Preventive Diabetic Care:

Race/Ethnicity vs. Socioeconomic Status

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Background:

Preventive medicine is the discipline of medicine that prevents disease or illness rather than curing it. Preventive medicine, as part of Public Health, is a relatively new topic in the grand scope of medicine. Public Health also focuses on preventing diseases, but it involves communities or large groups of people. Not all areas of public health are medically related. For example public health departments look at restaurant conditions with regards to food storage and safety. Preventive medicine, on the other hand, involves the use of medicine. Giving vaccines to prevent future illness or diseases is an excellent example of preventive medicine. Other terms that are sometimes used interchangeably with preventive medicine are Community Health and Community Medicine. (JPM, 2001)

Over time, through trial and error, doctors slowly develop ideas and theories that helped progress the idea of preventive medicine. Milestones involved in preventive medicine include vaccinations, antibiotics, oral birth control pills, and synthetic insulin. For example, the small pox vaccine was developed in 1796 by Edward Jenner and before 1865, when Joseph Lister introduced antiseptic methods during surgery, 50% of all patients died due to infection post-operatively. Another example happened in 1928 when Alexander Fleming discovered the germ killing power of a mold called penicillium, later to be known as penicillin. Penicillin and derivatives of penicillin are still used today in many antibiotics. (Milestones, 2006) In the 1950's Jonas Salk developed the first polio vaccine. Polio comes in an oral form, which is routinely used as part of childhood vaccination programs. Then in 1960 something happened that would change the face of the American family forever, Enovid, the first oral contraceptive pill was introduced to the United States. (Milestones, 2006)

Today there are many other oral contraceptives to choose from that prove to be very efficacious and because of this, unwanted childbirth has moved from normal behavior to something that is becoming rare. Throughout time preventive medicine has been practiced and continues to prove its worthiness, because of this, going back through history many lives have been saved. Recently, a lot of the focus of preventive medicine has been on Diabetes.

According to the Center for Disease Control and Prevention, 7% or 20.8 million Americans have some form of diabetes. An estimated 6.2 million people or about 1/3 of diabetics don't even know they have the disease. By 2050, an estimated 39 million Americans are expected to have diagnosed diabetes. Diabetes is the sixth leading cause of death. Over 200,000 people die each year due to disease related complications. `

Diabetes is a disease in which the body does not produce or properly use insulin. Insulin is a hormone that is needed to convert sugar, starches, and other food into energy for daily life. Type 2 diabetics either do not produce enough insulin or the cells in the body ignore the insulin by developing an insulin resistance. Diabetes is a disease that is diagnosed through abnormal blood sugars, but affects a multitude of systems in the body. Common diabetic symptoms include: frequent urination, excessive thirst, extreme hunger, unusual weight loss, increased fatigue, irritability, and blurry vision.

In order to actually diagnose diabetes, health care providers conduct one of two tests, the Fasting Plasma Glucose Test (FPG) or the Oral Glucose Tolerance Test (OGTT.) With the FPG test, a fasting blood glucose level between 100 and 125 mg/dl signals pre-diabetes. A person with a fasting blood glucose level of 126 mg/dl or higher has diabetes. With the OGTT test, a person's blood glucose level is measured after a fast

and two hours after drinking a glucose-rich beverage. If the two-hour blood glucose level is between 140 and 199 mg/dl, the person tested has pre-diabetes. If the two-hour blood glucose level is at 200 mg/dl or higher, the person tested has diabetes.

There are two main Types of Diabetes. Type 1, also known as juvenile diabetes, is usually diagnosed in children and young adults. It is also called insulin-dependant diabetes mellitus (IDDM) because insulin injections must be taken every day. Type 1 diabetes develops when the pancreas stops producing insulin. Insulin is normally made in a portion of the pancreas called the islet tissue. For unknown reasons, Type 1 diabetes develops when the body destroys the beta cells. Without insulin, the amount of sugar in the blood rises to unsafe levels, which means cells do not get the sugar they need. Over time, high blood sugar damages blood vessels and nerves throughout the body and increases the risk of eye, heart, blood vessel, nerve, and kidney disease. Very high blood sugar levels can be life-threatening.

Experts are still debating what factors cause type 1 diabetes. For some people it is genetic. Family members of people with the disease are more likely to get it; however most people with type 1 diabetes do not have a family history of it. Other causes may include environmental factors, race, and not being breast fed after 3 months. According to the American Diabetes Association, Type 1 diabetes accounts for only 5-10% of all cases. The most common form of diabetes is Type 2. With Type 2 diabetes, either the body does not produce enough insulin or the cells ignore the insulin. There are several myths as to what causes Type 2 diabetes. In truth eating sweets or the wrong food is not only the cause of diabetes. This may cause obesity which along with increasing age, lack

of physical activity, and genetics are factors that increase a person's chance of developing this disease. Someone is more likely to develop Type 2 diabetes if they are or have:

1. overweight
2. 45 years old or older
3. have a parent, brother, or sister with diabetes
4. family background is African American, American Indian, Asian American, Hispanic American/Latino, or Pacific Islander
5. have had gestational diabetes or gave birth to at least one baby weighing more than 9 pounds
6. a blood pressure is 140/90 or higher, or they have been told that they have high blood pressure
7. a HDL cholesterol is 35 or lower, or their triglyceride level is 250 or higher
8. are fairly inactive, or they exercise fewer than three times a week

Diabetes is a disease that is diagnosed through abnormal blood sugars, but affects a multitude of systems in the body. Complications associated with Type II diabetes are: cardiovascular disease, retinopathy, neuropathy, stroke, hypertension, amputation, and nephropathy. (ADA, 2006) Although there are multiple other complications from the disease, these are the most common.

