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## A Participant Model: Predictive Medical and Behavioral Factors of Prostate Cancer Screening Attendees at Markey

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# A Participant Model: Predictive Medical and Behavioral Factors of Prostate Cancer Screening Attendees at Markey

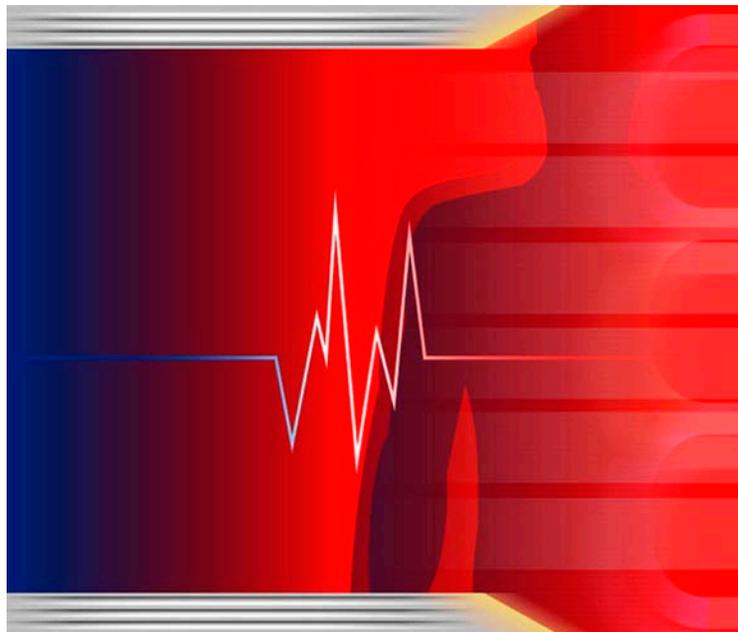
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*A Capstone Project Presented to the Faculty of the  
Martin School of Public Policy and Administration at the University of Kentucky*

*Written by:*

Shana L. Steinbach

April 23, 2009



## ***Executive Summary***

### **Problem Statement**

The Prostate Cancer Screening Program at the Markey Cancer Center co-sponsors prostate cancer screenings with the Prostate Cancer Education Council. All participation, including African-American attendance, has decreased 38% from years 2006 to 2008 and program managers are seeking insight to improve program participation by acquiring knowledge of behavioral and medical characteristics that may influence screening attendance. Because of the higher incidence of prostate cancer in African-American men (ACS, 2008), a specific program goal is also to increase screening attendance for this minority population.

### **Research Strategy**

Questions that assess participant behavior, personal, and family medical history are analyzed to determine specific relevant variables that may influence participation. A general description of the data and participation rates, for new and returning participants, is presented. Variable analysis will be conducted for certain behavioral factors and grouped variable analyses will be conducted for urinary, sexual and testosterone health symptoms. Relevant variables with predict returning participant behaviors.

### **Major Findings**

Personal and family health histories play an important role in participation. Men who consider themselves *high risk are more likely to smoke*, and returning participant models found that men with these variables are more likely to return. Returning African-American behavior is largely unknown although a small portion of men are suffering from testosterone health symptoms. Sexual health symptoms play an important role in the overall attendance of African-American men. Urinary health symptoms do not play an important role in the attendance of program participants. This might be unfortunate, considering that urinary symptoms are more relevant to prostate cancer than sexual health symptoms. There are no statistically significant differences related to race, but this is a policy problem, given that African-American's are more likely to have prostate cancer.

Most participants report receiving information about the program via: newspaper, friends and family, and by radio and television. Program managers can use the findings about behavioral and medical factors that affect participation to develop targeted marketing strategies. Marketing avenues that are effective and have not been explored are places of work and wives or significant others.

### **Recommendations**

It is recommended that program managers should focus marketing efforts on men with sexual and testosterone health symptoms, those who believe they are at *high risk* for prostate cancer to encourage retention. A special marketing effort towards African-Americans is essential in realizing program goals. Program managers should strategize marketing efforts via newspaper, radio, television, and the internet. Different motives underlie decisions to seek or return for screening including: high risk, health consciousness, and pressure from a wife, and marketing initiatives could target all of these. Greater success in attracting returning African-Americans would be relevant and is not, at present, occurring.

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## ***I. Background and Relevant Facts***

### ***A. Program Background***

This research paper reports findings from a survey given to prostate screening attendees at the Markey Cancer Center (Markey). Data from 2006-2008 were analyzed to identify factors, relationships, and trends in the behavior of both returning and new participants in the prostate cancer screening program. The goal of the research is to develop information that is useful to program managers, administrators, and grant givers in an effort to continue the program and increase attendance.

Organizations, such as the Prostate Cancer Education Council (PCEC) co-sponsor prostate cancer screenings to encourage early detection methods. Prostate cancer screenings at the Markey Cancer Center are held in conjunction with Prostate Cancer Awareness Week (PCAW), a national program coordinated by the PCEC. The PCEC currently has more than 600 research screening sites, and since its inception in 1989, has screened more than 3,000,000 men (PCEC, 2009).

PCAW is usually held in September, and Markey operates two (2) additional screening programs annually in April and December. Program participation is open for all Kentucky residents. The Kentucky Cancer Program, in conjunction with the University of Kentucky, runs the program and pays for nearly half of the program expenses with grant monies received from Toyota Motor Manufacturing. The grant

is currently managed by the Markey Cancer Foundation. To keep expenses low, the benefit of participating in the PCEC co-sponsored screening is that of discounted lab costs for Prostate Specific Antigen exams (PSA).

Currently, program managers advertise the program on local radio and television stations, in community newspapers, and on the UK HealthCare and PCEC websites. Analyses presented here will help target marketing efforts to improve program participation, specifically for African-American men. Under the direct supervision of the PCEC, Markey meets HIPPA and Internal Review Board (IRB) compliance for the study. However, targeting men for the program continues to need improvement.

In the state of Kentucky various initiatives are in place to encourage early detection and education about prostate cancer health. There are four cancer centers that participate in free or reduced cost prostate cancer screening programs: the University of Kentucky's Markey Cancer Center (Markey), the Jennie Stuart Medical Center in Hopkinsville, the Leonard Lawson Cancer Center located in Pikeville, and the James Graham Brown Cancer Center in Louisville. Geographically, Markey is the only Central Kentucky participating partner with the PCEC program.

Currently, three out of four screening sites in Kentucky participate in the PCEC co-sponsored longitudinal study; however, data are only available from Markey. A longitudinal study is a research study that extends for several years and is often aimed at developing conclusive evidence for policy makers. The program's

mission is to screen and educate Kentucky's men about the warning signs, health hazards, and treatment options of prostate cancer. There are 5 initiatives for the 2009 grant:

1. Provide education and instill awareness across the entire regional service area concerning prostate cancer, overall health and wellness, and the possibility and importance of early prostate cancer detection.
2. Provide specific opportunities for prostate cancer screening at no financial cost to participants.
3. Increase minority participation.
4. Maintain quality of current program.
5. Increase early detection rates, cure and quality of life.

Grant objectives are to improve attendance year after year, specifically for minority populations. Funding for cancer research, education, and screening has long been promoted by private and public donation. The most recent statistics by the PCEC estimate that that prostate cancer programs are underfunded and currently for every \$100 donated to breast cancer only \$1 is given to prostate cancer health and research programs. However Markey has been successful in seeking funding.

## **B. Relevant Facts**

Prostate cancer is the second leading cause of cancer death after lung cancer for men and is the second most common cancer after skin cancer (PCEC, 2008). Several years ago statistics estimated that prostate cancer would strike one in eleven males during their lifetime (PCEC, 2008). Today, it's one in six, and the American Cancer Society (ACS) predicts that 1 in 35 men or 28,660 will die of this disease in 2008 (ACS, 2009). Screening already plays a key role in the management of cervical and breast cancer, and is likely to become more important in the control of colorectal, prostate and lung cancer (ACS, 2009).

Prostate cancer isn't just a burden emotionally or physically—it's a burden financially. *CANCER*, a peer-reviewed journal for the American Cancer Society published a study that estimates the cumulative cost for prostate cancer at \$42,570 for five years, (Wilson, 2006) and individual out-of-pocket cost for other types of cancer survivors on average at \$8,900 (Harrington, 2009). Based on US Medicare data, the cost per life year saved by the two most popular prostate cancer screening mechanisms, the PSA and the Digital Rectal Exam (DRE), compared with no screening was \$12,502-\$15,213 for men aged 65, \$27,075 in men aged 70, and \$41,672-\$55,681 in men aged 75 (Barry, 1995).

Economic issues play an important role in medical decision-making, and are just as important in prostate cancer screenings (Imamura, 2008). The importance of the program is not only justified because of its ability to save lives but also the

economic and societal impact prostate screening can have on the community. Because identifying prostate cancer early provides men the best chance of survival and financial freedom, early detection represents one of the most promising approaches in reducing the growing cancer burden (Etzioni, 2003).

“The promise for early detection is that it will identify cancer while still localized and curable, preventing not only mortality, but reducing morbidity and costs.” (Etzioni, 2003). More than 2 million men in the United States who have had prostate cancer at some point are still alive today (ACS, 2009). According to the ACS, the death rate for prostate cancer has decreased, and if detected early, prostate cancer is considered highly curable. In fact, ACS also reports that the 5-year survival rate of men with prostate cancer detected in the earliest stages is 100% (PCEC, 2008). Screening serves as an early detection tool as 79% of all prostate cancers are discovered in their local and regional stages have a 5-year survival rate of 100%, and according to more specific data, 67% of men diagnosed with prostate cancer survive 10 years and 52% survive for 15 years (ACS, 2009).

Although prostate cancer mortality rates declined 4.4% among men nationally from years 2001 to 2005 (Rabin, 2008), prostate cancer incidence among African-American men remains more than twice as high among white men (ACS, 2008). Markey realizes the need to encourage the screening of African-American men, and specific program initiatives are being put in place to increase all minority screenings in 2009 (MCF, 2009). African-Americans are more likely to be diagnosed

with advanced stage diseases for breast, cervical, colorectal, lung, prostate, and ovarian cancers and men who have a longer time between doctor's visits have poorer survival rates (Wade, 2008) and substantial long-term prostate-related expenditures (Medical News Today, 2006).

Research shows that prostate cancer is disproportionately prevalent among African-American men. Average incidence of prostate cancer is 60% higher in African-American men when compared to white men, and African-American's have the highest mortality rate of any ethnic or racial group. (Crowford, 2003). Additionally, African-American men who have a family history of prostate cancer have a 75-80% higher risk of developing prostate cancer (Catalona, 2002). In fact, over twice as many African-American men are diagnosed with prostate cancer, and more than twice as many die from the disease (PCEC, 2009).

The relationship between prostate cancer incidence and African-American men proves to be important to prostate cancer screening programs, as there is also discussion that the financial burden of prostate cancer is more significant for African-Americans as they are more often lower on the socio-economic ladder and are more likely to be uninsured or underinsured. A lack of health insurance serves as an influence in screening decisions (Cancer Council, 2009), and the free prostate cancer screening program may be a solution for prostate cancer screenings for lower-income men.

According to the Kaiser Foundation, the uninsured rate of non-elderly African-American’s is 21% compared with 17% for the population as a whole (Wade, 2008). Currently, Markey’s prostate screening program has remained flat in targeting African-American men, as from years 2006 to 2008 screenings recruited nearly 7.3% of African-Americans, while according to the 2000 census the state of Kentucky’s African-American population is 7.7%. There is no statistically significant difference between population proportions and screening proportions, but the higher incidence of prostate cancer in African-Americans implies that the screening rate should be higher in this group. The program is currently seeing a decrease of almost 38% in attendance of all men, and program managers are looking for insights into how to improve participation.

