

2007 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

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 on average were 2.2 times more likely to have diabetes as non-Hispanic whites; 15.1 percent of AI/ANs aged twenty years and older and receiving 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 2003-2005 data revealed that the Nashville Area AI/AN age-adjusted diabetes prevalence rate was approximately two times greater than the IHS wide rate and four times greater than the US All Races rate. The IHS Nashville Area Diabetes Report presents an analysis of 2003-2006 data concerning AI/AN people with diabetes who receive care through IHS Nashville Area 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 health facility (I/T/U) 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.

The IHS Nashville Area includes 28 federally recognized Tribes and three Urban Indian Health Care Organizations, located in 12 states 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. There are approximately 60,000 American Indian AI/ANs residing on or near reservations located within 12 states, with another 75,000 AI/ANs residing in urban areas. 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. 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) programs in the Nashville Area. Twenty-two 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) process that follows a standardized method for assessing the diabetes care and the health status of diabetes patients seen at participating I/T/Us.⁴

The Nashville Area Aggregate Diabetes Report has an in-depth introduction and methodology section to which the readers of sister I/T/U specific Diabetes Reports should refer. The report uses two primary data sources -- a 2003-2006 Nashville Area Diabetes Audit dataset provided by the IHS Division of Diabetes Treatment and Prevention (DDTP), and I/T/U health facility electronic patient management systems³ or I/T/U provided health data. General comparison statistics available through the Centers for Disease Control and Prevention (CDC) Division of Diabetes Translation⁷⁻⁸ and DDTP are also used. The 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 explaining the logic underlying the calculations used to create Findings section results and the limitations of the data.
- A findings section presenting charts that describe comparisons of diabetes related data across 2003-2006. For background, first either an aggregate or an I/T/U specific User Population based prevalence of diabetes chart is provided. This is followed by a series of charts that compare Diabetes Audit data. 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 recommendations section.
 - Appendices that include a compendium of resources, a listing of participating I/T/Us by year, 2006 IHS wide Diabetes Audit comparison figures, and the raw data used to create the charts presented in the findings section.

I/T/U specific reports are bound separately from the aggregate level Nashville Area Diabetes Report. I/T/U specific Diabetes Reports are confidential and provided only to designated I/T/U officials. 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 level report and for each I/T/U to receive only its own data. With the exception of the diabetes prevalence graphs (Figures 1a-1c), the remainder of the tables (Tables 1-2) and graphs (Figures 2-37) presented in the Findings Section are based on an analysis of the Nashville Area 2003-2006 IHS Diabetes Audit data. Under this program staff at participating I/T/Us review the medical charts of persons with diabetes by comparing the care that has been provided and the results of various outcome measures to the IHS Standards of Care for patients with type 2 diabetes.⁵ Following the IHS Diabetes Audit instructions, annually a 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. Some I/T/Us complete the audit on the total active diabetic patient list and do not use a sample. Diabetes data analysis findings are summarized as follows:

- The Nashville Area AI/AN age-adjusted (US Census 2000 population) diabetes prevalence increased slightly since 2003, rising from 19.1% in 2003 to 20.7% in 2006. Age-adjusted diabetes prevalence rates calculated for the I/T/U specific levels showed a wide variance; for example, in 2006 ranging from a high of 32.8% to a low of 7.3%. For the three years (2003-2005) that IHS Wide and US All Race age-adjusted rates were available for comparison, the Nashville Area AI/AN age-adjusted diabetes prevalence rates on average were approximately two times greater than the IHS Wide rates and four times greater than the US All Races rates. 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); and for 2006, 15.5% (7,416/47,839). These figures reflect the existing large and disproportionate burden of diabetes in the Nashville Area AI/AN population.
- The Nashville Area crude (actual) prevalence of ischemic heart disease (IHD) among persons with diabetes has remained approximately constant since 2003, from 26.5% in 2003 to 25.9% in 2006. Since 2003, on average the Nashville Area's prevalence of IHD among persons with diabetes has been approximately 1.2 times greater than the 2003 All Races US rate. Prevalence of IHD among persons with diabetes calculated for the 21 Tribes included in the Nashville Area aggregate rate showed a wide range; for example, in 2006 with a high of 49.4% for one I/T/U and a low of 13.9% for another I/T/U. Tobacco cessation, a healthy weight, and regular exercise can all reduce the risk of IHD complications among patients with diabetes.
- Diabetes audit data reflect a moderate improvement for patients with a combination of ideal values (A1c, BP, LDL, BMI).
- Diabetes audit data reflect no improvement in glycemic control over time and less than 40% of the diabetic patients have A1c values less than 7% (<7.0).
- Diabetes audit data reflect few diabetic patients are of normal weight. Overweight and obesity are an added risk factors for hypertension and CVD.
- There appears to be a statistically significant increase in the percentage of patients with positive proteinuria and microalbuminuria.
- Diabetes audit data reflect a statistically significant increase in the percentage of patients with good LDL cholesterol levels (<100 mg/dL). Diabetes audit data reflect little change in the

percentage of patients with improved HDL cholesterol levels. Exercise is the primary activity that can improve HDL levels.

- Diabetes audit data reflect a statistically significant increase in the percentage of patients screened for depression. Many studies on the psychosocial aspects of chronic disease indicate that depression can affect the control of diabetes.

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:

- Continue to support the Diabetes 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.
- Develop and strengthen infrastructures necessary for the Diabetes 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.
- 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 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.
- Initiate the electronic diabetic 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 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.
- Initiate or continue efforts toward becoming recognized diabetes education programs via IHS or the American Diabetes Association. These recognition programs demonstrate that quality diabetes education services are being provided to a community.
- Utilize the technical support of the USET Tribal Epidemiology Center staff and Area Diabetes Consultant, 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. 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 process. 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. However, data anomalies are still present.
- Use the Nashville Area Diabetes Report and accompanying sister I/T/U specific diabetes reports to assist you in your efforts to advocate for continued SDPI funding which is scheduled to end in 2008.

Limitations of the diabetes prevalence rates presented in this report include:

- Patients that move into or out of the I/T/U's Contract Health Service Delivery Area (CHSDA; an area defined by those communities assigned to a particular Tribe by the IHS), between the report year end and the time of data extraction may be erroneously included in or excluded from the denominators.

- Because the diabetes prevalence findings are based primarily on the patient population utilizing the I/T/U, 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 associated with health care provided to patients at or outside of an I/T/U which has not been entered into the patient management system will not be 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.
- The CDC National Diabetes Surveillance System age adjusted diabetes prevalence rates are based on a different logic than the calculations used to produce the Nashville Area aggregate and I/T/U specific rates. Therefore caution is warranted when comparing the Nashville Area and I/T/U specific rates to the US and State All Race rates.

Limitations of the Nashville Area Diabetes Audit analysis include:

- The Diabetes Audit process reviews only individuals on the active diabetes registry.
- 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.
- Audit sample size impacts how well Diabetes Audit analysis results represent the health status of persons on the diabetes registries of participating facilities.
- The level of missing data for a particular variable impacts how well the results of a particular analysis represent a particular aspect of diabetic health status and/or diabetes program status.

ACKNOWLEDGEMENTS

This year's United South and Eastern Tribes, Inc. (USET), Nashville Area Diabetes Report and its sister Indian Health Service (IHS)/Tribal/Urban (I/T/U) specific Diabetes Reports would not be possible without the dedicated and professional work of Nashville Area I/T/U health program personnel. We want to extend special thanks to all the Nashville Area I/T/U Diabetes Coordinators and other I/T/U personnel that participate in the annual IHS Diabetes Care and Outcome Audit (Diabetes Audit).

Much of the financial support for the USET staff that produces this report comes from the IHS Division of Epidemiology and Disease Prevention (DEDP) and IHS Division of Diabetes Treatment and Prevention (DDTP).

We also want to give special recognition to Dr. James Schmidhammer, University of Tennessee at Knoxville, who assisted with developing the computer program to produce the Diabetes Audit charts and tables in this report; and to Ms. Karen Sheff and Dr. Ray Shields, IHS DDTP, who provided Diabetes Audit data used for making this report after performing many hours of data cleaning and formatting.

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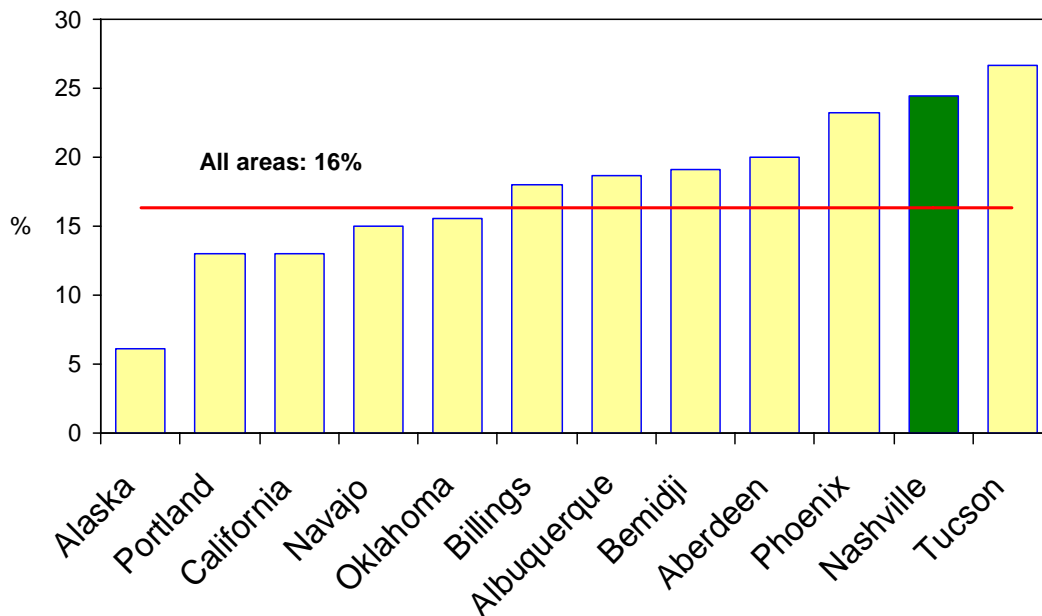
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INTRODUCTION

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 on average were 2.2 times more likely to have diabetes as non-Hispanic whites; 15.1 percent of AI/ANs aged twenty years and older and receiving 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 2003-2005 data revealed that the Nashville Area AI/AN age-adjusted diabetes prevalence rate was approximately two times greater than the IHS wide rate and four times greater than the US All Races rate. The IHS Nashville Area Diabetes Report presents an analysis of 2003-2006 data concerning AI/AN people with diabetes who receive care through IHS Nashville Area 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 health facility (I/T/U) 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 the health needs of 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 24 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 who works at USET. 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 (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	Towanda Band of Seneca
*Chitimacha Tribe of Louisiana	Tuscarora Nation
*Coushatta Tribe of Louisiana	*Mashantucket Pequot Tribal Nation
Jena Band of Choctaw Indians	Mohegan Tribe of Connecticut
Tunica-Biloxi Indians of Louisiana	*Narragansett Indian Tribe
*Mississippi Band of Choctaw Indians	*Wampanoag Tribe of Gay Head (Aquinnah)
*Poarch Band of Creek Indians	Mashpee Wampanoag Tribe
*Miccosukee Tribe of Indians of Florida	*Aroostook Band of Micmac
*Seminole Tribe of Florida	*Houlton Band of Maliseet Indians
*Catawba Indian Nation	*Passamaquoddy Tribe- Indian Township
*Eastern Band of Cherokee Indians	*Passamaquoddy Indian Tribe- Pleasant Point
*Seneca Nation of Indians	*Penobscot Indian Nation
*Oneida Indian Nation	AI Community House of New York
*St. Regis Mohawk Tribe	North American Indian Center of Boston
Onondaga Nation	Baltimore American Indian Center
Cayuga Nation of New York	

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 explaining the logic underlying the calculations used to create Findings section results and the limitations of the data.
- A findings section presenting charts that describe comparisons of diabetes related data across 2003-2006. For background, first either an aggregate or an I/T/U specific User Population based prevalence of diabetes chart is provided. This is followed by a series of charts that compare Diabetes Audit data. 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. For the I/T/U specific report the aggregate of the other

Nashville Area I/T/Us' audit data is represented as a series of dashes that coincide with the bars on each of the bar graphs.

- A recommendations section.
- Appendices that include a compendium of resources (Appendix A), a listing of participating I/T/Us by year (Appendix B), 2006 IHS Wide Diabetes Audit comparison figures (Appendix C), and the raw data used to create the charts presented in the findings section (Appendix D).

I/T/U specific reports are bound separately from the aggregate level Nashville Area Diabetes Report. The aggregate level report includes all of the aforementioned components. The I/T/U specific level 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 level report and for each I/T/U to receive only its own data.

METHODOLOGY

The Methodology section documents how the results of the Findings section and raw data appendices are generated. An overview of the diabetes data sources, methodologies, and limitations is provided.

Data Sources

Two primary data sources are used to create this Diabetes Report: 1) 2003-2006 Nashville Area IHS Diabetes Care and Outcome Audit (Diabetes Audit) dataset provided by the Indian Health Service (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. General comparison statistics available through the Centers for Disease Control and Prevention (CDC) Division of Diabetes Translation and DDTP are also used.

Methodology for Diabetes Audit Charts

With the exception of the diabetes prevalence graphs (Figures 1a-1c), the remainder of the tables (Tables 1-2) and graphs (Figures 2-37) presented in the Findings Section are based on an analysis of the 2003-2006 IHS Diabetes Audit data provided by participating Nashville Area I/T/Us. The IHS Diabetes Audit establishes a standardized method for assessing the diabetes care and the health status of diabetes patients seen at participating I/T/Us. The IHS Diabetes Audit applies a uniform process and standardized definitions to consistently monitor patient care patterns over time and make valid comparisons between participating I/T/Us. During the medical chart audit, diabetes care is compared to the IHS Standards of Care for patients with type 2 diabetes.³ Sites have the option to do a manual audit or an electronic audit. Instructions for the completion of the audit are available from the web site "www.dmaudit.com".⁴

Based on IHS Diabetes Audit instructions annually a 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). Some I/T/Us complete the audit on the total active diabetic patient list and do not use a sample. After Diabetes Audit data are collected by the Nashville Area Diabetes Consultant from participating I/T/Us, it is sent to designated IHS DDTP staff. The IHS DDTP staff then clean and organize the data so it can be aggregated at the Area and national levels for comparison, as well as be returned to the Area Diabetes Consultant and the I/T/Us Diabetes Coordinators for program planning and additional analyses.

It is important to note that the months included in each Nashville Area Diabetes Audit period covered by this report have varied across years which impacts comparability. The period covered by the 2006 Diabetes 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; and information about the periods covered by the 2003 and 2004 audits was unknown at the time this report was created. In the future, the Nashville Area Diabetes Consultant plans to coordinate calendar year based Nashville Area Diabetes Audits 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. In 2006, 20 Nashville Area I/T/Us submitted audit data, however only 18 were included in the aggregate. In 2005, 20 Nashville Area I/T/Us submitted audit data, however due to an operational error only 17 were included in the aggregate. In 2004, 18 Nashville Area I/T/Us submitted data and all were included in the aggregate. In 2003, 16 Nashville Area I/T/Us submitted data and all were included in the aggregate. See Appendix A for a list of participating I/T/Us by year.

Prior to 2007, the IHS DDTP returned aggregated Diabetes Audit data results to the Area Diabetes Consultant. In 2007 the IHS DDTP also provided the Nashville Area Diabetes Consultant a Statistical Analysis Software (SAS) patient level dataset, which allows co-morbidity analyses, determinations of

statistically significant differences, and yearly comparisons between a particular I/T/U and the aggregate of the other participating Nashville Area I/T/Us. For the aggregate report comparisons are made between the aggregate of 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. For the I/T/U specific report the aggregate of the other Nashville Area I/T/Us' audit data is represented as a series of dashes that coincide with the bars on each of the bar graphs.

For a particular Diabetes Audit chart, with regards to the chart variable being presented, records with missing data for the chart variable were excluded from the analysis and thus not included in the denominator used to generate the results presented in a particular chart (see Findings Section Table 2 - Missing Diabetes Audit Variable Value Percentages). The method of excluding records with missing values from the denominator differs from the IHS DDTP's current method whereby such records are included in the denominator when generating the Diabetes Audit figures presented in annual IHS Area Diabetes Audit analysis comparison reports distributed to the IHS Area Diabetes Consultants. These methodological differences may impact the comparability of the Nashville Area Diabetes Report audit findings to the DDTP provided IHS wide audit analyses figures. To compare the 2006 Nashville Area Diabetes Report audit figures to IHS wide audit figures, Appendix C provides a modified version of the 2006 IHS wide audit analysis calculations in which records with missing values have been removed from the denominator.

SAS computer programs are written to create the Diabetes Audit charts. Part of the analysis process is weighting the Nashville Area aggregate level data according to the size of the diabetic population attending each I/T/U, and the number of records sampled. If all I/T/Us participating in the Diabetes Audit audited 100% of their patients with diabetes, no weighting would be necessary. Because some I/T/Us audit a random sample or fraction of their patients with diabetes, a weighting procedure must be applied to calculate accurate estimates of audit statistics at the Area level. When an estimate is calculated from a random sample, instead of an entire population, we must account for the fact that each person audited actually represents more than one person in the population, depending on how many people are audited vs. how many people have diabetes - otherwise the results may not be an accurate representation of the population from which the sample was selected. Accordingly, all Nashville Area and IHS wide Diabetes Audit aggregate results are adjusted, but I/T/U specific Diabetes Audit results are not adjusted.

Three different statistical tests are applied on Diabetes Audit chart data. For each test a p-value threshold of less than 5% are used to determine if an observed difference is believed true or due to chance. A summary of data used to create each chart, perform the statistical significance tests, and the results of the test are provided in Appendix D. 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 the possible values for a particular Charting Variable change from year to year. If the test is statistically significant (p-value < 0.05), one can conclude that at least two of the years have different distributions. The results of this test is provided in Appendix D.
- Trend across years: This test examines whether there is a correlation between Year and the values of the Charting Variable. If the test is statistically significant (p-value < 0.05), then one can conclude that a correlation exists. When the Charting Variable has only 2 or 3 categories, it is often easy to see how the trend manifests itself over the years. If the Charting Variable has many categories, it is usually more difficult to see. The results of this test are provided both as a footnote to the charts as well as in Appendix D. NOTE: This test is only valid when the Charting Variable value possibilities are numeric (binary, ordinal, or interval). If one of the values of the Charting Variable corresponds to "Refused", or "Unknown", or another categorical concept, then this test

cannot be used. In some I/T/Us, there may be no occurrences of "Refused", and the other values for the Charting Variable are truly numeric. In this case, the test can be used. However, for the same Charting Variable, in a different I/T/U, there may be occurrences of "Refused", in which case the test is invalid, even though it is reported.

- Difference between I/T/U and aggregate of other I/T/Us: For 2006 only, this test compares the distribution in the I/T/U with the distribution in all the other I/T/Us collectively. If an I/T/U did not have 2006 data in the Diabetes Audit SAS dataset then this test was not run. For those I/T/Us that data was available to run this test, if the test is statistically significant (p -value < 0.05), then one can conclude that a difference exists. When data was available the results of this test is provided both as a footnote to the charts as well as in Appendix D. NOTE: This test is only applied on the I/T/U specific report charts, not on the Nashville Area report charts.

Limitations of the Nashville Area Diabetes Audit analysis include:

- The audit process reviews only individuals on the active diabetes registry. These are defined as persons with diabetes who regularly attend the I/T/Us clinics or diabetes clinics, including having at least one primary care I/T/U visit within 12 months preceding a report period's end. 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.
- Audit sample size impacts how well Diabetes Audit analysis results represent the health status of persons on the diabetes registries of participating facilities.
- The level of missing data for a particular variable impacts how well the results of a particular analysis represent a particular aspect of diabetic health status and/or diabetes program status.

Methodology for Diabetes Prevalence Charts

To calculate Nashville Area and I/T/U specific 2003-2006 calendar year based diabetes prevalence rates age-adjusted to the US Census 2000 All Race population (Figure 1a), USET analysts either extract data stored in participating I/T/U electronic patient management systems or utilize I/T/U provided age group specific population and diabetes case data. The age-adjusted percentage is an estimate that minimizes the effects of different age distributions and allows comparisons between different populations. It represents what the crude percentage would have been in the population if that population had the same age distribution as a standard population, in this case the US Census 2000 population. The overall non-adjusted (crude) rates are provided in the narrative. Crude age specific diabetes prevalence rates are shown in Figure 1b, which is provided in the aggregate report and available upon request for each of the I/T/U specific reports. Crude prevalence of ischemic heart disease (IHD) among persons with diabetes rates are shown in Figure 1c. Appendix A identifies the I/T/Us included in the Nashville Area aggregates by year.

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; it consists of more than 60 software applications and has been developed so that data can be used to evaluate clinical quality as well as public health.⁵ For those Nashville Area I/T/Us that use RPMS, USET analysts extract age group specific population and diabetes case data using the RPMS Q-MAN data query application.

The Q-MAN generated User Population denominator definition used to calculate the AI/AN diabetes prevalence rates is as follows:

- User Population is based on calendar year

- 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 the three years prior to the last day of the report year, and,
- All demo or "dummy" patients are excluded.

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

- An individual had to be a member of the Q-MAN generated User Population denominator.
- An individual had to have at least one diagnosis of ICD-9 codes⁶ 250.00-250.93 before or during the report period.

The Q-MAN generated User Population denominator definition used to calculate the prevalence of IHD among AI/ANs with diabetes is as follows:

- An individual had to be a member of the Q-MAN generated User Population denominator.
- An individual had to have at least one diagnosis of ICD-9 codes⁶ 250.00-250.93 before or during the report period.

The Q-MAN generated numerator definition used to calculate the crude prevalence of IHD among AI/ANs with diabetes is as follows

- An individual had to be a member of the Q-MAN generated User Population denominator made up of individuals who had at least one diagnosis of ICD-9 codes⁶ 250.00-250.93 before or during the report period.
- An individual had to have at least one diagnosis of ICD-9 codes⁶ 410.0-414.9, 428.0-428.9, or 429.2 before or during the report period.

The IHS DDTP provided IHS wide age adjusted diabetes prevalence rates for 2003 to 2005 that are based on a slightly different methodology than the USET method. The IHS DDTP rates are based on a fiscal year, not calendar year. The IHS DDTP rates use different age groups (i.e. instead of separating 0-8 year age group from the 9-14 year age group, these groups are combined).

For non-AI/AN population diabetes prevalence comparisons, CDC National Diabetes Surveillance System All Races US and state population age adjusted diabetes prevalence rates are used. Limitations of these data are that they are self-reported and use different age groups than the Q-MAN generated User Population method. The US All Races calculations are based on data collected on all ages (but grouped differently) 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

The prevalence of IHD among persons with diabetes is based on all ages and is not age-adjusted. For comparison purposes, an age-adjusted 2003 All Races US rate¹⁴ from the CDC National Diabetes Surveillance System is used. Limitations include: comparison data are age adjusted, self reported, are among persons with diabetes aged 35 years and older, and calculated for only one year.

For the prevalence of IHD among persons with diabetes rate comparisons, an age-adjusted 2003 All Races US rate⁹ from the CDC National Diabetes Surveillance System is used. Limitations include:

comparison data are age adjusted, self-reported (Cardiovascular Disease -- heart disease, angina or heart attack), are among persons with diabetes aged 35 years and older, and calculated for only one year.