Cardiovascular disease directly affects the heart and the vascular system. Retinopathy is damage to the retina of the eye due to lack of blood supply. Neuropathy is a disease of the nervous system, in diabetic patients it is usually seen by the numbness of the fingers and toes. Stroke is caused by either an acute blockage of an artery to the brain

or from a bleed somewhere in the brain. Either one can cause part of the brain to die due to lack of oxygen. Hypertension is the medical name for high blood pressure. Amputation is the removal of a specific part of the body. Often in diabetics feet/legs are removed due to lack of ability to heal, causing gangrene to develop. Furthermore, diabetic nephropathy is caused by a buildup of protein in the kidneys. It is a progressive disease that often results in dialysis. (CDC, 2006)

A common misconception about diabetes is that simply eating foods high in sugar content causes diabetes. Poor food choices may cause obesity, however increasing age, lack of physical activity, and genetics are factors that increase your chance of developing Type 2 diabetes. The afore mentioned complications come with an enormous expense. In 2002 the American Diabetes Association (ADA) estimated the economic cost of diabetes was $132 billion dollars which by some experts is considered an under estimation. In 1997 the total cost of care related to diabetes was $44 billion. (ADA, 2006)

Of the $132 billion of total cost in 2002, direct medical expenses were $92 billion. When broken down the $92 billion looks like this: $23.2 billion of that was for diabetic care, $24.6 billion for chronic diabetes related complications, and $44.1 billion went for general medical conditions associated with diabetics. The remaining $40.8 billion, of the original $132 billion, went to things like lost work time, restricted activities, mortality, and permanent disability. (ADA, 2006)

In 1997 the average annual medical cost for diabetics was $10,071, in 2002 that number jumped to $13,243, amounting to an increase of more than 30%. On the other hand the average annual cost of health care for a non-diabetic was just $2,560 in 2002.

The difference in annual health care spending between diabetics and non-diabetics is that diabetic spending was an average of 517% more in 2002 than non-diabetics. (ADA, 2006) Diabetes accounted for $88 million disability days and it was responsible for 176,000 new cases of permanent disability as reported by the ADA in 2002. There are also immeasurable expenses that family and friends endure such as care or transportation.

Expense is one problem diabetics face, but lack of medical insurance is another issue that they face. The Census Bureau in 2007 reported that the number of Americans without medical insurance was 47 million in 2006. This was a record from the previous year. The bureau reported an increase of 7.2 million since 2000. In 2003 they reported that 45 million Americans were without medical insurance, which is 1out of 6 people nation-wide. Extrapolating this data to 2010, one might expect to see approximately 50 million people without medical insurance. With nearly 50 million people without health insurance, many people with diabetes are going with little or no treatment. Figuring that 7% of the U.S. are diabetic, about 3.5 million people are diabetic and without health insurance in the U.S.

The U.S Department of Health and Human Services reports that 54 million (one in six) Americans have pre-diabetes. Pre-diabetes is a condition in which blood sugar levels are higher than normal but not high enough to be diagnosed with diabetes. Those with pre-diabetes are likely to develop Type 2 diabetes within 10 years. The good news is that moderate weight loss and regular exercise can prevent or delay the onset. (CDC, 2006)

There are several studies being conducted regarding prevention of diabetes and its related complications. First, a study published in the American Journal of Preventive

Medicine looks at two populations of African Americans. The study looks at the glycemic and lipid control of the study participants. If both glycemic and lipid numbers are kept low then future diabetic problems are less likely to occur, in turn resulting in less care needed. In a similar study, the researchers looked at: glucose levels for the previous year, cholesterol, smoking, blood pressure, if there was an eye and foot exam in the last year, protein in urine, dental exam, depression screening, and weight reduction. These items were all monitored over the previous year. The study found that if these were monitored carefully, fewer problems resulted in the future. (AJPM, 2001) Furthermore, a study conducted at the University of Michigan with regards to pre-diabetes showed positive results. Researchers using diet, exercise and a pre-diabetes drug called metformin had amazing results. The metformin group showed a 38% reduction in developing diabetes and the group that had diet/exercise showed a 58% reduction in developing diabetes. (University of Michigan, 2005)

In a study published in 2001 by the American Journal of Preventive Medicine, the researchers examined levels of diabetes preventive care services and lipid control. The study consisted of 625 African American adults with diabetes. In the study participants underwent an interview regarding their preventive care services that they had received. Some participants of the study (70-80%) reported receiving annual eye, foot, and lipid exams. Only 46% reported having Glycosylated Hemoglobin tests. Only 31% reported physical activity and 40% reported self-monitoring of blood glucose. A lack of insurance was the most common excuse for not seeking care. The study concluded that diabetes preventive care services were comparable to U.S. estimates, but glycemic, lipid, and levels of self-management behaviors were poor. (Gregg et al, 2001)

In a similar study looking at the socioeconomic aspect of preventive care, Rabi et al (2006), found that low income appears to be associated with a higher prevalence of diabetes and diabetes related complications. The objective of the study was to determine whether income was associated with referral to a diabetes center within a universal health care system. The study was conducted looking at diabetics in Canada. The study concluded that low income was associated with a higher prevalence of diabetes.

Continuing to look at social class differences, Williams-Oladele and Barnett (2005) published a study looking at race, ethnicity, and social class differences in preventive care among persons with diabetes. They analyzed data from the Behavioral Risk Factor Survey for 1998-2001. The study targeted non-Hispanic Black, non-Hispanic White and Hispanic populations. They found that Blacks and Hispanics engaged more frequently in preventive care than Whites. They found that Whites were more likely to smoke and to not have seen a doctor in the previous year. They found that persons of lower social class were at a greater risk of not receiving preventive care regardless of race/ethnicity.