### C. General Data Description

The program had a total of 1,019 participants comprised of 945 non African-American participants and 74 African-American participants from years 2006 to 2008.

**Chart 1: Total Participation, New versus Returning 2006-2008**

	2006		2007		2008		Total
	Returning	New	Returning	New	Returning	New	
<b>All Participants</b>	258	136	220	158	178	69	<b>1,019</b>
<b>African-American Participants</b>	20	10	14	10	8	12	<b>74</b>
<b>Total Participation</b>	<b>394</b>		<b>378</b>		<b>247</b>		
<b>Return %</b>	<b>65%</b>		<b>58%</b>		<b>73%</b>		
<b>New %</b>	<b>35%</b>		<b>42%</b>		<b>27%</b>		
<b>African-American Participation</b>	<b>30</b>		<b>24</b>		<b>20</b>		
<b>Return %</b>	<b>66%</b>		<b>58%</b>		<b>40%</b>		
<b>New %</b>	<b>33%</b>		<b>41%</b>		<b>60%</b>		

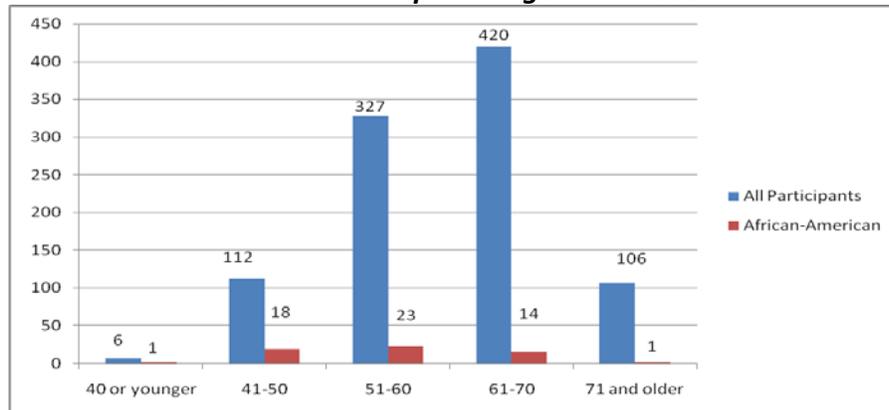
\*Source: PCEC 2008.

Total participation has fallen year over year from 2006 to 2008. Total participation was at 394 participants in 2006, 378 in 2007, and 247 in 2008. Total program participation has decreased 38% from years 2006-2008. Of those participants, the percentage of returning participants from 2006 to 2008 was 65% in 2006, 58% in 2007 and 73% in 2008. Although 2008 had a record **returning** participant year of nearly 73%, total new participation dropped nearly 30% from 2006 to 2008.

The specific data for African-American men followed a similar pattern. There was a 44% drop in total participation from 30 in 2006 to 20 in 2008. Although the number of **new** participants grew by nearly 45%, there was a decrease in **returning** African-American participants by 65%.

The most common age group for participation was 61-70 for all participants (Chart 1) and between ages of 51-60 for African-American men. The majority of total participation among men older than 51 years of age, but African-American participants are generally younger than the majority of other participants.

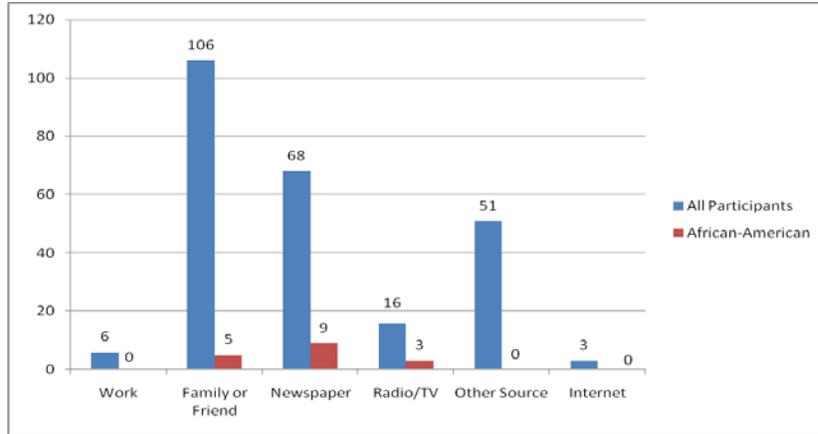
**Chart 1: Participant's Age 2006-2008**



\*Source PCEC 2009

The most common way that participants learned about the program, as 3-year averages report (Chart 2) was by two popular methods: *friends and family* and the *newspaper*.

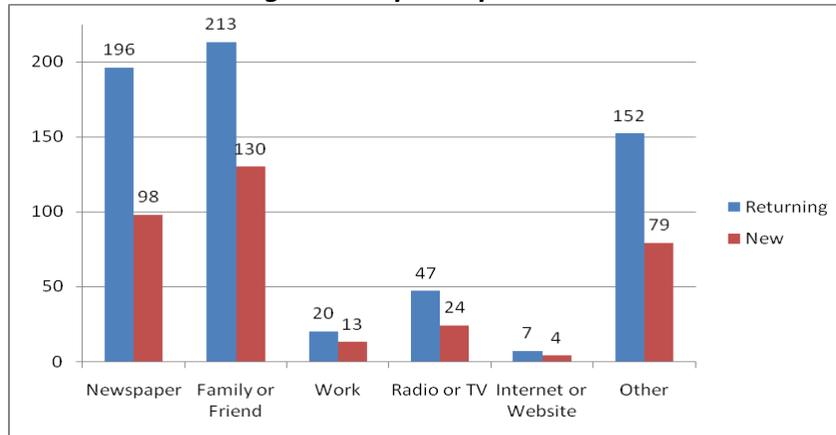
**Chart 2: How did you hear about the screening, all participants 2006-2008**



\*Source PCEC 2009

There was little difference in the results between new and returning participants, although the source of receiving word of the program via *work* plays an important role for *returning* participants, and *radio and television* play an important role in drawing *new* participants (Chart 3) and specifically African-American men (Chart 4).

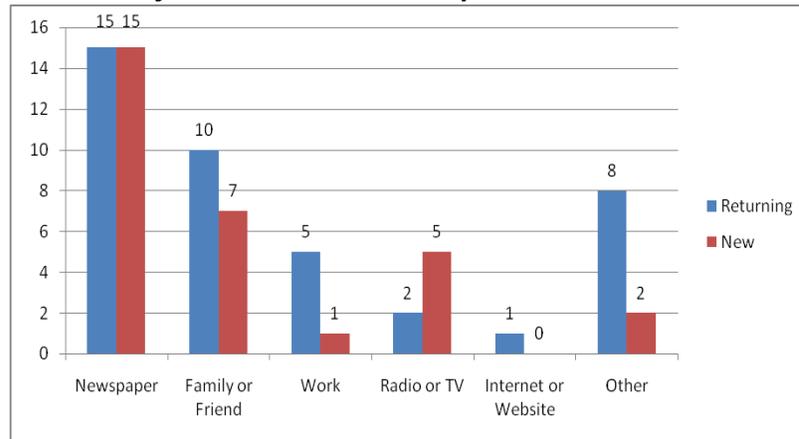
**Chart 3: How did you hear about the screening, returning vs. new participants 2006-2008**



\*Work variable was tracked in 2007 & 2008 only

\*Source PCEC 2009

**Chart 4: How did you hear about the screening,  
African-American Participants 2006-2008**



\*Work variable tracked only in 2006 & 2007

\*Source: PCEC 2009

It is important to note that the *work* variable was only tracked in 2007 and 2008, and it can be reasonably predicted that it would have been important in 2006. The “other” category appears to be a strong third, but due to a lack of specifics, that method of program marketing was eliminated from this analysis.

## **II. Research Design**

Panel data or data that follows the participant through a series of methodical questions over multiple time periods helped me examine medical and behavioral factors that may encourage program attendance. Behavioral and medical factors will include attendance rationale, health implications, family cancer incidence, and the feeling of being at *high risk* for prostate cancer. Medical factors include whether men are currently suffering from urinary, sexual and testosterone health symptoms and will also record if they are obese (tracked by participant’s BMI). Participant models was developed using a statistical regression from relevant variables.

Data will be analyzed for behavioral and medical differences in returning versus new participation, and for African-American men specifically. For research clarification, a new participant in 2008 did not participate in 2007 or 2006, a new participant in 2007 did not participate in 2006, and a new participant in 2006 did not participate in 2005. Data collected from PCEC patient-doctor questionnaires will be statistically analyzed to estimate medical and behavioral characteristics in an attempt to uncover attendance rational and to give managers better participant understanding. Theses medical and behavioral factors will then predict **future** participation models for new and returning program attendees.

**Specific** assessments will be made for behavioral questions, while **grouped** medical factor analyses will be made for urinary, sexual and testosterone symptom evaluations. **Specific** assessments will address each factor for significance. **Grouped** assessments will group responses to track individuals who are feeling one or more symptoms on an index of suffering from urinary, testosterone or sexual health problems. Analyses are split between returning and new participants to analyze differences. The following hypothesis and research questions will be addressed:

**A. Hypothesis:**

There are several medical and behavioral factors that contribute to participation in the prostate cancer screening program including the feeling of being at *high risk* and being *health conscious*. Participants with a family history of prostate cancer and

personal health status as related to urinary, sexual, and testosterone health symptoms are more likely to attend the program.

***Research Questions:***

What behavioral factors influence the decision for men to attend a screening?

What medical factors influence the decision for men to attend a screening; including family, personal medical history and current urinary, sexual and testosterone health issues?

What do participants feel categorizes them as “high risk”? Does smoking influence this assumption?

Are there specific behavioral and medical factors for African-American men?

What factors affect participation?

What factors can program managers use to improve and expand the program?

**Assessments will be made in the following ways:**

1. *Behavioral characteristics*- will ***specifically*** assess participant behavior and lifestyle indicators for attending the screening, current personal health status, and family medical history. The analysis will use regression to estimate the effect of relevant factors of new versus returning participants.

These are discrete or categorical variables. Percentages will describe the relevance of personal and family health history, and incidence of smoking regarding those who identify themselves as high-risk candidates. A factor analysis will also be completed to estimate reason attended.

2. *BMI test*- **will specifically** assess participants BMI as a lifestyle indicator to predict the difference between new and returning program participants.
3. *Urinary Symptoms Evaluation*- will be **grouped** to assess if the participant is suffering from urinary symptoms as a possible reason of attending the screening. A participant will be characterized as “suffering from symptoms” if a problem occurs at least half or more than half of the time, if they are urinating more than three times a night, and if they are dissatisfied with their urinary condition. Using factor analyses to summarize the indicators, the analysis estimates if there is a relationship between suffering from urinary symptoms and attending the screening.
4. *Sexual Health Inventory*- will be **grouped** to assess if the participant is suffering from sexual health issues as a possible reason for attending the screening. A participant will be characterized as “suffering from symptoms” if a symptom occurs at least half or more than half of the time, if they have low confidence in an erection, have difficulty or if they do not attempt intercourse. Factor analyses will summarize the conditions.

5. *Testosterone Test*- survey questions will be **grouped** to assess if the participant is suffering from testosterone health issues as a possible reason of attending the screening. A participant will be characterized as “suffering from symptoms” if a response of “yes” is marked for any or all of the questions. Factor analyses will summarize the conditions.
  
