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TITLE: A Neighborhood-Based Intervention to Reduce Prostate Cancer Disparities

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**14. ABSTRACT**

**Background:** The goal of this study is to develop an educational intervention about prostate cancer (PCa). The intervention will be targeted to at-risk men in neighborhoods with poor PCa outcomes.

**Methods:** After utilizing Pennsylvania cancer registry data to identify 4 high risk PCa neighborhoods in Philadelphia, we conducted a focus group of at-risk men (N=26, ages 40-69) in high risk neighborhoods. We developed PCa educational materials and trained 8 Community Health Workers to provide small group education for men from the neighborhoods (N=273). Surveys were administered pre-, post-, 1 month and 4 months after the educational intervention.

**Results:** We did not detect statistically significant differences between control and intervention neighborhoods for questions on PCa knowledge, concerns, completing a follow-up with a doctor, intent for future screening, and decisional conflict.

**Conclusions:** We found that men in high risk neighborhoods generally have are knowledgeable about PCa. Methods for identifying highest risk neighborhoods and training community health educators to disseminate information to at-risk men may be effective for decreasing PCa disparities.

**15. SUBJECT TERMS**
Prostate Cancer; Neighborhoods; Focus Groups; Community Health Workers; Knowledge

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## 1. Introduction

Research shows that men who reside in low-income neighborhoods are less likely to be screened for PCa and more likely to have aggressive forms of PCa. Given these facts, it can be surmised that men who live in economically deprived neighborhoods are at high risk for poor PCa outcomes due to delayed timing of detection and the nature of the disease. Given that screening recommendations present conflicting guidelines while suggesting that additional research of high risk populations is needed, many men, particularly those living in low-resource neighborhoods, are not equipped to make informed decisions about screening. The neighborhood can serve as a key setting to recruit at-risk men for a neighborhood-based study that aims to increase knowledge and informed decision making about PCa screening. This study has the potential to lead to higher informed decision-making about PCa screening in populations of men that are most susceptible to PCa, perhaps reducing PCa disparities related to late disease presentation. The short-term goal of this project is to increase PCa awareness and prompt shared decision making about screening. The long-term goal is to prevent advanced disease and decrease PCa mortality in high-risk neighborhoods. We plan to eliminate barriers to PSA screening and provide men with tools that can be used to engage themselves with health professionals and neighborhood members in caring for future health concerns. By targeting high risk neighborhoods (those with the highest rates of advanced PCa in Philadelphia), we are most likely to impact the population that will benefit the most from PCa screening and targeted intervention focused on PCa education and the informed decision making process.

**Specific Aim 1: To identify neighborhoods with disproportionately high rates of advanced prostate cancer and describe patient- and neighborhood-level risk factors associated with the high risk neighborhoods**

**Specific Aim 2: To develop, using a mixed methods approach, a targeted educational intervention about prostate cancer for men who live in high-risk neighborhoods**

**Specific Aim 3: To test the impact of the targeted intervention on levels of knowledge, anxiety, and informed decision making about PCa screening**

**Sub-aim 4: To observe the rates of PCa screening in the intervention and control groups**

## 2. Keywords

Prostate Cancer; Neighborhoods; Focus Groups, Community Health Workers, Knowledge

## 3. Accomplishments

3. a. MAJOR GOALS OF THE PROJECT / RELATED ACCOMPLISHMENTS

**Statement of Work – Year 1**

Major Goal 1: Quantitative Analysis *(Led by PI Charnita Zeigler-Johnson, Thomas Jefferson University)*

- IRB approval
    - IRB approval was obtained initially June 2015 and renewed May 2016. (SOW date: November 2015)
- Obtain PA Cancer Registry, CHDB and Philadelphia Mortality data
    - These data were obtained from the PA Cancer Registry and the Policy Map program during the summer/fall of 2015. (SOW date: January 2016)
- Geocode and Map cases
    - Geocoding and mapping of prostate cancer cases was completed by team member Dr. Russell McIntire in March 2016. (SOW date: March 2016)
- Conduct Aim 1 Analysis

- The goal of aim 1 was to identify high-risk neighborhoods. This milestone was completed July 2016. A number of steps were taken to identify the highest risk neighborhoods. After geocoding patient addresses to the census-tract level, multiple maps of the data were created to indicate prostate cancer incidence and mortality. Using SEER data, mean age-standardized incidence (SIR) and mortality rates (SMR) were calculated for each census tract. A composite rate was developed by our team to select high-risk census tracts of the city based upon combined mean SIR, SMR and tumor aggressiveness. High-risk Philadelphia neighborhoods encompass the highest risk census tracts. (SOW date: May 2016)

- Patient addresses were geocoded to the census tract level. Maps were created to identify high and low risk census tracts in Philadelphia.[1] Figure 1 shows the number of high stage (regional + distant) prostate cancer cases diagnosed by census tract in Philadelphia (2005-2014). High stage incidence varied greatly in the city, from 0-7 high stage cases per census tract. Men diagnosed with regional and distant stage are not eligible for active surveillance protocols, and those diagnosed at distant stage are at increased risk for prostate cancer mortality. The map identifies which census tracts are enclaves for more advanced prostate cancer. Our team members developed a risk composite score to assist with selection of high-risk neighborhoods for focus groups and intervention testing.[1] The risk composite is the sum of mean age standardized incidence rate (SIR), age standardized mortality rate (SMR), and mean tumor aggressiveness (coded tumor Gleason score + stage). The score was calculated for each census tract to identify geographic areas with higher than expected prostate cancer incidence and mortality and more aggressive disease patterns. Figure 2 shows the location of the four selected neighborhoods for our focus groups and intervention. The neighborhoods include the high-risk census tracts identified with the risk composite score. They are

located in the Northwest (East Mount Airy, West Oak Lane, Germantown), North (Tioga, West Allegheny, Strawberry Mansion), and West (Wynnefield, Overbrook and Cobbs Creek, Cedar Park) regions of the city. We published this research in Preventive Medicine. [1]

- We characterized prostate cancer patients in the PA Cancer Registry. [2] Frequencies and median values of patient characteristics were computed. The total number of patients was 10,802. The median age was 65. Fifty-seven percent were married at diagnosis. The majority of patients were Black (44%), White (33%), and Hispanic (9%). The remainder was Asian, mixed race, or other. The majority of patients (54%) had an intermediate or high Gleason score at diagnosis. Seventeen percent was diagnosed with regional or distant stage prostate cancer. The Kruskal-Wallis test was used to examine age medians. Chi-square tests were used to examine categorical variables. Significant differences were observed for all variables of interest ($p<0.001$). Black and Hispanic patients were younger and less likely to be married compared to White patients. Tumor grade and stage were highest among Black patients.

- Graphs were created to examine prostate cancer trends by race for Philadelphia.[2] Age-adjusted incidence and mortality rates were obtained from the PA Cancer Registry website. The percent change over time was calculated by our team members. Trends in proportions were calculated from geocoded data. Logistic regression models adjusting for age were calculated to determine significant changes in proportions over time. Interactions between race and year were used to examine differences over time for proportion of advanced stage and grade.

  We found comparable decreases in prostate cancer incidence rates for all race/ethnic groups over time. For mortality, there were some differences. Prostate cancer mortality was rare among Hispanics, so mortality rates were not calculated. While there was a 32% decrease in prostate cancer-

specific mortality for white men and 14% decrease among all men, only a 5% decrease was observed for Black men.

While the proportion of White PCa patients in Philadelphia did not differ over time (OR=0.99, 95% CI=0.97-1.00), the proportion of African Americans increased (OR= 1.03, 95% CI=1.02-1.05) and the proportion of Hispanics decreased (OR=.0.95, 95% CI=0.93-0.97). Over time, there was an increase in the proportion of high grade (Gleason score 7-10) Hispanic cases (OR=1.11, 95% CI=1.05-1.18), but no significant changes for high tumor stage (regional and distant). Among older men (age 65+), there were no significant differences in the proportions over time. However, among younger men, we observed that a significant increase in Black high stage cases (OR=1.07, 95% CI=1.01-1.13) and Hispanic high-grade cases (OR=1.14, 95% CI=1.05-1.23). We published this work in the Journal of Racial and Ethnic Health Disparities. [2]

- Tables comparing features of census tracts grouped by SIR and SMR were created using Kruskal-Wallis for continuous variables and chi-square tests for categorical variables. Higher (>1.00) SIR and SMR indicated that rates were higher than expected. Lower (≤ 1.00) SIR and SMR indicated lower than expected rates. We examined patient-level and neighborhood-level variables by SIR and SMR. Census tracts with higher SIR were younger at diagnosis (p=0.015), had a higher proportion of Black patients (<0.001), and higher tumor grade (<0.001). (Table 1) There was also a lower number of men and lower median income in highest SIR census tracts. The percent of residents living in poverty was highest among the lowest SIR census tracts. (Table 1)

  Regarding low and high SMR areas, there were no differences in patient age. (Table 2) However, all other variables of interest were significantly different (p<0.001). High SMR areas were more Black and unmarried. There was a higher percentage of high grade and high stage prostate

cancer at diagnosis. There were fewer men, lower median income, and higher poverty among high SMR census tracts.