There are multiple limitations with the diabetes prevalence rates presented in this report:

- One of the criteria for inclusion in the Q-MAN generated denominators is that the patient must reside within the CHSDA. The patient management systems (RPMS and commercial products) record and store new residence information over previous residence information. The denominators are created retrospectively. 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 in or excluded from the denominators.
- The patient management system data are always changing because new information is constantly being added, edited, and deleted. Therefore the dataset may change slightly with each subsequent extraction.
- Because the diabetes prevalence findings are based primarily on the patient population utilizing the I/T/U, 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 associated with health care provided to patients at or outside of an I/T/U which has not been entered into the patient management system will not be 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 prevalence and occurrence of IHD among persons with diabetes rates are based on a different logic than the calculations used to produce the Nashville Area aggregate and I/T/U specific rates. Therefore caution is warranted when comparing the Nashville Area and I/T/U specific rates to the US and State All Races rates.

FINDINGS

Diabetes Prevalence

Figure 1a

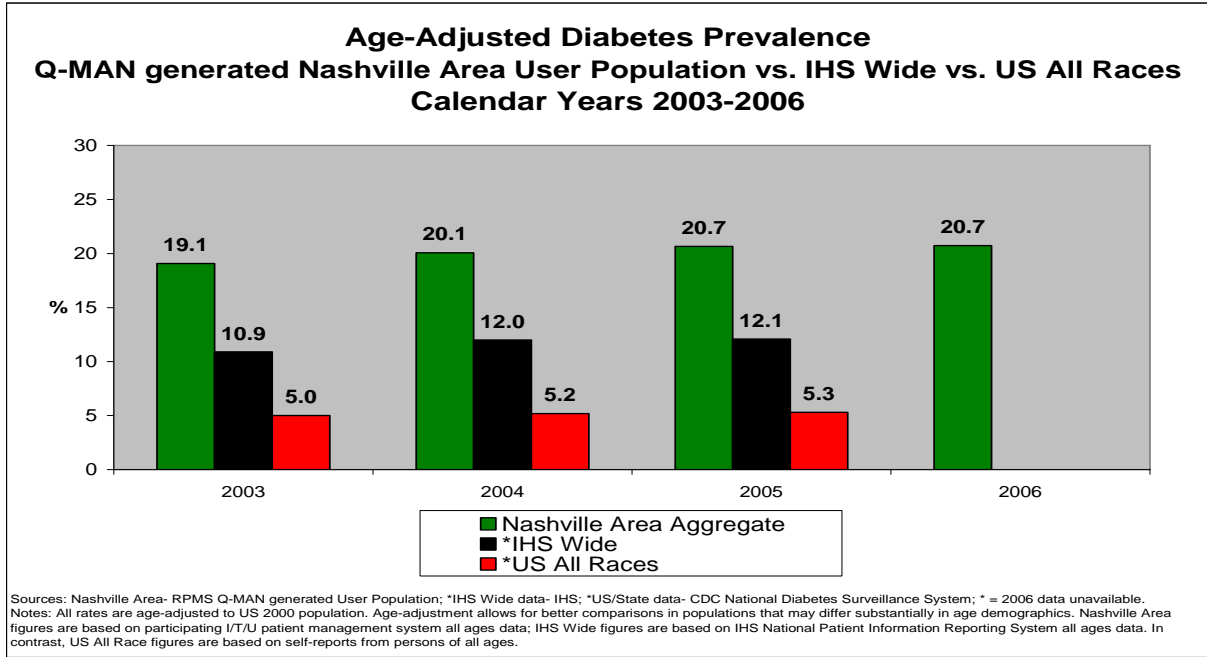
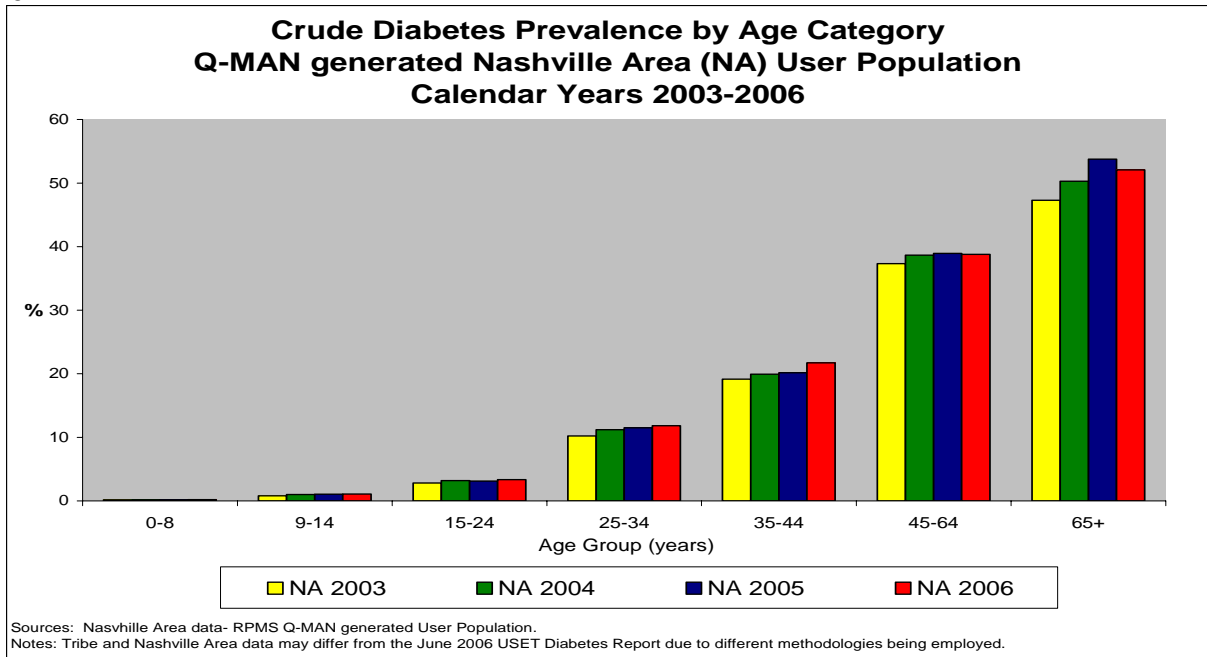


Figure 1b



Diabetes prevalence was calculated based on data collected on 23 Nashville Area tribes (see Appendix B) following the Q-MAN generated User Population definition (see Methodology Section). The age-adjusted prevalence rate is an estimate that minimizes the effects of different age distributions and allows comparisons between different populations. It represents what the crude (non-age adjusted) percentage would have been in the population if that population had the same age distribution as a standard population. For this report we use the US Census 2000 All Races population as the standard population.

Figure 1a shows that the Nashville Area AI/AN age-adjusted (US Census 2000 population) diabetes prevalence increased slightly since 2003, rising from 19.1% in 2003 to 20.7% in 2006. Age-adjusted diabetes prevalence rates calculated for the I/T/U specific levels showed a wide variance; for example, in 2006 ranging from a high of 32.8% to a low of 7.3%. For the three years (2003-2005) that IHS Wide and US All Race⁷ age-adjusted rates were available for comparison, the Nashville Area AI/AN age-adjusted diabetes prevalence rates on average were approximately two times greater than the IHS Wide rates and four times greater than the US All Races rates. Having an age-adjusted diabetes prevalence rate that is approximately two times greater than the IHS wide rate and 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); and for 2006, 15.5% (7,416/47,839). Figure 1b shows crude Nashville Area AI/AN diabetes prevalence rates by age group; in 2006, 0.2% of persons less than 9 years, 1.1% of persons age 9-14 years, 3.3% of persons age 15-24 years, 11.8% of persons age 25-34 years, 21.7% of persons age 35-44 years, 38.8% of persons age 45-64 years, and 52.1% of persons age 65 years and older had diabetes.

Figure 1c

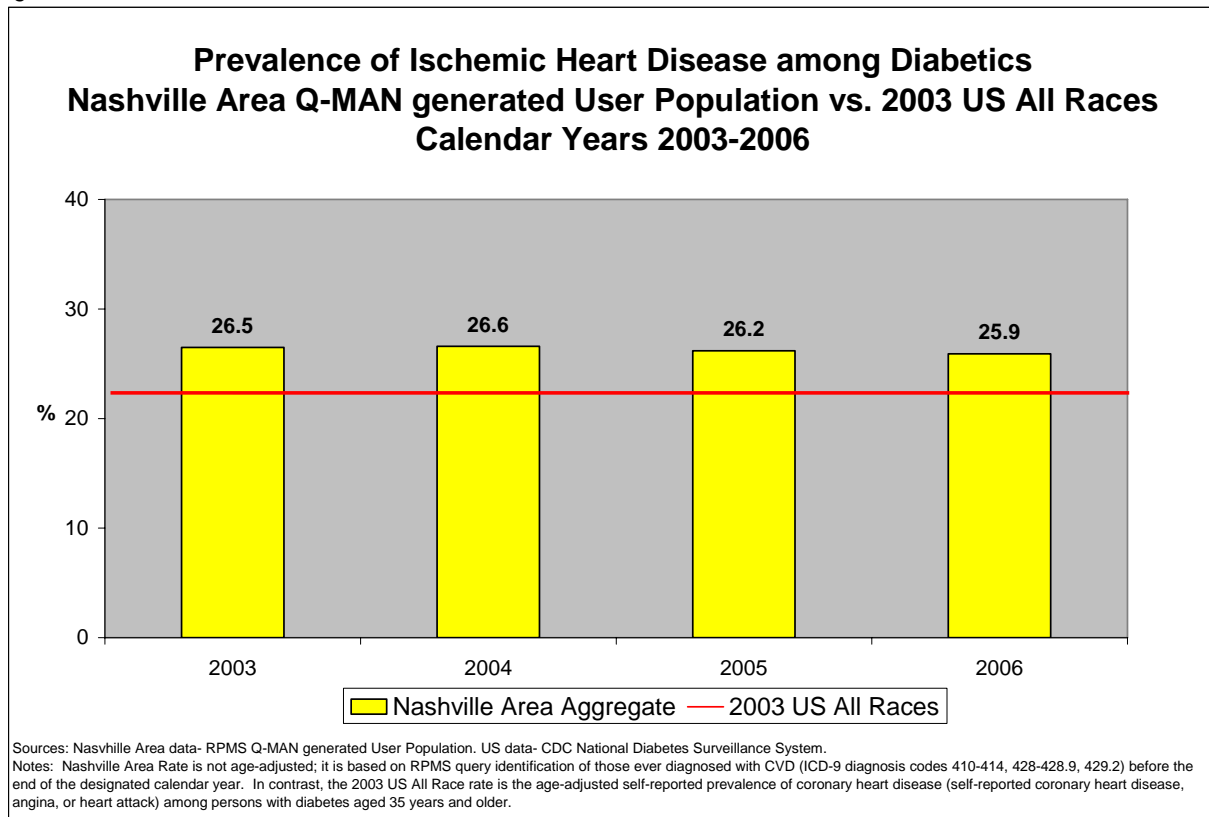


Figure 1c shows that the Nashville Area crude (actual) prevalence of ischemic heart disease (IHD) among persons with diabetes has remained approximately constant since 2003, from 26.5% in 2003 to 25.9% in 2006. Since 2003, on average the Nashville Area's prevalence of IHD among persons with diabetes has been approximately 1.2 times greater than the 2003 All Races US rate⁹. Prevalence of IHD among persons with diabetes rates calculated for the 21 Tribes included in the Nashville Area aggregate rate showed a wide range; for example, in 2006 with a high of 49.4% for one I/T/U and a low of 13.9% for another I/T/U. IHD is a serious complication of diabetes and will more than likely continue to rise considering the high prevalence of diabetes.⁹ Tobacco cessation, a healthy weight, and regular exercise can all reduce the risk of IHD complications among patients with diabetes.

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 IHS Diabetes Care and Outcome Audit (hereinafter referred to as Diabetes Audit) data.⁵ Data are generated from audits performed on the records of selected patients in the diabetes registries of participating Nashville Area I/T/Us from 2003 to 2006. The Diabetes Audit (electronic or manual) captures data for each patient record audited on numerous health variables consistent with standards of diabetes care and health status for diabetes patients (see Methodology for more details).

Audit Sample Size

Table 1 below provides a comparison of the Nashville Area Diabetes Audit sample size to the IHS wide sample.

Table 1. Comparison of Diabetes Audit Sample Sizes

Audit Level	2003			2004			2005			2006		
	Registy Total	Sample Size	%	Registy Total	Sample Size	%	Registy Total	Sample Size	%	Registy Total	Sample Size	%
Nashville Area	4590	1042	22.7	5358	1765	32.9	5232	2153	41.2	5148	2676	52.0
IHS wide	110,305	30,192	27.4	117,225	33,769	28.8	115,710	40,627	35.1	122,885	48,524	39.5

For 2006, the Nashville Area Diabetes Audit sample was 1.3 times larger than the IHS wide audit. Sample size impacts how well Diabetes Audit analysis results represent the health status of persons on the diabetes registries of participating facilities.

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. Table 2 below shows the amount of missing data for a particular variable by year. 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 diabetes program status that is being analyzed.

Table 2: Missing Diabetes Audit Variable Value Percentages

	Percent Missing			
	2003	2004	2005	2006
Variable				
Sex	0.0%	0.0%	0.0%	0.0%
Age Category	0.1%	0.0%	0.0%	0.0%
Duration of DM Category (10 Year)	3.5%	7.0%	17.4%	16.7%
BMI Category	6.7%	3.1%	2.4%	4.0%
HbA1c	9.3%	14.8%	16.2%	13.9%
Blood Pressure Category	9.8%	16.3%	18.2%	13.5%
Tobacco Use	14.9%	19.0%	11.3%	47.6%
Tobacco Cessation Counseling	77.4%	75.8%	78.8%	69.9%
Creatinine Category	18.1%	28.5%	16.6%	16.4%
Cholesterol Category	25.6%	25.7%	41.2%	31.0%
LDL Category	29.2%	27.5%	43.4%	30.2%
HDL Category	27.2%	26.6%	41.7%	31.7%
Triglyceride Category	26.4%	26.6%	41.5%	32.0%
Urinalysis Past Year	1.4%	0.9%	0.7%	0.9%
Proteinuria Present	0.0%	0.0%	0.0%	0.0%
Microalbuminuria Present	0.0%	0.0%	0.0%	0.0%
Hypertension Present & ACE Use	0.0%	0.0%	0.0%	0.0%
Proteinuria/Microalbuminuria Present & ACE Use	0.0%	0.0%	0.0%	0.0%
Chol=>240 & Lipid Agent Use	0.0%	0.0%	0.0%	0.0%
LDL=>160 & Lipid Agent Use	0.0%	0.0%	0.0%	0.0%
Any Diet Education Provided	2.7%	0.2%	0.0%	0.4%
Diet Education by Registered Dietician	2.7%	0.2%	0.0%	0.4%
EKG Done Last 5 Years	0.0%	0.0%	0.0%	0.0%
PPD Positive	2.7%	0.3%	0.0%	1.2%
PPD Positive & Tx Complete	0.0%	0.0%	0.0%	0.0%
PPD Negative & Last PPD After DM Dx	0.0%	0.0%	0.0%	0.0%
TB Status Unknown	0.0%	0.0%	0.0%	0.0%
Foot Exam Past Year	1.3%	0.2%	0.1%	0.4%
Eye Exam Past Year	1.5%	0.1%	1.3%	0.4%

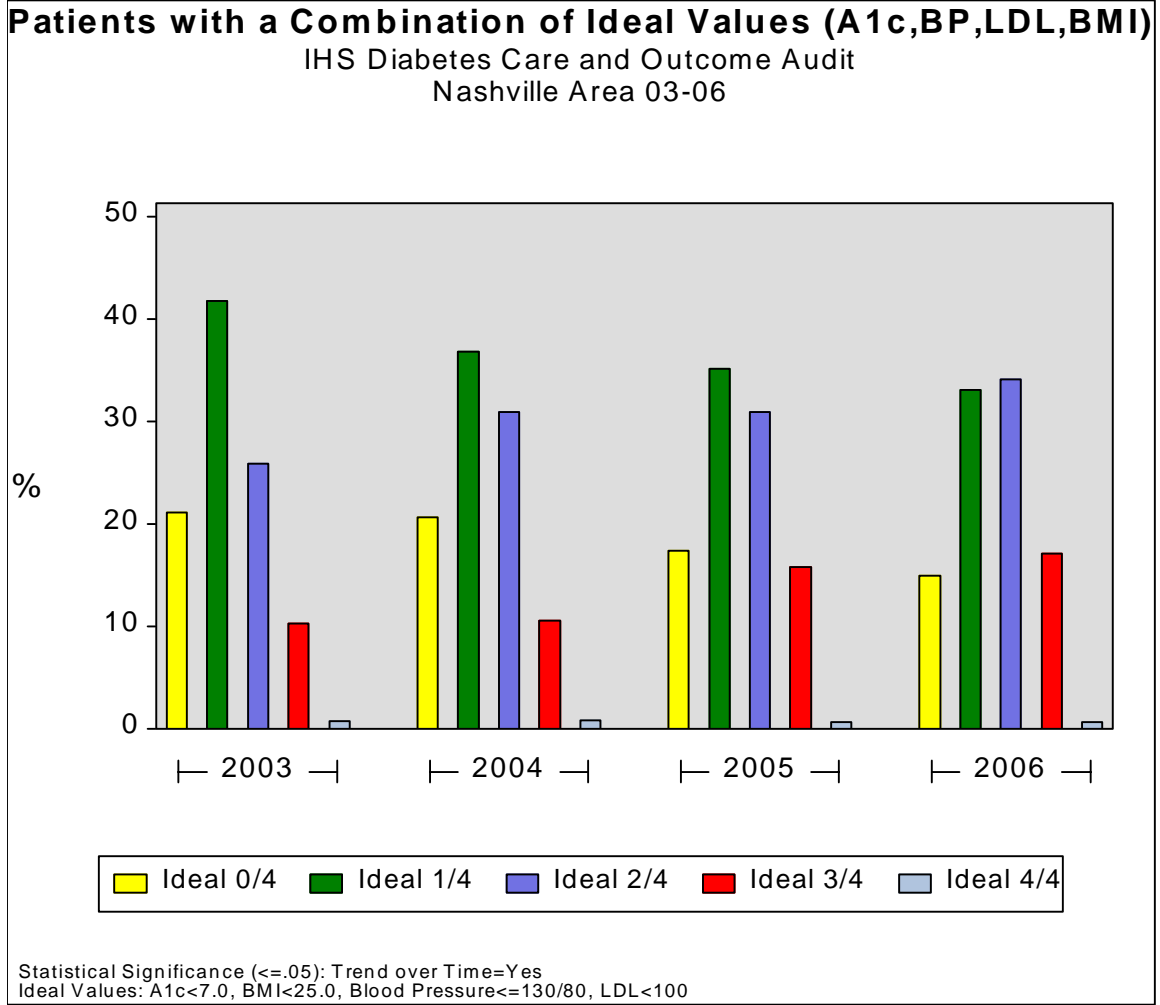
	Percent Missing			
	2003	2004	2005	2006
Dental Exam Past Year	4.1%	0.4%	0.2%	0.7%
Flu Vaccine Past Year	0.8%	0.3%	0.2%	0.5%
Pneumovax Ever	2.0%	0.5%	0.5%	0.6%
TD Past 10 Years	1.7%	0.5%	0.9%	0.6%
Depression Active Diagnosis	0.0%	0.0%	0.2%	0.6%
No Active Depression Dx - Depression Screen	.	.	0.0%	0.0%
Number of Ideal Values (HbA1c, BP, LDL, BMI)	35.9%	37.9%	52.3%	39.2%
GFR Category	18.2%	28.5%	16.6%	16.4%
Treatment Category	3.2%	1.3%	3.4%	1.4%

For 2006 data displayed in Table 2 above, an analysis of missing data levels shows that:

- These variables were missing data for 40% or more of the records: Tobacco Use, Tobacco Cessation Counseling.
- These variables were missing data for 20 to 39% of the records: Cholesterol Screening Results, Low Density Lipid Screening Results, High Density Lipid Screening Results, Triglyceride Screening Results, Number of Ideal Values (HbA1c, BMI, Blood Pressure, LDL).
- These variables were missing data for 10 to 19% of the records: Duration of Diabetes, HbA1c, Blood Pressure, Creatinine, GFR.

Analysis of a Combination of Variables

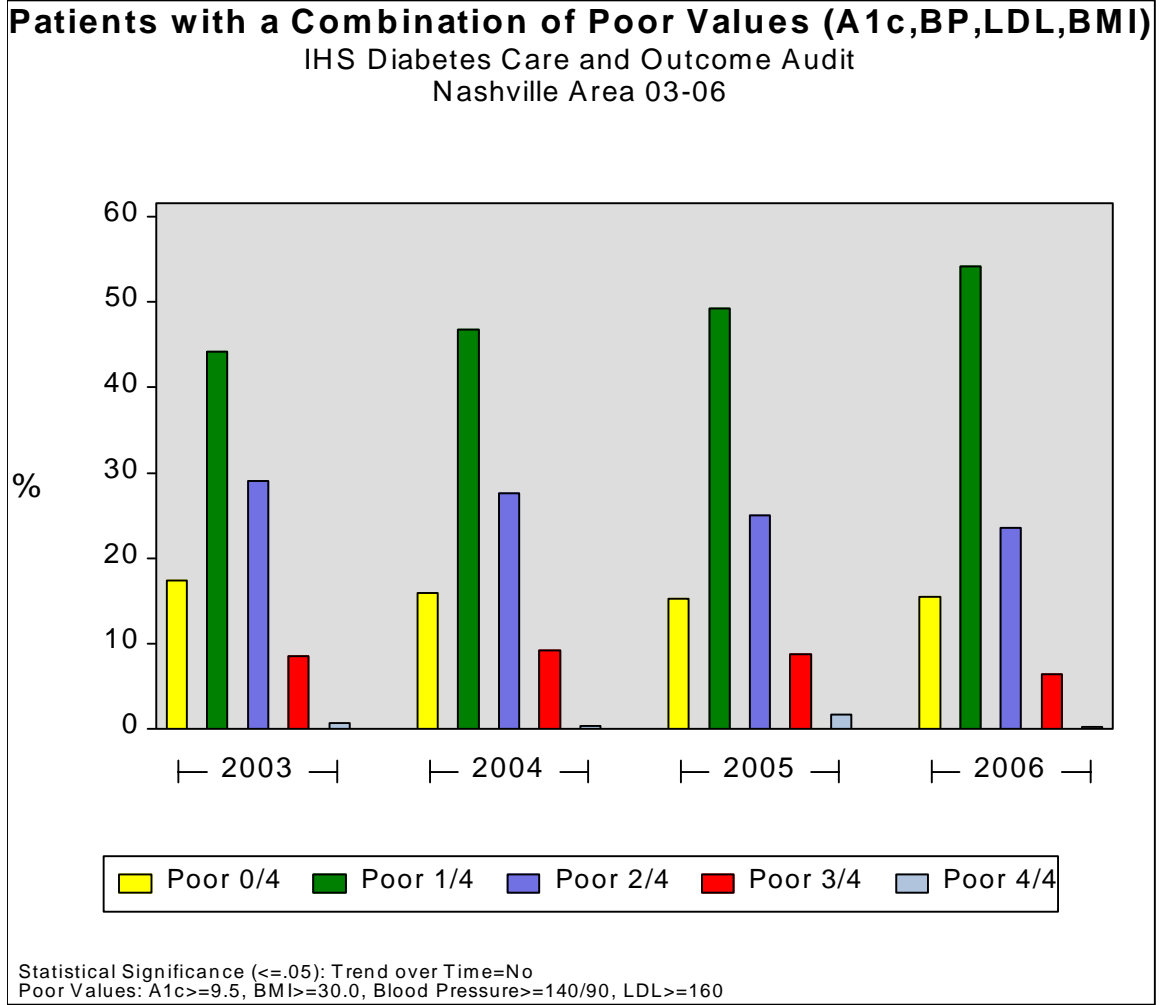
Figure 2



Diabetes audit data reflect a moderate improvement for patients with a combination of ideal values (HbA1c, BMI, Blood Pressure, LDL).