6. *Participant Models*- will analyze variables found in the above tests in a regression to predict **future** new and returning participant behavior.

*Responses to the following questionnaire are used in analysis:*

**1. GENERAL DATA DESCRIPTION**

Age

What race/ethnicity best describes you?

Years participated in PCAW?

How did you hear about the free screening during Prostate Cancer Awareness Week?

**2. BEHAVIORAL INVENTORY**

Do you smoke or have you been a smoker?

What health conditions or procedures do you/have you had?

What is your family health history?

Why are you attending this screening program?

**3. MEDICAL INVENTORY- BMI CALCULATION**

**4. MEDICAL INVENTORY- URINARY SYMPTOMS EVALUATION**

How long after you had a sensation of not emptying your bladder completely after you finish urinating?

How often have you had to urinate again less than two hours after you finish urinating?

How often have you found that you stopped and started again several times when you urinate?

How often have you found it difficult to postpone urination?

How often have you had a weak urinary stream?

How often do you push or strain to begin urination?

If you spent the rest of your life with your urinary condition just the way it is now, how would you feel?

**5. MEDICAL INVENTORY- SEXUAL HEALTH INVENTORY**

How do you rate your confidence that you could get and keep an erection?

When you had erections with sexual stimulation, how often were your erections hard enough for penetration (entering your partner)?

During sexual intercourse, how often were you able to maintain your erection after you had penetrated (entered) your partner?

During sexual intercourse, how difficult was it to maintain your erection to completion of intercourse?

**6. MEDICAL INVENTORY- LOW TESTOSTERONE TEST (FY '08 % '09 only)**

Do you have a decrease in libido (sex drive)?

Do you have a lack of energy?

Do you have a decrease in strength and/or endurance?

Have you lost height?

Have you noticed a decreased "enjoyment in life"?

Are you sad and/or grumpy?

Are your erections less strong?

Have you noticed a recent deterioration in your ability to play sports?

Are you falling asleep after dinner?

Has there been a recent deterioration in your work performance?

### **III. Analysis, Findings and Limitations**

This research study focuses on assessing participant behavior related to their medical history, family health history, and any personal reasons for attending the screening. Analysis and findings will report on the success of current marketing and outreach methods, a participant’s behavioral and medical reasons for attending the screening, and their BMI as a lifestyle indicator.

#### **A. Behavioral Factors:**

Behavioral factors will address a participant’s lifestyle through variables, such as their amount of exercise per week, amount of fat in their diet, smoking, and current health problems. Some of these behaviors are also variables in the predictive returning participant models discussed later in the analysis. As displayed in Table 3, most participants have a diet medium in fat (Chart 5), do not smoke (Chart 7) and exercise 2-3 times per week (Chart 10). Interestingly, the incidence of participant smoking is nearly 32%, a higher percentage than the current state of Kentucky’s average at 28.3% (WebMD, 2009).

**Table 3: Current Participant Behavior 2006-2008**

<b>Behavior</b>	<b>Frequency</b>
Diet Medium in Fat	74%
Do Not Smoke	74%
Exercise 2-3 times per week	42%

Current African-American behavior and general participant behavior match show nearly identical results based on their amount of fat in diets, smoking and frequency of exercise although more than 12% of African-American men had a diet high in fat nearing over 2 times that of the average in the entire dataset of fat in diet at 6% (Chart 6).

**Table 4: Current African-American Participant Behavior 2006-2008**

<b>Behavior</b>	<b>Frequency</b>
Diet Medium in Fat	72%
Do Not Smoke	78%
Exercise 2-3 times per week	42%

A participant's personal and family medical history provides insight into the rationale behind attendance. Participants, as a whole, commonly suffer from high cholesterol and high blood pressure—two very common health conditions (Medicine Net, 2009). It is important to note that there are several factors that follow with relatively high incidence such as: enlarged prostate, prostate infection, erectile dysfunction, heart disease, and type 2 diabetes (Chart 11). Health conditions specific to African-Americans follow similarly (Chart 12) with the exception that African-American men had a significantly higher rate of diabetes at 20.3% compared to the dataset at 7.8%. Specific health symptoms for urinary, sexual, and testosterone problems will be assessed for attendance relevance in the medical section below.

The last behavioral factor assessed was the reason the men attended the screening. Overwhelmingly, new and returning participants (Chart 15 & 16) attended the screening because they *wanted to be certain they did not have prostate cancer* for both all participants and for African-American men specifically. The second most popular attendance reason was the factor *I am very health conscious*. Although the other factors remain somewhat level in relationship to each other, African-American men had a large portion of nearly 30% of total attendees declare they were at *high risk* compared with total participation at 11% (Chart 15 & 16), and mostly they were returning participants.

A factor analysis of reasons for attending indicates there may be several different motivations and influences for attending. The strongest factor will have the highest numerical weight for each variable in Table 5. The first (strongest) factor is *high risk* (and family history) without a desire for certainty; this is a well-informed group seeking testing. The second factor is *general health consciousness*. The third factor is a combination of *high risk* and *desire for certainty*, and the fourth is *wife's encouragement*. The existence of different factors implies a need for different advertising to reach differently motivated men. The certainty some seek cannot be promised, of course, but advertising can target high risk men, health conscious men, and wives.

**Table 5: Factor Analysis of Reason Attended 2006-2008**

<b>Variable</b>	<b>Factor 1</b>	<b>Factor 2</b>	<b>Factor 3</b>	<b>Factor 4</b>
I think I am at high risk	<b>*0.3808</b>	-0.0498	<b>*0.1245</b>	-0.0410
My wife encouraged me to attend	0.0834	-0.1467	-0.2013	<b>*0.1081</b>
I want to be certain I don't have prostate cancer	-0.2802	-0.1573	<b>*0.1265</b>	-0.0083
I am very health conscious	-0.0620	<b>*0.3413</b>	-0.0210	0.0250
I am interested in men's health	-0.1999	-0.0082	<b>0.1067</b>	0.0985
I have a family history of prostate cancer	<b>*0.1880</b>	0.0352	<b>0.1322</b>	<b>0.1357</b>

\*Strongest variables in each factor

A particular behavioral assessment will look at those who considered themselves *high risk* and by looking at their family health history we can determine what factors they consider to be threatening for prostate cancer incidence. For example, in Chart 13, among total participants it is sensible that men who deemed themselves *high risk* for prostate cancer had a relatively high incidence of prostate cancer in their family, and primarily the incidence of prostate cancer in their father. The incidence of diabetes in the family was the second most common family health history factor in men who believe they are *high risk* for prostate cancer, a health factor that has no proven health correlation with prostate cancer. (Perhaps the fact that diabetes is associated with many other health problems is important here.) Finally, although it is a variable for *personal* health and not *family* health- the factor of participant's smoking was assessed for those who considered themselves *high risk*. The addition of a participant smoking variable proved to be a very strong factor to men believing they are at *high risk* for prostate cancer. However, there is no scientific basis for such a belief.

Those African-American men who attended the screening did not have a high incidence of family prostate cancer, but instead declared themselves *high risk* for relatively high incidences of family history with diabetes and heart disease and if they smoked (Chart 14). Smoking appears to have strong effect in men who consider themselves *high risk* for prostate cancer for both African-American men and also for the entire dataset.

There were seven variables that showed statistical difference in behavior between returning versus new participants: These split variables between new and returning participants all had a statistically significant mean difference with p-values less than .05. Variables that have higher means show relevance to participants that are new or returning. For example, new participants tend to have diets higher in fat, tend to be smokers, have a higher BMI, think they are at *high risk for prostate cancer*, and were encouraged by their wives to attend the screening. Men who have had prostate infections and are *interested in men’s health* are more likely to be returning participants.

**Table 6: Relevant Behavioral and Medical Variables 2006-2008**

<b>Variable</b>	<b>P-Value</b>	<b>Higher Mean</b>
Amount of diet in fat	0.003	New
Smoking	0.049	New
Prostate Infection	0.025	Returning
BMI	0.036	New
I think I am at High Risk for Prostate Cancer	0.006	New
My Wife Insisted I attend the Screening	0.002	New
I am Interested in Overall Men’s Health	0.049	Returning

These variables indicate there are differences in the behavior between new and returning participants and should therefore be placed into “participant model” regressions for further differentiation between *future* new and returning participant behavior.

**B. BMI Test**

BMI proves to be significantly different between all new and returning participants, with a p-value of .036. In African-American men the variable also proves worthy of further investigation between new and returning participants with a p-value of .028<.05. Generally, new participants tend to have a higher BMI than returning. This difference may have implications to participant lifestyle and health. BMI may also have a relationship to other health variables assessed in participant models.

**Table 7: BMI Returning versus New Participant Difference 2006-2008**

<b>Variable</b>	<b>P-Value</b>	<b>Higher Mean</b>
BMI All Data	0.036	New
BMI African-American men	0.028	New

**C. Medical Factors**

A look at a participant’s health regarding urinary, sexual, and testosterone symptoms may indicate additional reasons for attendance. Each of these is represented by a factor analysis, which indicates that all measures can be combined

into a nearly equally-weighted index. Only one factor matters at all, unlike the analysis of reasons for attendance, above. A specific t-test was performed for urinary, sexual, and testosterone health symptoms and by converting t-test values to p-values, we can look for variable relevance for those with p-values that are <.05.

**Table 8: Health Symptoms New versus Returning Participant Difference 2006-2008**

<b>Variable</b>	<b>P-Value All Participants</b>	<b>P-Value African-American Men</b>	<b>Higher Mean</b>
Urinary Health Problems	0.469	0.456	Returning
Sexual Health Problems	<b>*0.014</b>	<b>*0.035</b>	New
Testosterone Factors	<b>*0.015</b>	0.064	New

*\*Results are relevant*

We can see that there are two variables that show significance, sexual health symptoms and testosterone health symptoms. The results show that sexual and testosterone health symptoms are more relevant to new participants and that men with urinary health symptoms are more likely to be a returning participant. The statistical analysis suggests no difference between these two groups on the urinary variable. This is unfortunate, given that urinary health problems are much more closely related to prostate cancer detection than the other two factors, sexual health and testosterone problems (May Clinic, 2009).

#### ***D. Returning Participant Models***

Using some of the relevant variables found in the foregoing analysis, a participant model can be estimated for new and returning participants both for the all participants and for African-American men specifically. Relevant medical

variables used in the model were urinary, sexual health, and testosterone factors and behavioral. The independent variables are: age, ethnicity, smoking, BMI, if they considered themselves *high risk*, *health conscious*, if they were *interested in overall men's health*, and if their *wife encouraged them to attend* the screening as shown in this regression and the dependent variable is if the participant was returning.