Figure1. Number of High Stage Cases per Census Tract in Philadelphia (2005-2014)

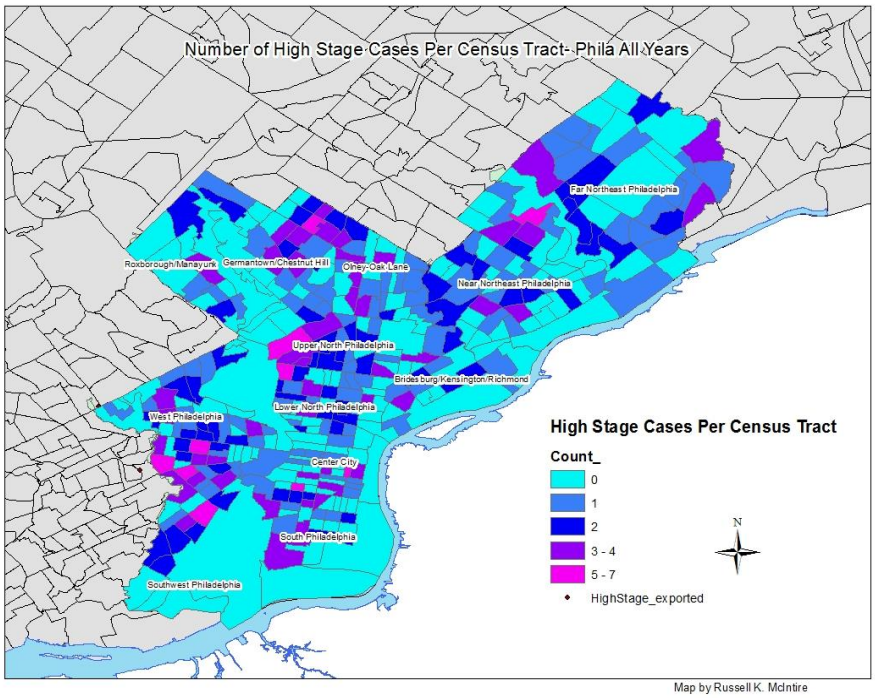


Figure 2. Identification of four High Risk Neighborhoods

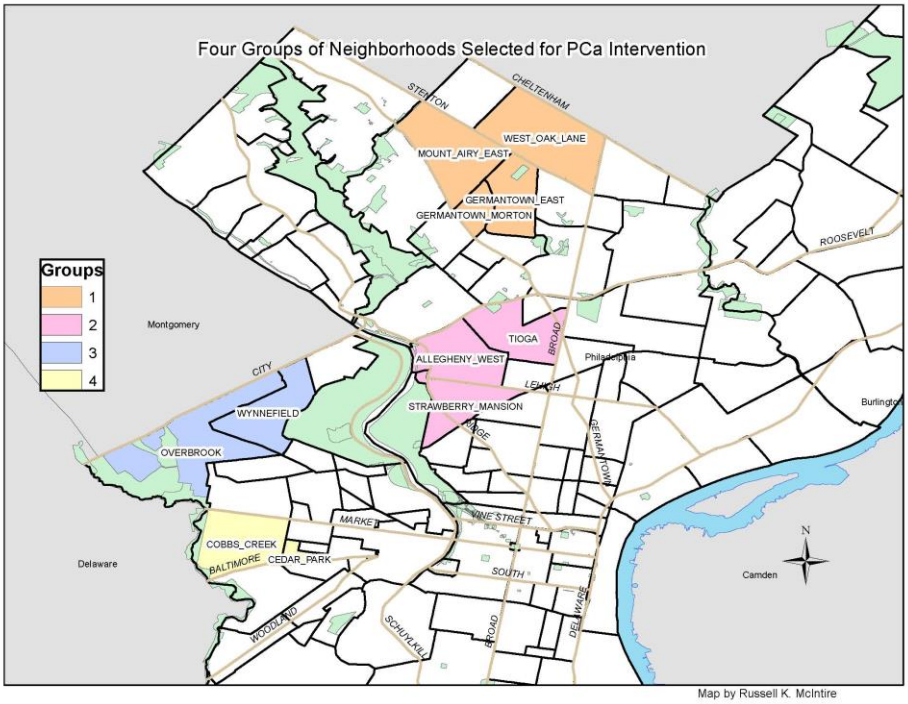



Table 1: Comparison of SIR groups, PA Cancer Registry 2005-2014, Philadelphia

| Variables of Interest | | Standardized Incidence Rates | | | | p-value |
|---|---|---|---|---|---|---|
| | | 0.14-0.50 (N=34) | 0.51-1.00 (N=1970) | 1.01-2.00 (N=7047) | 2.01-5.00 (N=949) | |
| Median Age, years (IQR) | | 67 (58-70) | 66 (59-73) | 65 (58-72) | 65 (58-71) | **0.015** |
| Race/Ethnicity | White | 8 (24%) | 1107 (56%) | 2103 (30%) | 58 (6%) | **<0.001** |
| | Black | 20 (59%) | 345 (18%) | 3332 (47%) | 699 (74%) | |
| | Native American | 0 | 1 (<1%) | 3 (<1%) | 0 | |
| | Asian | 0 | 76 (4%) | 71 (1%) | 1 (<1%) | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Hispanic | 3 (9%) | 193 (10%) | 628 (9%) | 103 (11%) | |
| | Other | 0 | 22 (1%) | 80 (1%) | 1 (<1%) | |
| | Unknown | 3 (9%) | 226 (11%) | 830 (12%) | 86 (9%) | |
| Married | | 7 (39%) | 507 (51%) | 1740 (48%) | 251 (47%) | 0.061 |
| PCa-specific mortality | | 1 (3%) | 117 (6%) | 446 (6%) | 71 (7%) | 0.507 |
| All mortality | | 4 (12%) | 341 (17%) | 1294 (18%) | 192 (20%) | 0.249 |
| Tumor Grade | High | 17 (55%) | 881 (49%) | 3462 (54%) | 505 (59%) | **<0.001** |
| Tumor Stage | Localized | 28 (88%) | 1417 (83%) | 5064 (83%) | 684 (80%) | 0.468 |
| | Regional | 2 (6%) | 180 (11%) | 650 (11%) | 102 (12%) | |
| | Distant | 2 (6%) | 108 (6%) | 375 (6%) | 66 (8%) | |
| Tumor Stage | High | 4 (13%) | 288 (17%) | 1025 (17%) | 168 (20%) | 0.192 |
| Tumor Aggressiveness | Localized stage and High Grade | 11 (37%) | 765 (46%) | 2589 (45%) | 328 (39%) | **0.005** |
| | Regional stage or High Grade | 16 (53%) | 633 (38%) | 2518 (44%) | 351 (43%) | |
| | Regional stage and High grade | 1 (3%) | 144 (9%) | 517 (9%) | 88 (11%) | |
| | Distant Stage | 2 (7%) | 108 (7%) | 375 (6%) | 66 (8%) | |
| Neighborhood Variables | Median number of males in census tract (IQR) | 850 (623-850) | 1045 (790-1361) | 1010 (775-1276) | 848 (653-931) | **<0.001** |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Median income (IQR) | 37716 (35862-39419) | 44696 (36214-56912) | 38862 (32297-47120) | 34196 (31646-38109) | **<0.001** |
| | Percent Poverty (IQR) | 40 (23-40) | 17 (11-27) | 21 (11-34) | 27 (19-36) | **<0.001** |

Table 2: Comparison of SMR groups, PA Cancer Registry 2005-2014, Philadelphia

| Variables of Interest | | Standardized Mortality Rates | | | | p-value |
|---|---|---|---|---|---|---|
| | | 0-0.50 (N=4926) | 0.51-1.00 (N=3052) | 1.01-2.00 (N=2001) | 2.01-6.00 (N=624) | |
| Median Age, years (IQR) | | 66 (59-72) | 65 (58-72) | 65 (58-72) | 65 (58-72) | 0.244 |
| Race/Ethnicity | White | 2317 (48%) | 870 (29%) | 283 (14%) | 49 (8%) | **<0.001** |
| | Black | 1292 (27%) | 1494 (49%) | 1288 (64%) | 455 (73%) | |
| | Native American | 1 (<1%) | 2 (<1%) | 1 (<1%) | 0 | |
| | Asian | 98 (2%) | 39 (1%) | 17 (<1%) | 2 (<1%) | |
| | Hispanic | 385 (8%) | 309 (10%) | 215 (11%) | 58 (9%) | |
| | Other | 65 (1%) | 21 (1%) | 21 (1%) | 7 (1%) | |
| | Unknown | 668 (14%) | 316 (10%) | 176 (9%) | 53 (8%) | |
| Married | | 1237 (49%) | 783 (50%) | 455 (44%) | 142 (43%) | **<0.001** |
| PCa-specific mortality | | 141 (3%) | 224 (7%) | 205 (10%) | 100 (16%) | **<0.001** |
| All mortality | | 699 (14%) | 592 (19%) | 459 (23%) | 177 (28%) | **<0.001** |
| Tumor Grade | High | 2291 (51%) | 1508 (54%) | 999 (56%) | 314 (58%) | **<0.001** |