Analysis of a Combination of Poor Variables

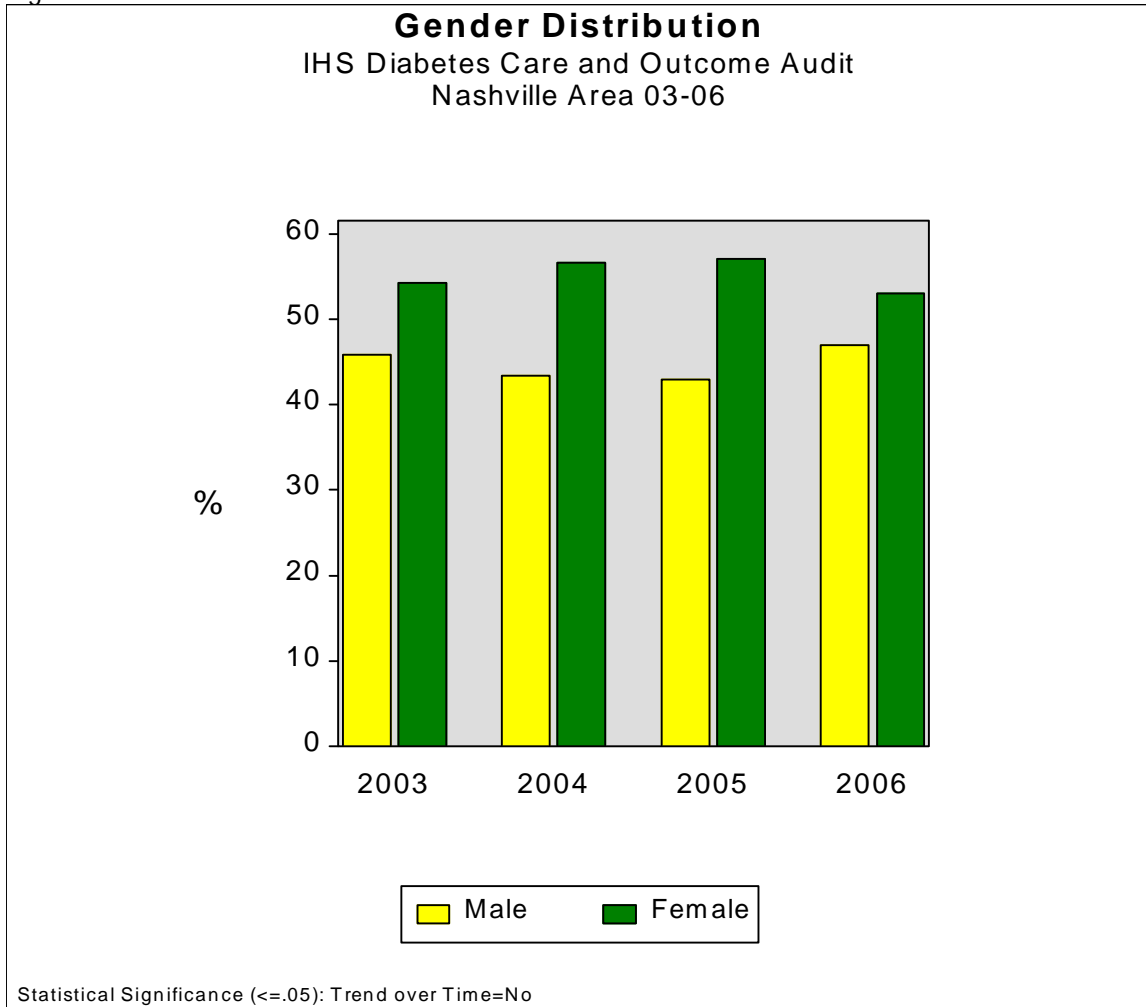
Figure 3



Diabetes audit data reflect a moderate decrease in the percentage of patients with combinations of poor values (HbA1c, BMI, Blood Pressure, LDL).

Gender Distribution

Figure 4

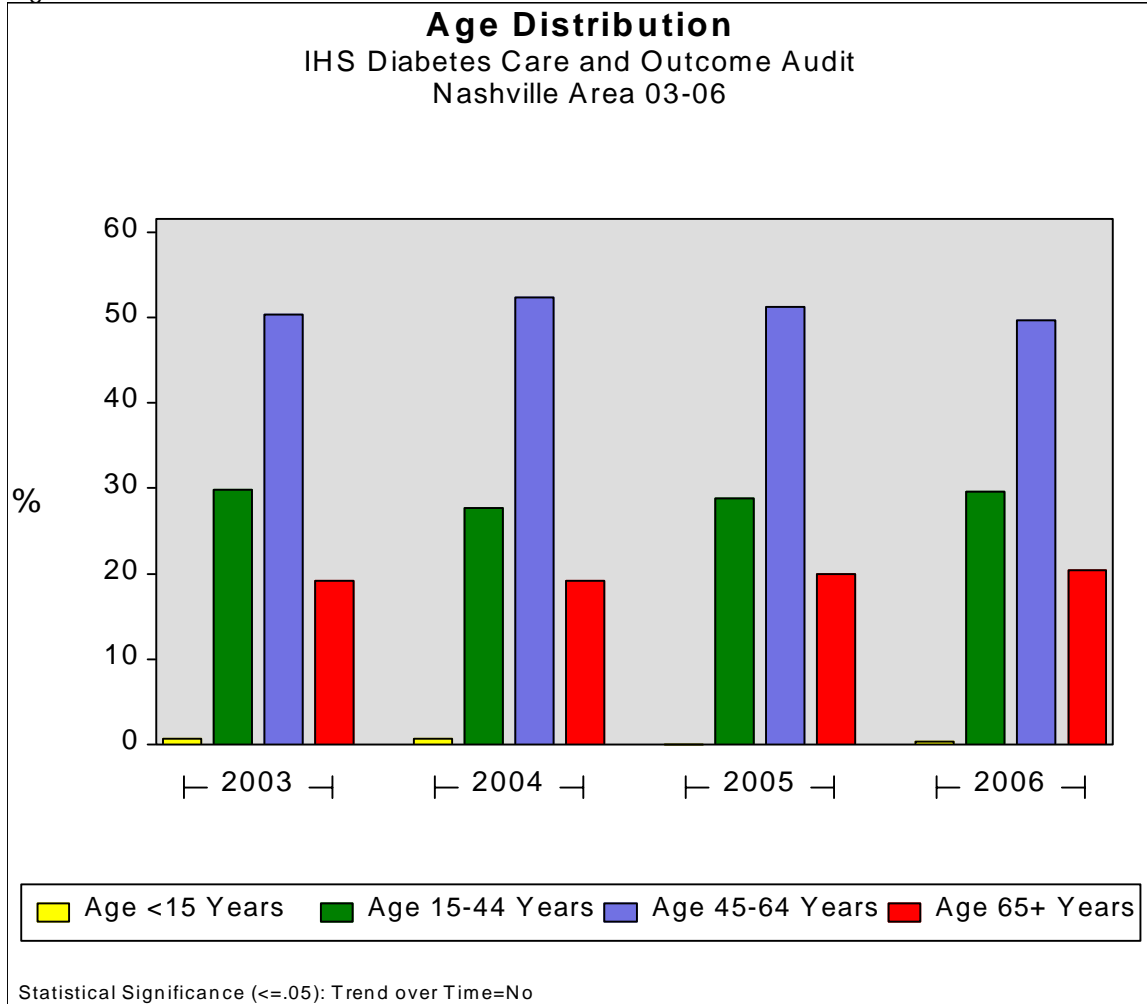


Diabetes audit data reflect a higher percentage of women with diabetes, which mirrors national AI/AN statistics.

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 5

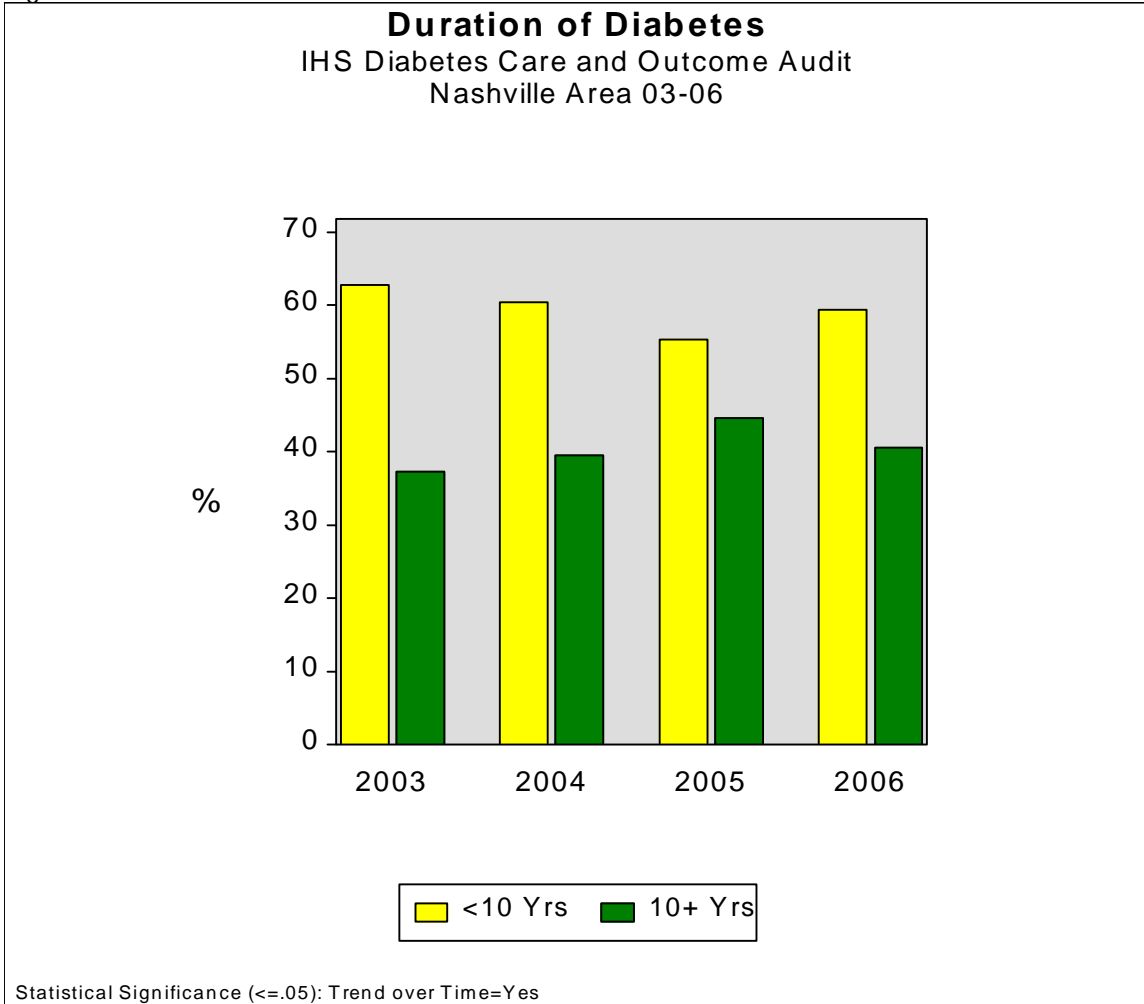


The age distribution indicates that a higher percentage of diabetic individuals fall in the 45-64 year of age group. The Aggregate Nashville Area Diabetes audit data do not reflect a trend that young adults are the fastest growing age group developing type 2 diabetes.

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 recommend care can reduce the risk of diabetes complications.

Figure 6

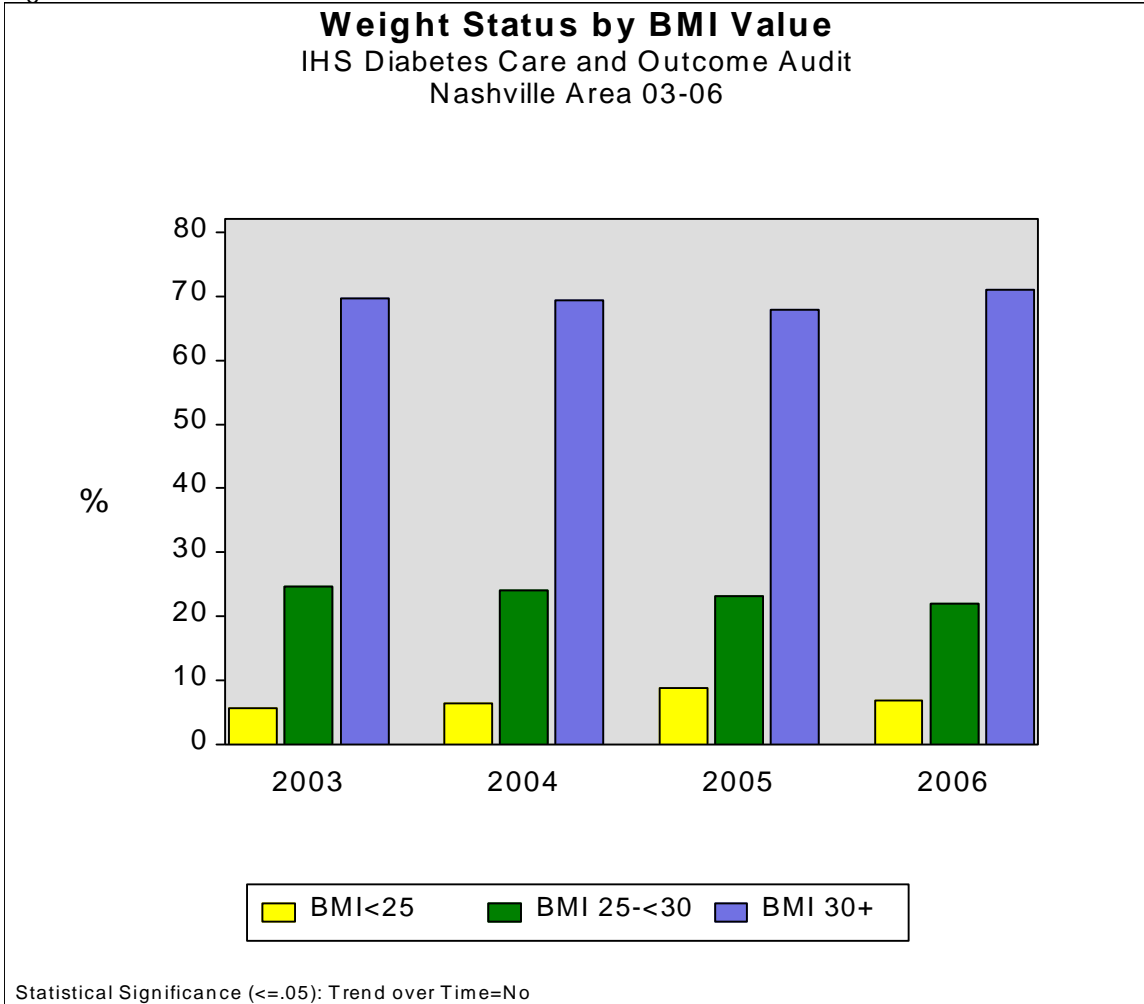


The diabetes audit data reflect that the duration category of 10+ years is growing in the Nashville Area and that the trend over time is statistically significant.

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 7

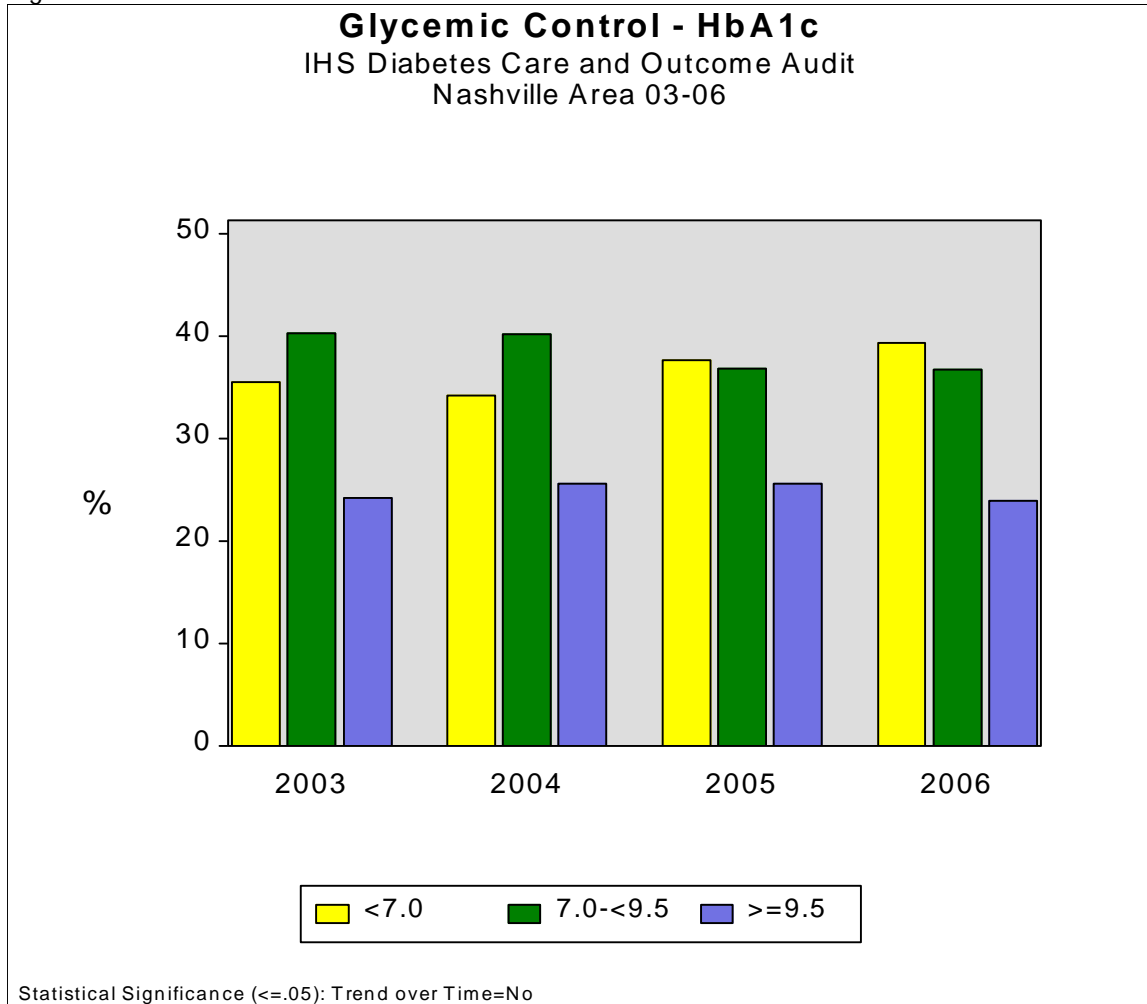


Diabetes audit data reflect few diabetic patients are of normal weight. Being overweight or obese is also a risk factor for hypertension and cardiovascular disease.

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 8

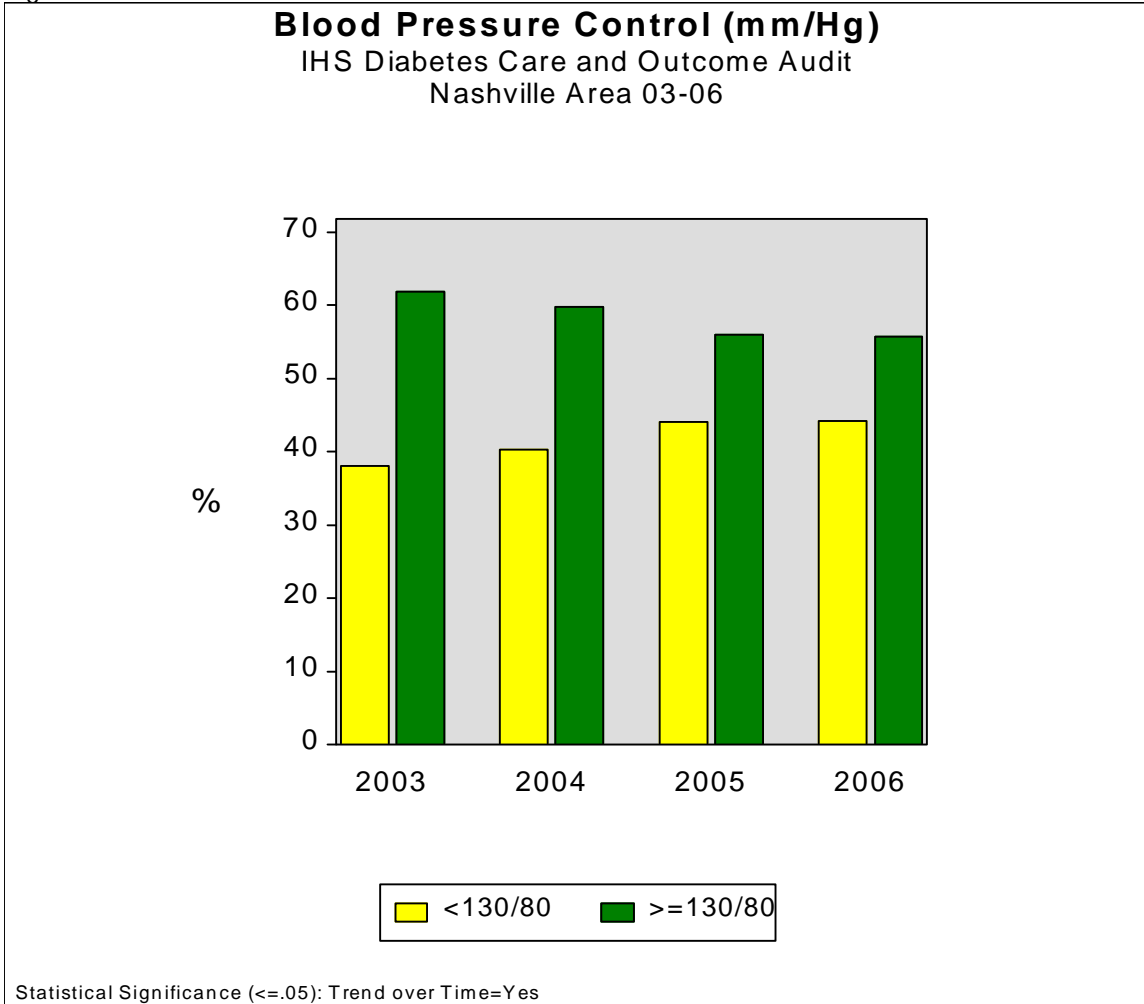


Diabetes audit data reflect no improvement in glycemic control over time and less than 40% of the diabetic patients have A1c values less than 7% (<7.0).