**Table 9: Predictive Returning Participant Model**

Variable	Coefficient	T-Test Value	P-Value
I consider myself health conscious	-0.168	-3.200	*0.001
Testosterone Health Symptoms	-0.052	-2.280	*0.023
Sexual Health Symptoms	-0.021	-1.120	0.262
I am interested in overall men's health	-0.018	-0.240	0.808
My wife encouraged me to attend	-0.008	-0.070	0.941
Age	-0.003	-1.460	0.143
BMI	0.002	0.700	0.483
Urinary Health Symptoms	0.030	1.310	0.190
Smoking	0.078	2.070	*0.039
I think I am at high risk	0.114	2.560	*0.011
African-American Participant	0.087	1.110	0.268

\***Negative Values**= Unlikely returning participant behavior

\***Positive Values**= Likely behavior for returning participants

\***Variables** show relevance in model

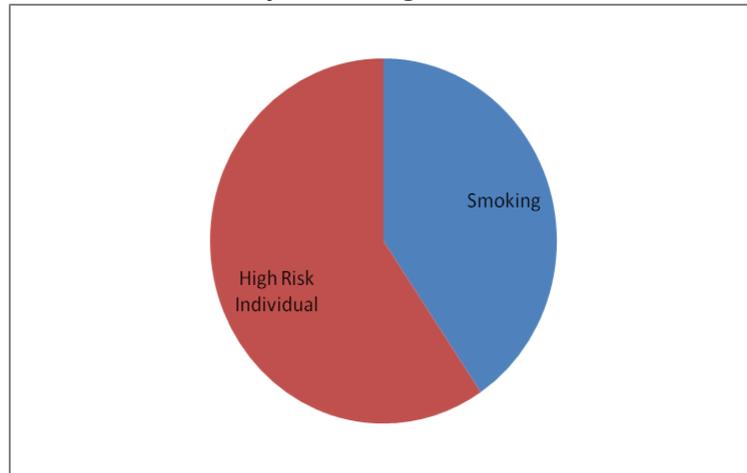
Data with negative coefficients signify that the variable is **unlikely** behavior for a returning participant, and variables with positive coefficients are behaviors that are **likely** for returning participants. Further analysis will consider whether these variables **did** have an impact by assessing their p-values. Men who consider themselves health conscious and have testosterone health symptoms are **less likely** to return and men who thought they were high risk or smoked were **more likely to return**. Behavior variables that had proven significance in a participant **not returning** was if they considered themselves *health conscious* (p-value of .001) and if

they had testosterone health symptoms (p-value of .023). Variables that proved significant for **returning** participants were if they thought they were at *high risk* (p-value of .039) and if they smoked (p-value of .011).

This model may also educate program managers on other predictive behaviors: smokers and high risk individuals being more likely to return, urinary symptoms having no obvious effect on returning participants. For entire participation, urinary health symptoms are showing no significance in future program attendance.

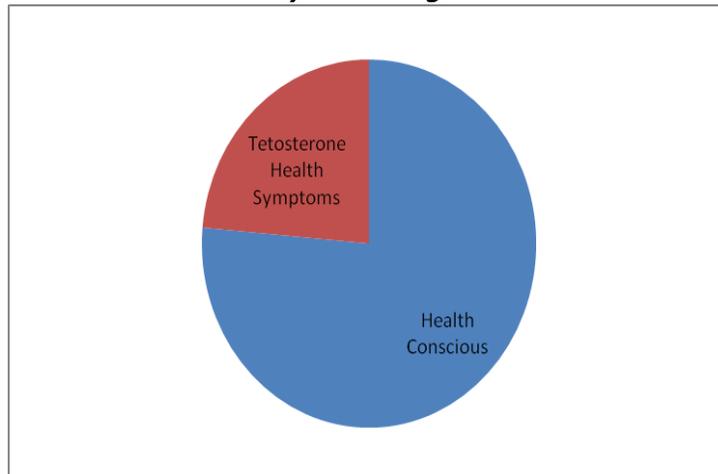
Model 1 predicts the **likely** behavior that the majority of returning participants will consider themselves *high risk*, and a significant portion will smoke. This is possibly explained by positive relationship between those who consider themselves *high risk* and who smoke. Note that these values don't equal 1, but instead represent a proportion of the found relevant behaviors. There may be several behavioral variables that influence screening attendance that may be unknown. The behavior of feeling at *high risk* was slightly more significant and therefore may represent more of the population.

**Model 1: Likely Returning Predictive Behavior**



Model 2 displays the **unlikely** characteristics of a returning participant's behavior. The majority of participants who don't return tend to feel health conscious, and about one-fourth are suffering from a loss of testosterone. Note that these values don't equal 1, but instead represent a proportion of the found relevant behaviors. There may be several behavioral variables that influence screening attendance that may be unknown. The behavior of feeling at *health conscious* was substantially more significant and therefore may represent more of the population.

**Model 2: Unlikely Returning Predictive Behavior**



African-American participant models can also be derived using similar variables that may have significance on future African-American attendance:

**Table 10: Predictive Returning Participant Model African-American Men**

Variable	Coefficient	T-Test Value	P-Value
I consider myself health conscious	-0.266	-0.670	0.509
Urinary Health Symptoms	-0.096	-0.810	0.426
Sexual Health Symptoms	-0.248	-2.780	*0.009
Interested in overall men’s health	-0.188	-0.280	0.783
I think I am at high risk	-0.004	-0.010	0.989
Age	-0.011	-0.810	0.424
BMI	0.041	1.460	0.153
Testosterone Health Symptoms	0.167	2.030	*0.051
Smoking	0.090	0.480	0.632
My wife encouraged me to attend	0.068	0.090	0.930

\***Negative Values**= Unlikely returning participant behavior

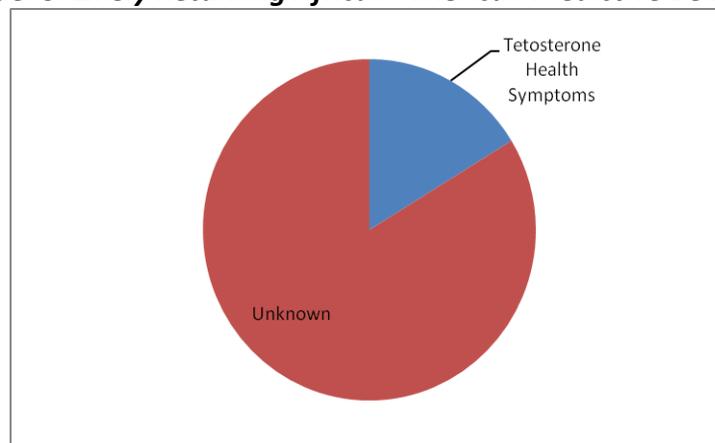
\***Positive Values**= Likely behavior for returning participants

\***Variables** show relevance in model

Factors that predict African-American likely and unlikely returning behavior have similar independent variables and the dependent variable. It is **unlikely** that a returning African-American man is attending the screening because he is encountering sexual health symptoms and it is **likely** that a returning participant is encountering low testosterone symptoms. Urinary health symptoms are in fact, showing no relationship for returning participation in future years. We can also infer from the participant model that African-Americans are just as likely to return as other participants, as there was no statistical significant difference. Since prostate cancer is more likely for African-American men, equal participation can become a problem.

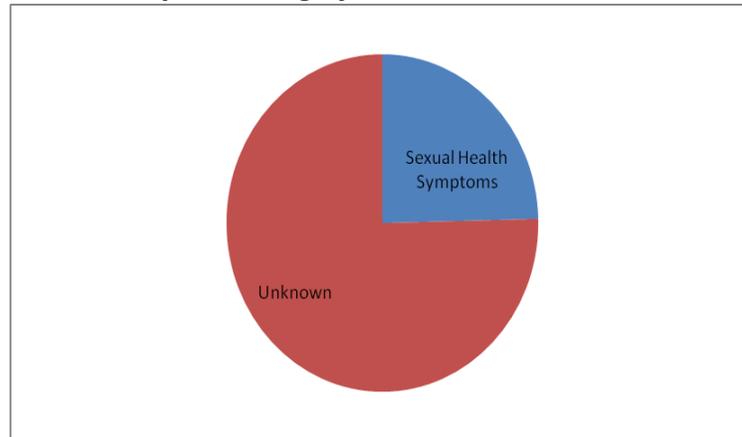
Models 3 and 4 both show that the likely and unlikely returning African-American participant behavior is largely unknown. This may be reflective of the low number of African-American screening participants. Model 3 predicts that returning African-American men are somewhat of a mystery. However, nearly 1 in 5 are suffering from a loss of testosterone. Note that these values don't equal 1, but instead represent a proportion of the found relevant behaviors. The behavior of suffering from *testosterone health symptoms* held small significance, and there may be untracked behavioral variables that influenced attendance.

**Model 3: Likely Returning African-American Predictive Behavior**



Model 4 predicts that nearly 25 percent of returning African-American men aren't suffering from sexual health symptoms, and a large portion of the population is left unknown. Unknown behavior proves to be a difficulty in specifically increasing this particular minority involvement. Note that these values don't equal 1, but instead represent a proportion of the found relevant behaviors. The behavior of suffering from *sexual health symptoms* held small significance, and there may be untracked behavioral variables that influenced attendance.

**Model 4: Unlikely Returning African-American Predictive Behavior**



**E. Study Limitations**

Screening anxiety is a strong behavioral factor that may affect participant's attendance and is not assessed in the study. Previous studies assessing anxiety as a component of prostate cancer have been inconclusive. Although studies have shown that the screening does not seem to cause any major psychological distress in the majority of men, it is to be expected that a higher level of psychological distress has been observed in those who screen positive (Carlsoon, 2007). The fear of a positive test could hinder attendance rates, and this could be a factor in the apparent tendency of those with worse health habits to avoid returning.

Other program initiatives are to teach and educate participants about prostate cancer and prostate health, and to recommend follow-up if needed. The research failed to provide information as to whether participants are learning about prostate cancer health and its warning signs. The single largest factor derived from reasons for participation is *high risk* or family history with a *desire for certainty*,

which indicates some knowledge of the medical issues. There are other factors, and those attending for other reasons could be educated about prostate cancer.

The amendment of the survey year after year proves very difficult in accurately coding variables and in maintaining consistency in the program. Some relevant variables to determine the program's mission were dropped after 2006. It was very helpful for the PCEC to maintain consistency in the program questionnaire and to code variables similarly year after year. The survey also tracked amount of knowledge program participants have about prostate cancer. At only one time did the study ask the question, and therefore it was thrown out due to the extremely limited responses. This question should be asked on future questionnaires, as education is an important part of the program's mission. It would have been nice to analyze more data than that of a three year period. Data should have been available from 2003-2008, but the PCEC had misplaced 2005 data. It also would have been a more conclusive study to look at data from other PCEC screening sites within the state of Kentucky.

Variables that may have been significant were eliminated from analyses as they were incomplete. Questionnaires failed to track variables such as the relevant "other" category on method of learning about the program, and the "work" variable wasn't captured in 2006 at all. I anticipate the "work" variable would have more significance with complete data.

#### **IV. Conclusion and Recommendations**

Prostate Cancer Screening serves as an effective means of early detection as backed by numerous literature and research sources. The data presented shows an effective means of generalizing participant behavior and those factors which influence medial attendance. Participant models should help program managers understand their served populations. The findings from the study may help program managers market the program more effectively and more efficiently.

Certain variables have more relevance in screening attendance than others. Variables that had some behavioral and medical significance were: smoking, diet in fat, BMI, urinary, testosterone and sexual health symptoms, and if the participants were *health conscious* or not. Variables that showed significant difference between likely and unlikely **returning** participant behavior were placed into participant models to predict whether or not they will return. These participant models may be useful to program managers in understanding screening participant behaviors and to help target program marketing efforts to encourage retention.

Participant models generally showed that **returning** participants believed they were at *high risk* for prostate cancer, and tended to smoke. However, the program seems to discourage retention of men who are self-declared *health conscious* and who may be suffering from a loss of testosterone. Program managers should work on recruiting and retaining men with these behaviors. It is good that men at *high risk* are attracted to the program, but other groups can be targeted

more specifically: those who are generally health conscious, and wives of men who are not! It would be helpful for program manager's to use participant model concepts to continue to predict behavior, and to apply these methods to other cancer screening programs.