Finally, a study published by Nelson, Chapko, Reiber and Boyko (2005) looks for an association between type of health insurance coverage and the quality of care provided to individuals with diabetes in the U.S. The data was also obtained from the 2000 Behavioral Risk Factor Surveillance System. The study had 11,647 participants with diabetes. The factors that were looked at were a population over the age of 65, under the age of 65, type of insurance they had, and what specific diabetes care measures they participated in. They also looked at race, ethnicity, annual income, gender, education and insulin use. The study concluded that uninsured adults with diabetes were predominantly

racial minorities and low income individuals. They also received fewer preventive services than those with insurance.

All of these studies agree that the lower the income, the less likely a person is to take preventive steps in diabetic care. Also all of these studies were conducted with data prior to 2001. Even though the Rabi et al (2006) study was conducted in Canada we can learn from it by the fact that Canada has universal heath care, yet low income people still don't treat diabetes. By researching data from 2004-2007 we can get a better understanding for current diabetes trends.

Question:

What relation does race/ethnicity and socioeconomic status play in preventive diabetes care?

Study:

The Behavioral Risk Factor Surveillance System by the CDC has a multitude of data regarding diabetes, and is a national survey that is conducted annually. Survey questions can be divided up by race, gender, age, income, and education. By combining data from the surveys one can expect to obtain a better grasp on the social aspects of diabetes. The data compared were diabetes status, exercise, body mass index (BMI), and health care access/coverage on a nationwide graph. The raw data from the surveys were compiled into an excel file to create graphs. The graphs created showed trends in diabetes on a national level from 2004 to 2007. The first category was with regards to diabetes. The surveyor asked volunteers if they had ever been told by a doctor that they had diabetes. Of the affirmative responders were divided by income, gender, age, race, and level of education. The next topic graphed was BMI. People were asked what their

body mass index was. There were three subgroups in the BMI category. The first subgroup was a BMI of less than 24.9, the next group was a BMI of between 25 and 29.9, and the third group was with a BMI of greater than 30. Each group was also graphed by income, gender, age, race, and level of education. The next category graphed was access to health care. This was specific to adults 18 to 64 and they were asked if they had access to health care. The yes responses were graphed by, income, age, race, and level of education from 2004-2007. The last category graphed was exercise. The participants were asked if they had participated in any physical activities over the last month. That category was also grouped into income, age, race, and level of education. Furthermore by searching pub med and the CDC website one would expect to find information regarding diabetes, race, gender, and socioeconomic status from other sources.

Results:

In figure 1, participants who responded yes when asked if they were told they had diabetes by a doctor, trended as follows:

1. more men than women have diabetes
2. 65 and older had the highest rate while 18-24 had the lowest rate
3. those making under $15,000/year had highest rate
4. participants with less than a high school diploma had highest rate
5. Black and multiracial groups had the highest rates while Hispanic had the lowest

In figure 2, respondents were asked what their BMI was. There were three sub-groups, neither overweight nor obese (BMI < 24.9), overweight (BMI 25.0 - 29.9), obese (BMI 30.0 - 99.8).

1. BMI <24.9
    a. more females than men

b. 18-24 is highest, 65 and over is lowest
c. Income fluctuates, but in 2007 $50,000 or more was highest
d. College graduates was highest
e. White was highest while Black was lowest

2. BMI 25-29.9
    a. more men than women
    b. 55-64 and 65+ were the highest in this group
    c. $50,000 was highest group while <$15,000 was lowest
    d. College graduate was highest
    e. Hispanic was highest while group labeled other was lowest

3. BMI >30
    a. more men than women, but very similar
    b. 65+ was highest while 18-24 was lowest
    c. Less than $15,000 was highest while $50,000+ was lowest
    d. Less than high school diploma was highest, college grad was lowest
    e. Black was highest while group Other was lowest

In figure 3, participants who had no access to health care, the following results were seen:

1. 18-24 had the least access
2. those who make less than $15,000/ year have least access
3. those with less than a high school diploma have least access
4. Hispanic had the least access while white respondents had the most

In figure 4, shows physical activity over last month:

1. 18-24 had most activity
2. those making $50,000+ had most physical activity
3. college grads had most while less than high school diploma had least
4. White had most and Hispanic had least physical activity

Discussion:

There is a growing trend of increased obesity and increasing rates of diabetes, yet the trend of exercise is nearly consistent. One might expect to see a decrease in exercise

if the rate of obesity is increasing. All the graphs show increasing rates of obesity and decreasing rates of non-obese, but the amount of exercise is remaining steady. It is possible that the respondents are misunderstanding what constitutes exercise. This misunderstanding might explain why there are increasing numbers of obese. People may think they are getting exercise, when in fact they are not.

As for the diabetics the results are mostly supported by what the American Diabetes Association, the NIH and the CDC lists on their website regarding persons at risk of diabetes. One contrary finding was the low incidence of diabetes in Hispanics. There could be several factors that affect this finding. First, it has been published that 40% of diabetics don't know they are diabetic, so it is possible that they don't know they are diabetic. Secondly, the Hispanic responders might not regularly see health care professionals. Graph 3c shows Hispanics have the least access to health care thus supporting the idea that many might not know that they have diabetes. The National Diabetes Information Clearinghouse (NDIC) states that Hispanics have a 90 percent increased risk of developing diabetes and they also state that Hispanics are 1.9 times more likely to have diabetes arguing further that the data obtained is not accurate with regards to Hispanics. Also there are often language barriers to overcome with Hispanic respondents.

In a press release from the CDC in 2008 the number of diabetics in the U.S. has climbed to 24 million or 8% of the population. They found that diabetes disproportionately affects the elderly, 25% of 60 and older. They also found that after adjusting population age differences between groups Native Americans comprised 16%, Blacks comprised 11%, Hispanics 10.4%, Asian Americans 7.5% and Whites 6.6% of

diabetic in each race group. Further more Blacks and Hispanics are at the greatest risk in the US for developing diabetes over their lifetime. In fact over 50% of Hispanic women are expected to develop diabetes over their lifetime according to the CDC. The information give by the National Institute of Health is along the lines of the CDC. According to the NIH 4% of Blacks have undiagnosed diabetes bring the overall total to 14.7%.

