/80) among patients with diabetes. Audit data reflect a slight but statistically significant improvement over time (2003-2007) in the percentage of ACE/ARB inhibitor use among diabetic patients with hypertension.
Dyslipidemia & Lipid Management	Audit data reflect a statistically significant increase in the percentage of patients with good total cholesterol, good LDL cholesterol (<100 mg/dL), and good triglyceride results (<150 mg/dL) . The percentage of patients with good high-density lipids (HDL =>40) has not changed significantly over time. Diabetes audit data reflect an overall decrease in the use of lipid-lowering agent among patients with high LDL >= 160 mg/d. This decrease is not considered statistically significant.

Category	Summary of Findings (continued)
Weight Status	The Diabetes audit data reflect very few diabetic patients with normal weight. Being overweight or obese is also a risk factor for hypertension and cardiovascular disease. In 2007, approximately 72% of the patients with diabetes were obese (BMI 30+).
Combination of Ideal Values (HbA1c, BP, LDL, BMI)	Diabetes audit data reflect a significant increase in the percentage of patients with a combination of three ideal values (HbA1c, Blood Pressure, LDL, BMI). Few patients have a combination of four ideal values.
Nephropathy Assessment and Medication for Treatment	Audit data reflect that for this Area's diabetic population, proteinuria, creatinine and GFR results did not change significantly over time (2003-2007). However, there was a statistically significant increase over time in the percentage of patients with a positive microalbuminuria result. Data also reflect that in 2007 approximately 22% of the diabetic patients have a calculated GFR <60 and therefore need follow-up. Data reflect a statistically significant increase over time in the use of an ACE/ARB inhibitor among patients with proteinuria/microalbuminuria.
Depression Assessment	There was a significant increase in the percentage of patients with an active diagnosis of depression and in the percentage of patients being screened for depression over time (2005-2007).
Tobacco Use/Counseling	2007 audit data reflect a statistically significant increase over time (2003-2007) in the percentage of patients using tobacco. Audit data reflect a decrease in tobacco counseling over time (2003-2007). In addition, there continues to be a large percentage of missing data for this variable. Because this variable includes non-numeric categorical values, the trend over time statistical significance test is not valid.
Dental, Eye, Foot Exams	Audit data reflect no change in the percentage of completed dental and eye exams between 2003 and 2007. There was a decrease in foot exams during this same time period. Because these variables include non-numeric categorical values, the trend over time statistical significance test is not valid.
Diet Education	The percentage of patients receiving any diet education decreased significantly over time (2003-2007). There was no statistically significant change over time in the percentage of patients who had received diet education from an RD.
Vaccines (Flu, Pneumovax, Tetanus-Diphtheria)	There was a slight increase in the percentage of patients that received a flu and tetanus-diphtheria vaccination per diabetes standards of care between 2003 and 2007; however, there was no improvement over time in pneumovax vaccination coverage. Because these variables include non-numeric categorical values, the trend over time statistical significance test is not valid.
PPD Status (Tuberculosis Skin Test) & Screening Rates	The percentage of patients with PPD Status unknown increased significantly between 2003 and 2007. The percentage of diabetic patients receiving a PPD screening has not significantly changed over time.

GENERAL RECOMMENDATIONS

Based on the findings of this report and the observations of the Nashville Area Diabetes Consultant it is recommended that the Nashville Area I/T/Us:

1. Continue to support the IHS Diabetes Care and Outcome Audit process. This initiative provides a valuable tool to assess the health status and issues for the population with diabetes. I/T/Us are encouraged to continue supporting this effort and working with USET in creating reports such as the Nashville Area Diabetes Report.

2. Develop and strengthen infrastructures necessary for the IHS Diabetes Care and Outcome Audit including quality documentation, quality data entry and implementation of IHS Standards of Care for Adults with type 2 diabetes. Additionally, a team approach contributes greatly to the continuing efforts of both the audit and surveillance initiatives at the I/T/U level.

3. Use the data and recommendations in the Nashville Area Diabetes Report and accompanying sister I/T/U specific diabetes reports to advocate for increased quality improvement efforts directed at diabetes treatment and prevention programs. This report helps provide a framework and baseline for local sites, USET and the NAO to measure their diabetes quality improvement efforts and to guide their decisions on where to target diabetes dollars.

4. Initiate the electronic diabetes audit process and implement “census” verses “sample” data collection. As I/T/Us continue to utilize the RPMS and DMS package, more sites should elect to use the electronic audit within the RPMS system. The electronic audit process is less time consuming than a manual audit and can provide more consistent data if data entry and data quality are good. It still does take time with the set-up process but less than a manual audit. Proper documentation, coding and data entry are vital to the use of the electronic audit.

5. Though this report does not address the diabetes education process, I/T/Us are encouraged to initiate or continue efforts toward becoming recognized diabetes education programs. This recognition demonstrates that quality diabetes education services are being provided to a community. Sites can gain this recognition via the American Diabetes Association or IHS.

6. Utilize the technical support of the Area Diabetes Consultant and USET Tribal Epidemiology Center staff, as well as IHS resources in the ongoing development of local diabetes programs.

7. Continue to improve the quality of diabetes data that is available for analysis. Mechanisms to continue to improve and strengthen the quality of data available from RPMS and other systems should remain a top priority. Quality data is essential for these reports to reflect the current health status of individuals and to document the use of evidenced based practice with diabetes, hence this recommendation is vital to the ongoing trending and reporting processes. Data quality has improved greatly in the past years as reflected by the number of programs participating in the Diabetes Audit and surveillance project, the number of programs using RPMS and DMS and increased number of programs using the electronic diabetes audit; however, data anomalies are still present.