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 9

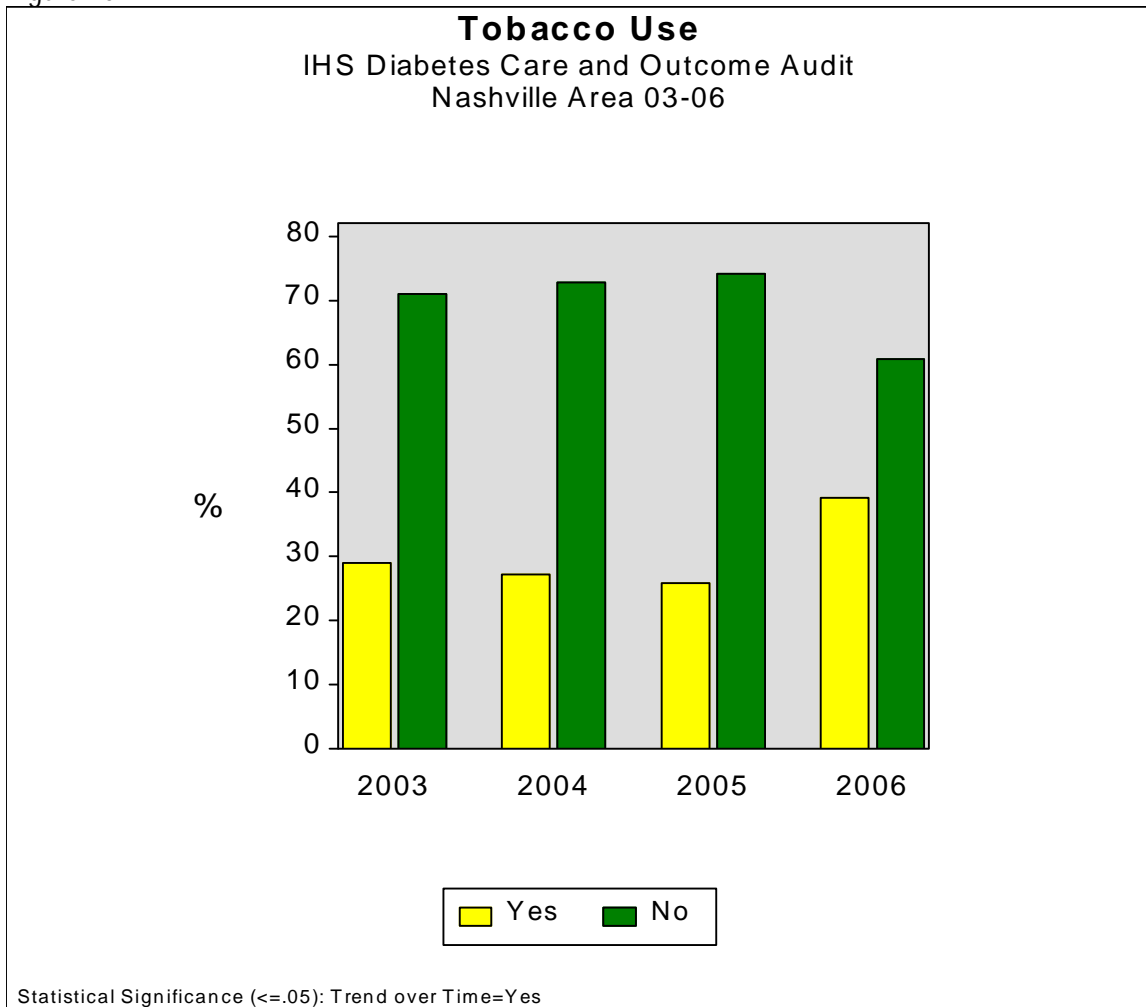


Diabetes audit data reflect a statistically significant improvement in blood pressure control.

Tobacco Use/Counseling

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

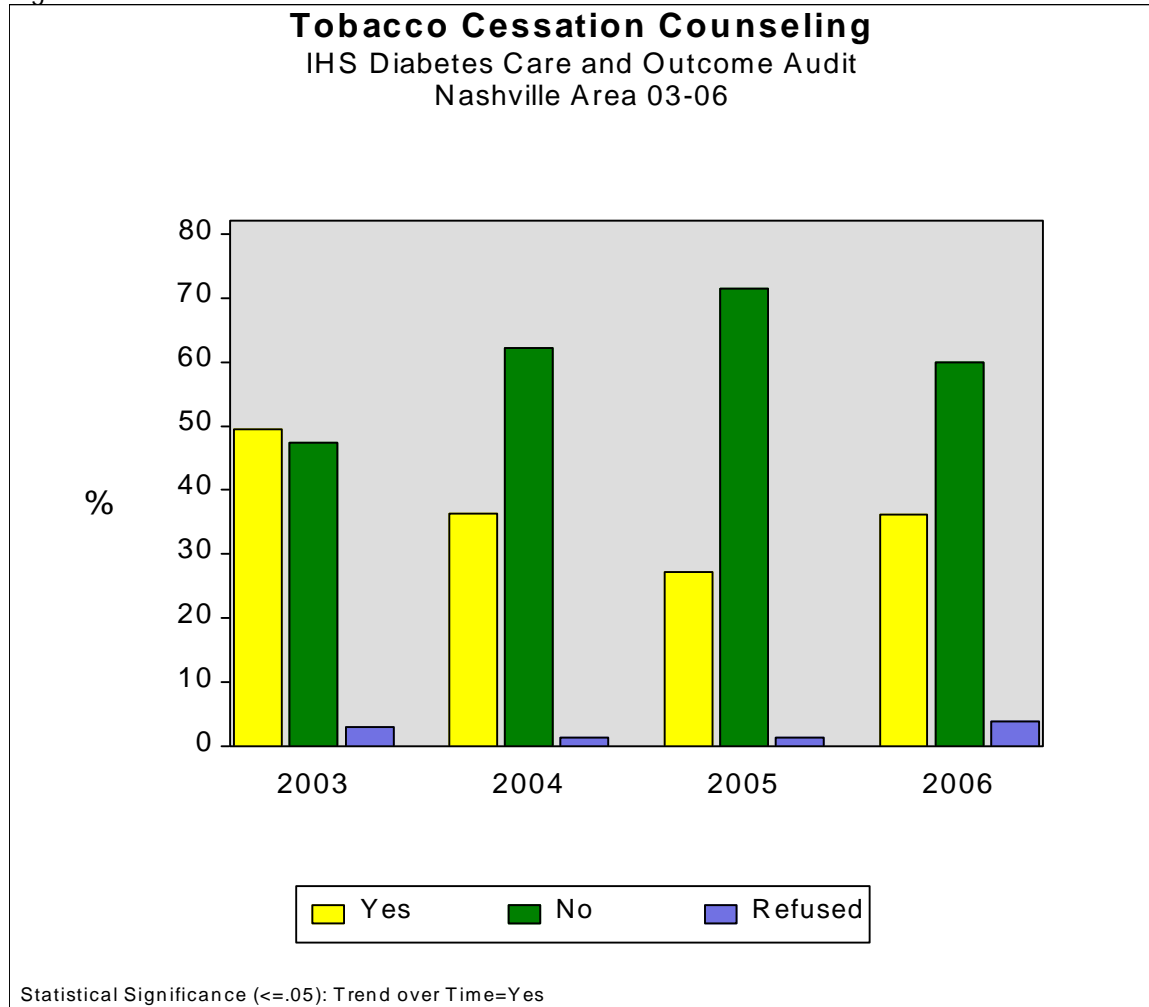
Figure 10



Diabetes audit data reflect a statistically significant increase in tobacco use, however because there is a high level of missing data in 2006, caution is warranted when interpreting this finding.

Tobacco Use-Cessation Counseling

Figure 11

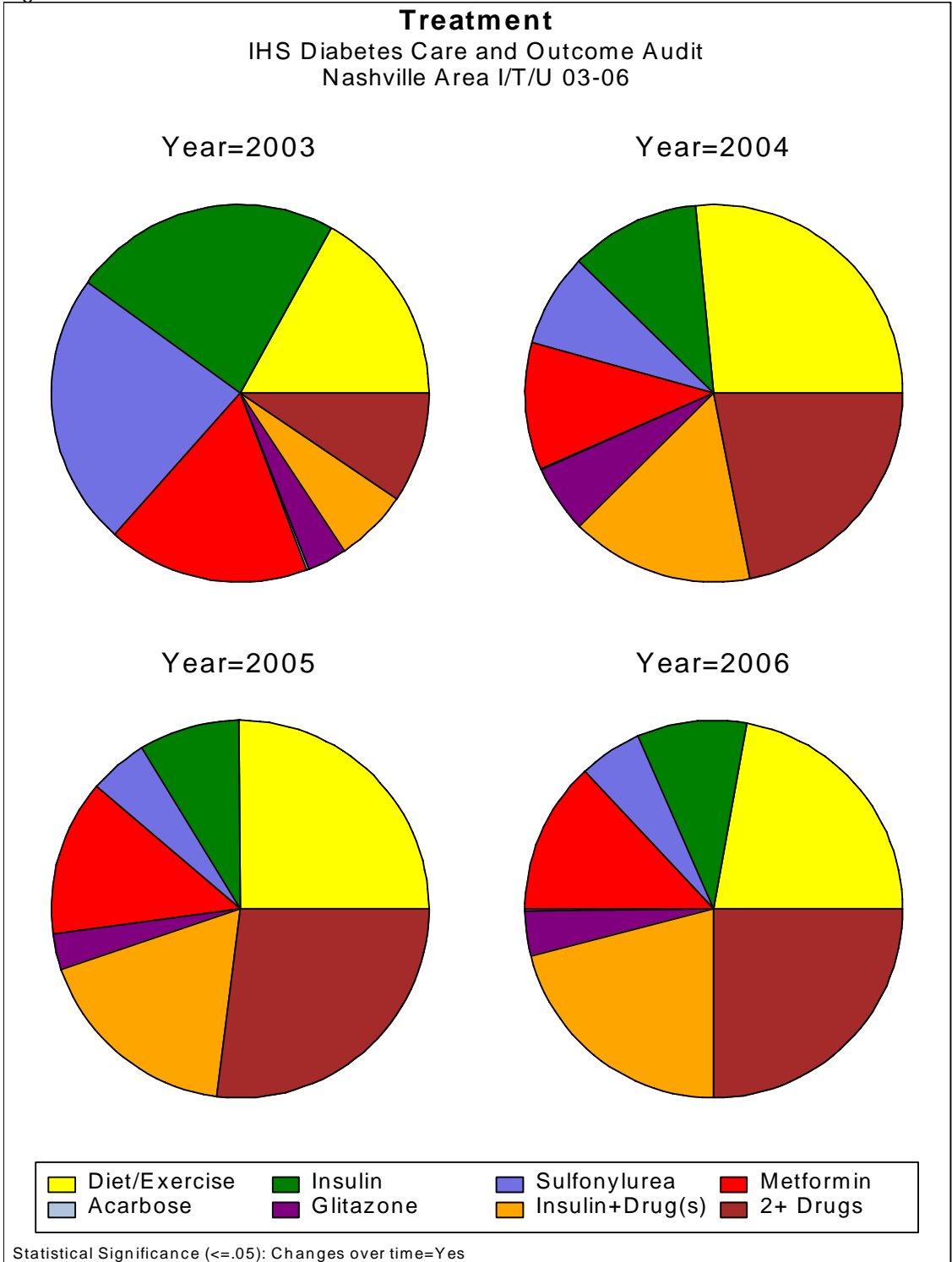


Diabetes audit data reflect an overall decrease over time in the percentage of diabetic patients who use tobacco receiving tobacco counseling; however there was a slight increase between 2005 and 2006. Data issues related to tobacco counseling may be the lack of counseling being offered by clinic staff or lack of documentation of counseling. Because this variable includes non-numeric categorical values, the Trend over Time statistical significance test is not valid

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 12

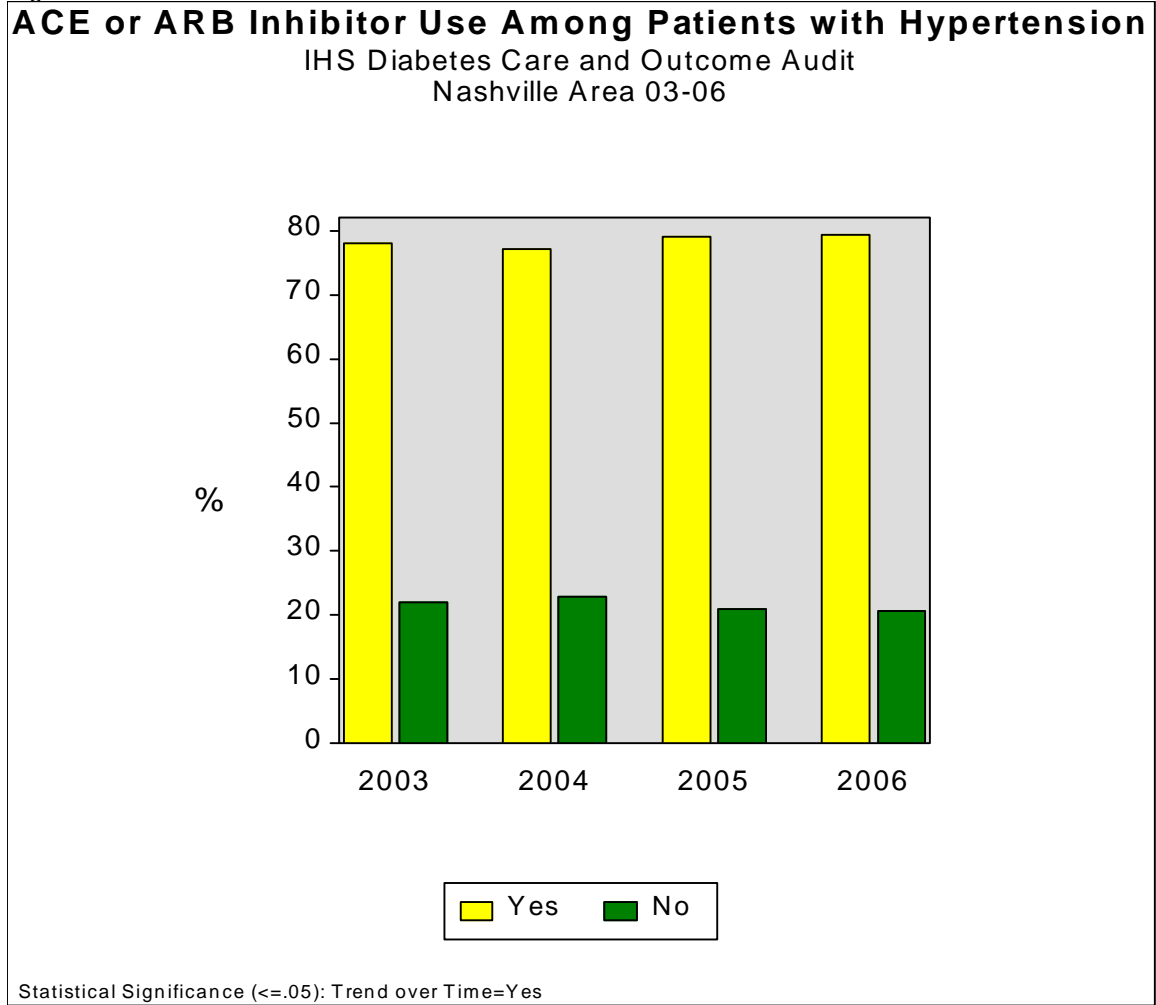


Diabetes audit data reflects a statistically significant increase in drug therapy. Multi-drug therapy should be monitored to determine whether a trend is emerging.

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

A number of medications are used regularly for individuals with diabetes to address other significant health conditions associated with diabetes. 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 13

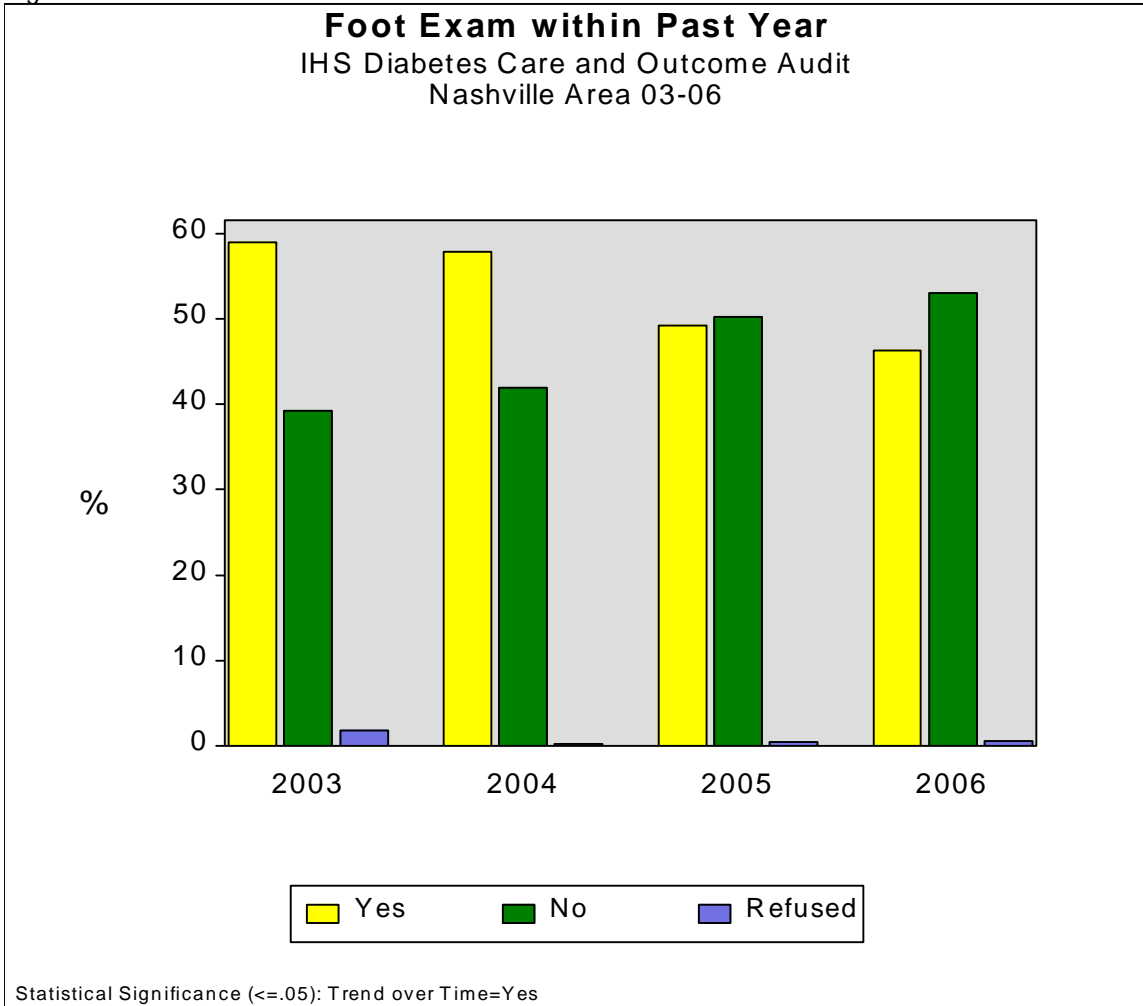


Diabetes audit data reflect a statistically significant high use of ACE or ARB for treating hypertension.

Preventive Care Measures-Foot Exams

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

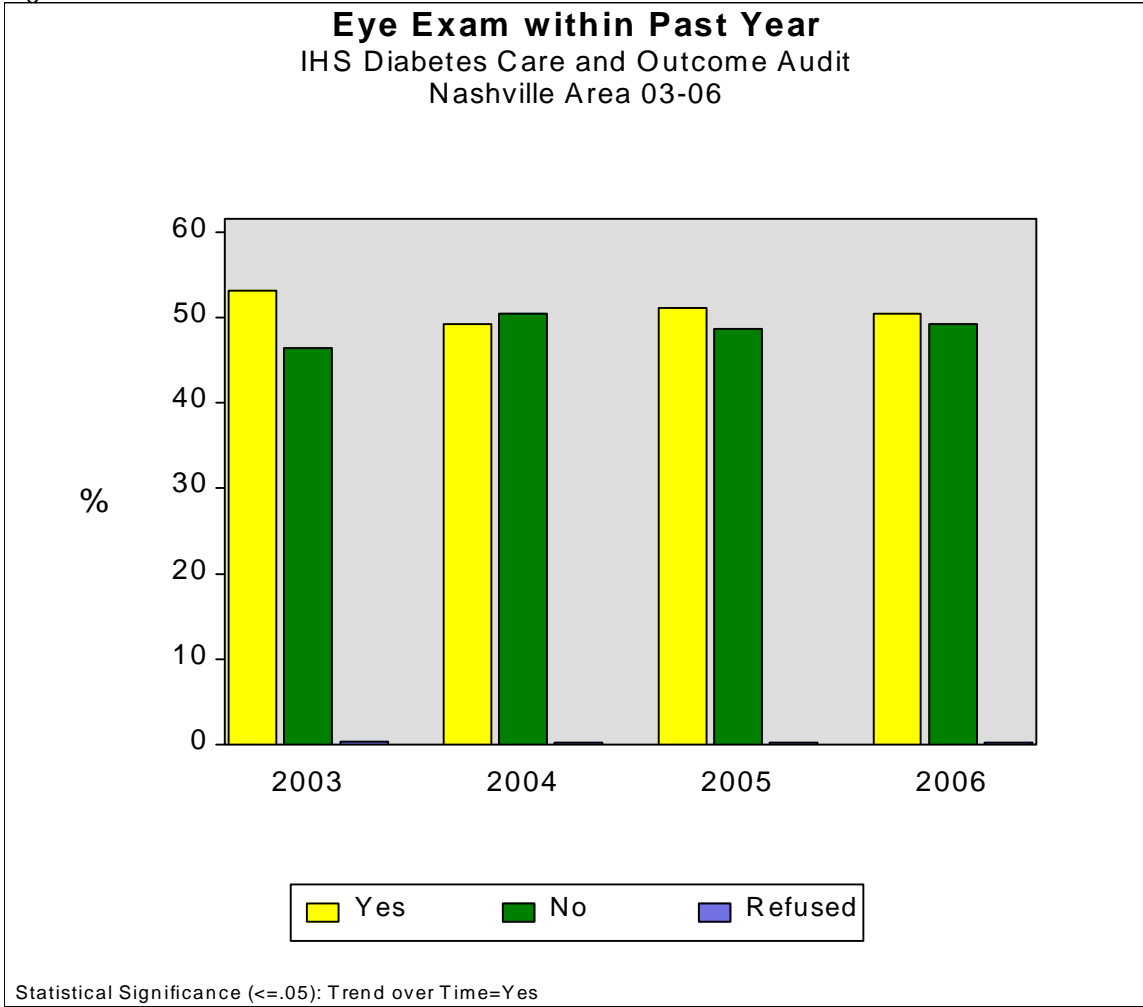
Figure 14



Diabetes audit data reflect a decreased percentage of foot exams. Because this variable includes non-numeric categorical values, the Trend over Time statistical significance test is not valid