It is also important for program managers to notice the decrease in participation for this three-year period. As this is a grant-funded program, attendance is imperative to its survival. A marketing plan should be put in place to increase participation in the upcoming years. Currently, the most effective marketing method is word of mouth via friends and family and the use of newspaper ads for new participants. There are two marketing methods that should be explored. New participants can be recruited by advertising on the radio or television, and returning participants should be sought at places of work.

The internet proved to have nearly no impact, which clearly needs to be addressed as it has become a critical marketing tool in the 20<sup>th</sup> century. Known for its ability to provide inexpensive advertising, all avenues of internet marketing are feasible. Marketing via [www.uky.edu/healthcare](http://www.uky.edu/healthcare) should be explored.

African-American participation has also decreased in this three-year period. Because program initiatives focus on increasing minority participation and their higher incidence of prostate cancer, program managers should pay special attention to under-utilized marketing methods. To target the African-American population program specifically, managers should look at reaching out to potential places of

employment. Other successful marketing mediums were also the newspapers and on radio and television.

Despite the smaller sample size available, results indicated that sexual health problems attracted African-Americans to the program, but proved to be an unlikely behavior for a returning participant. This suggests both a means of advertising that might work and the need to emphasize that urinary problem symptoms are also a reason to participate, and in fact may be medically more relevant.

Although predictions for African-American men are largely unknown, these models do show two relevant likely and unlikely behaviors for returning men. If there is a likely predictive behavior, a minority of new African-American men will be suffering from a loss of testosterone, and it is unlikely that returning African-American men will be suffering from sexual health symptoms. These two specific behaviors tell managers that to increase the African-American participation specific marketing methods should target these symptoms.

It appears that men in general aren't educated on the relation of urinary symptoms to that of prostate cancer as explained by the National Kidney and Urologic Disease Information Clearinghouse. It's unfortunate that urinary symptoms played a nominal role in participation attendance. Instead men are more likely to be suffering from sexual health problems, and therefore relating these symptoms to the potential that they may have prostate cancer.

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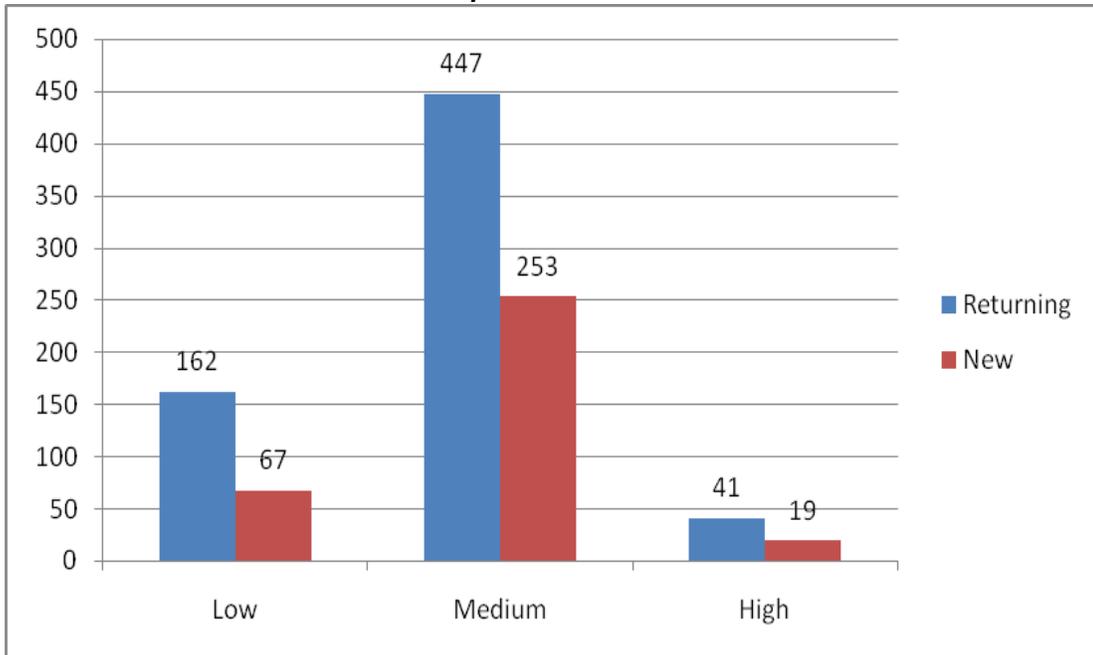
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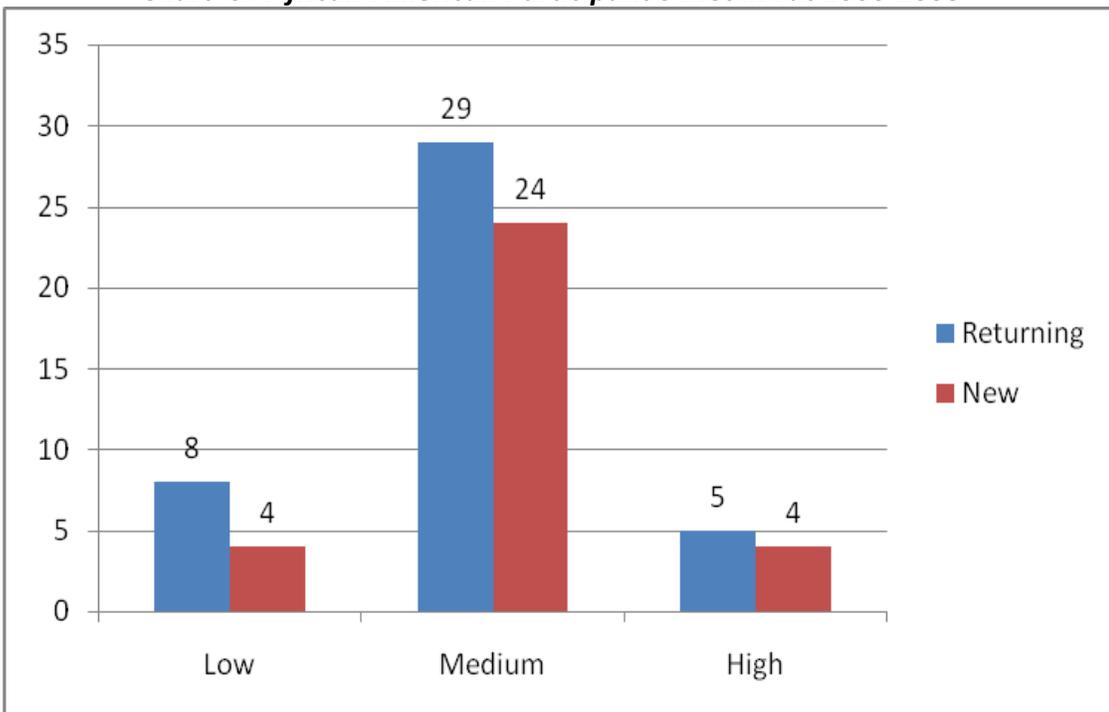
## VI. Appendices: Charts and Tables