8. Use the Nashville Area Diabetes Report and accompanying sister I/T/U specific diabetes reports to assist in efforts to advocate for continued IHS Special Diabetes Program for Indians funding which is scheduled to end in 2008.

REFERENCES

1. National Institutes of Health, U.S. Department of Health and Human Services. (2005). *National Diabetes Statistics fact sheet: general information and national estimates on diabetes in the United States, 2005.* Bethesda, MD.

2. Burros RN. (2006). *Prevalence of diagnosed diabetes among American Indians and Alaska Natives, 2004.* Presentation given to Division of Diabetes Translation, Centers for Disease Control and Prevention, Albuquerque, NM.

3. The Unofficial IHS Diabetes Care & Outcomes Audit Support Site. (2007). *AUDIT07 Diabetes Care and Outcomes Chart Audit for Quality Assurance and Quality Improvement* Retrieved. 5-21-07 from http://www.dmaudit.com/Aud07Instr/aud07instructions.htm

4. Indian Health Service (US). (2007). *Resource and Patient Management System.* Retrieved 5-21-07 from http://www.ihs.gov/Cio/RPMS/index.cfm?module=home&option=index

5. Hart AC et al. (2004). *ICD-9-CM Professional.* 6 ed. (pgs. 75-6). Salt Lake City, UT

6. Indian Health Service (US). (2008). *The IHS National Data Warehouse*. Retrieved 3-25-08 from http://www.ihs.gov/CIO/DataQuality/warehouse/index.asp

7. Division of Diabetes Translation, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention (US). (2007). *Prevalence of Diagnosed Diabetes per 100 Population, by Age, United States, 1980–2005.* Retrieved 5-24-07 from http://www.cdc.gov/diabetes/statistics/prev/national/tprevage.htm

8. Division of Diabetes Translation, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention (US). (2007). National Diabetes Surveillance System. *State specific estimates of diagnosed diabetes among adults.* Retrieved 5-24-07 from http://www.cdc.gov/diabetes/statistics/prev/state/tPrevalenceTotal.htm

9. Division of Diabetes Treatment and Prevention, Indian Health Service (US). (2006). *Indian Health Service Standards of Care for Adults With Type 2 Diabetes.* Albuquerque, NM.

10. Anderson JA et al. (2001). *The prevalence of co-morbid depression in adults with diabetes.* Diabetes Care. 2001; 24:1069–78.

11. Lin EHB et al. (2004). *Relationship of depression and diabetes self-care, medication adherence, and preventive care.* Diabetes Care. 2004; 27:2154–60.

APPENDIX A

Resources

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Links to Consider

Diabetes Audit
http://www.dmaudit.com

IHS
Integrated Diabetes Education Recognition Program
http://www.ihs.gov/MedicalPrograms/Diabetes/recognition/iderp_app1.asp

IHS
RPMS/DMS manual includes information on electronic audit
http://www.ihs.gov/Cio/RPMS/PackageDocs/bdm/bdm_020u.02.pdf

American Association of Indian Physicians
http://www.aaip.com

IHS, Division of Diabetes Treatment and Prevention
http://www.ihs.gov/MedicalPrograms/Diabetes/index.asp

National Diabetes Education Program
http://www.ndep.nih.gov
http://www.cdc.gov/diabetes/ndep/index.htm

American Diabetes Association, Awakening the Spirit
http://www.diabetes.org/communityprograms-and-localevents/nativeamericans.jsp

APPENDIX B

May 2008 Nashville Area Diabetes Report
I/T/Us data included in diabetes audit calculations by year
The listed I/T/Us were included in each year's prevalence calculations

I/T/U	2003	2004	2005	2006	2007
Alabama-Coushatta Tribe of Texas	X		X	X	X
Chitimacha Tribe of Louisiana		X	X	X	X
Coushatta Tribe of Louisiana	X	X	X	X	X
& Jena Band of Choctaw Indians					
& Tunica-Biloxi Indians of Louisiana					
Mississippi Band of Choctaw Indians	X	X	X	X	X
Poarch Band of Creek Indians	X	X	X	X	X
Miccosukee Tribe of Indians of Florida	X	X	X	X	X
Seminole Tribe of Florida		X	X	X	X
Catawba Indian Nation	X	X	X	X	X
Eastern Band of Cherokee Indians	X	X	X	X	X
* Seneca Nation of Indians	X	X	X	X	X
Oneida Indian Nation	X	X	X	X	X
St. Regis Mohawk Tribe		X	X	X	X
Mashantucket Pequot Tribal Nation	X	X	X	X	X
& Mohegan Tribe of Connecticut					
Narragansett Indian Tribe	X	X	X	X	X
Wampanoag Tribe of Gay Head (Aquinnah)			X	X	X
Aroostook Band of Micmacs	X	X	X	X	X
Houlton Band of Maliseet Indians	X	X	X	X	X
Passamaquoddy Tribe- Indian Township	X	X	X	X	X
Passamaquoddy Indian Tribe- Pleasant Poir	X	X	X	X	X
* Penobscot Indian Nation	X	X	X	X	X

Notes: * = Due to local data concerns 2004 Seneca data not included in 2004 aggregate prevalence calculation.
& = Jena Band, Tunica-Biloxi, and Mohegan did not participate in the 2003-2007 Diabetes Audit process.

APPENDIX C

Raw Data with Associated
Diabetes Audit Charts and Statistical Tests
(provided as an electronic file)