Preventive Care Measures-Eye Exam

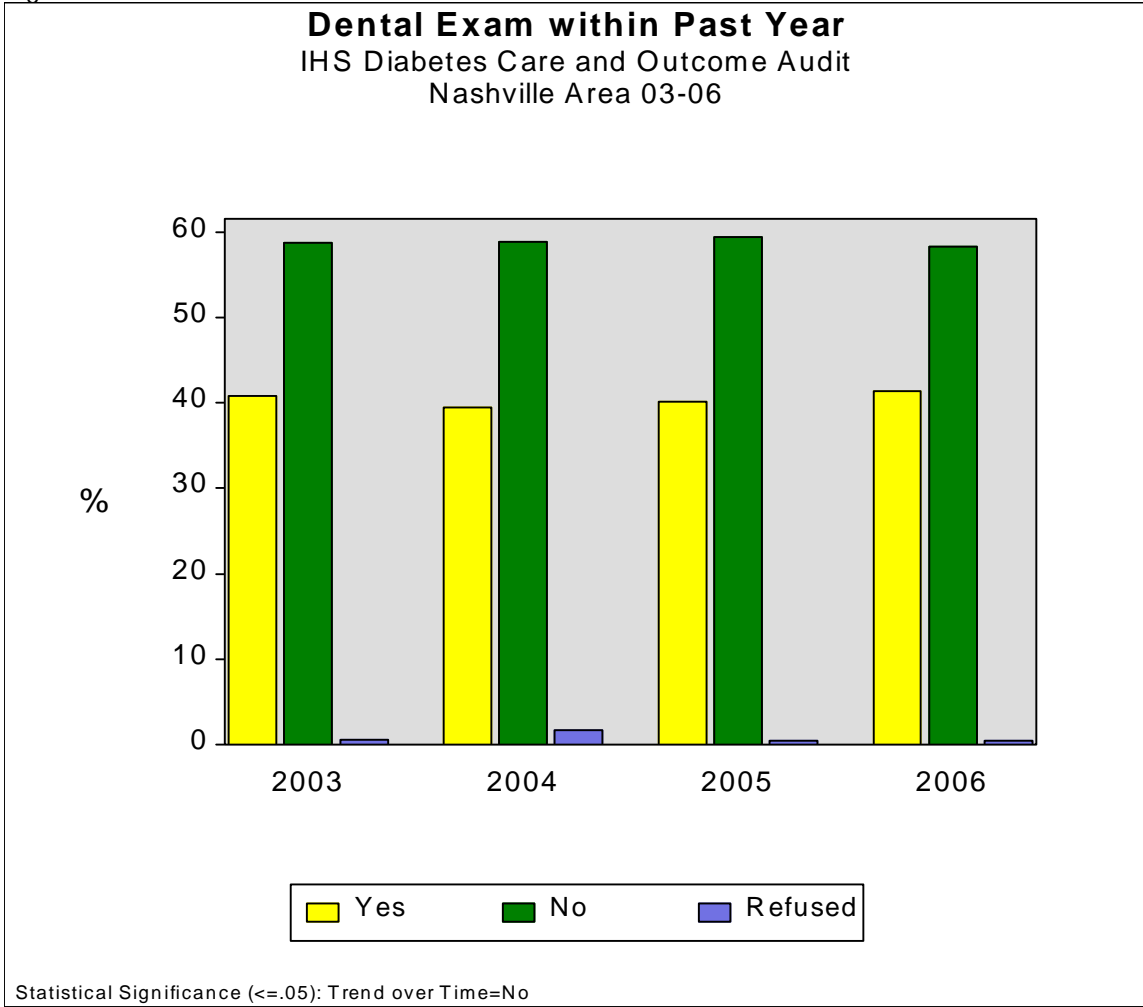
Figure 15



Diabetes audit data reflect the percentage of eye exams for diabetic retinopathy remains about the same. Because this variable includes non-numeric categorical values, the trend over time statistical significance test is not valid

Preventive Care Measures-Dental Exam

Figure 16

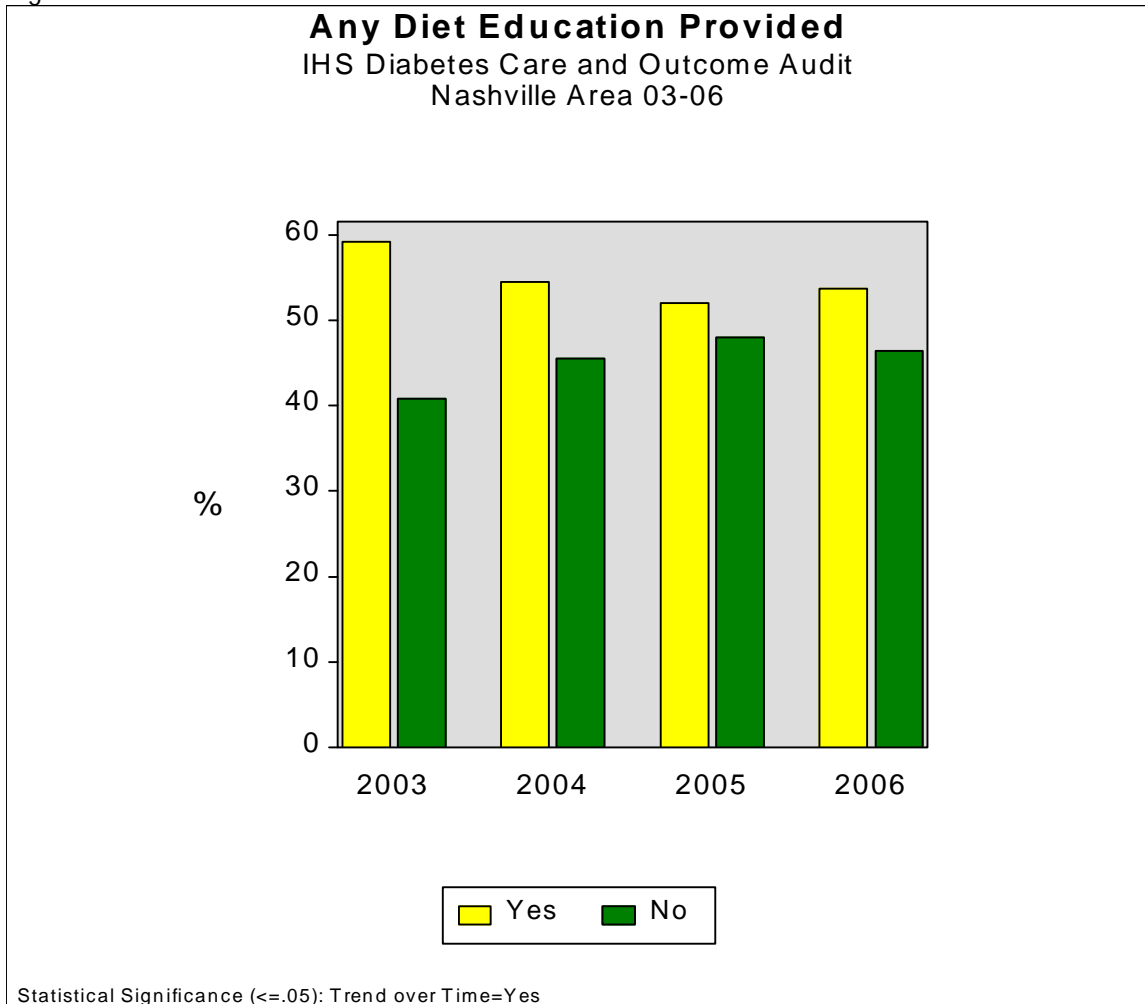


Diabetes audit data reflect the dental access to care has not improved. Because this variable includes non-numeric categorical values, the trend over time statistical significance test is not valid

Education

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

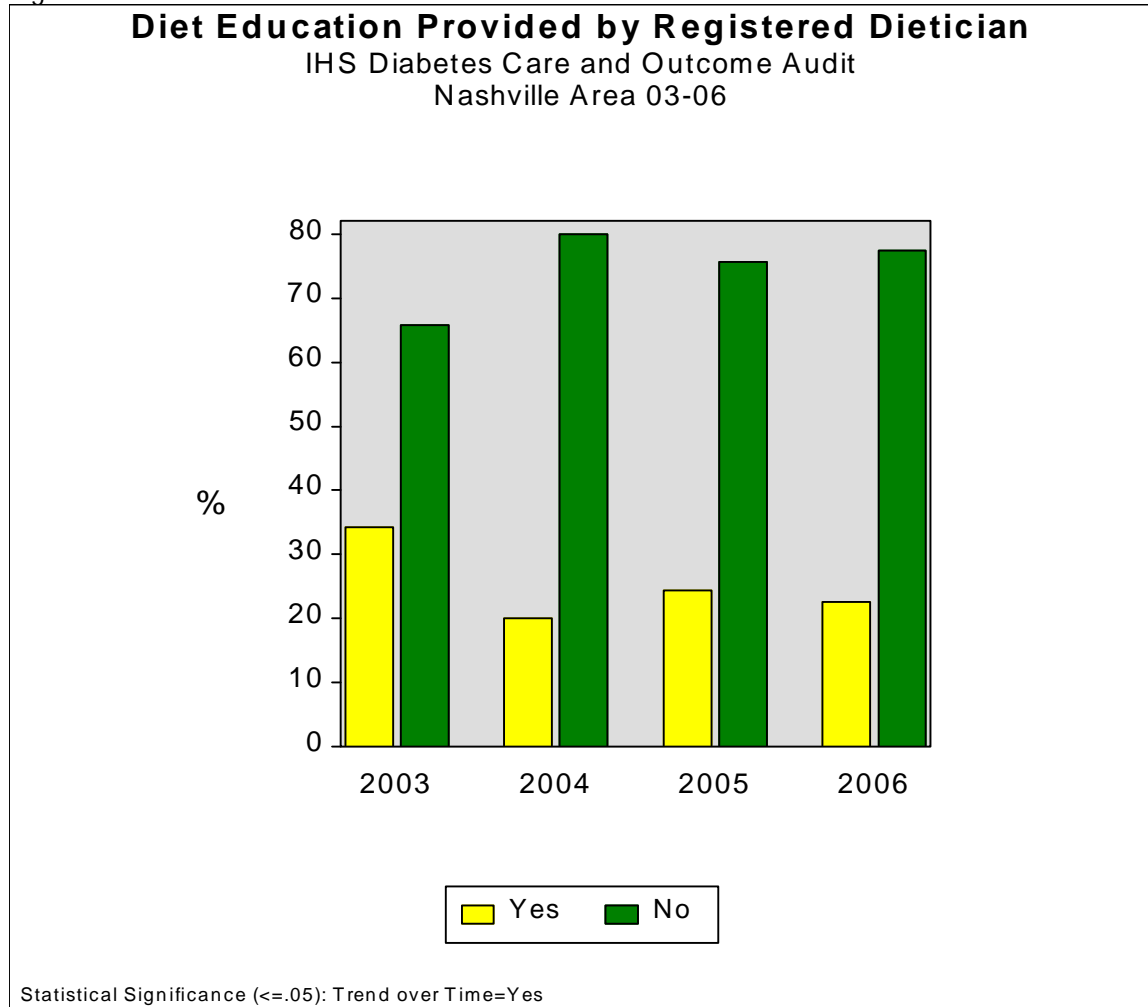
Figure 17



Diabetes audit data reflect a statistically significant decrease in diet education.

Education Provided by Registered Dietician

Figure 18

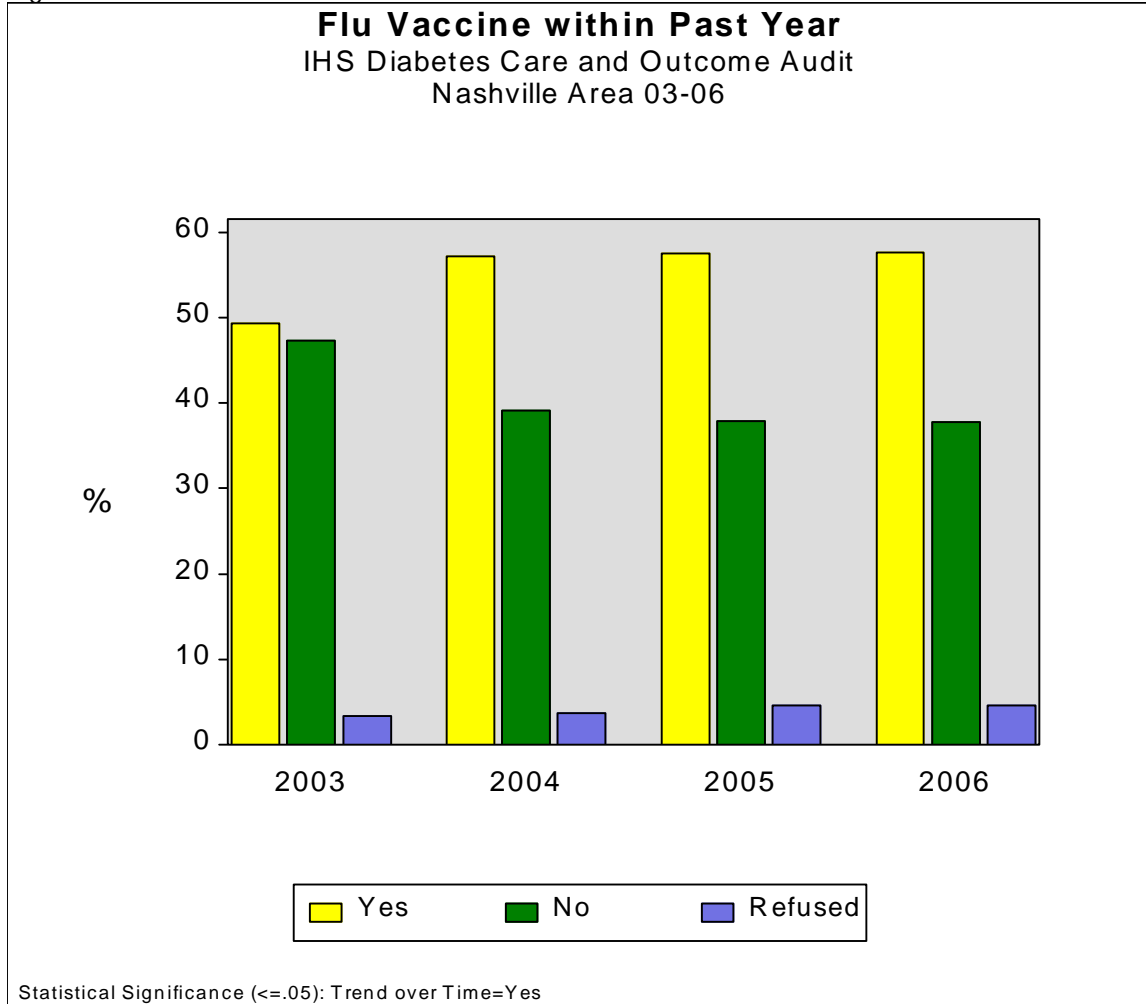


Diabetes audit data reflect a statistically significant decrease in the percentage of diabetic patients receiving diet education by a registered dietitian.

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.

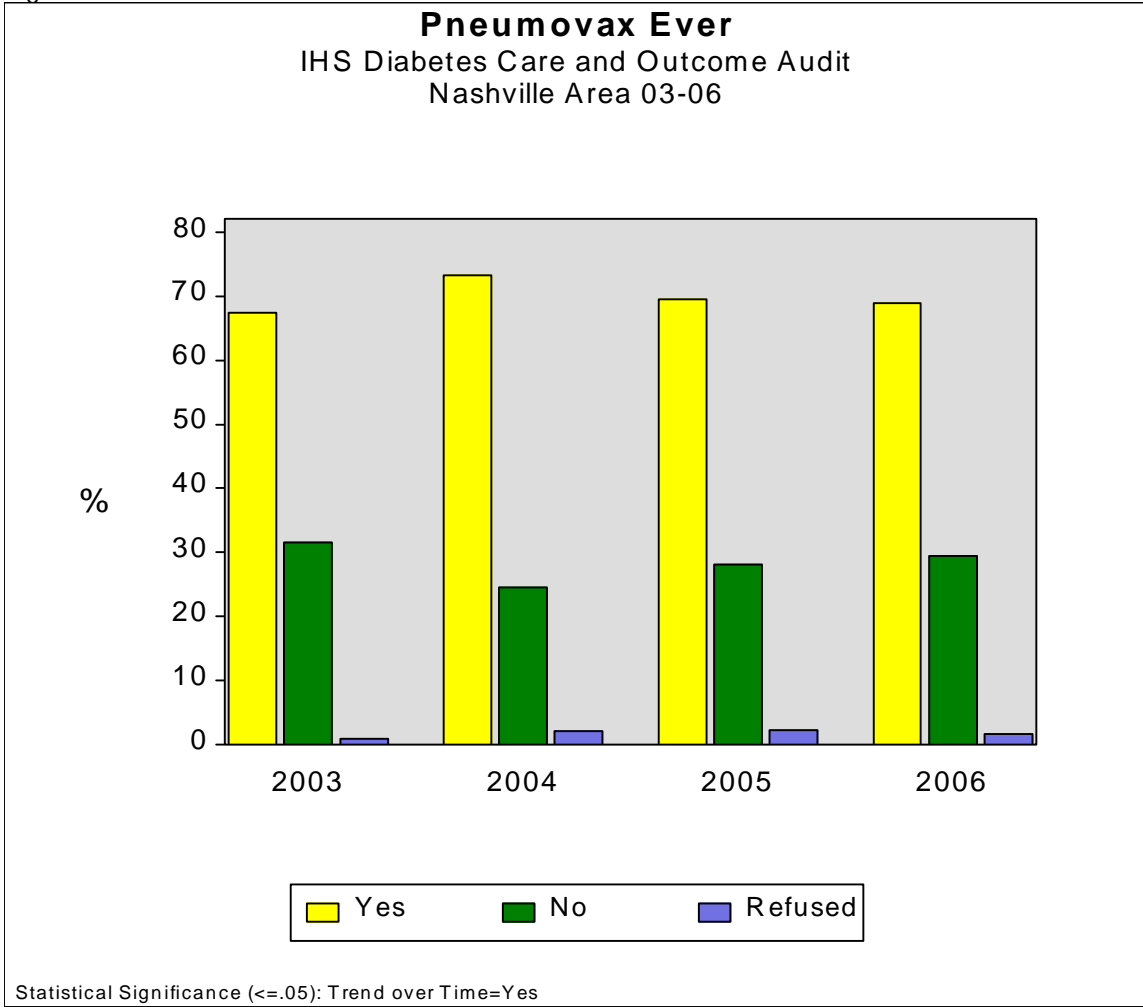
Figure 19



Diabetes audit data reflects little change in administration of influenza vaccine. Because this variable includes non-numeric categorical values, the trend over time statistical significance test is not valid

Immunizations-Pneumovax

Figure 20

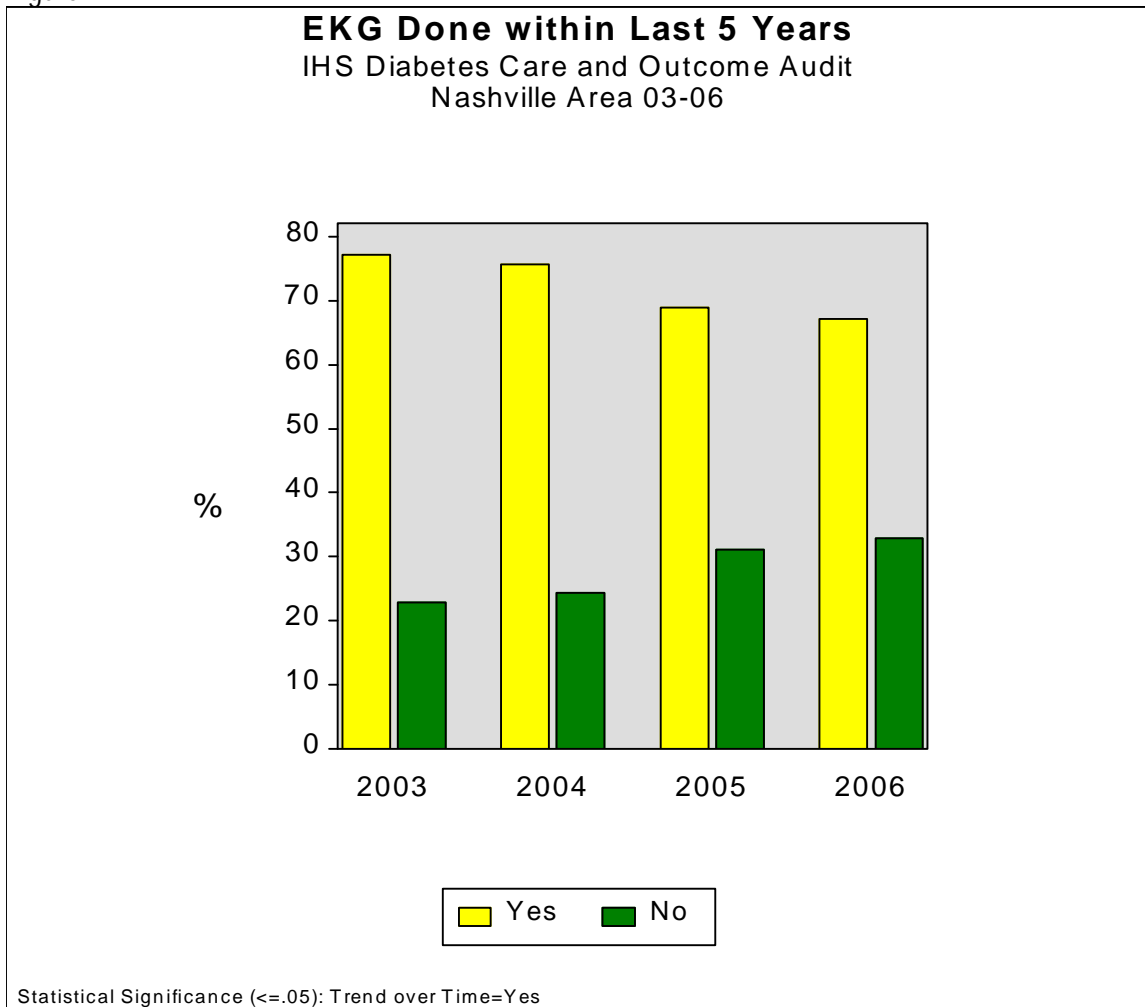


Diabetes audit data reflects little change in Pneumovax coverage. Because this variable includes non-numeric categorical values, the trend over time statistical significance test is not valid

EKG

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

Figure 21

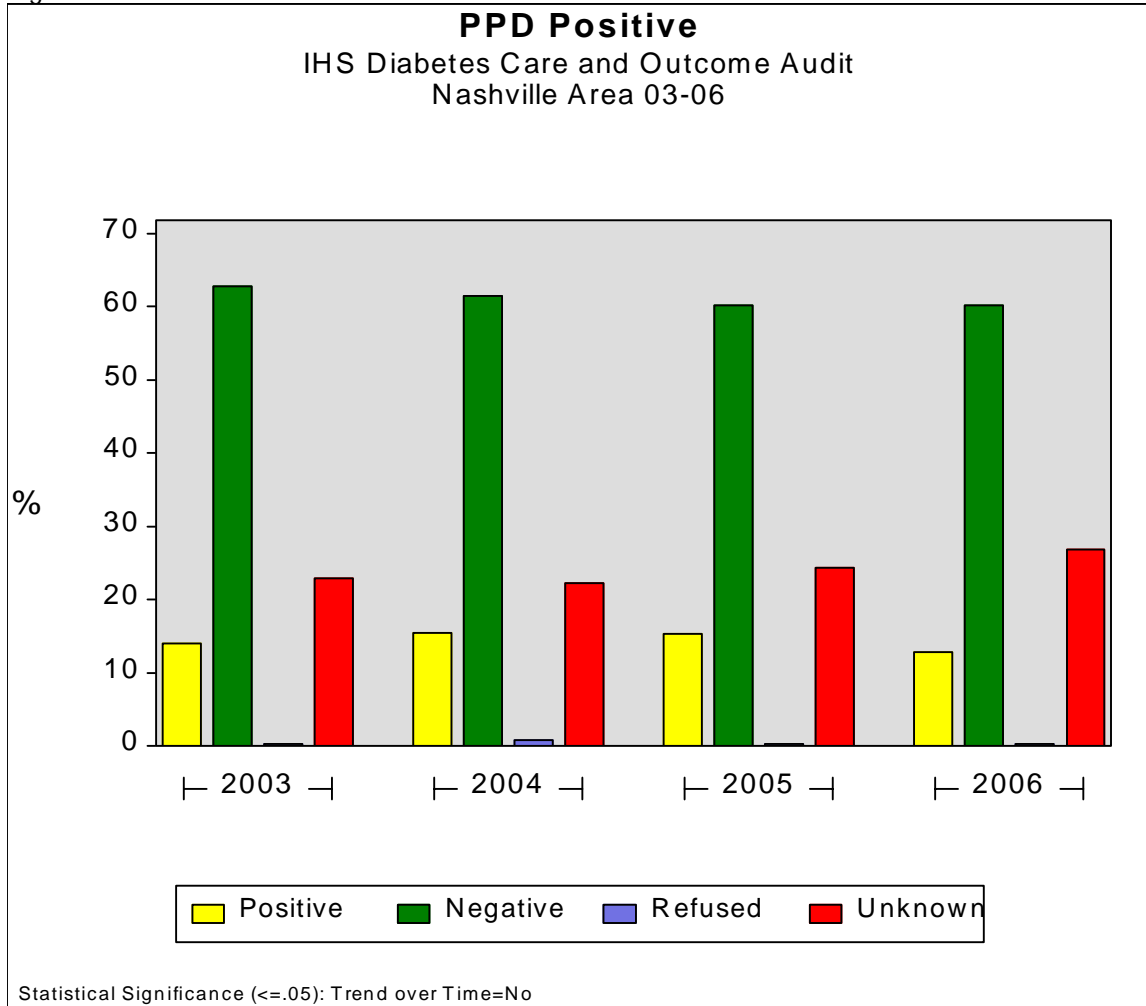


Diabetes audit data reflect a statistically significant decrease in the percentage of EKGs.