| | | | | | | |
|---|---|---|---|---|---|---|
| Tumor Stage | Localized | 3464 (85%) | 2210 (83%) | 1411 (80%) | 443 (80%) | **<0.001** |
| | Regional | 442 (11%) | 289 (11%) | 200 (11%) | 49 (9%) | |
| | Distant | 190 (5%) | 178 (7%) | 151 (9%) | 64 (12%) | |
| Tumor Stage | High | 632 (15%) | 467 (17%) | 351 (20%) | 113 (20%) | **<0.001** |
| Tumor Aggressiveness | Localized stage and High Grade | 1775 (45%) | 1089 (42%) | 678 (40%) | 203 (38%) | **<0.001** |
| | Regional stage or High Grade | 1644 (41%) | 1091 (42%) | 710 (42%) | 233 (43%) | |
| | Regional stage and High grade | 356 (9%) | 237 (9%) | 159 (9%) | 38 (7%) | |
| | Distant Stage | 190 (5%) | 178 (7%) | 151 (9%) | 64 (12%) | |
| Neighborhood Variables | Median number of males in census tract (IQR) | 1071 (796-1365) | 1018 (761-1321) | 909 (727-1180) | 780 (609-991) | **<0.001** |
| | Median income (IQR) | 44596 (35793-52182) | 38862 (32480-44375) | 36116 (31414-39714) | 31833 (30950-40408) | **<0.001** |
| | Percent Poverty (IQR) | 15 (8-27) | 21 (11-31) | 28 (16-37) | 34 (25-40) | **<0.001** |

## **Statement of Work – Year 2**

Major Goal 2: Elicitation Phase *(Led by Co-PI Amy Leader, Thomas Jefferson University)*

- Conduct Focus Groups

    - Focus groups were completed September 2016. Twenty-six men participated in the focus groups: seven from West Philadelphia/Overbrook, 7 from Lower North Philadelphia, 7 from Germantown/West Oak Lane, and 5 from Southwest Philadelphia/Cobbs Creek (Figure 1). The mean age of the men was 52 years old and all were African American (reflecting the population of the neighborhoods). Seventeen were single and nine were married or living with a partner. Eleven had a high school diploma, while the remainder (n=16) had completed some college, vocational training, or technical school. Six men were employed full time, six were retired, five were on disability coverage, and the remainder (n=10) were employed part time or were looking for work. This group of men was generally health conscious, with 19 of the 27 reporting that they see their health care provider regularly. Fifteen of the 27 reported having no family history of prostate cancer (those with a personal history of prostate cancer were excluded), while 12 had a brother, father, or uncle who had experienced prostate cancer. (SOW date: October 2016)

Major Goal 3: Intervention Development Phase *(Led by Co-PI Amy Leader, Thomas Jefferson University)*

- Prepare Training Materials

    - We created two educational booklets for the study, one for the intervention arm (PCa education) and one for the control arm (general health education). The PCa education booklet contained information on risk factors, basic anatomy, screening techniques and decision making about screening. The general health education booklet contained information on diabetes, hypertension, and substance use. Table 3 briefly describes the contents of each booklet. (SOW date: December 2016)

Table 3. Contents of the Educational Material.

| Intervention Booklet | | Control Booklet | |
|---|---|---|---|
| **Topic** | **Brief Description** | **Topic** | **Brief Description** |
| PCa Risk | Factors include: age, race/ethnicity, family history, diet, weight, smoking | Annual Doctor Visits | Detection of problems at earlier stage, age based preventive health guidelines |
| Prostate Information | What it is, where it is, what it does, commons symptoms indicating problem | Respect Your Body | Healthy diet, exercise, sleep schedule |
| PCa Screening Techniques | PSA and DRE explanations | Drugs | Alcohol consumption, smoking cessation |
| Screening Decision Making | Discuss screening with Dr./family/friends, Pros and cons, Post-screening | Mental and Emotional Health | Stress, anxiety and depression and their effect on health |

- Identify and Train Community Health Educators
    - Selection of Community Health Educators (CHEs)

      Fifteen men applied from the four neighborhoods applied to be a CHE. Most of the men either participated in the focus groups and expressed interest in becoming involved in the project or were referred by men who had attended the focus groups. Each applicant provided two references and a resume, if possible. Potential candidates were interviewed in-person by two team members who assessed their prior experience, interpersonal skills, understanding of the program, presenting skills, time management, organization, and ability to work autonomously. A study team member verified one or both of the provided references. From this process, 10 of the 15 men were offered CHE positions; all accepted the offer to participate.

- CHE Training Sessions

The training program consisted of eight sessions over five months (outlined in Table 2). It was developed based on previous experiences and knowledge of the research team. Each of the sessions was conducted in-person and was about an hour and a half in length, resulting in roughly 20 hours of training. The men were also given assignments to complete at home, such as reviewing education materials. The educators were paid $23 per hour throughout their training. Eight of the 10 men completed the training program.

The first session consisted of an introduction to the project and the research team, as well as an explanation of the role of a CHE. Basic information on PCa was provided and the men were sent home with additional educational materials to review. The second session was devoted to further PCa education along with solicitation of feedback for the project logo. The third session focused on outreach training that included information on verbal and non-verbal interaction skills, tailoring a message for an audience, and appearance and safety during recruitment. [11] We also reviewed a list of ten important facts to know about PCa, written by the research team. This list included a basic description of the prostate, racial disparities, symptoms, screening options and recommendations, screening pros and cons and PCa management.

Because the CHEs were integrated into the research study, they were required to complete human subjects training. During the fourth session, a representative from the Jefferson Institutional Review Board spoke to the men about informed consent and ethical issues involved in community research. The fifth session was dedicated to the informed decision making process relating to PCa screening. Due to the varying opinions among healthcare organizations' regarding PCa screening it was important for the men to understand the benefits and risks of screening. Benefits of screening discussed included the simplicity of the test and the fact that

cancer is easier to treat with an earlier diagnosis. Risks of screening discussed included the unreliability of the PSA test and the fact that not all PCa requires immediate treatment (i.e., .active surveillance for early stage low risk PCa).

For the sixth session, the men were introduced to a human subjects training program geared toward CHEs. [12] This program served as a modified version of the standard CITI training program and was beneficial for the CHEs because it is tailored to the community setting with the use of real world examples. The men were asked to complete the online program on their own; arrangements were made for any CHEs without Internet access to complete the training at our worksite. Finally, the men continued to review and provide feedback on study materials.

The seventh session involved a presentation on community outreach and the steps to leading an education session. This included a didactic session on how to facilitate a session in a meaningful and engaging way when participants might find the conversation difficult. The eighth session involved a final review of the intervention education booklet and review and feedback on the study surveys. The men were also able to practice recruitment and education delivery with an emphasis on how to address common problems or difficult situations.

Following the first three community health education sessions the CHE were brought together for a debriefing session where each man was given the opportunity to talk about his experiences. Common challenges were addressed and the men were given the opportunity to practice handling these difficult situations. One hour of this session was devoted to additional training by the Penn Center for Community Health Workers, which addressed topics like time management during the education sessions and keeping sessions on topic. For the tenth and final session, the men were asked to review and give feedback on the control booklet and education materials. The CHEs were given time to practice

and become comfortable teaching out of the control education booklet. At the conclusion of training, the men were asked to evaluate their perception of the training program by completing a brief survey. Table 4 outlines the contents of each of the training sessions.

Table 4. Training Sessions of Community Health Educators.

| Session # | Topics Covered at the Training Sessions |
|---|---|
| 1 | Introduction to project goals/aims, scope of work, overview of PCa screening |
| 2 | PCa education; review of study logo |
| 3 | Outreach training; top ten to know |
| 4 | Presentation by Jefferson IRB on informed consent and research in the community |
| 5 | Informed decision making about PCa screening |
| 6 | Human research protections training program overview for community researchers, review and edit session materials |
| 7 | Presentation on community outreach, steps to leading an education session, review of survey |
| 8 | Review final booklet; arguments and counter-arguments for recruitment; practice sessions |
| 9 | Debriefing from initial education sessions, identification of common challenges and practice handling these situations |
| 10 | Control session training, control booklet reviewed, practice sessions |

Attendance during the training program was high considering the part time nature of this work with an overall attendance rate of 69.2% across the 9 sessions. If anyone missed a session, the project manager followed up with them to review the missed material, and they were provided assignments to complete at home. (SOW date: March 2017)

**Statement of Work – Year 3**

Major Goal 4: Survey Development *(Led by Co-PIs, Charnita Zeigler-Johnson and Amy Leader, Thomas Jefferson University)*

This study assessed participants at four time points: at baseline, immediately after an educational session, one-month post-session, and four-months post-session. All four surveys included ten knowledge questions based on the study educational materials, four questions that assess decisional conflict, self-reported PCa screening status, intent to screen (if screening is incomplete), and the extent of concern (anxiety) in developing PCa. The baseline survey also included questions on fatalism, perceptions of neighborhood environment, spirituality, an abbreviated question on preference of medical decision-making (doctor, shared, myself), a 5-question scale assessing informed decision making in the last 12 months with health care providers, and demographics. The post session survey included all of the baseline measures (except demographics) and 15 questions to evaluate the session. The one-month and four-month surveys repeated all key outcome measures. (SOW date: Fall 2017)

Major Goal 5: Study Recruitment and Intervention *(Led by Co-PI Amy Leader, Thomas Jefferson University)*

We recruited 273 men. Approximately half lived in the intervention neighborhoods; the remainder lived in the control neighborhoods. Each participant was invited to attend a health education session in his neighborhood. Recruitment techniques included handing out flyers, hanging posters in community agencies and public places, posting on social media, and disseminating on grassroots advocacy listservs. Interested men screened for study eligibility via telephone, online, in person with a CHE, or immediately prior to the start of a session. Eligibility requirements included being male, associated with one of the high risk neighborhoods, between the ages of 40-69, and no previous diagnosis of PCa.