The Office of Minority Health (OMH), part of the U.S. Department of Health and Human Services has statistics posted regarding diabetes among populations. They found that Mexican Americans are 1.7 times more likely to have been diagnosed with diabetes than Whites. Hispanics are 1.7 times more likely to start end stage renal disease treatment as a result of diabetes than Whites. Furthermore they found that Hispanics were 1.5 times more likely to die from diabetes than Whites. As for percentages that were age adjusted the OMH found 12.4% of Mexican Americans were diabetic and 6.4% of Whites are diabetic. Out of every 100 Hispanic diabetics 19 men and 18.9 women were observed to have visual impairment. Out of every 100 White diabetics 16.9 men and 19.3 women had been observed to have visual impairment.

The U.S. Department of Health and Human Services has identified cultural and economic barriers that affect how Hispanics treat diabetes. They found that Hispanics distrust insulin therapy. Also it was found that Hispanics would rather treat diabetes with traditional therapies than modern therapies. Finally they also state that there is a fatalistic acceptance in the Hispanic community of diabetes.

The University of Michigan conducted a survey to help determine why diabetes is worse for minorities. The main factors found that minorities have a low drug adherence

and more emotional distress that worsens diabetes. Specifically the study found that African American patients are less likely than white patients to take diabetes medications as prescribed. Latino patients are more likely to suffer from emotional distress due to being diagnosed with diabetes. They also found that socioeconomic, clinical, health care, and self management issues account for 14% of the difference in blood sugar control between African Americans and white Americans.

Conclusions:

The key to reducing diabetes is not just treating, but preventing in the first place. The findings show that high school dropouts and the poor have increased rates of obesity and diabetes. Also Blacks are at a greater risk of developing diabetes than other racial groups. Furthermore the lower the income level, the greater the risk of diabetes and obesity. As Americans become more overweight and live longer the rate of diabetes continues to increase thus creating a larger expense on society. Many of these expenses are never recouped due to the uninsured not seeking preventive treatment. When leaving diabetes untreated the complications, are far more expensive than treatment. Often the people with complications end up in the emergency room, thus adding to the overall expense. By studying current trends society can learn and possibly curb the future of diabetes demographics. Also public awareness of BMI, access to healthcare, and activity awareness can contribute to future outcomes of diabetes demographics. Health education programs in schools and in communities could have a positive impact on future health. By targeting at risk populations with education about diet, exercise, diabetes complications and BMI would bring awareness to the public thus reducing overall complications.

Future directions:

Clinical study:

Conduct a 6 month activity clinical trial involving male and female subjects less than 40 years old of who are at risk of developing type 2 diabetes. The goal of study is to determine if access to a free gym and activity awareness can promote weight loss, lower A1C, improve blood pressure, and lower blood pressure.

Study:

Enroll 12 male and 12 female subjects into 6 month activity clinical trial. Potential subjects will be contacted by mail to determine interest. Subjects will be prescreened for eligibility. Each subject will have an initial physical to determine eligibility where a small blood sample, weight, height, blood pressure, and heart rate will be taken. Subjects meeting inclusion criteria will be consented and enrolled. Upon enrollment subjects will be given a pedometer, activity diary, and enrollment to nearby gym. Subjects will be monitored at 1 month, 3 months, and 6 months. At 1 month weight, blood pressure, and heart rate will be taken. At the 3 and 6 month visits, blood, weight, blood pressure, and heart rate will be taken. Throughout study subject will call, or email daily pedometer readings to clinical coordinator. Upon completion of study subjects will receive $150 compensation and will keep pedometer and diary.

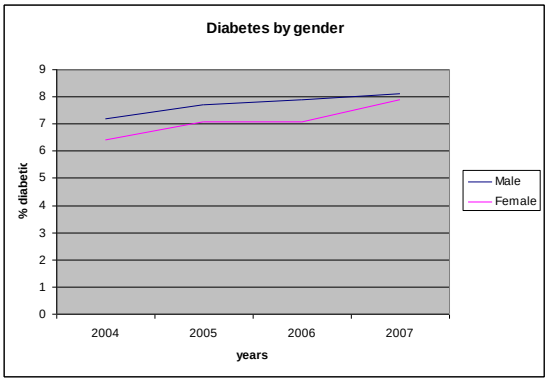
Inclusion criteria: Male/Females under 40 with a BMI greater than 29.9.

Exclusion criteria: Subjects with uncontrolled blood pressure. Subjects pregnant or nursing. Subjects that have a gym membership.

Figures:

Figure 1.

a.



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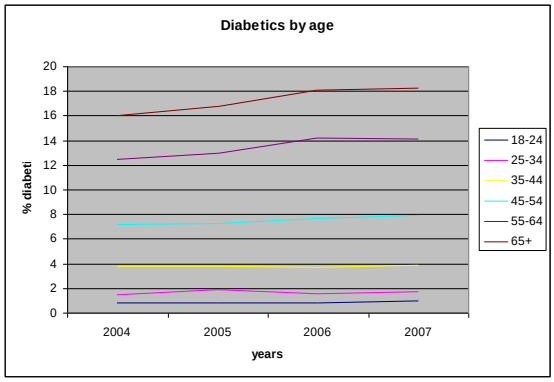

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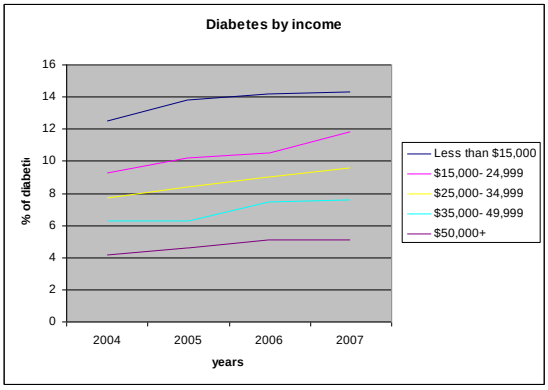