Tuberculosis 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.

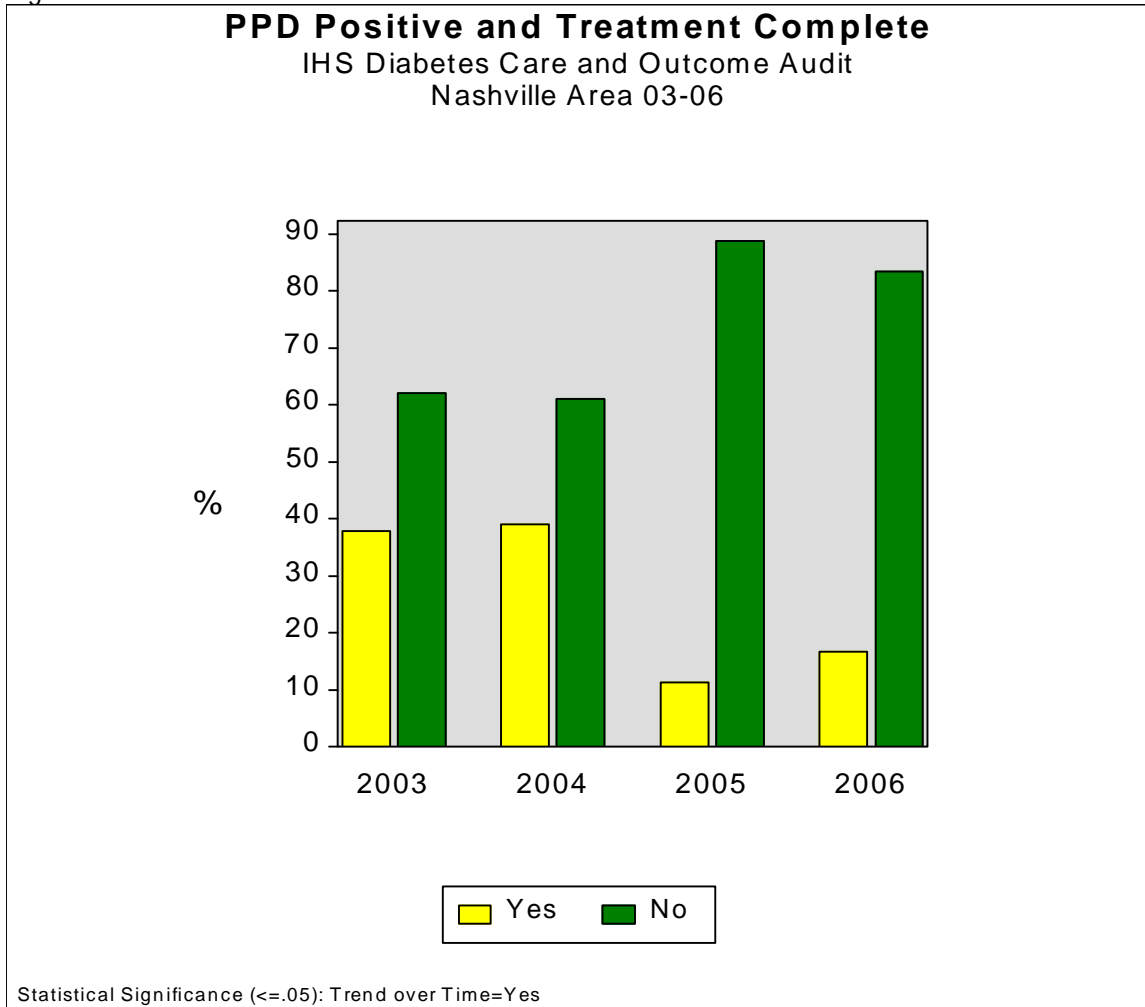
Figure 22



Diabetes audit data reflect a slight increase in the percentage of diabetic patients whose tuberculosis skin test (PPD) status is unknown.

Tuberculosis Screening and Treatment-Positive PPD (also known as the tuberculosis skin test)

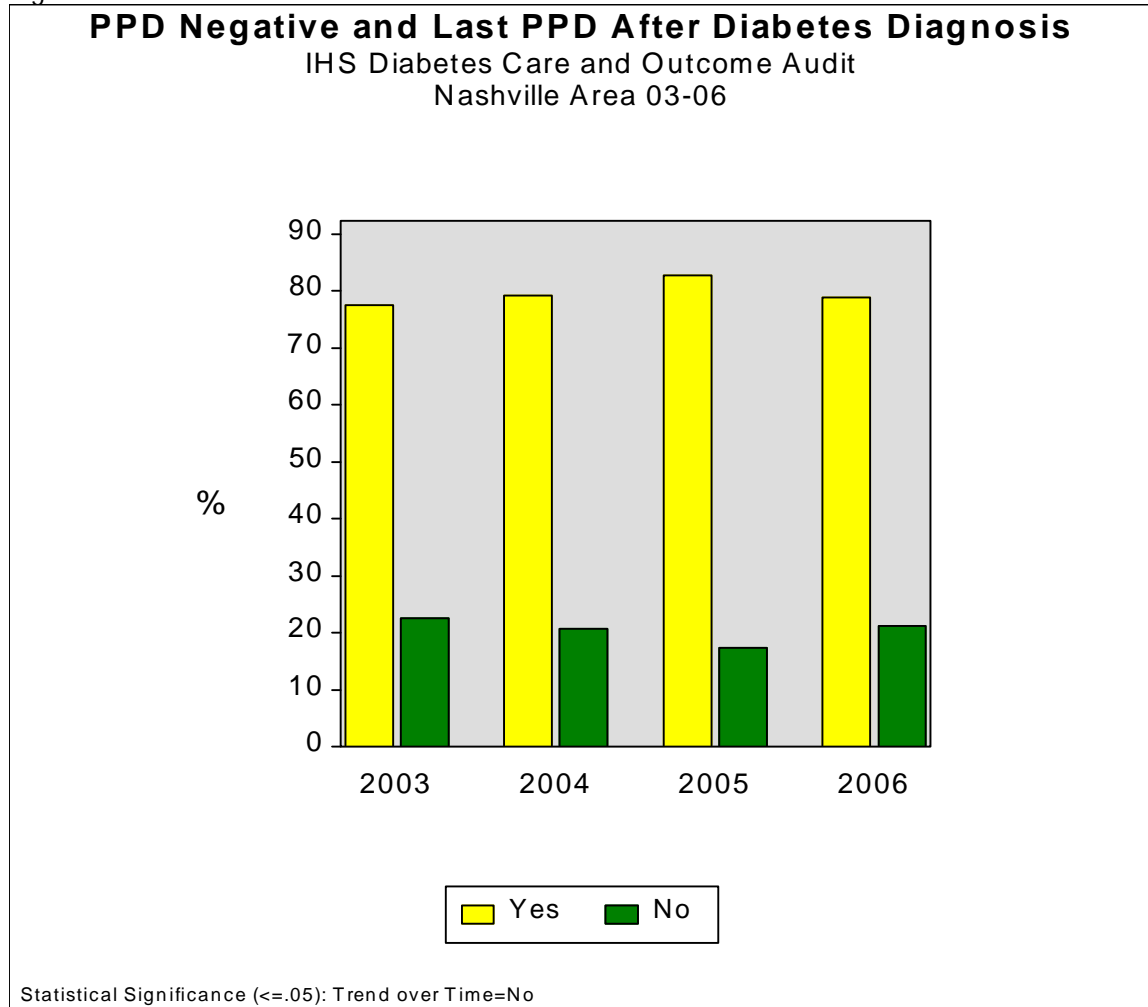
Figure 23



Diabetes audit data reflect a statistically significant decrease in the percentage of patients with positive PPDs completing treatment.

Tuberculosis Screening and Treatment-PPD Negative

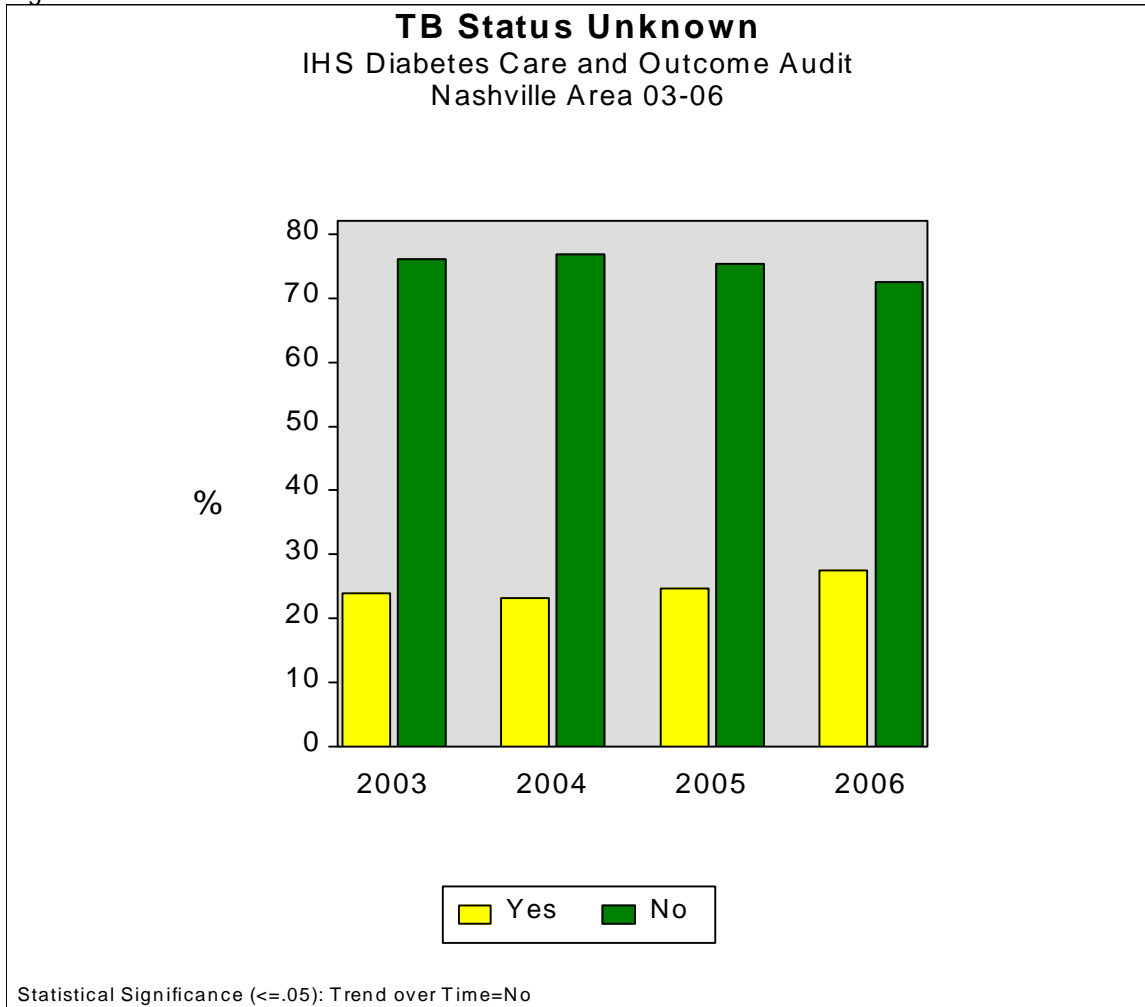
Figure 24



Diabetes audit data reflect no change in the percentage of patients with negative PPD receiving a PPD following diabetes diagnosis.

Tuberculosis Screening-Status Unknown

Figure 25

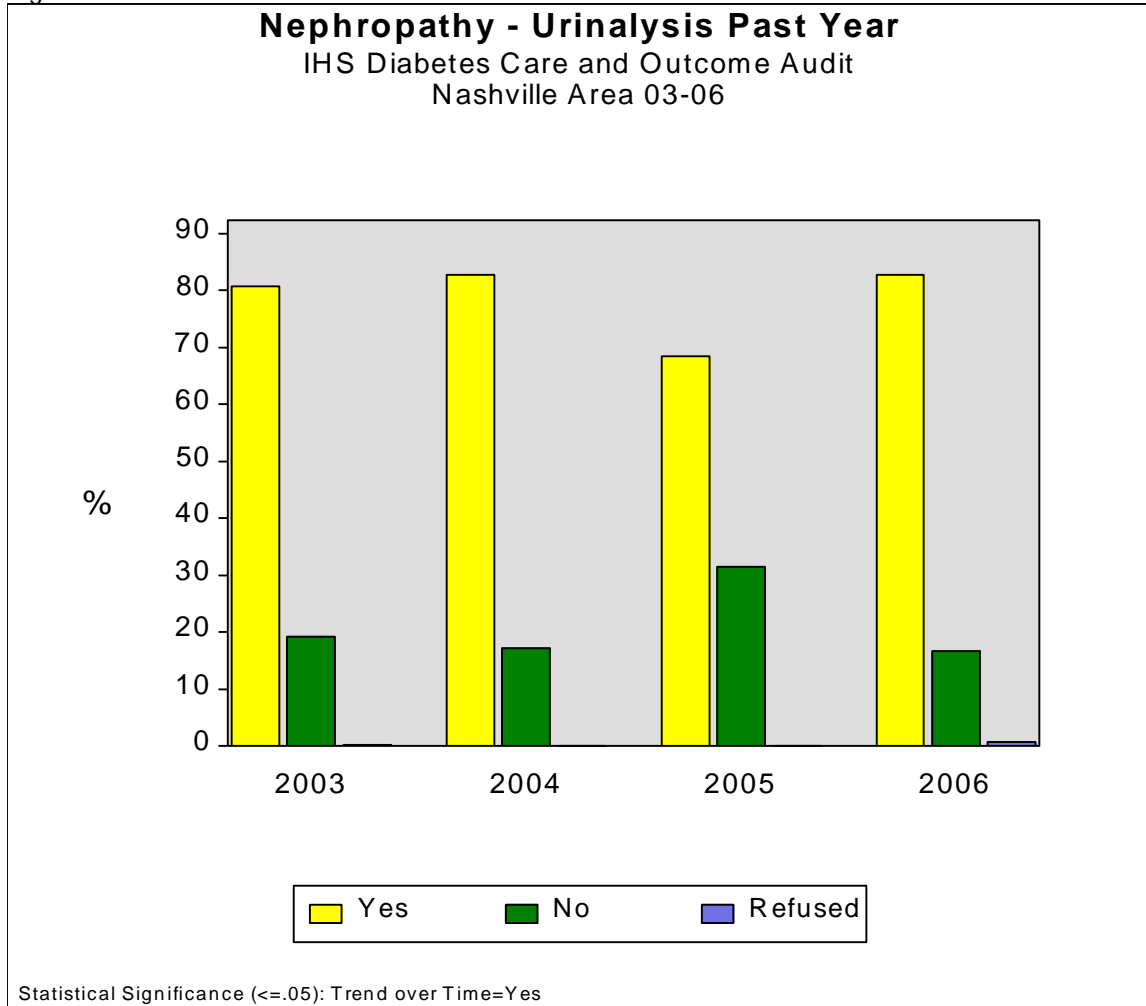


Follow-up is recommended where TB status is unknown.

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.

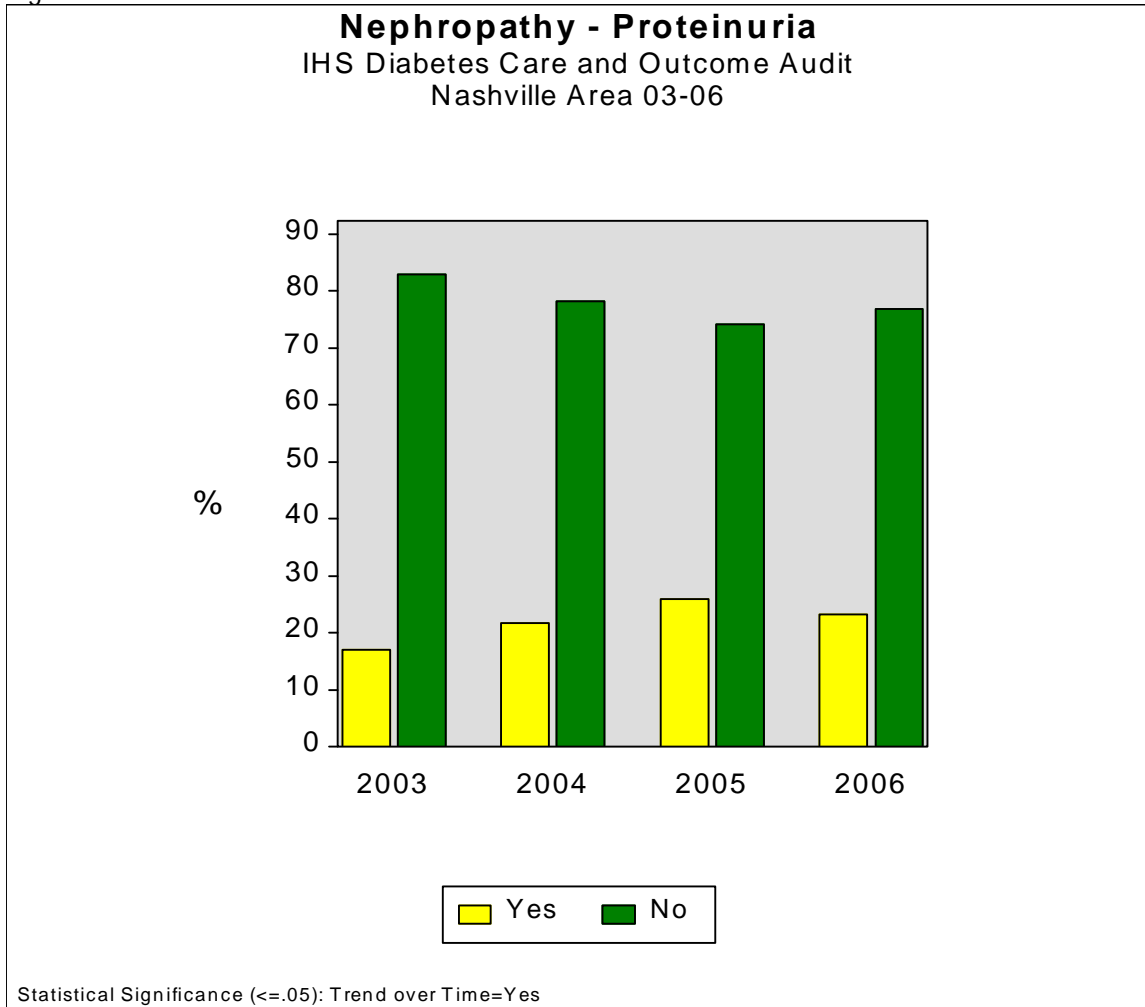
Figure 26



For 2003-2004 and 2006, approximately 20% of those audited had not had a urinalysis recorded. Because this variable includes non-numeric categorical values, the trend over time statistical significance test is not valid

Kidney Disease Assessment-Nephropathy-Proteinuria

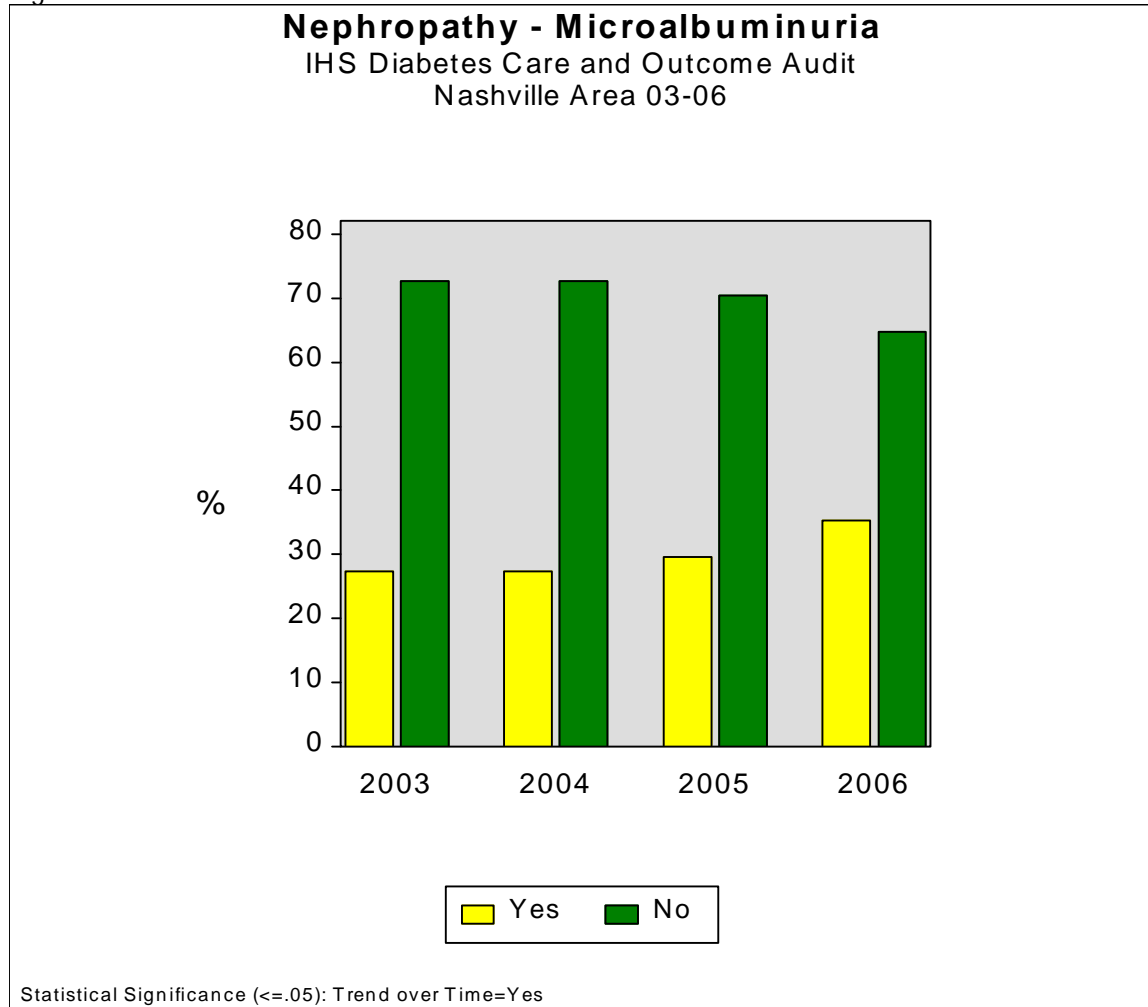
Figure 27



Diabetes audit data reflect a statistically significant increase in the percentage of patients with positive proteinuria.