Health education sessions were designed to be intimate and interactive and to foster a safe environment to talk about health. One or two CHE, depending on skill and ability, led each session comprised of 6 to 10 men from the neighborhood. Sessions were held in community venues, such as libraries, non-profit organizations, places of worship, and barbershops. First, the

CHE obtained informed consent and administered a baseline survey to participants. Then, the CHE used the educational booklet to guide a discussion about PCa or general health, depending on the neighborhood. Participants were encouraged to participate and ask questions. Questions that could not be answered by the CHE were forwarded to the research team for follow-up. Men were able to take the booklet home with them and encouraged to continue the dialogue with family members and their health care provider. Men also were given resources about where to obtain health care in their neighborhood, particularly if they are uninsured. Finally, each participant completed a post-session survey. Each participant was mailed a $25 Visa gift card for his time and participation; the gift card was remotely reloaded with $25 upon completion of the 1-month and 4-month surveys. The 1-month and 4-month surveys were completed via telephone. (SOW date: October 2018)

Major Goal 6: Preliminary Analysis of the Intervention *(Led by PI Charnita Zeigler-Johnson, Thomas Jefferson University)*

- **Statistical Methods**

We conducted descriptive analysis of the EMPaCT data using frequency tables and chi-square statistics for categorical variables. Kruskal-Wallis statistics were used to determine p-values for continuous variables.

Knowledge scores were computed at baseline and post education session by taking the sum of correct answer indicators (10 points per correct response) on a 10-item questionnaire designed for assessing PCa knowledge (i.e., a 100 point knowledge scale). Knowledge was calculated if at least half of the questions were answered and missing responses were considered incorrect responses. There were 33 participants who did not answer any questions on the baseline knowledge survey and 8 who did not answer any of the post session knowledge questions (3 who did not answer any questions on baseline or post session knowledge surveys). One other participant was missing responses to 7 of the 10 knowledge questions. Every other participant had knowledge scores at both times and their change in knowledge at post session was calculated

by subtracting their baseline knowledge score from the post session knowledge score. Knowledge was assessed by the same questionnaire at 1-month and 4-month follow-up calls.

Concern about getting PCa, plans to talk to doctor, and screening plans were assess on a Likert scales (4-point, 5-point, and 5-point, respectively). The SURE assessment of decisional conflict for PCa screening was scored by averaging the 5-point Likert scores on four items (higher scores indicated less decisional conflict) among participants who answered at least two questions. Changes in these scales at post session were calculated by subtracting their baseline score from the post session score.

Histograms overlay the distributions of the endpoints and make visual comparisons between the study groups (educational intervention vs. educational control). Estimated normal probability density functions are overlaid, as well. Linear mixed models were fitted to the change data where the neighborhood was treated as a random effect, study group was the main fixed effect, and the model was adjusted for covariates including mean-centered age and marital status. These models were used to compute covariate adjusted least squares mean estimates by study group. The significance level of each test was set *a priori* to 0.05 and all analyses were conducted using SAS v9.4 (SAS Institute, Cary, NC, USA).

- **Results**

Our final sample included 273 men from high-risk neighborhoods in Philadelphia. Ninety-two percent were African-American/Black. The median age was 53 years (range 27-83 years). Twenty-two percent were currently married, 62% had less than a high school education, 88% had health insurance, and 64% knew someone who had been diagnosed with PCa. Although these were all high burden PCa neighborhoods, we observed differences in demographics by neighborhood. There were significant differences in the percent of African-American/Black PCa patients ($p=0.045$), median body mass index (BMI, $p=0.025$), percent with less than a high school education ($p=0.031$), and percent of current smokers ($p<0.001$, Table 5). However, there were no overall differences detected in other characteristics related to PCa beliefs, knowledge, and screening by neighborhood. (Table 6).

PCa was relatively high among men from high PCa burden neighborhoods. There were no differences in PCa knowledge by age group ($p=0.71$), marital status ($p=0.63$), or history of PSA test (0.95). However, in univariate analysis, PCa knowledge differed by educational attainment. Men with more than HS education had higher PCa knowledge than those with less education (score 90 vs. 80, $p=0.03$).

**Table 5. Demographics of EMPaCT Participants by Neighborhood**

| | Intervention | | Control | | P-value |
|---|---|---|---|---|---|
| | Northwest N=63 | North N=63 | West N=63 | Southwest N=84 | |
| Median age | 53 | 55 | 54 | 52 | 0.772 |
| % Black | 86 | 92 | 95 | 95 | **0.045** |
| % Married | 29 | 23 | 17 | 20 | 0.565 |
| Median BMI | 28 | 28 | 26 | 27 | **0.025** |
| % < HS education | 12 | 13 | 29 | 16 | **0.031** |
| % insured | 87 | 92 | 88 | 84 | 0.653 |
| % current smokers | 31 | 58 | 74 | 73 | **<0.001** |

**Table 6. EMPaCT Participant Characteristics by Neighborhood**

| | | Intervention | | Control | | P-value |
|---|---|---|---|---|---|---|
| | | Northwest N=63 | North N=63 | West N=63 | Southwest N=84 | |
| Beliefs | Little control | 23% | 19% | 20% | 16% | 0.854 |
| | Cancer=death | 49% | 37% | 45% | 38% | 0.492 |
| | Rather not know chance | 19% | 10% | 24% | 16% | 0.221 |
| Knowledge | 100% score | 19% | 16% | 10% | 23% | 0.172 |
| | <80% score | 21% | 32% | 32% | 20% | 0.206 |
| Screening | Talked with doctor about | 52% | 66% | 58% | 53% | 0.428 |
| | Ever screened | 40% | 60% | 60% | 44% | 0.056 |

See Tables 7 and 8 and Figures 3-7 below. In these preliminary results, we have not detect statistically significant differences between the intervention and control groups for knowledge during follow-up. The post-session changes also tended to be modest between groups for questions on concerns, talk to doctor, intent for future screening, and decisional conflict. Additional research into sub-groups of our study participants will help us to understand why baseline PCa knowledge was very similar among our intervention and control groups and who can benefit most from future educational interventions.

**Table 7. Endpoint mean changes (with standard errors) between baseline and follow-up time point by study group adjusted for imbalances in age and marital status.**

| Endpoint | Treatment Effect | Between-group p-value | Group Mean | Within-group p-value |
|---|---|---|---|---|
| **At Post Session** | | | | |
| Intervention | 3.48 (2.53) | 0.17 | 2.87 (2.31) | 0.22 |
| Control | | | -0.61 (2.22) | 0.78 |
| **At 1 Month** | | | | |
| Intervention | 5.95 (5.27) | 0.26 | 10.49 (4.14) | 0.01 |
| Control | | | 4.54 (1.13) | 0.26 |
| **At 4 Months** | | | | |
| Intervention | 4.60 (3.37) | 0.17 | 8.41 (3.08) | 0.01 |
| Control | | | 3.80 (2.88) | 0.19 |

**Table 8. Secondary endpoint mean changes (with standard errors) between baseline and post-session by study group adjusted for imbalances in age and marital status.**