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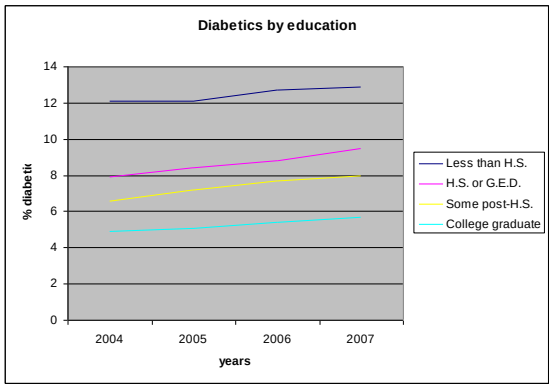

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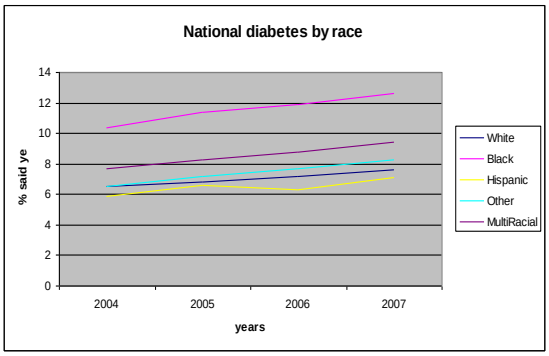

Figure 1a shows occurrence of diabetes in males vs females 2004 to 2007. Figure 1b shows the occurrence of diabetes by age. Figure 1c shows the occurrence of diabetes by income. Figure 1d shows the occurrence of diabetes by education and figure 1e shows the occurrence of diabetes by race.

Figure 2.

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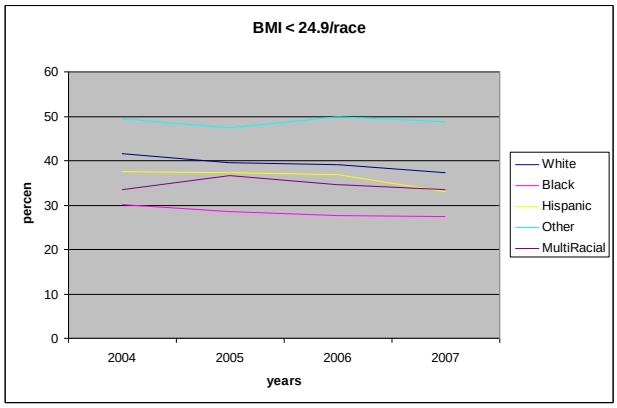

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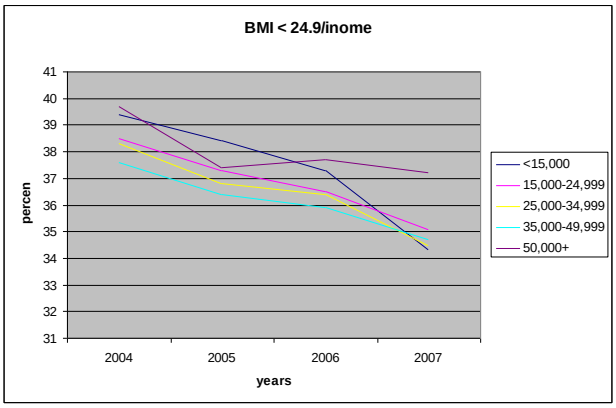

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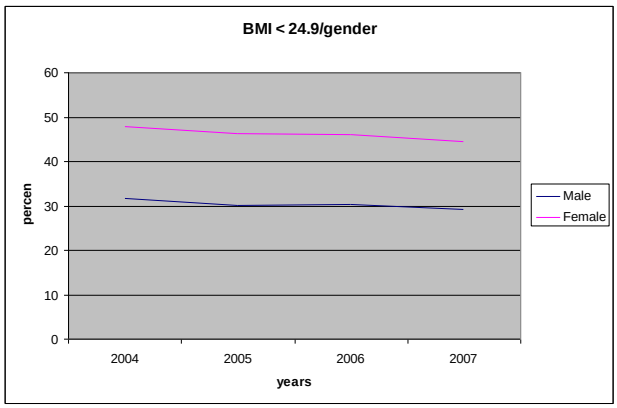

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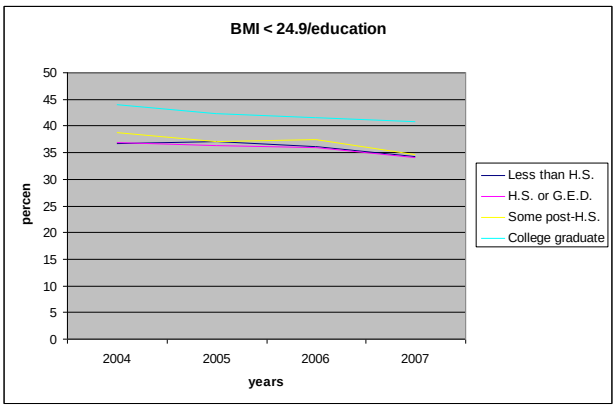

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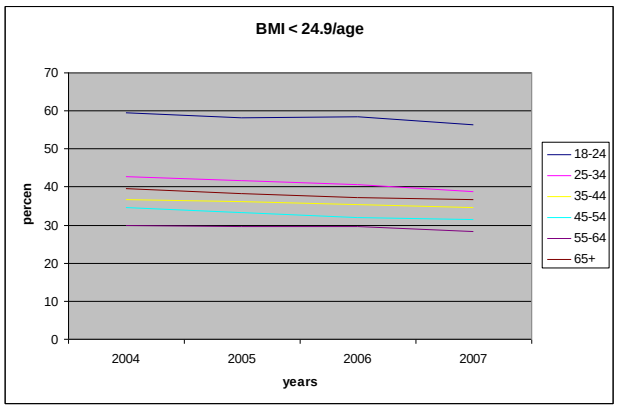