Kidney Disease Assessment-Nephropathy-Microalbuminuria

Figure 28

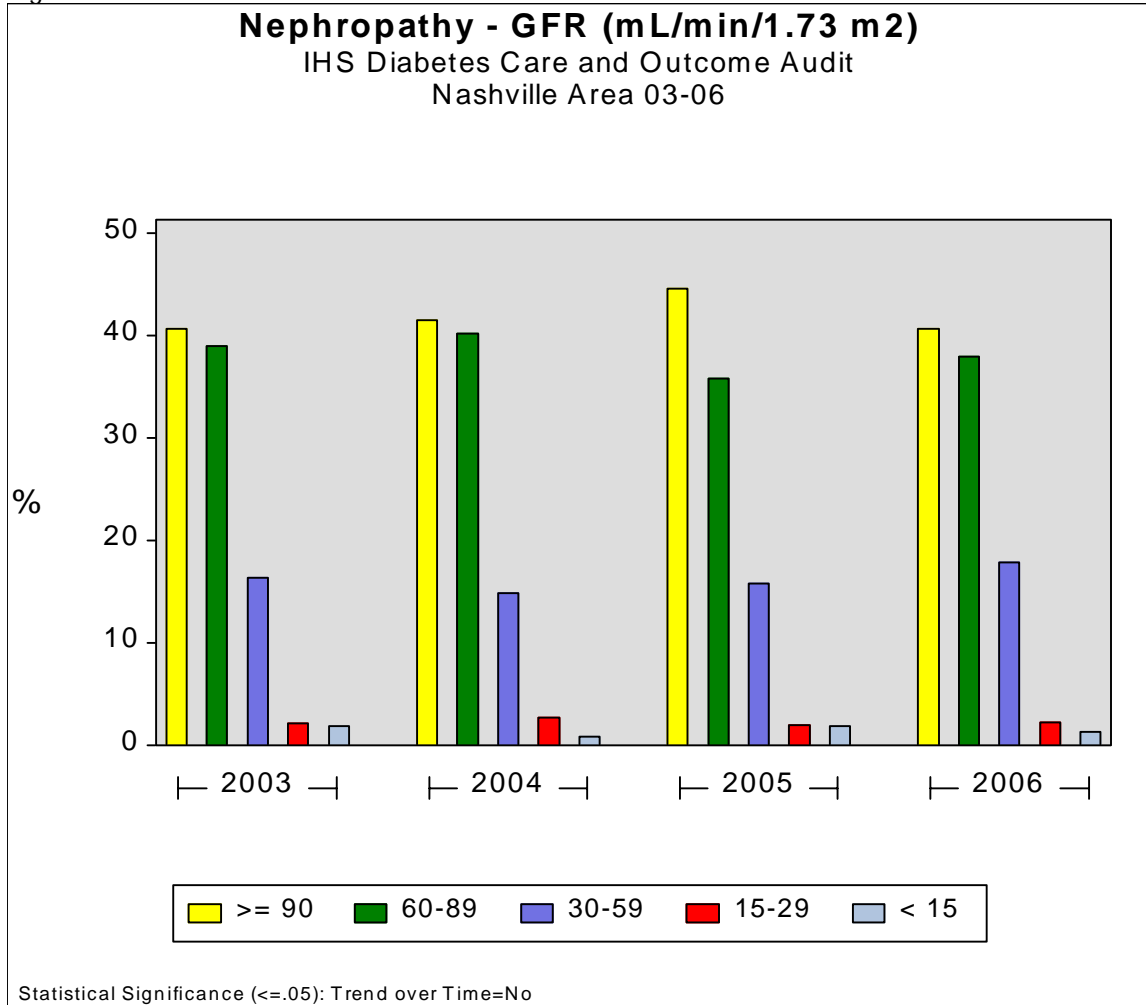


Diabetes audit data reflect a statistically significant increase in the percentage of patients with positive microalbuminuria.

Kidney Disease Assessment-GFR

Glomerular Filtration Rate (GFR) is a measure of the kidney's ability to filter blood, which is a measure of kidney function. A GFR calculation of < 60 mL/min/1.73 m² requires follow-up.

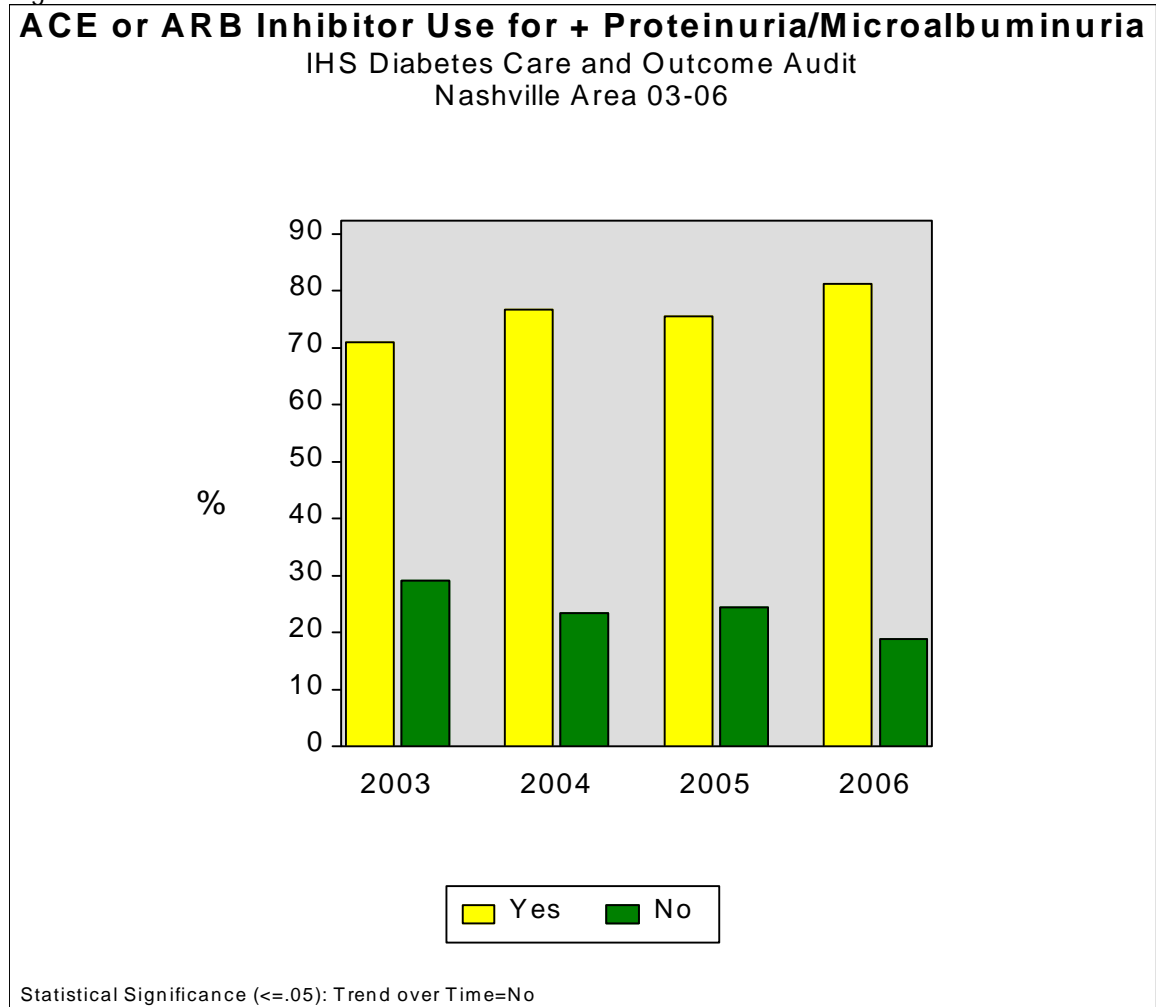
Figure 29



Diabetes audit data reflect in 2006 that approximately 20% of the patients with diabetes need additional follow-up based on GFR calculation of < 60.

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

Figure 30

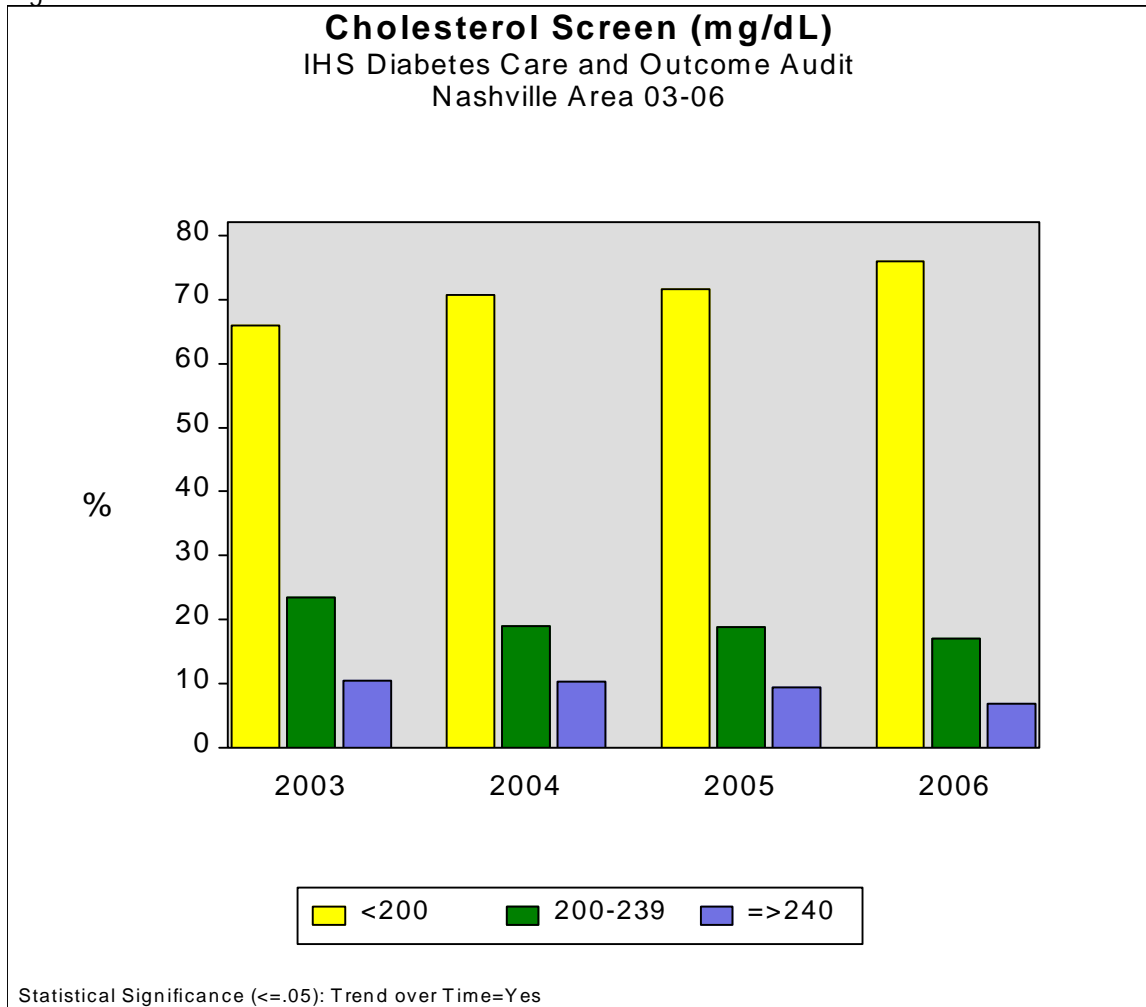


Diabetes audit data reflect that the percentage of patients using ACE or ARBs for treatment of chronic kidney disease has increased over time.

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. Please note all the following charts indicate a decrease in percentage of lipid panels completed in the previous year. These health factors should be monitored to ensure a trend is not emerging.

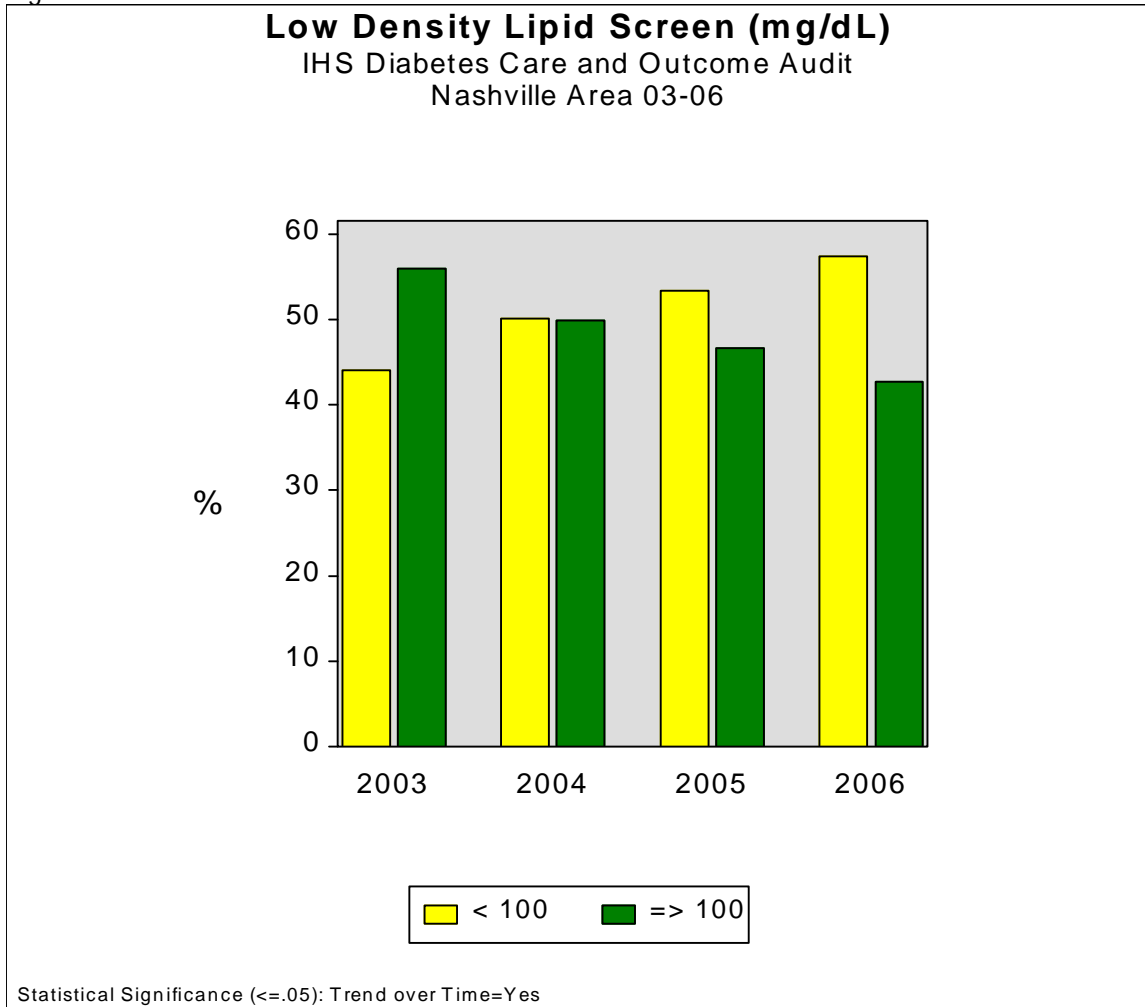
Figure 31



Diabetes audit data reflect a statistically significant increase in the percentage of patients with good cholesterol levels (<200 mg/dL).

Lipid Results- Low Density Lipids

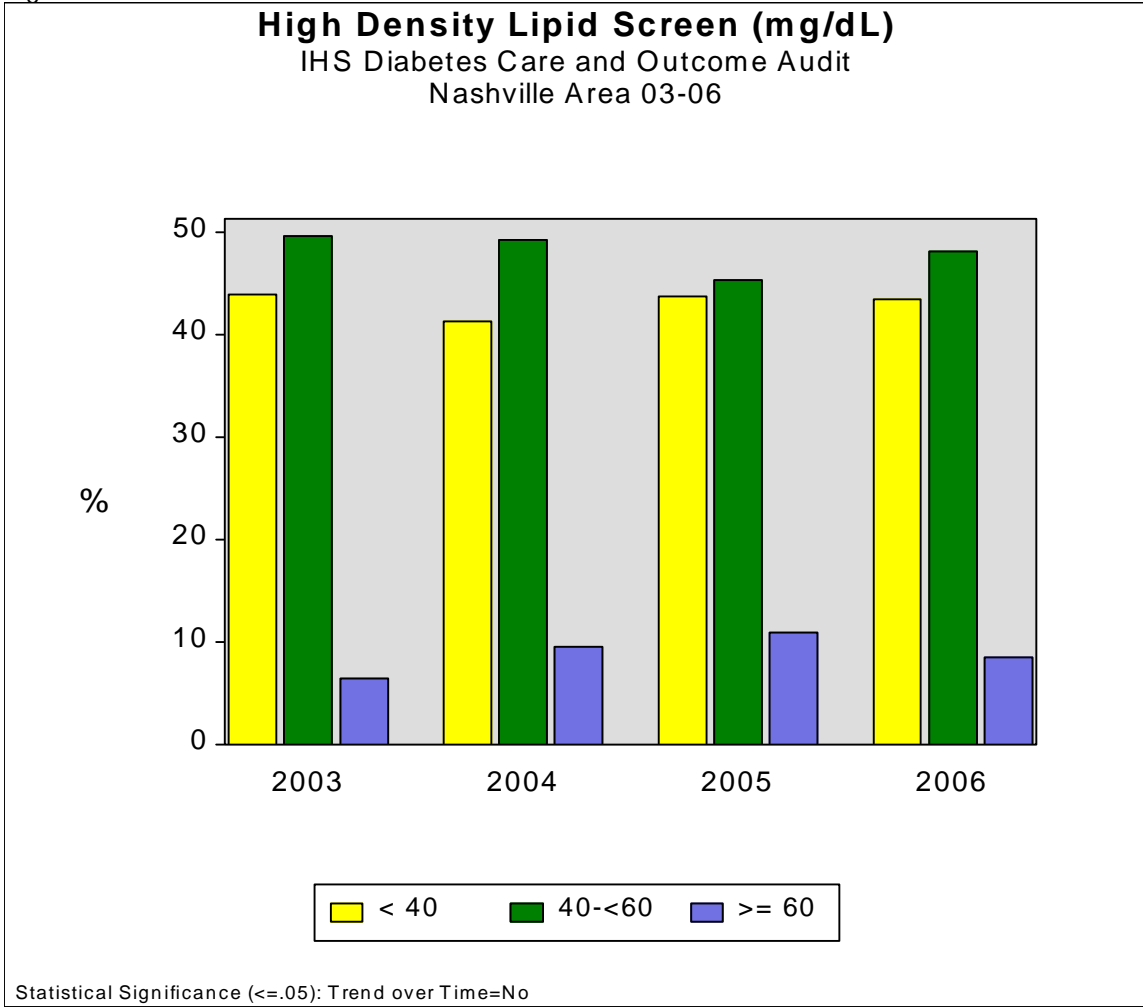
Figure 32



Diabetes audit data reflect a statistically significant increase in the percentage of patients with good LDL cholesterol levels (<100 mg/dL).

Lipid Results-High Density Lipids

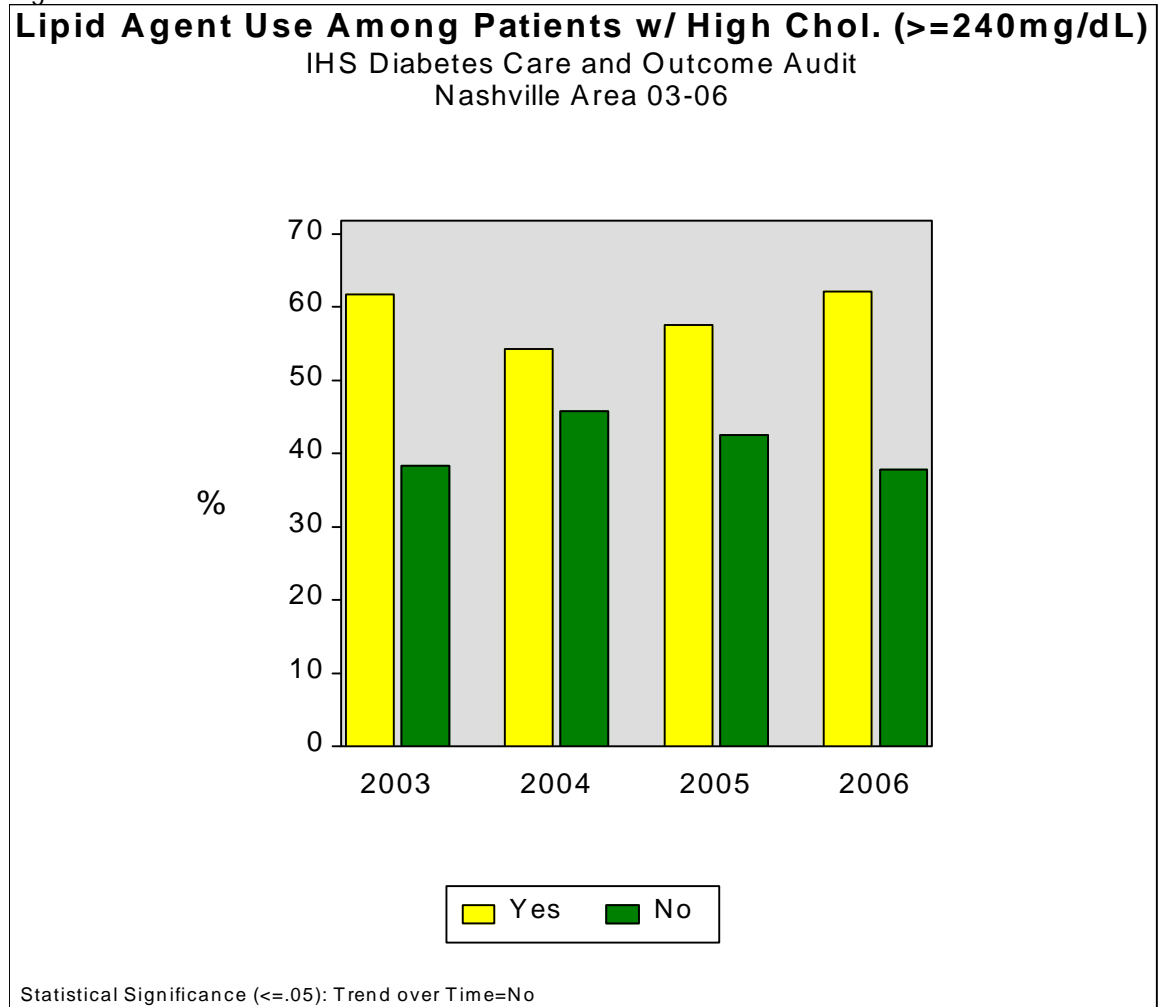
Figure 33



Diabetes audit data reflect little change in the percentage of patients with improved HDL cholesterol levels. Exercise is the primary activity that can improve HDL levels.