**Chart 5: Participant's Diet in Fat 2006-2008**



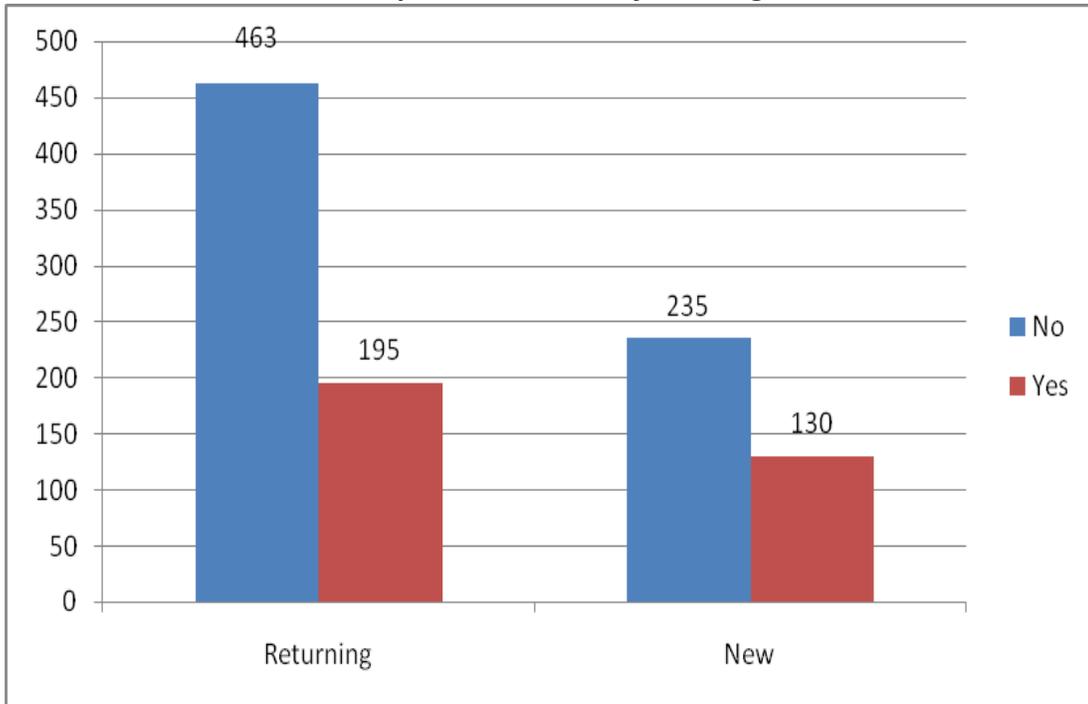
*\*Source: PCEC 2008*

**Chart 6: African-American Participant's Diet in Fat 2006-2008**



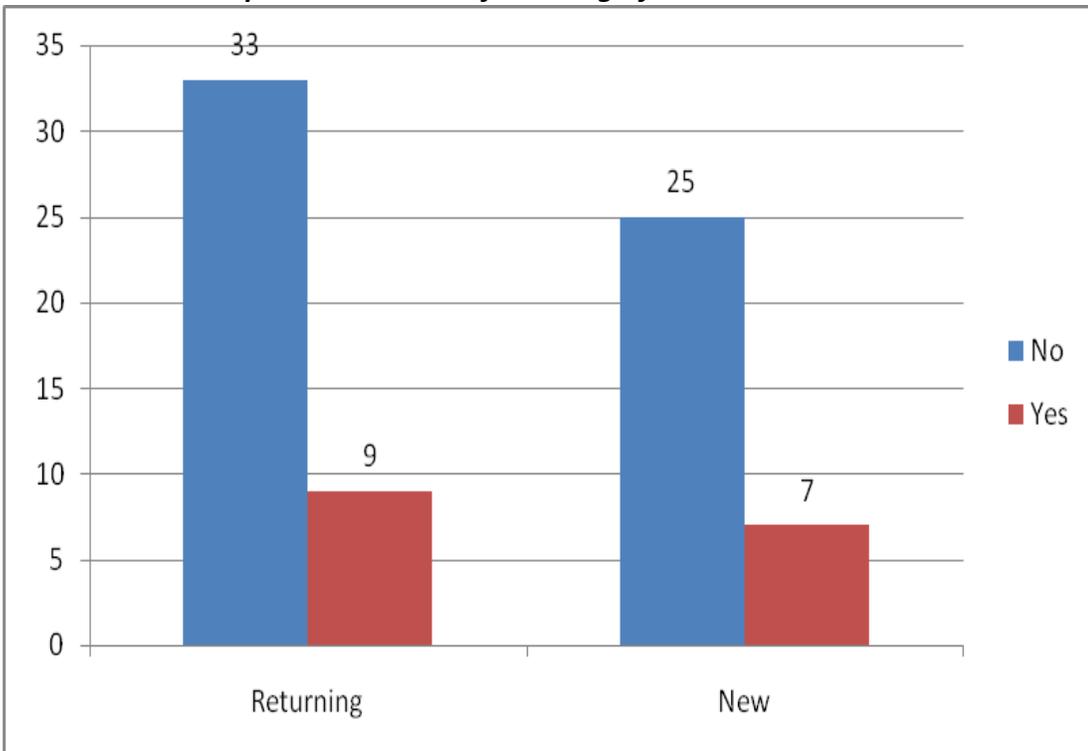
*\*Source: PCEC 2008*

**Chart 7: Participant's Incidence of Smoking 2006-2008**



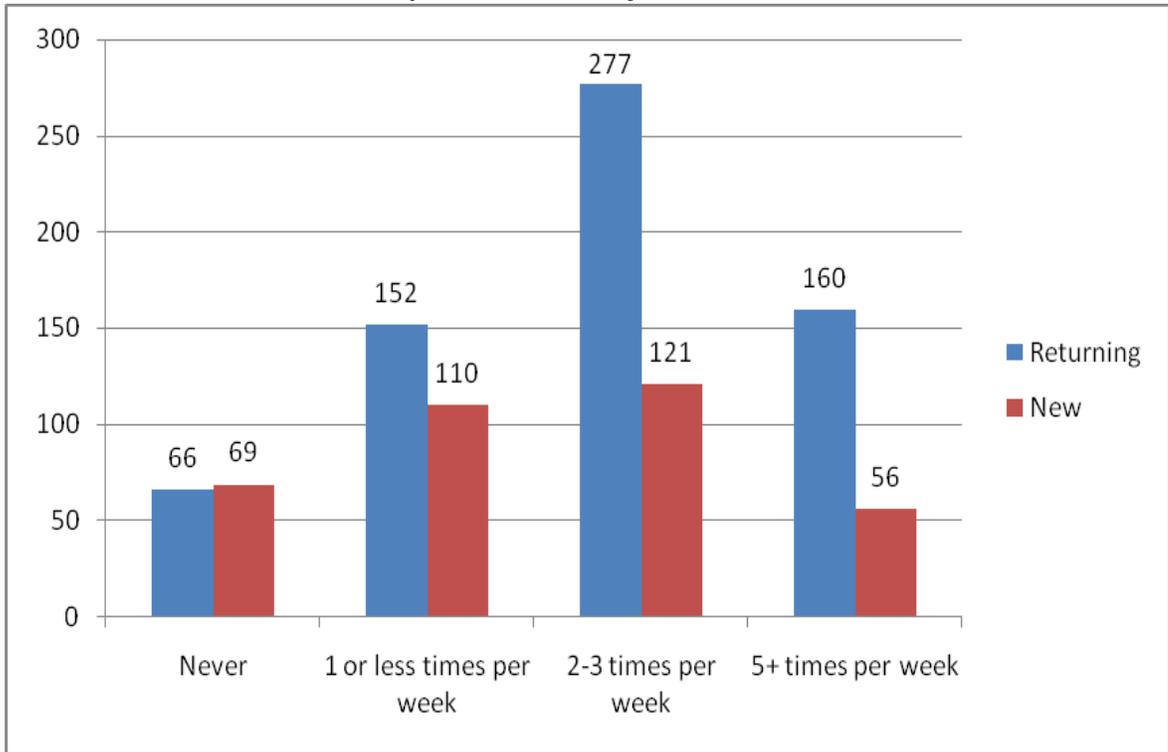
*\*Source: PCEC 2008*

**Chart 8: Participant's Incidence of Smoking African-American Men 2006-2008**



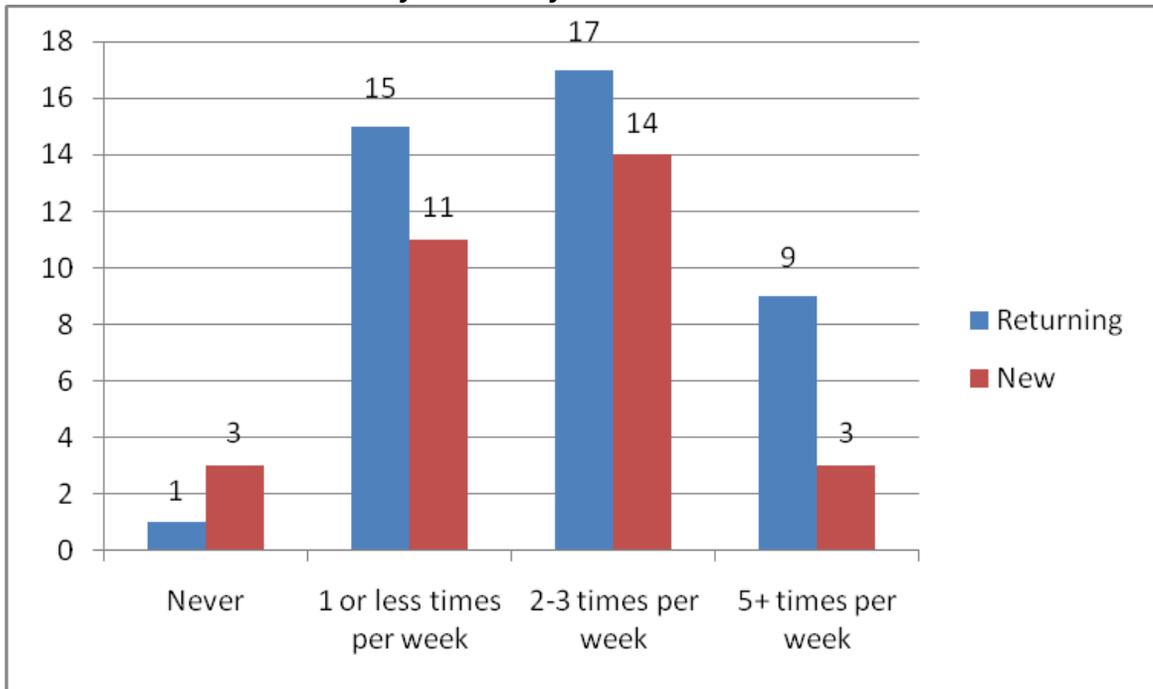
*\*Source: PCEC 2008*