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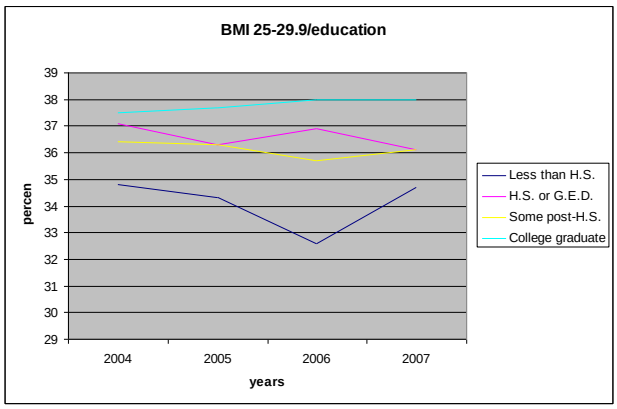

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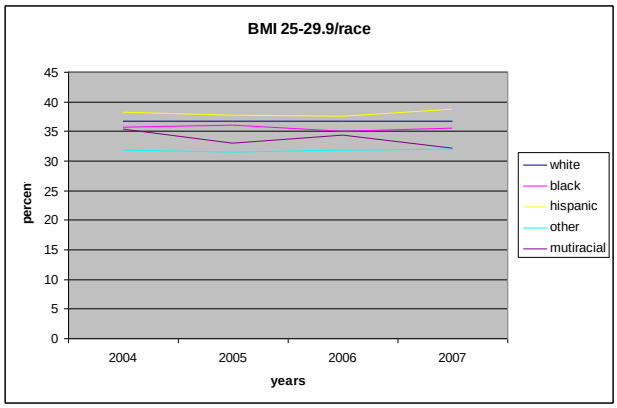
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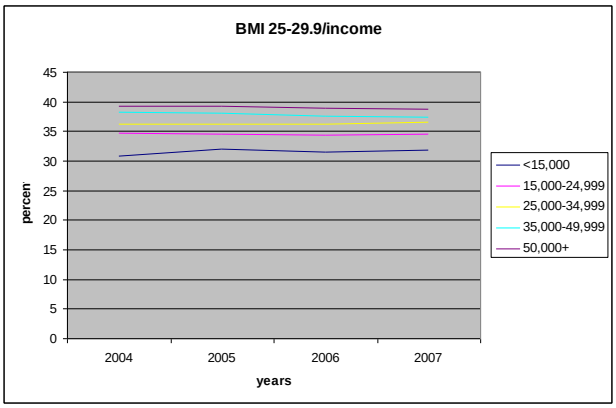
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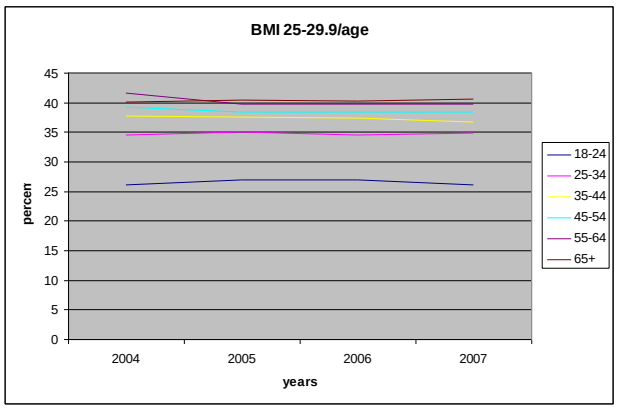
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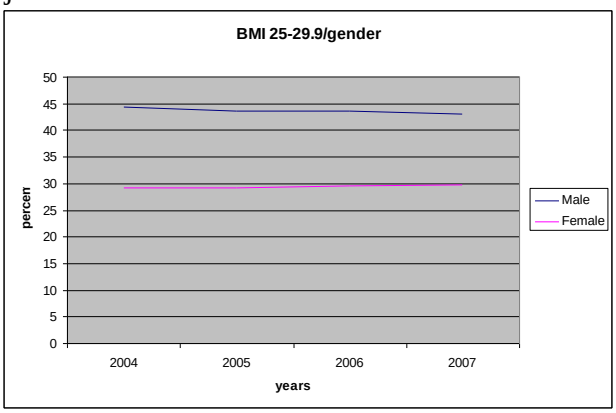
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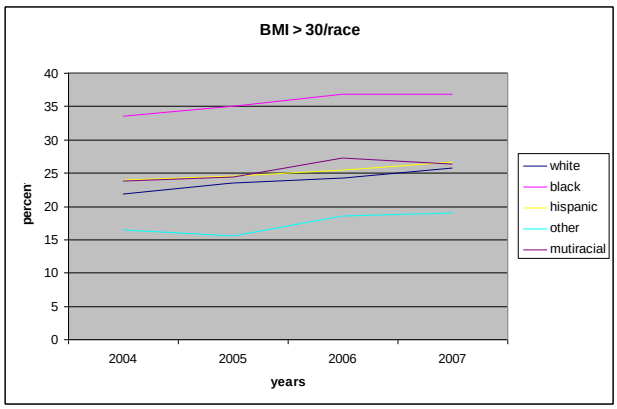
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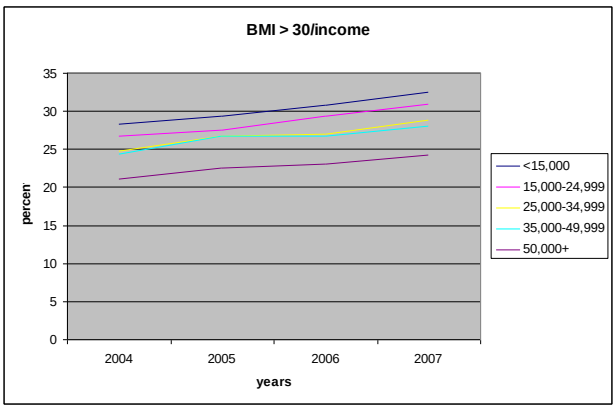
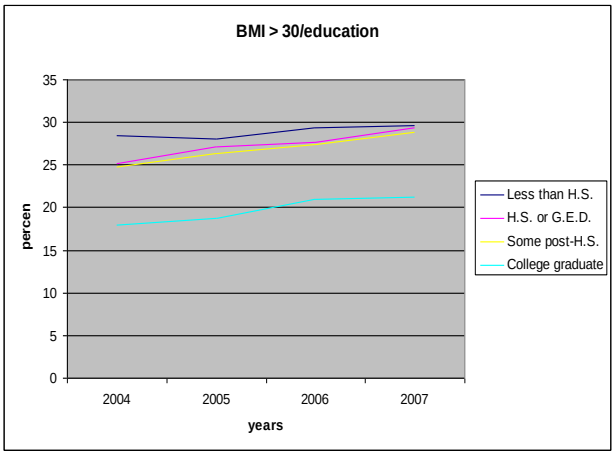
mutiracial