Lipid Treatment-High Cholesterol

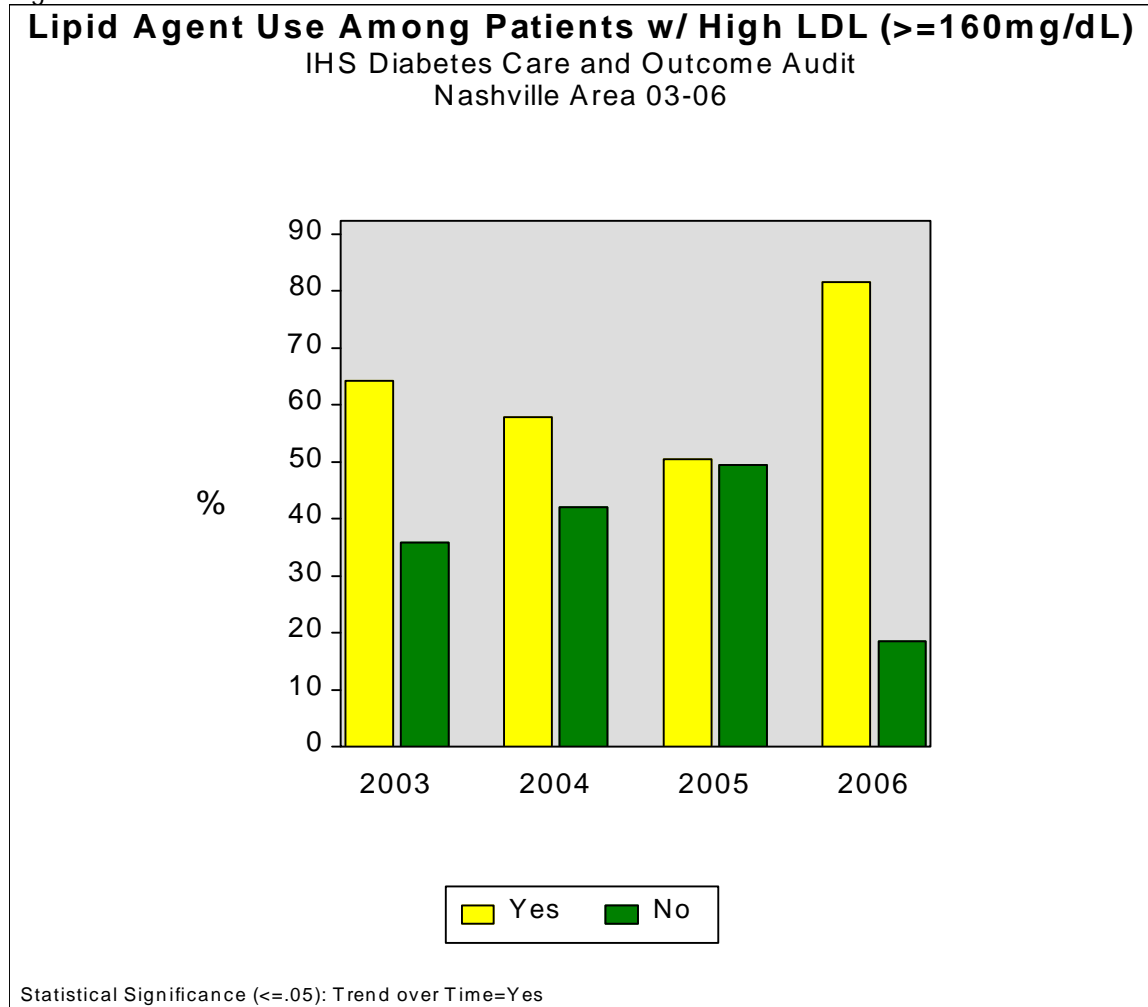
Figure 34



Diabetes audit data reflect that the percentage of patients receiving a lipid-lowering agent with cholesterol ≥ 240 has remained relatively unchanged over time, but with an increase since 2004.

Lipid Treatment

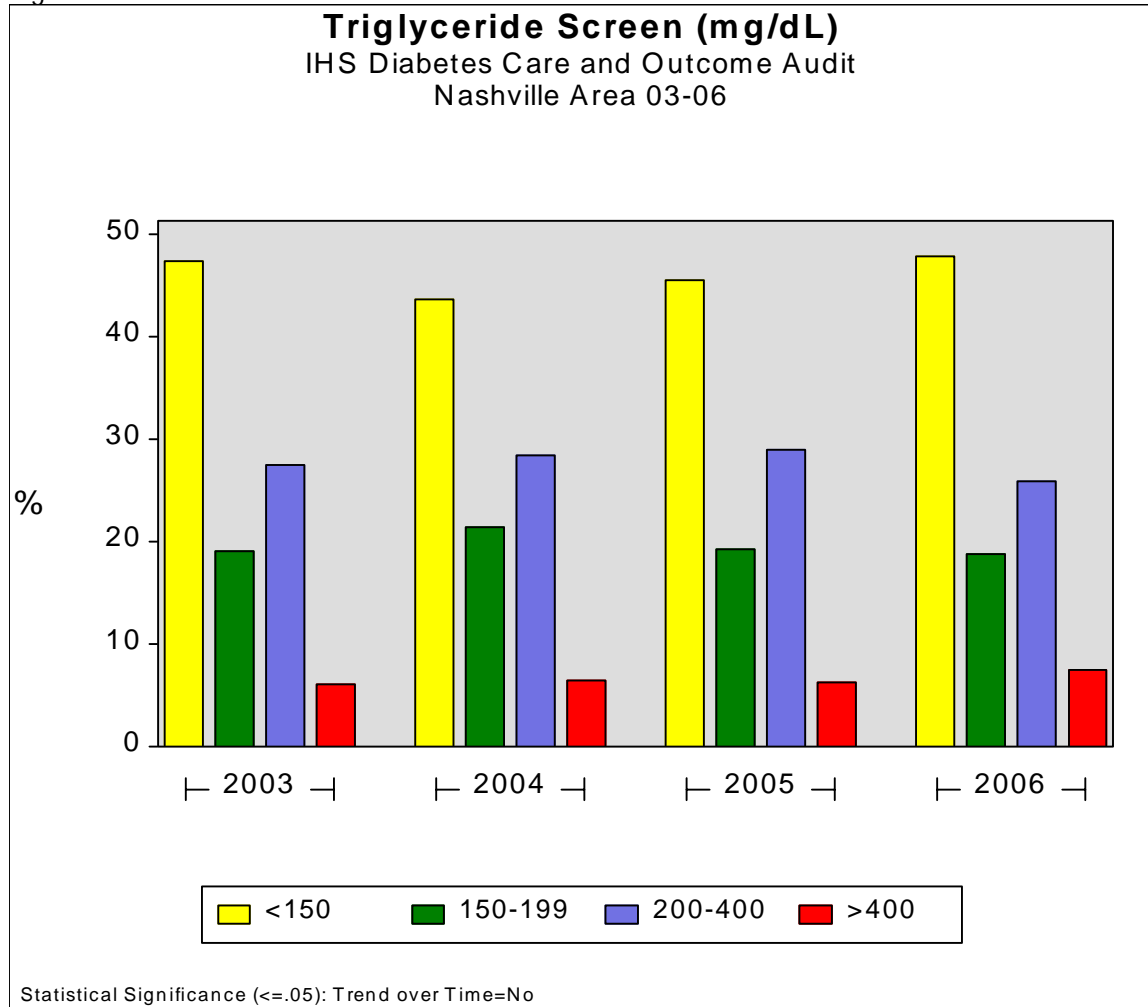
Figure 35



Diabetes audit data reflect a statistically significant increase in the percentage of patients receiving a lipid-lowering agent with cholesterol ≥ 160 compared to 2005.

Triglyceride Screen

Figure 36

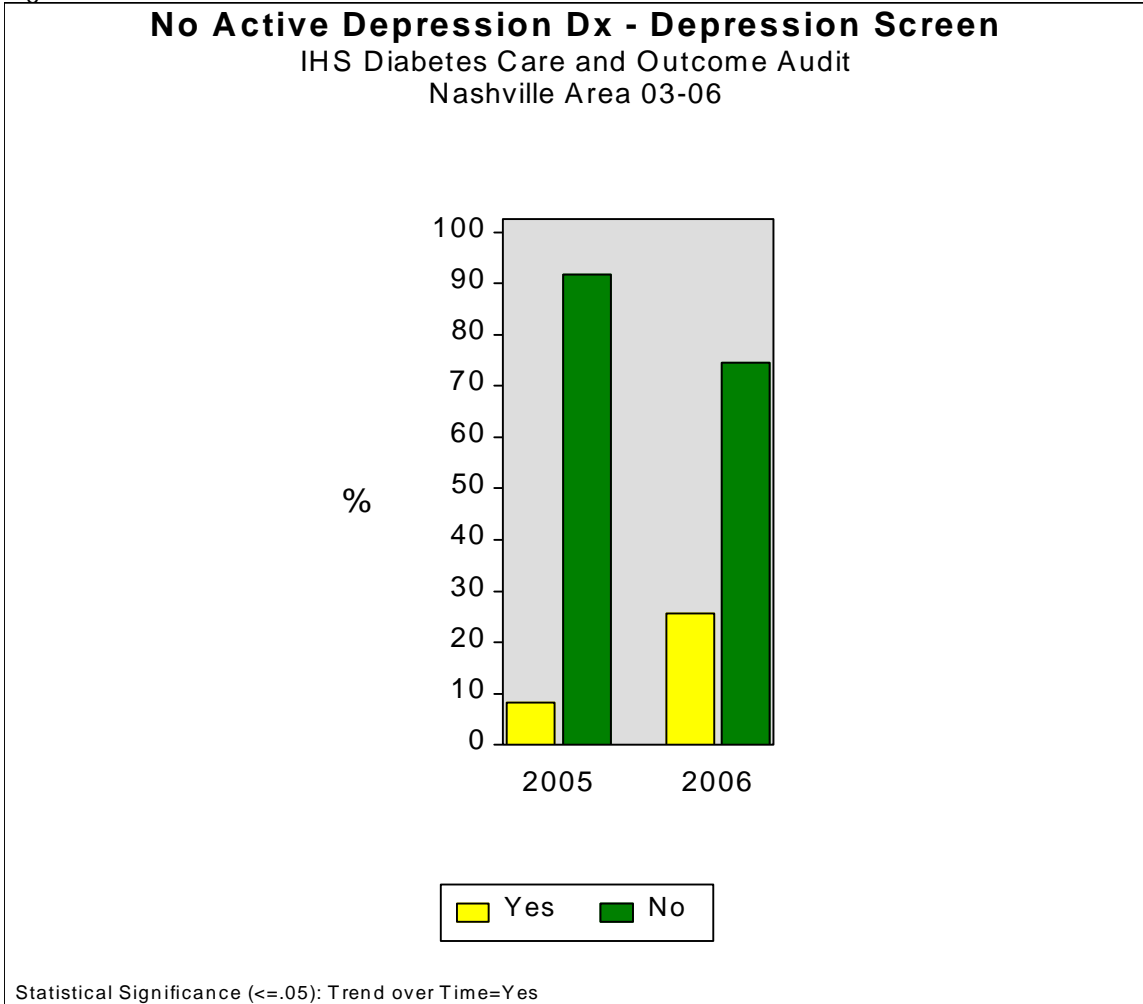


Diabetes audit data reflect little change over time in the distribution of triglyceride levels.

Depression Screen

Studies have shown that many people with diabetes also have depression and that depression may affect the control of diabetes.^{10,11} This indicator was added in 2005 and will continue to be trended in upcoming years.

Figure 37



Diabetes audit data reflect a statistically significant increase in the percentage of patients screened for depression.

Summary

Diabetes data analysis findings are summarized as follows:

- The Nashville Area AI/AN age-adjusted (US Census 2000 population) diabetes prevalence increased slightly since 2003, rising from 19.1% in 2003 to 20.7% in 2006. Age-adjusted diabetes prevalence rates calculated for the I/T/U specific levels showed a wide variance; for example, in 2006 ranging from a high of 32.8% to a low of 7.3%. For the three years (2003-2005) that IHS Wide and US All Race age-adjusted rates were available for comparison, the Nashville Area AI/AN age-adjusted diabetes prevalence rates on average were approximately two times greater than the IHS Wide rates and four times greater than the US All Races rates⁷. 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); and for 2006, 15.5% (7,416/47,839). These figures reflect the existing large and disproportionate burden of diabetes in the Nashville Area AI/AN population.
- The Nashville Area crude (actual) prevalence of ischemic heart disease (IHD) among persons with diabetes has remained approximately constant since 2003, from 26.5% in 2003 to 25.9% in 2006. Since 2003, on average the Nashville Area's prevalence of IHD among persons with diabetes has been approximately 1.2 times greater than the 2003 All Races US rate⁹. Prevalence of IHD among persons with diabetes rates calculated for the 21 Tribes included in the Nashville Area aggregate rate showed a wide range; for example, in 2006 with a high of 49.4% for one I/T/U and a low of 13.9% for another I/T/U. Tobacco cessation, a healthy weight, and regular exercise can all reduce the risk of IHD complications among patients with diabetes.
- To help with the interpretation of the burden of diabetes on the population and health care system, it is noted that as the AI/AN population increases so may the number of diagnosed diabetic cases but not necessarily with a parallel increase in prevalence due to the expanding denominator. In such cases it is important to recognize that an absolute increase in case load or health event is important in itself, even without an increase in prevalence rate.
- Diabetes audit data reflect a moderate improvement for patients with a combination of ideal values (A1c, BP, LDL, BMI).
- Diabetes audit data reflect no improvement in glycemic control over time and less than 40% of the diabetic patients have A1c values less than 7% (<7.0).
- Diabetes audit data reflect few diabetic patients are of normal weight. Overweight and obesity are an added risk factors for hypertension and CVD.
- There appears to be a statistically significant increase in the percentage of patients with positive proteinuria and microalbuminuria.
- Diabetes audit data reflect a statistically significant increase in the percentage of patients with good LDL cholesterol levels (<100 mg/dL). Diabetes audit data reflect little change in the percentage of patients with improved HDL cholesterol levels. Exercise is the primary activity that can improve HDL levels.
- Diabetes audit data reflect a statistically significant increase in the percentage of patients screened for depression. Many studies on the psychosocial aspects of chronic disease indicate that depression can affect the control of diabetes.

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 diabetic 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 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 process. 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. However, data anomalies are still present.
8. Use the Nashville Area Diabetes Report and accompanying sister I/T/U specific diabetes reports to assist you in your efforts to advocate for continued IHS Special Diabetes Program for Indians funding which is scheduled to end in 2008.

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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

<p>United South and Eastern Tribes, Inc. Tribal Health Program Support 711 Stewarts Ferry Pike Suite 100 Nashville, TN 37214 Phone 615-872-7900 Fax 615-872-7417</p> <p>Dianna Richter, RD, MPH, CDE Area Diabetes Consultant drichter@usetinc.org</p> <p>USET Tribal Epidemiology Center Epidemiologists: John Mosely Hayes, DrPH jmhayes@usetinc.org Chris Compher, MPH ccompher@usetinc.org Christy Duke, MPH cduke@usetinc.org</p> <p>Byron G. Jasper, DDS Deputy Director, Tribal Health Program Support bjasper@usetinc.org</p> <p>Wes Cornelius Data Coordinator wcornelius@usetinc.org</p>	<p>IHS Division of Diabetes Treatment and Prevention 5300 Homestead Road, NE Albuquerque, NM 87110 Phone: 505-248-4182 Fax: 505-248-4188</p> <p>Kelly Acton, MD, MPH, FACP Director kelly.acton@na.ihs.gov</p> <p>Lorraine Valdez, BSN-RN, MPA, CDE Nurse Consultant s.lorraine.valdez@mail.ihs.gov</p> <p>Tammy Brown, MPH, RD, BC-ADM, CDE Nutrition Consultant tammy.brown@ihs.gov</p>
<p>IHS Nashville Area Office 711 Stewarts Ferry Pike Nashville TN 37214 Phone 615-467-1500 Fax 615-467-1501</p> <p>Palmeda Taylor, PhD Area Psychologist Behavioral Health Consultant Palmeda.Taylor@ihs.gov</p> <p>Michelle Ruslavage, BSN, RN, CDE Health Promotion Disease Prevention Michelle.ruslavage@ihs.gov</p>	<p>Links to Consider Diabetes Audit http://www.dmaudit.com</p> <p>IHS Integrated Diabetes Education Recognition Program http://www.ihs.gov/MedicalPrograms/Diabetes/recognition/iderp_app1.asp</p> <p>IHS RPMS/DMS manual includes information on electronic audit http://www.ihs.gov/Cio/RPMS/PackageDocs/bdm/bdm_020u.02.pdf</p> <p>American Association of Indian Physicians http://www.aaip.com</p> <p>IHS, Division of Diabetes Treatment and Prevention http://www.ihs.gov/MedicalPrograms/Diabetes/index.asp</p> <p>National Diabetes Education Program http://www.ndep.nih.gov http://www.cdc.gov/diabetes/ndep/index.htm</p> <p>American Diabetes Association, Awakening the Spirit http://www.diabetes.org/communityprograms-and-localevents/nativeamericans.jsp</p>

APPENDIX B

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

Note: * - Seneca and Penobscot data was not included in the 2003-2006 prevalence of IHD among diabetics calculations.

Note: & - Jena Band, Tunica-Biloxi, and Mohegan did not participate in the 2003-2006 Diabetes Audit process.

Note: # - St. Regis/Poarch completed audit data 05-06 & ACOT in 05, but not included in Area Audit Aggregate due to operational error.

Note: These Nashville Area I/T/Us currently did not receive USET services during 2003-2006.

Onondaga Nation

Cayuga Nation of New York

Towanda Band of Seneca

Tuscarora Nation

Mashpee Wampanoag Tribe (recognized in 2007)

Amer. Indian Community House of New York

North American Indian Center of Boston

Baltimore American Indian Center

Appendix C

2006
IHS Wide Diabetes Care and Outcome Audit
Analysis Results
(with/without missing data records for comparison)

**2006 IHS Wide Diabetes Care and Outcome Audit
Analysis Results, with/without missing**

Audit Field	Modified Missing Removed	Normal Missing Not Removed
# in registry	122,885	122,885
# charts audited	48,524	48,524
% registry audited	39.0	39.0
Male (%)	41.3	41.3
Female (%)	58.7	58.7
Age <15 Years (%)	0.2	0.2
Age 15-44 Years (%)	22.1	22.1
Age 45-64 Years (%)	51.4	51.4
Age 65+ Years (%)	26.4	26.4
Type 1 (%)	1.2	1.2
Type 2 (%)	98.8	98.8
Duration <5 Years (%)	33.0	28.6
Duration <10 Years (%)	60.6	52.5
Duration 10+ Years (%)	39.4	34.1
Duration Missing (%)		13.4
Normal: BMI<25 (%)	8.0	7.8
Overweight: BMI 25-29.9 (%)	23.3	22.8
Obese: BMI 30+ (%)	68.6	67.0
BMI Missing (%)		2.4
Overwt, BMI>85%tile (%)	82.2	80.2
Obese, BMI>95%tile (%)	57.7	56.3
HbA1c <=6.5 (%)	29.0	27.0
HbA1c 6.6-6.9 (%)	10.7	10.0
HbA1c 7.0-7.9 (%)	21.9	20.4
HbA1c 8.0-8.9 (%)	13.4	12.4
HbA1c 9.0-9.9 (%)	8.8	8.2
HbA1c 10.0-10.9 (%)	6.5	6.1
HbA1c 11.0 or higher (%)	9.8	9.1
HbA1c Missing (%)		6.8
BP <120/<70 (%)	11.7	10.5
BP 120/70-<130/<80 (%)	30.2	27.2
BP 130/80-<140/<90 (%)	30.9	27.8
BP 140/90-<160/<95 (%)	21.8	19.6
BP 160/95 or higher (%)	5.4	4.8
BP Unknown (%)		10.1
Known HTN (%)	79.7	79.5
Tobacco current user (%)	22.3	22.3
Counsel rate/users (%)	34.4	33.7
Tobacco not current user (%)	66.7	66.7
Tobacco not in chart (%)	11.0	11.0
Diet alone (%)	17.4	17.4
Insulin alone (%)	9.3	9.3
Sulfonylurea alone (%)	7.9	7.9
Metformin alone (%)	13.0	13.0
Acarbose alone (%)	0.1	0.1
Glitazone alone (%)	2.7	2.7
2 or more Oral (%)	30.1	30.1
Insulin and Oral (%)	18.7	18.7
Tx Unknown/Refused (%)	0.8	0.8

**2006 IHS Wide Diabetes Care and Outcome Audit
Analysis Results, with/without missing (continued)**

ACE [overall] (%)	71.5	71.4
ACE in overt proteinuria (%)	79.6	79.5
ACE in known HTN (%)	81.9	81.8
ACE unknown [overall] (%)	0.5	0.5
Aspirin or other/30+ (%)	70.5	70.3
None/30+ (%)	28.2	28.1
Refused/30+ (%)	1.4	1.4
Aspirin Missing (%)		0.2
Lipid agent unknown (%)	0.8	0.8
Lipid agent/cholesterol ≥ 240 (%)	71.4	70.3
Lipid agent/LDL > 100 (%)	57.2	56.4
Statin only/on lip agent (%)	71.8	71.8
Other only/on lip agent (%)	10.5	10.5
Statin+other/on lip agent (%)	17.7	17.7
Foot exam (%)	53.1	53.1
Eye exam (%)	54.8	54.7
Dental exam (%)	37.9	37.8
Diet education (%)	54.4	54.3
RD diet education (%)	27.7	27.6
Diet education refused (%)	1.2	1.2
Exercise education (%)	47.3	47.2
Exercise ed refused (%)	1.0	1.0
DM education (%)	61.1	61.0
DM education refused (%)	0.9	0.9
Flu vaccine (%)	59.5	59.4
Flu vaccine refused (%)	3.9	3.9
Pneumovax (%)	75.8	75.7
Pneumovax refused (%)	2.1	2.1
TD (%)	78.7	78.6
TD refused (%)	1.0	1.0
EKG done/30+ (%)	78.3	78.3
EKG last 3 years/30+ (%)	54.7	54.7
EKG last 5 years/30+ (%)	66.1	66.1
PPD+/+meds (%)	12.3	6.5
PPD+/no meds or unk (%)	19.4	12.5
PPD- after Dx (%)	46.2	29.7
PPD- before Dx (%)	17.0	10.9
PPD- date or Dx date unk. (%)	7.3	4.7
PPD status unknown (%)	35.7	35.7
UA past 12 months (%)	82.0	81.6
UA not done 12 months (%)	17.9	17.8
UA unknown (%)		0.5
UA refused (%)	0.1	0.1
Proteinuria present (%)	20.1	16.2
Proteinuria absent (%)	79.9	64.2
Proteinuria unknown (%)		19.6
Microalbumin pos/PU neg (%)	23.0	19.2
Microalbumin neg/PU neg (%)	60.2	50.1
Microalb not test/PU neg (%)	16.8	14.0
Microalb unknown/PU neg (%)		16.7

**2006 IHS Wide Diabetes Care and Outcome Audit
Analysis Results, with/without missing (continued)**

Creatinine done (%)	89.1	89.1
Creat <2.0 (%)	96.4	85.9
Creat 2.0-4.9 (%)	2.8	2.5
Creat out of range (%)	0.8	0.7
Creatinine not done (%)	10.9	10.9
Cholesterol done (%)	76.9	76.9
Chol <200 (%)	76.3	58.7
Chol 200-239 (%)	16.5	12.7
Chol =>240 (%)	7.2	5.6
Cholesterol not done (%)	23.1	23.1
LDL done (%)	72.9	72.9
LDL <100 (%)	57.5	41.9
LDL 100-129 (%)	27.7	20.2
LDL 130-160 (%)	10.6	7.8
LDL >160 (%)	4.1	3.0
LDL not done (%)	27.1	27.1
HDL done (%)	74.1	74.1
HDL <35 (%)	23.9	17.7
HDL 35-45 (%)	40.2	29.8
HDL 46-55 (%)	21.7	16.1
HDL >55 (%)	14.2	10.5
HDL not done (%)	25.9	25.9
Triglyceride done (%)	74.9	74.9
Trig <150 (%)	46.0	34.4
Trig 150-199 (%)	20.9	15.7
Trig 200-400 (%)	26.8	20.1
Trig >400 (%)	6.3	4.7
Triglyceride not done (%)	25.1	25.1
Depression active DX (%)	20.7	20.6
Depression NOT active DX (%)	79.3	79.1
Depression status unknown		0.2
Dep screen/not active DX (%)	25.6	25.4

Appendix D

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