**Chart 9: Participant's Amount of Exercise 2006-2008**



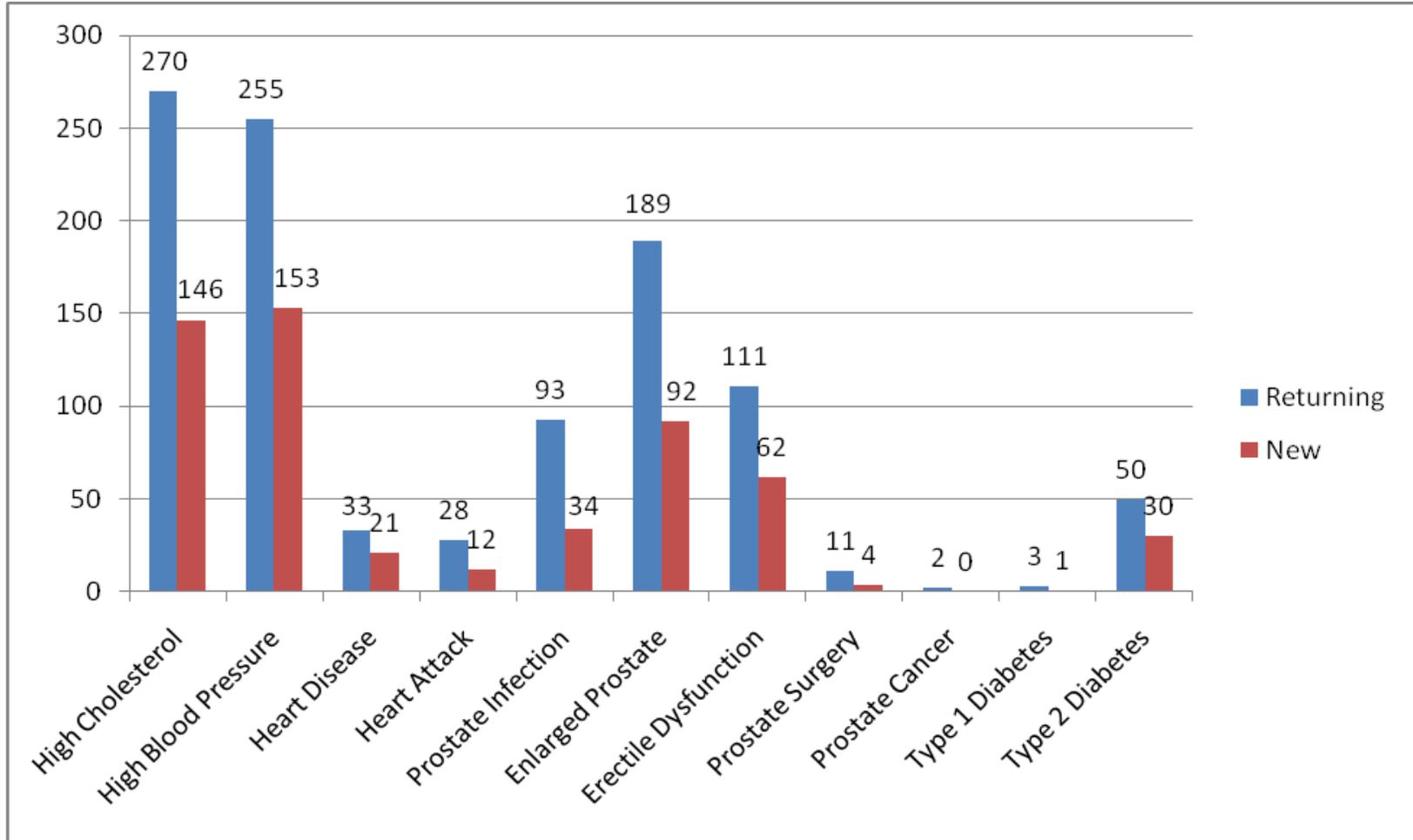
*\*Source: PCEC 2008*

**Chart 10: Amount of Exercise African-American Men 2006-2008**



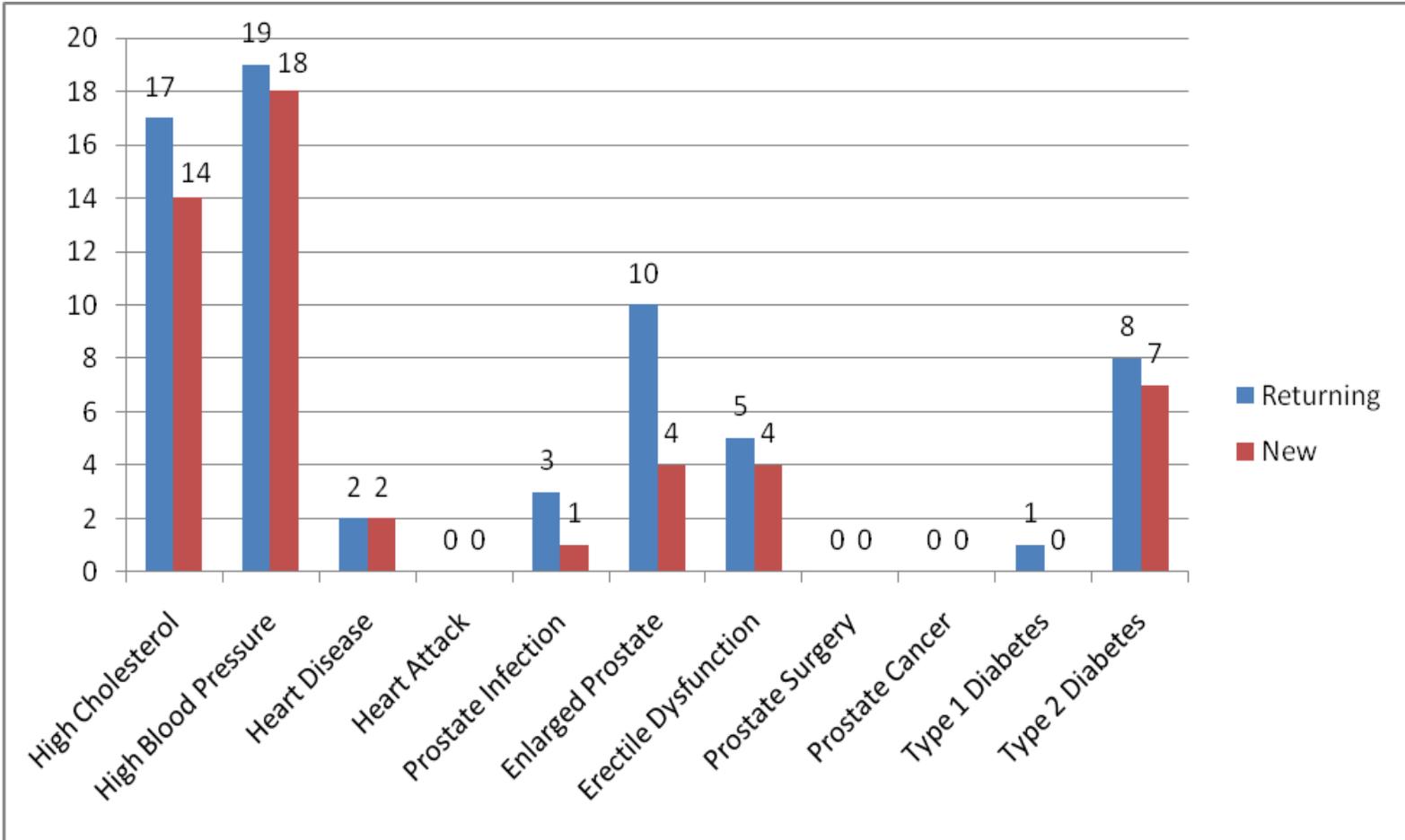
*\*Source: PCEC 2008*

**Chart 11: Participant's Health Conditions 2006-2008**



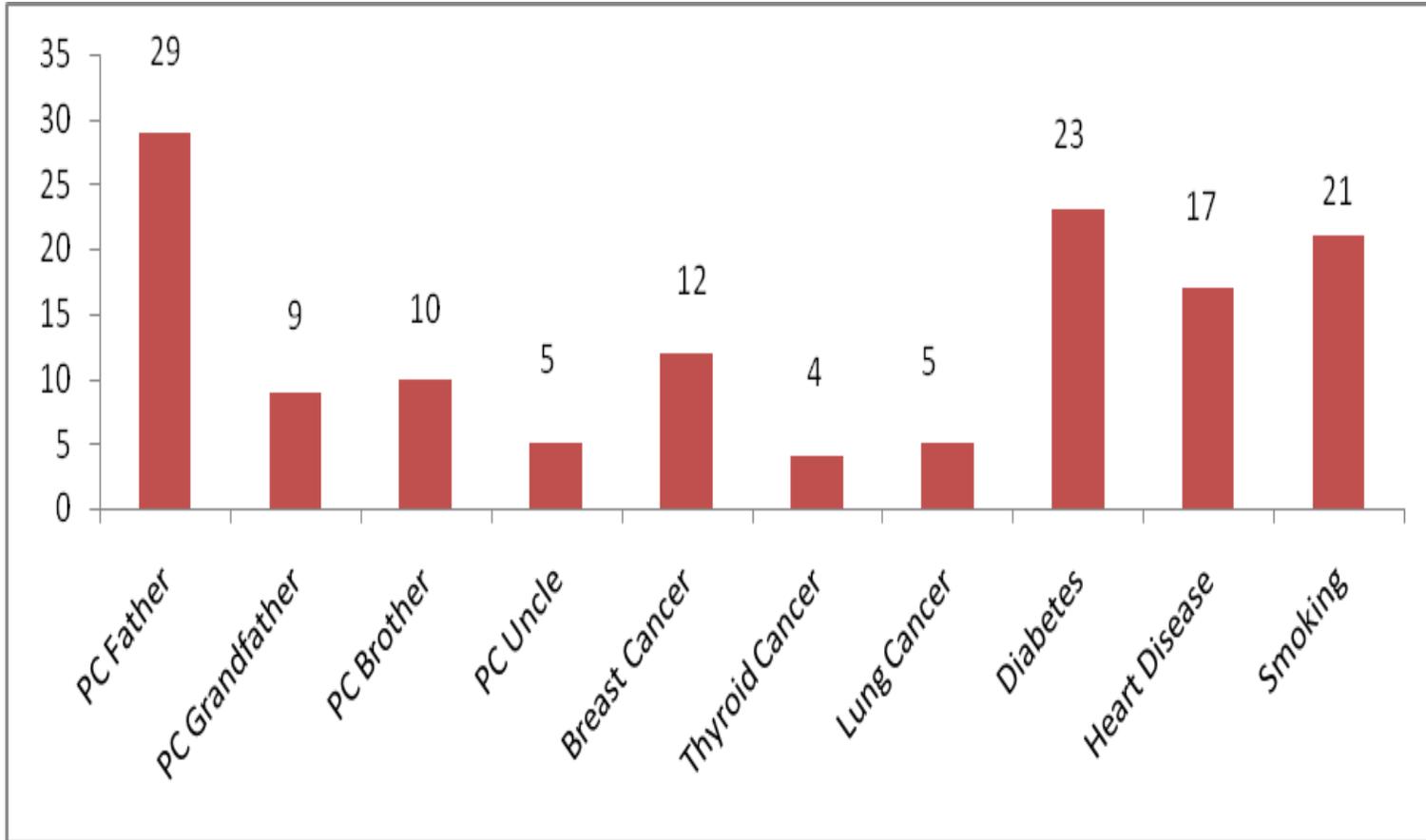
\*Source: PCEC 2008

**Chart 12: Participant's Health Conditions African-American Men 2006-2008**



*\*Source: PCEC 2008*

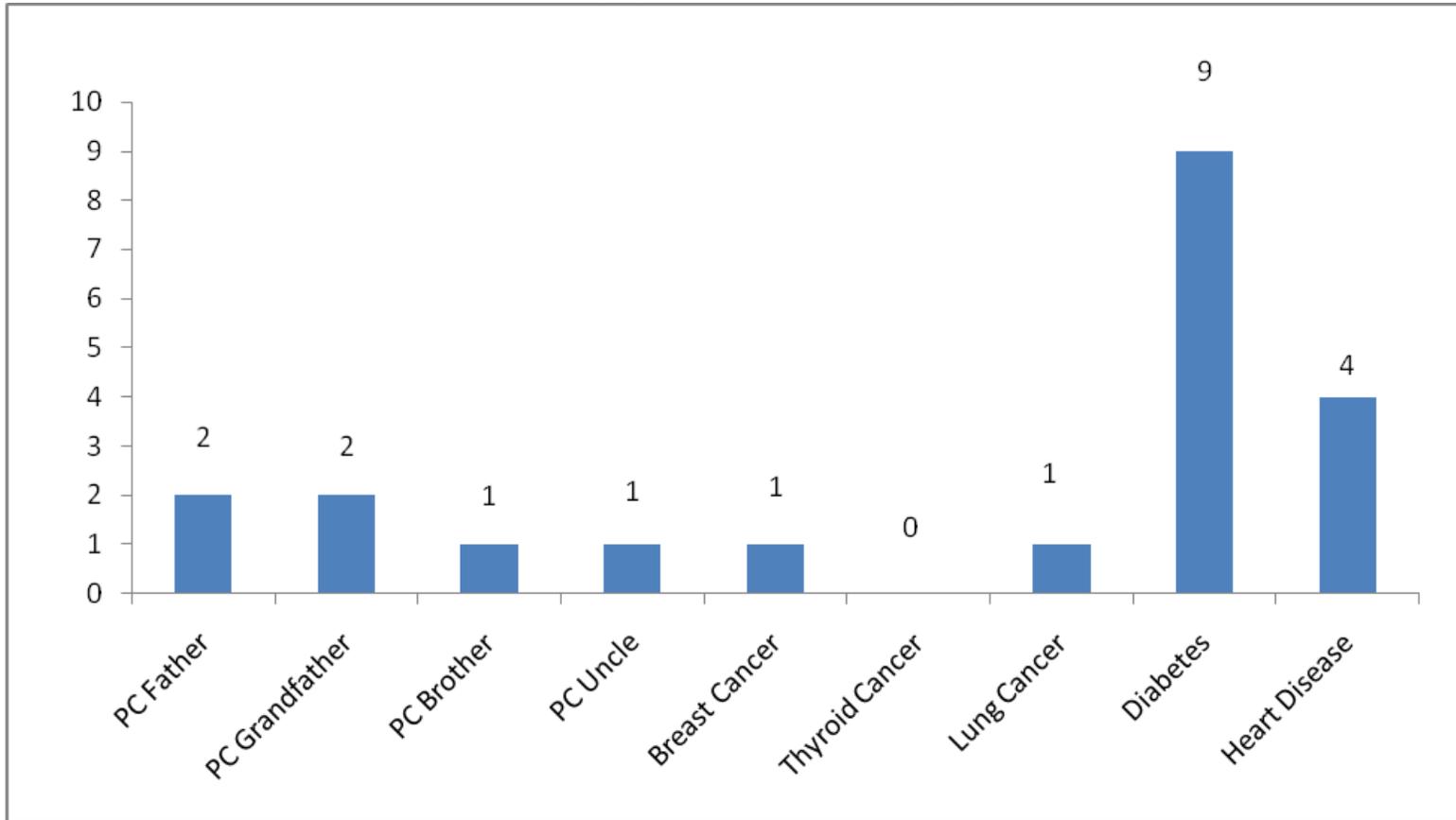
**Chart 13: Participant's Health History- High Risk 2006-2008**