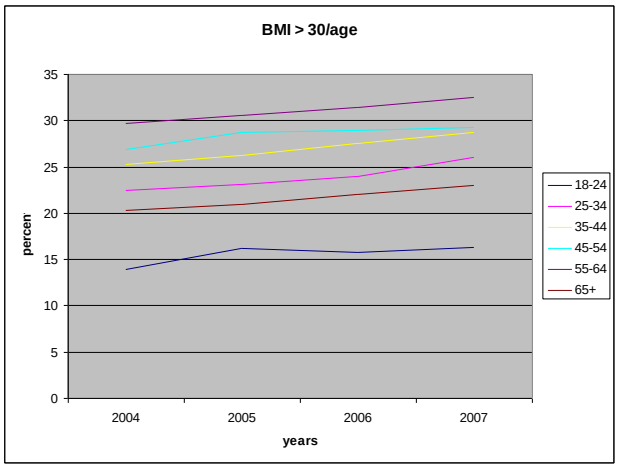
l.


BMI > 30/income
percen
35
30
25
20
15
10
5
0
2004
2005
2006
2007
years
<15,000
15,000-24,999
25,000-34,999
35,000-49,999
50,000+

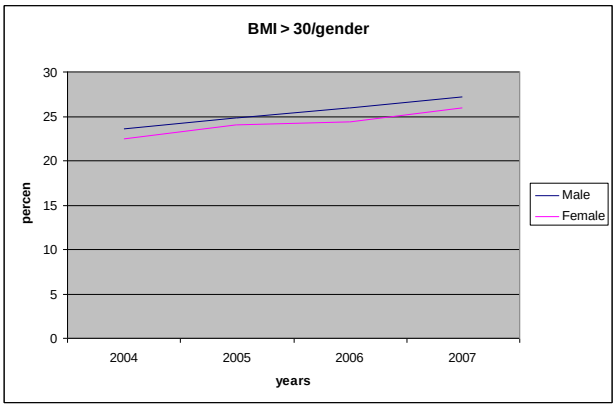
m.



n.



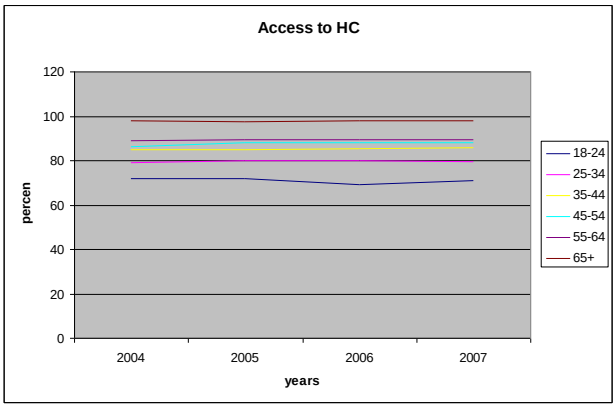
o.



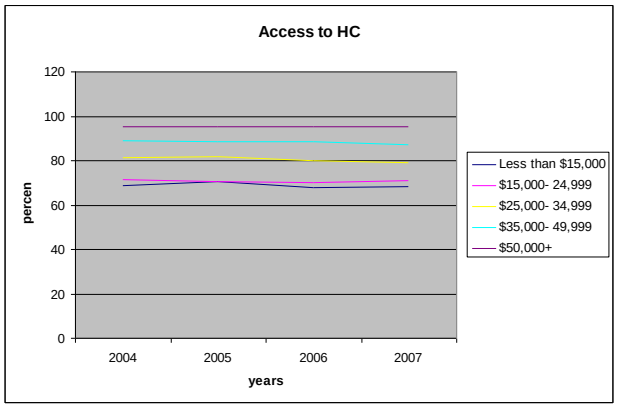
All figures show percentage trends between 2004 and 2007. Figure 2a shows the percentage of people by race with a BMI of less than 24.9. Figure 2b show the percentage people by income level with a BMI of less than 24.9. Figure 2c shows the percentage of males/females with a BMI of less than 24.9. Figure 2d shows the percentage of people divided by education with a BMI of less than 24.9. Figure 2e shows the percentage of people divided into age groups with a BMI of less than 24.9. Figure 2f shows the percentage of people divided by education with a BMI of 25-29.9. Figure 2g shows the percentage of people by race with a BMI of 25-29.9. Figure 2h shows the percentage of people by income level with a BMI of 25-29.9. Figure 2i shows the percentage of people divided into age groups with a BMI of 25-29.9. Figure 2j show the percentage of males/females with a BMI of 25-29.9. Figure 2k shows the percentage of people by race with a BMI over 30. Figure 2l shows the percentage of people by income with a BMI over 30. Figure 2m shows the percentage of people by education with a BMI over 30. Figure 2n shows the percentage of people divided by age with a BMI over 30. Finally figure 2o show the percentage of male/females with a BMI over 30.