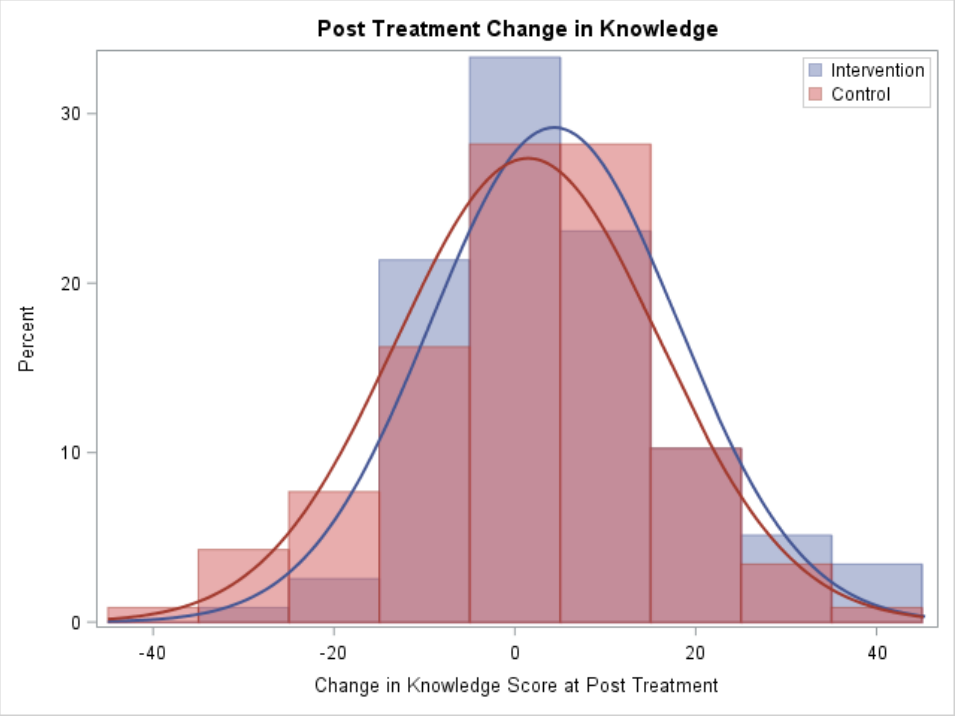
| Endpoint | Treatment Effect | Between-group p-value | Group Mean | Within-group p-value |
|---|---|---|---|---|
| **Concern** | | | | |
| Intervention | 0.02 (0.12) | 0.87 | 0.06 (0.14) | 0.70 |

| | | | | |
|---|---|---|---|---|
| Control | | | 0.04 (0.14) | 0.80 |
| **Talk to Doctor*** | | | | |
| Intervention | 0.30 (0.23) | 0.19 | 0.71 (0.23) | <.01 |
| Control | | | 0.42 (0.22) | 0.05 |
| **Screening Plans** | | | | |
| Intervention | 0.18 (0.25) | 0.49 | 0.55 (0.24) | 0.02 |
| Control | | | 0.38 (0.23) | 0.10 |
| **Decisional Conflict*** | | | | |
| Intervention | 0.18 (0.10) | 0.21 | 0.32 (0.11) | <.01 |
| Control | | | 0.14 (0.10) | 0.16 |

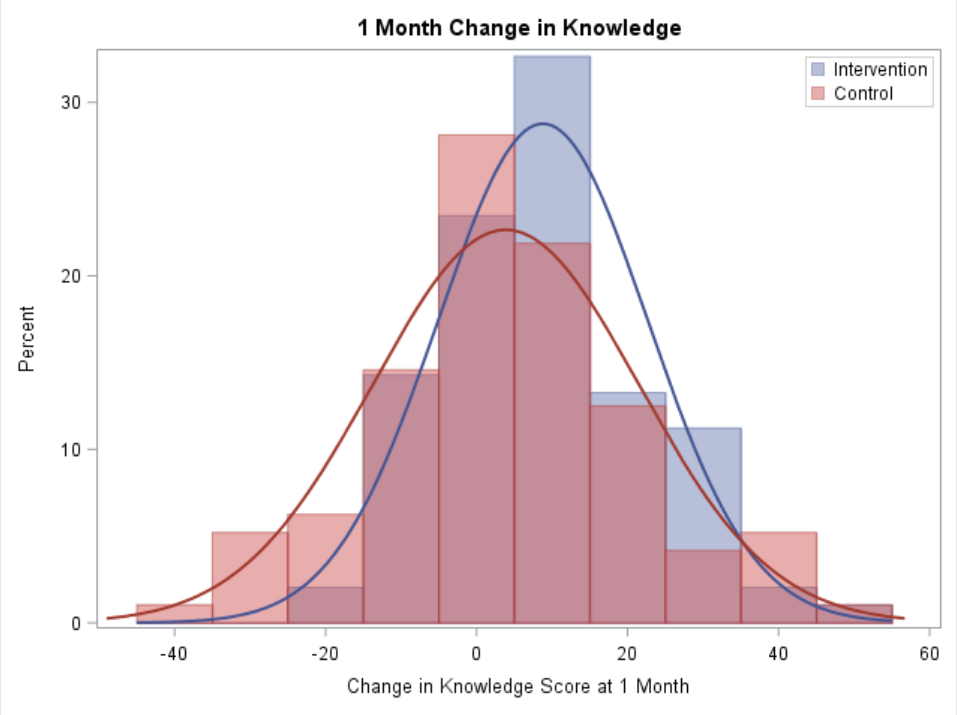
*The random effects for neighborhood could not be estimated for these endpoints and the model was reduced to a fixed-effects model. The effects and group means are unbiased estimates; however, the p-values are biased downward.

**Figure 3. Knowledge score changes from baseline at A. post treatment (n=225), B. 1 month follow-up (n=185), and C. 4 month follow-up (n=158).**

**A.**




**B.**



C.