\*Diabetes, Heart Disease and Lung Cancer were tracked in 2007 and 2008 only

\*Source: PCEC 2008

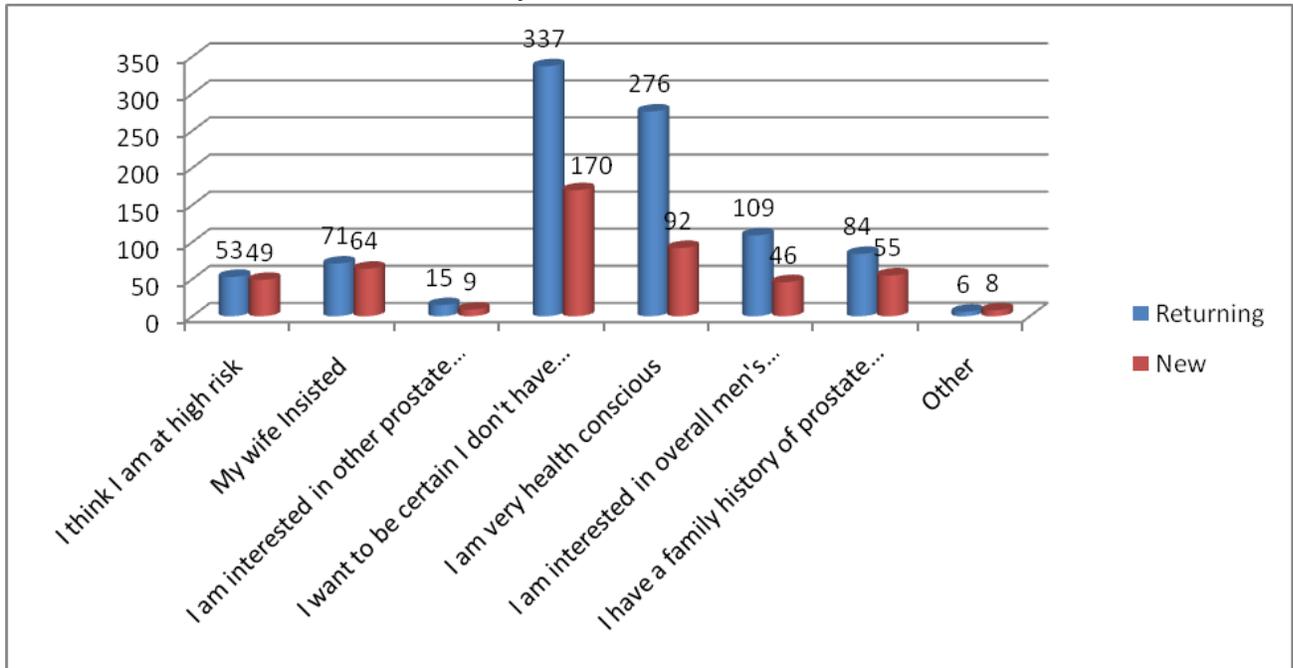
**Chart 14: Health History African-American Men- High Risk 2006-2008**



\*Diabetes, Heart Disease and Lung Cancer were tracked in 2007 and 2008 only

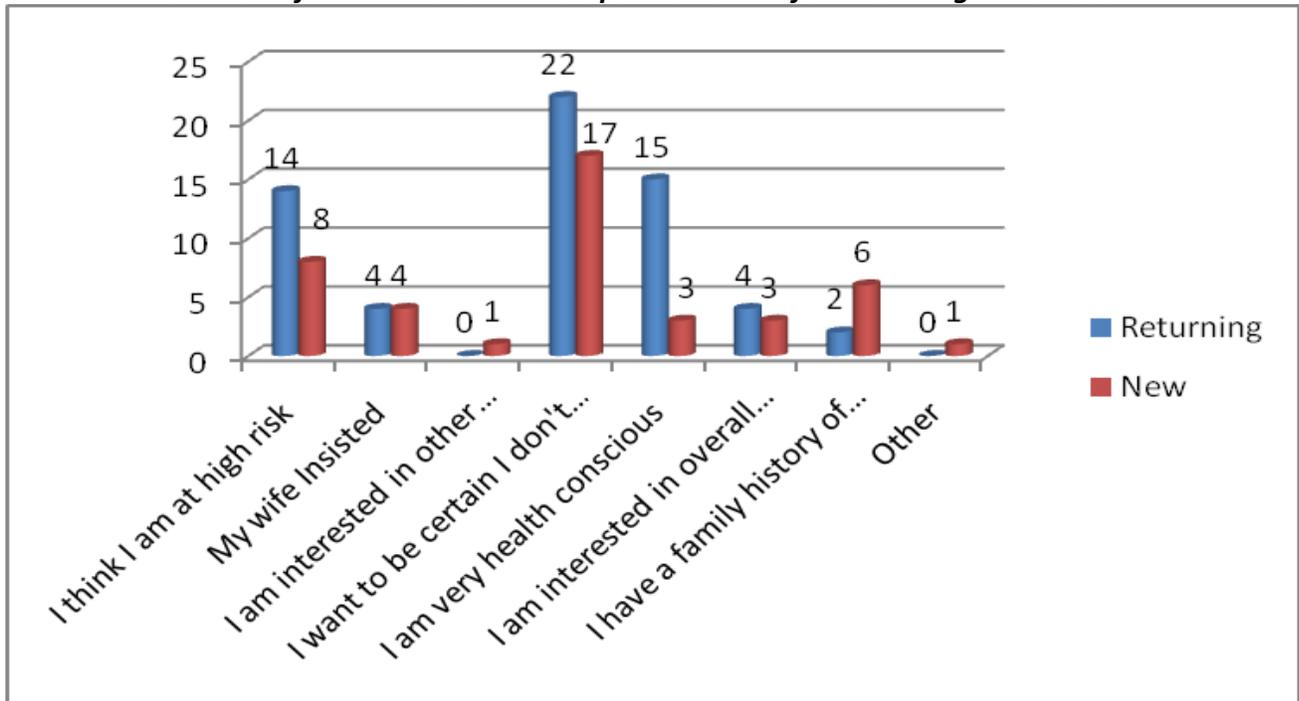
*\*Source: PCEC 2008*

**Chart 15: Participant Reason Attended 2006-2008**



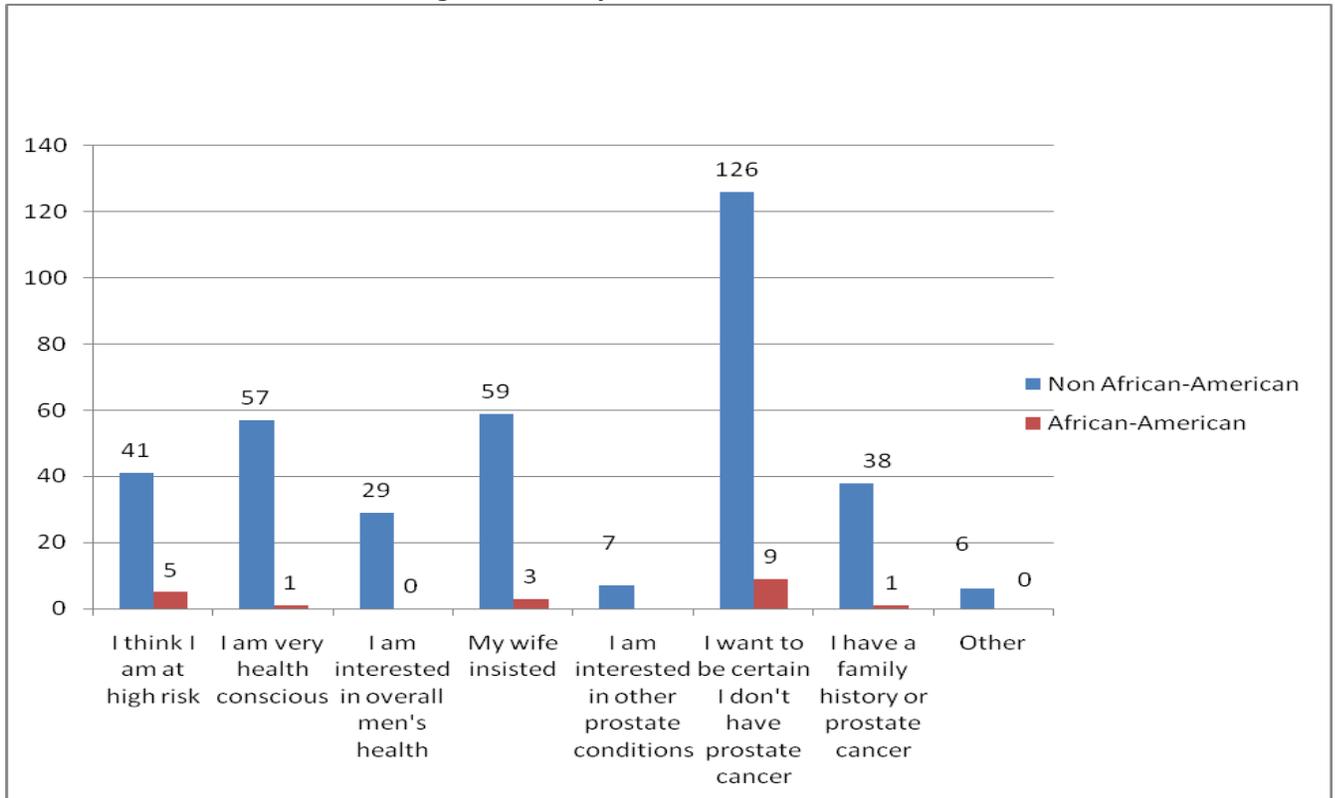
\*Source: PCEC 2008

**Chart 16: African-American Participant's Reason for Attending 2006-2008**



\*Source: PCEC 2008

**Chart 17: New Program Participants: Reason Attended 2006-2008**



\*Source: PCEC 2008

**Table 11: Factor Analysis Pattern Matrix, Urinary Symptoms:**

Variable	Factor 1	Factor 2	Factor 3
Sensation of not emptying your bladder	*0.7794	-0.104	-0.1218
How have have you had to urinate?	*0.7309	0.1731	-0.0586
How often have you found you stopped and started?	*0.7887	-0.1496	-0.0760
How often have you found it difficult to postpone?	*0.7117	0.1554	840
How often have you had a weak urinary stream?	*0.7574	-0.1483	0.0765
How often do you push or strain to begin urination?	*0.7377	-0.1501	0.1212
How many times do you get up to urinate at night?	*0.5918	0.1916	0.0644
How would you feel about your urinary condition?	*0.5902	0.1212	-0.0805

\*Results are relevant

**Table 12: Factor Analysis Pattern Matrix, Sexual Health Symptoms:**

<b>Variable</b>	<b>Factor 1</b>	<b>Factor 2</b>	<b>Factor 3</b>
How do you rate your confidence that you could get and keep an erection?	<b>*0.6619</b>	0.0775	0.0393
When you had erections, how often were they hard enough for penetration?	<b>*0.8698</b>	0.1186	-0.0122
How often were you abot to maintain your erection?	<b>*0.9195</b>	0.0476	-0.0254
How difficult was it to maintain your erection to completion?	<b>*0.9132</b>	-0.0917	0.0189
How often was intercourse satisfactory to you?	<b>*0.8905</b>	-0.01286	-0.0105

*\*Results are relevant*

**Table 13: Factor Analysis Pattern Matrix, Testosterone Health Symptoms:**

<b>Variable</b>	<b>Factor 1</b>	<b>Factor 2</b>	<b>Factor 3</b>
Do you have a decrease in libido?	<b>*0.8986</b>	0.1898	0.1118
Do you have a lack of energy?	<b>*0.9307</b>	0.0505	-0.1439
Do you have a decrease in strength and/or endurance?	<b>*0.9075</b>	0.1444	-0.1505
Have you lost height?	<b>*0.9186</b>	-0.1087	0.0377
Have you noticed a decreased "enjoyment in life"?	<b>*0.9459</b>	-0.1734	0.0404
Are you sad and/or grumpy?	<b>*0.9441</b>	-0.1807	0.0522
Are your erections less strong?	<b>*0.8414</b>	0.2381	0.1256
Have you noticed a recent deterioration in your ability to play sports?	<b>*0.9089</b>	0.0302	-0.0759
Are you falling asleep after dinner?	<b>*0.9068</b>	-0.0349	0.0271
Have there been a recent deterioration in your work performance?	<b>*0.9568</b>	-0.1153	-0.0139

*\*Results are relevant*