Figure 3.

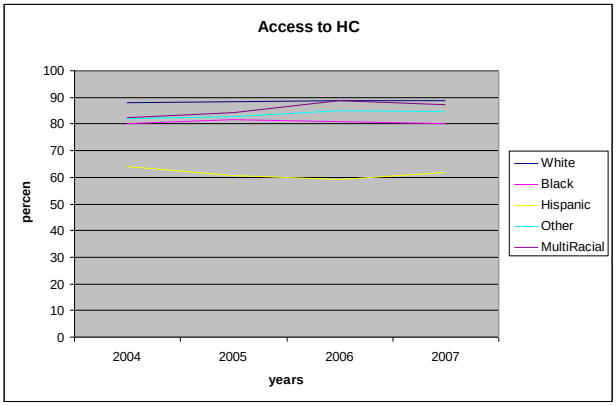
a.



b.



c.



d.

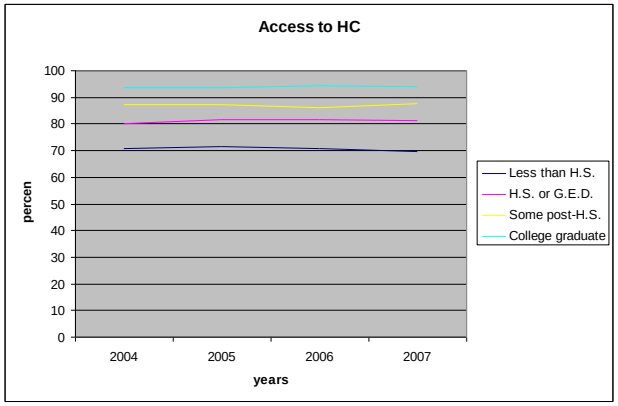
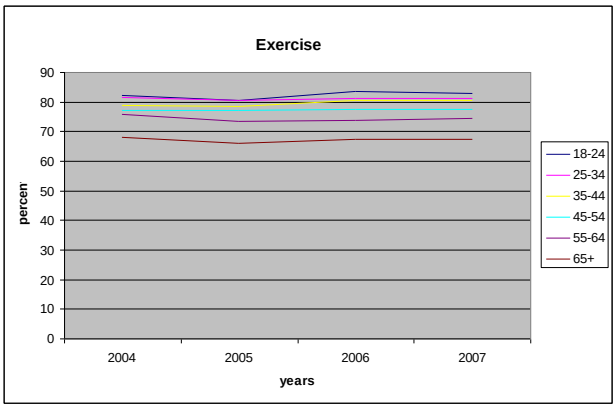


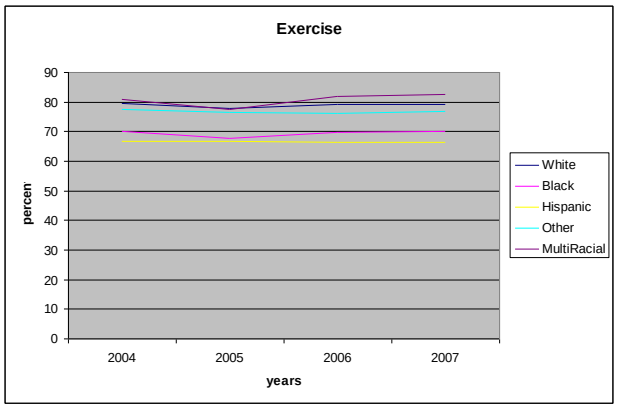
Figure 3 shows the results from the respondents that said that they have access to health care and is divided up by age in a, by income in b, by race in c, and by education in d.

Figure 4.

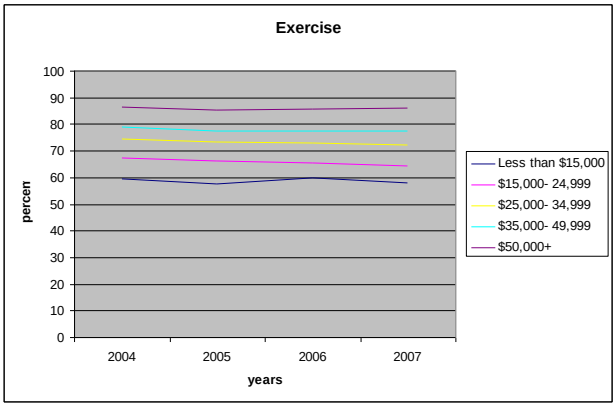
a.



b.



c.



d.

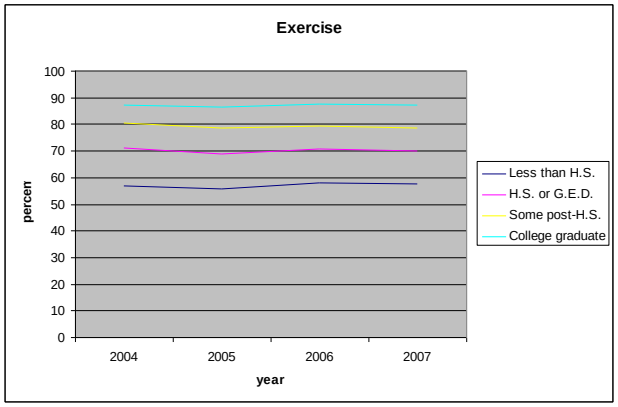


Figure 4 shows the percentage of people that said that they exercise several times weekly and is divided up by age in figure a, by race in b, by income in c, and by education in figure 4d.

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