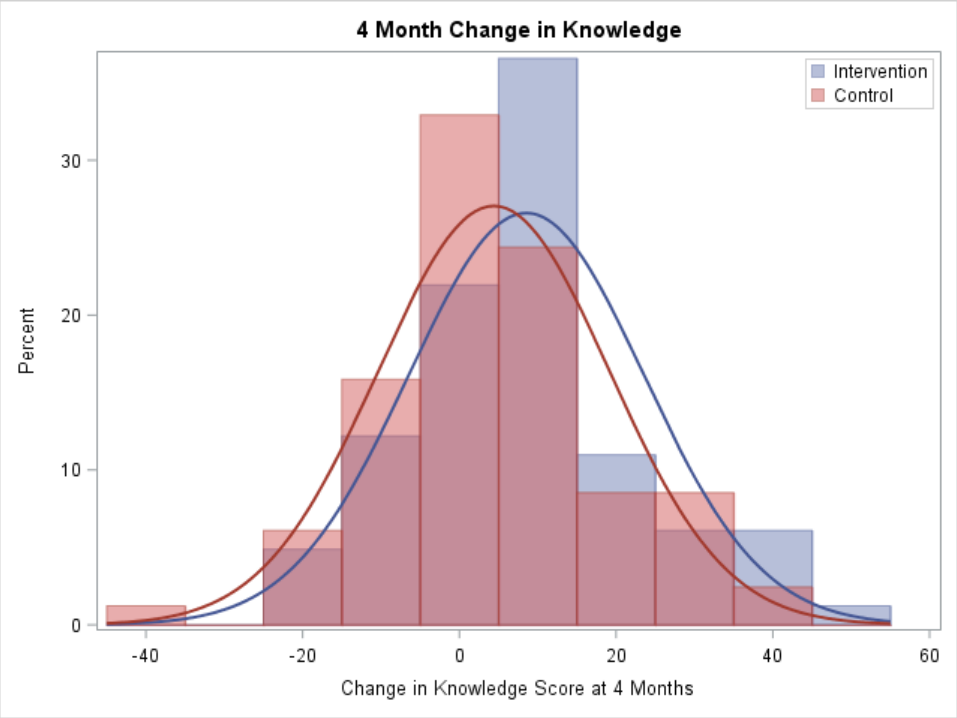



**Figure 4. How concerned are you about getting PCa? (n=176)**

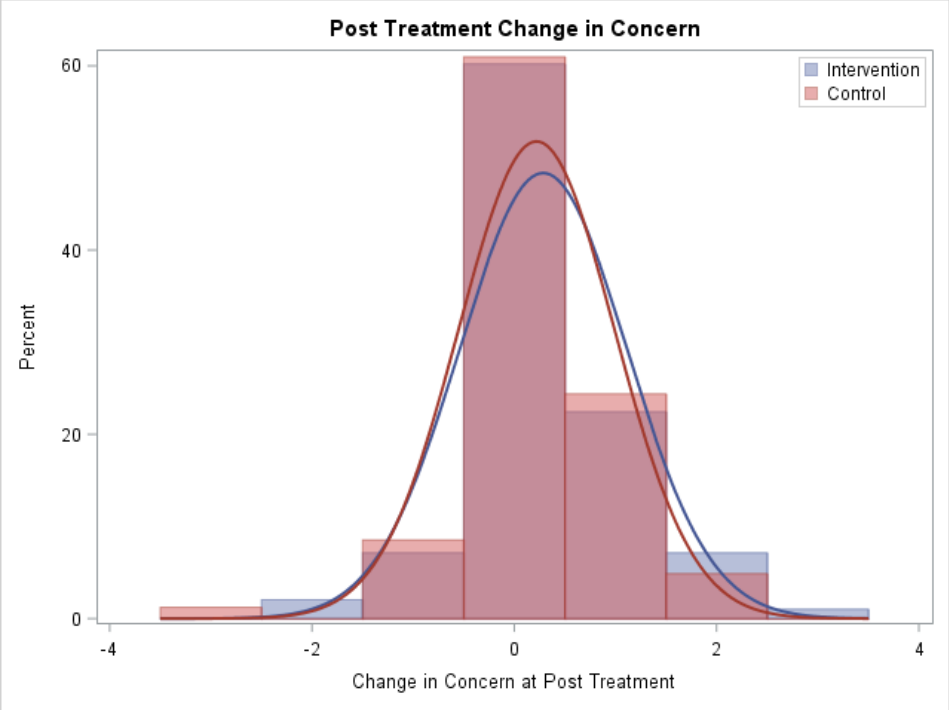


**Figure 5. Plan to talk to your doctor in the next 6 months about PCa screening? (n=217)**

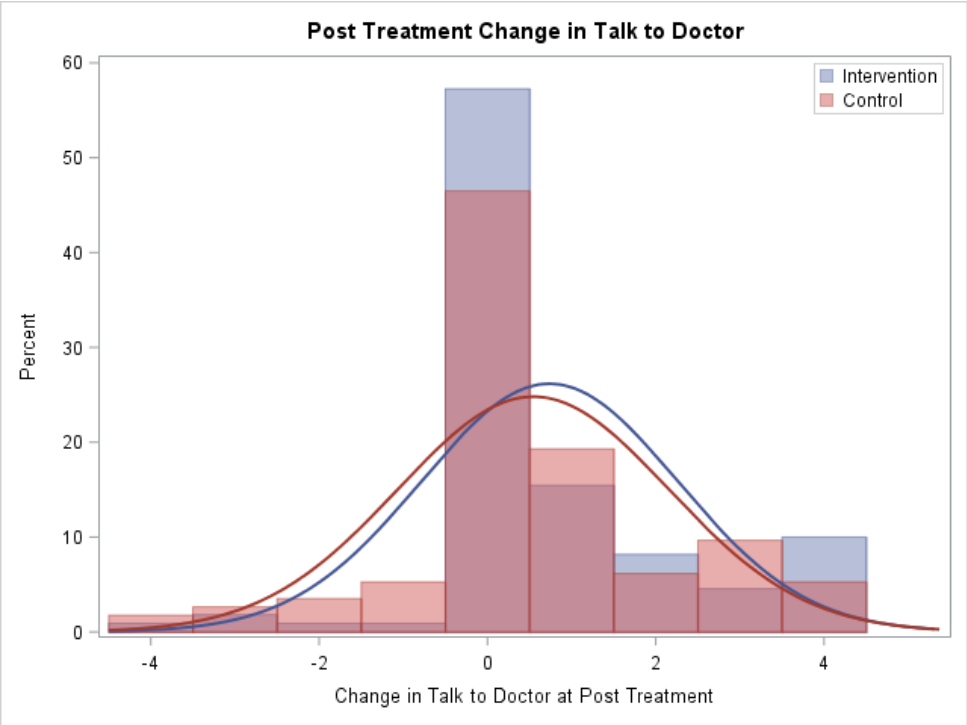



**Figure 6. Do you plan on getting screened for prostate cancer in the next 6 months? (n=210)**

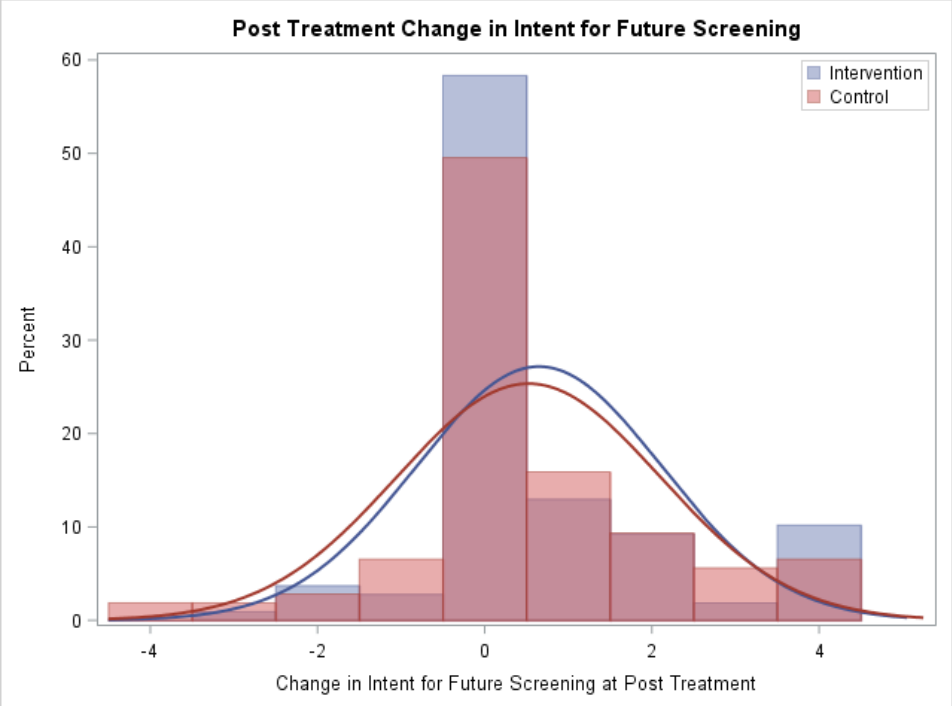
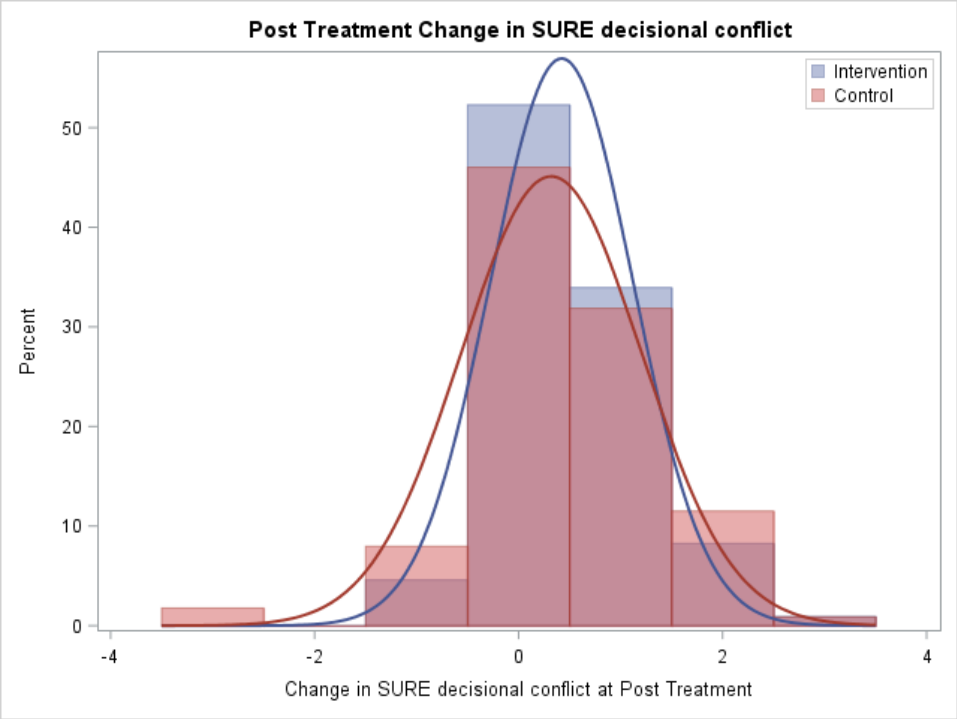


**Figure 7. SURE survey of decisional conflict (higher scores are better). (n=216)**




Major Goal 7: Disseminating Results to Community Members *(Led by Co-PI Amy Leader, Thomas Jefferson University)*

See section C.3. for details. A copy of the disseminated newsletter is located in the Appendix. (SOW date: October 2018)

- **Milestones**
  - Achieved: Completion of focus groups in high-risk areas. Study name changed to "Empowering Men about Prostate Cancer Together (EMPaCT)". Development of PCa educational materials and video. Training and mobilization of community health workers from high-risk

neighborhoods. Recruitment and conduct of "control" group educational sessions. Establishment of database. Recruitment of study participants. Completion of educational sessions. Survey administration. Preliminary data analysis. Publication of two scientific publications. Dissemination of results to study participants and session venues.

- In progress: Analysis of final results from the follow-up calls. A manuscript related to the study design (covering all study aims) is in preparation.

3. b. OPPORTUNITIES FOR TRAINING AND PROFESSIONAL DEVELOPMENT

- Dr. Charnita Zeigler-Johnson (PI) attended the Pennsylvania Prostate Cancer Coalition Conference (September, 2017). She also attended the 2017 North American Association of Central Cancer Registries Conference (June, 2017) and the Urban Health Summer Institute Workshop on Using GIS for Urban Health which was held at Drexel University, Philadelphia, PA (June 2018).
- Dr. Leader (co-PI) attended the 2017 CDC National Cancer Conference (August, 2017).
- Dr. Earl Bowen (consultant) attended the AACR Conference on the Science of Cancer Health Disparities in Racial/Ethnic Minorities and the Medically Underserved (September, 2017) He participated in the 2017 AACR Scientist-Survivor Program held during the conference.
- Dr. Russell McIntire (GIS expert) attended the American College of Epidemiology Annual Meeting (September, 2017)
- Ms. Siani Snaith (undergraduate summer research fellow) received training on toolkit development related to Community Health Educators.

3. c. DISSEMINATION TO COMMUNITIES OF INTEREST

The researchers at Jefferson worked with MEE Productions, a minority-owned health communications firm in Philadelphia and a subcontractor on the grant, to create a newsletter for the men and community agencies that participated in the study. The newsletter included an educational section on prostate cancer, an overview of the study, a list of the health educators and the organizations that participated, a preliminary showcase of results, and resources in Philadelphia for men who needed assistance with housing, employment, legal advice and health care. Newsletters were mailed to the home of each male who participated; copies were hand-delivered to men who resided in transitional housing programs at the time of the intervention. Additionally, copies of the newsletter were distributed to the community-based organizations throughout Philadelphia that participated in the study, for them to see the results of the study and use the newsletters as they desired. A copy of the newsletter is included in the appendix.

3. d. PLANS FOR THE NEXT REPORTING PERIOD

Nothing to report.

## 4. Impact

4. a. IMPACT ON THE DEVELOPMENT OF THE PRINCIAL DISCIPLINE OF THE PROJECT

Individual patient characteristics do not fully explain the occurrence of advanced disease among prostate cancer cases, and only a subset of patients is at risk for advanced disease and related mortality. Studying prostate cancer within the context of environmental factors may help to elucidate prostate cancer causes and progression and provide additional information about the groups of men that are at highest risk for advanced disease. To date, targeting populations for interventions has been determined by race or income characteristics of communities. However, not all members of a particular race/ethnic or socioeconomic group are at the same risk for poor cancer outcomes. We have also observed from our analyses that there

are differences in the neighborhoods that are at highest PCa risk vs. those with the highest proportions of black/African American residents or low-income residents. The creation of a composite score to objectively identify high-risk areas for prostate cancer is novel and can be used by other epidemiologists to study cancer risk and target highest risk communities for focus groups and interventions.

The results of this study also will provide an important contribution to the existing body of knowledge on methods to increase informed decision making about PCa among men who are potentially at high risk for disease and are living in low resource communities. Using CHEs is one method to deliver the information to men in a culturally sensitive manner.

4. b. IMPACT ON OTHER DISCIPLINES

The results of this study will be important for reducing PCa disparities and could be applied by other researchers to other cancer disease sites. We cannot overstate the importance of thoughtful, community-based formative research. Our focus groups were integral to the successful development of study materials geared toward men living in the identified neighborhoods. The men in the focus groups told us exactly what they would want to see in an intervention, how to frame it, and who to partner with to bring credibility to the effort. The focus groups served as one of our primary means of recruiting men to become CHEs. Including a diverse group of CHEs and/or advocates can be vital to the success of many community-based studies, assisting participant recruitment and study implementation. CHEs and cancer advocates can provide vital feedback on education materials and surveys to help shape effective interventions for diverse communities.

4. c. IMPACT ON TECHNOLOGY TRANSFER

Nothing to report.

4. d. IMPACT ON SOCIETY BEYOND SCIENCE AND TECHNOLOGY

Nothing to report.

## 5. Changes/problems

There were no significant changes in any aspect of this project.

## 6. Products

6. a. JOURNAL PUBLICATIONS

- Zeigler-Johnson C, Keith S, McIntire R, Robinson T, Leader A, Glanz K. Racial and Ethnic Trends in Prostate Cancer Incidence and Mortality in Philadelphia, PA. Journal of Racial and Ethnic Health Disparities, doi: 10.1007/s40615-018-00534-z, 2018.

- McIntire RK, Keith SW, Leader AE, Glanz K, Boamah M, Klassen A, Zeigler-Johnson C. Methods for Identifying Neighborhoods with High Burdens of Prostate Cancer. Preventive Medicine 112: 47-53, 2018.

6. b. BOOKS OR OTHER NON-PERIODICAL, ONE-TIME PUBLICATIONS

6. c. OTHER PUBLICATIONS, CONFERENCE PAPERS, AND PRESENTATIONS

Six abstracts/presentations have developed thus far from the analyses for the EMPaCT Study:

1) McIntire RK, Keith SW, Leader A, Glanz K, Zeigler-Johnson C. Where to Intervene? Methods for Selecting Neighborhoods for a Prostate Cancer Intervention in Philadelphia. National Cancer Institute Geospatial Conference, Bethesda, MD. 2016 Notes: Oral Presentation.

2) Zeigler-Johnson C, Keith SW, McIntire R, Leader A, Glanz K. Local Trends in Prostate Cancer: The Role of Race. The Science of Global Prostate Cancer Disparities in Black Men Conference, Orlando, FL. 2016 Notes: Poster Presentation.

3) Zeigler-Johnson C, McIntire R, Keith SW, Leader A, Glanz K. Characteristics of Local

Geographic Areas with Low and High Prostate Cancer Risk. 2017 North American Association of Central Cancer Registries, Albuquerque, NM. 2017 Notes: Oral Presentation.

4) Leader A, Bowen Jr E, Quinn A, Weddington P, Fortune T, Sauls D, Glanz K, Zeigler-Johnson C. Uncovering African American Males' Understanding and Perceptions about Prostate Cancer Screening: Formative Research for a Neighborhood-Based Educational Intervention. 2017 CDC National Cancer Conference, Atlanta, GA. 2017 Notes: Poster Presentation.

5) Leader A, Bowen Jr E, Quinn A, Weddington P, Fortune T, Sauls D, Glanz K, Zeigler-Johnson C. Uncovering African American Males' Understanding and Perceptions about Prostate Cancer Screening: Formative Research for a Neighborhood-Based Educational Intervention. AACR Conference on the Science of Cancer Health Disparities in Racial/Ethnic Minorities and the Medically Underserved, Atlanta, GA. 2017 Notes: Poster Presentation.

6) McIntire R, Keith S, Leader A, Glanz K, Boamah M, Zeigler-Johnson C. (2017) Methods for Identifying Neighborhoods with High Burden of Prostate Cancer. American College of Epidemiology Annual Meeting, New Orleans, LA. 2017 Notes: Poster Presentation.

6. d. WEBSITES OR INTERNET SITES

An educational video was developed by members of the EMPaCT research team and posted on You Tube for dissemination.

https://www.youtube.com/watch?v=No4_LPg1-Tk&feature=youtu.be

6. e. TECHNOLOGIES OR TECHNIQUES

Nothing to report.

6. f. INVENTIONS, PATENT APPLICATIONS, AND/OR LICENSES

Nothing to report.

6. g. OTHER PRODUCTS

With the help of a summer research fellow, we developed a toolkit that contains training and evaluation components used by the Community Health Educators during the EMPaCT Study.

## 7. Participating and Other Collaborating Organizations

| | |
|---|---|
| Name: | Charnita Zeigler-Johnson (no change) |
| Project Role: | |
| Researcher Identifier (ORCID ID) | |
| Nearest Person Month Worked | |
| Contributions to Project | |
| Funding Support | |
| | |
| Name: | Amy Leader (no change) |
| Project Role: | |
| Researcher Identifier (ORCID ID) | |
| Nearest Person Month Worked | |
| Contributions to Project | |
| Funding Support | |

| | |
|---|---|
| Name: | Karen Glanz (no change) |
| Project Role: | |
| Researcher Identifier (ORCID ID) | |
| Nearest Person Month Worked | |
| Contributions to Project | |
| Funding Support | |
| | |
| Name: | Siani Snaith (no change) |
| Project Role: | |
| Researcher Identifier (ORCID ID) | |
| Nearest Person Month Worked | |
| Contributions to Project | |
| Funding Support | |
| | |
| Name: | Scott Keith (no change) |
| Project Role: | |
| Researcher Identifier (ORCID ID) | |
| Nearest Person Month Worked | |
| Contributions to Project | |
| Funding Support | |
| | |
| Name: | Anna Marie Quinn (no change) |

| | |
|---|---|
| Project Role: | |
| Researcher Identifier (ORCID ID) | |
| Nearest Person Month Worked | |
| Contributions to Project | |
| Funding Support | |
| | |
| Name: | Jill McDonald (no change) |
| Project Role: | |
| Researcher Identifier (ORCID ID) | |
| Nearest Person Month Worked | |
| Contributions to Project | |
| Funding Support | |

**7.** a**.** CHANGE IN ACTIVE OTHER SUPPORT OF THE PI/SENIOR PERSONNEL

Nothing to report.

7. b. OTHER ORGANIZATIONS INVOLVED AS PARTNERS

- Organization name: University of Pennsylvania

  Location of Organization: Philadelphia, PA

  Partner's Contribution to the Project: In-kind support (computers), Community Outreach Core support, Community Health Workers (training and support), meeting rooms, and collaboration.

- Organization name: MEE Productions, Inc.

  Location of Organization: Philadelphia, PA

Partner's Contribution to the Project: In-kind support (computers), videography equipment, focus group leaders, and collaboration.

## 8. Special Reporting Requirements

Collaborative Award – Both the Initiating PI and Partnering PI will provide a copy of this report.

## BIBLIOGRAPHY


1. McIntire RK, Keith SW, Boamah M, Leader AE, Glanz K, Klassen AC, et al. (2018) A Prostate Cancer Composite Score to Identify High Burden Neighborhoods. Prev Med 112: 47-53.
2. Zeigler-Johnson C, Keith S, McIntire R, Robinson T, Leader A, Glanz K (2018) Racial and Ethnic Trends in Prostate Cancer Incidence and Mortality in Philadelphia, PA: an Observational Study. J Racial Ethn Health Disparities.

## 9. Appendices

Appendix 1 -- Abstracts

"Characteristics of Philadelphia Census Tracts with High Prostate Cancer Risk"

C. Zeigler-Johnson1, Russell McIntire1, Scott W. Keith1, Amy Leader1, K. Glanz2

Thomas Jefferson University1, University of Pennsylvania2, Philadelphia, PA

Prostate cancer (PCa) risk varies by census tracts (CT). Using age-standardized incidence (SIR) and mortality rates (SMR), PCa disparities can be studied by focusing on CT with higher than expected rates of PCa. The goal of this study is to determine factors associated with living in high SIR and SMR CT. We geocoded Pennsylvania Cancer Registry PCa data for Philadelphia, PA (2005-2014) to compute SIR and SMR for each census tract. Three PCa risk groups were created: low (SIR and SMR<1); intermediate (SIR or SMR≥1, not both); high (SIR and SMR≥1). Logistic regression models examining low vs. intermediate and low vs. high risk (including patient age, race, tumor aggressiveness, PSA, and CT median income) were used to examine associations with higher risk areas. Models including CT median income showed that high PCa risk CT were associated with increased proportions of older patients (OR=1.32, 95% CI=1.01-1.73) and Black (OR=16.25, 95% CI=13.14-20.10), Hispanic (OR=4.41, 95% CI=3.29-5.92) or other non-white patients (OR=2.31, 95%CI=1.74-3.07). There was a protective association of higher CT median income (2nd quartile OR=0.43, 95% CI=0.34-0.55, 3rd quartile OR=0.20, 95% CI=0.16-0.26; 4th quartile OR=0.17, 95% CI=0.13-0.23). Except for age and 2nd quartile median income, similar associations were found comparing low to intermediate PCa risk CT. Although we did not detect independent associations between high PCa risk areas by clinical factors, we observed associations by patient-level age and race and indicators of CT median income. These characteristics can be used to target communities for interventions to decrease PCa risk where SIR or SMR estimates are unreliable or unavailable at the census tract level.

"Uncovering African American Males' Understanding and Perceptions about Prostate Cancer Screening: Formative Research for a Neighborhood-Based Educational Intervention"

Amy Leader1, Earl Bowen, Jr.2, Anna Quinn1, Pamela Weddington3, Thierry Fortune3, David Sauls4, Karen Glanz5, Charnita Zeigler-Johnson1

Thomas Jefferson University1, PA Prostate Cancer Coalition2, MEE Inc. 3, Delaware Prostate Cancer Coalition4, University of Pennsylvania5

While much is known about males' awareness and opinions about prostate cancer screening, less is known about how African American males, in particular, view the topic. Additionally, we sought to gain insight about how a neighborhood-based intervention aimed at increasing informed decision making about prostate cancer screening should look and feel. Four focus groups were held in predominately low-resource neighborhoods of Philadelphia, PA in September 2016. Discussions explored knowledge and attitudes towards prostate cancer screening, understanding of the risks and benefits of screening, and views on making decisions about screening. Participants also shared thoughts on designing a neighborhood based intervention for African American males, including credible message senders, recruiting strategies, culturally sensitive language and dialogue, and incentives for participation. Focus groups were led by a professional moderator who was also a peer of the men. Sessions were video recorded and content analyzed by members of the research team to uncover dominant themes and important recommendations for the future intervention. In total, 22 African American men ages 40 to 69 participated in a focus group (mean age 52; 62% single; 43% with a college or graduate degree). Men had limited understanding of prostate cancer or possible screening modalities, and very few could articulate the risks and benefits of screening. However, the men recognized the seriousness of prostate cancer and the importance of early detection. When designing the intervention, pastors, physicians, city council members, and local civic leaders are all trusted messengers. Recruitment should come from within the community and sessions should be hosted by organizations with strong ties to the community. Sessions should be led by men who can deliver accurate information in plain and simple language and not be judgmental of current behavior or lifestyle choices. The men agreed that a general prevention intervention, rather than one specifically focused on prostate cancer, would draw more interest. Lastly, the men felt that monetary compensation would be important to participation, particularly in low-resource neighborhoods where rates of unemployment are high. While knowledge about prostate cancer screening was low, enthusiasm for bringing information about prostate cancer to men in their neighborhoods was quite high. Understanding the cultural, social, and environmental realities in a community will lead to the development of a much stronger and relevant educational intervention.

Appendix 2 – Scientific Publications and EMPaCT Newsletter

Preventive Medicine 112 (2018) 47–53

Contents lists available at ScienceDirect

Preventive Medicine

journal homepage: www.elsevier.com/locate/ypmed

# A Prostate Cancer Composite Score to Identify High Burden Neighborhoods

Russell K. McIntire[a,*], Scott W. Keith[b], Maxwell Boamah[c], Amy E. Leader[a,d], Karen Glanz[e], Ann C. Klassen[f], Charnita M. Zeigler-Johnson[d]

[a] Jefferson College of Population Health, Thomas Jefferson University, Philadelphia, PA, United States
[b] Division of Biostatistics, Department of Pharmacology and Experimental Therapeutics, Thomas Jefferson University, Philadelphia, PA, United States
[c] Department of Epidemiology and Biostatistics, Dornsife School of Public Health, Drexel University, Philadelphia, PA, United States
[d] Division of Population Sciences, Department of Medical Oncology, Thomas Jefferson University, Philadelphia, PA, United States
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ARTICLE INFO

*Keywords:*
Prostate cancer
Neighborhood
Incidence
Mortality

ABSTRACT

This study presents a novel geo-based metric to identify neighborhoods with high burdens of prostate cancer, and compares this metric to other methods to prioritize neighborhoods for prostate cancer interventions. We geocoded prostate cancer patient data ($n$ = 10,750) from the Pennsylvania cancer registry from 2005 to 2014 by Philadelphia census tract (CT) to create standardized incidence ratios (SIRs), mortality ratios (SMRs), and mean prostate cancer aggressiveness. We created a prostate cancer composite (PCa composite) variable to describe CTs by mean-centering and standard deviation-scaling the SMR, SIR, and mean aggressiveness variables and summing them. We mapped CTs with the 25 highest PCa composite scores and compared these neighborhoods to CTs with the 25 highest percent African American residents and the 25 lowest median household incomes. The mean PCa composite score among the 25 highest CTs was 4.65. Only seven CTs in Philadelphia had both one of the highest PCa composite scores and the highest percent African American residents. Only five CTs had both the highest PCa composites and the lowest median incomes. Mean PCa composite scores among CTs with the highest percent African American residents and lowest median incomes were 2.08 and 1.19, respectively. The PCa composite score is an accurate metric for prioritizing neighborhoods based on burden. If neighborhoods were prioritized based on percent African American or median income, priority neighborhoods would have been very different and not based on PCa burden. These methods can be utilized by public health decision-makers when tasked to prioritize and select neighborhoods for cancer interventions.

## 1. Introduction

Prostate cancer is the most common cancer and second-leading cause of cancer death among men in the United States. In 2016 there were over 180,000 new cases of prostate cancer in U.S and over 26,000 prostate cancer deaths. In the United States there are enormous health disparities regarding prostate cancer outcomes with incidence rates among African American 70% higher than among Whites, and mortality rates twice as high among African American men (American Cancer Society, 2016a).

In a recent draft recommendation statement, the US Preventive Services Task Force noted that health care providers should have a conversation with men ages 55 to 69 about the benefits and harms of prostate-specific antigen-based screening for prostate cancer (United States Preventive Services Task Force, 2017). The American Cancer Society recommends that this provider-patient discussion begin at age of 50 among men who are at average risk of prostate cancer and have a life expectancy of at least 10 years, and earlier for men at higher risk (American Cancer Society, 2016b). Educational interventions to normalize this informed decision-making process among at-risk men in the U.S. have increasingly targeted at-risk men in community-based settings. Neighborhoods are an important focus for prostate cancer prevention initiatives because the demographics of people that live in neighborhoods are often similar, and prostate cancer has been shown to vary by census tracts (Zeigler-Johnson et al., 2011). Therefore, organizations conducting cancer prevention initiatives can impact individuals at risk for cancer-related outcomes by focusing on neighborhoods composed of individuals with the greatest cancer-related burden.

Because of resource constraints, public health organizations are constantly tasked with implementing programs and policies that make

*Abbreviations:* CT, Census tract; PCa, prostate cancer; SIR, Standardized incidence ration; SMR, Standardized mortality ratio; SD, Standard deviation

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the greatest population health impact while minimizing costs. Prioritizing which interventions, activities, and geographic areas to focus on for disease prevention is a major effort among local, state, and national public health organizations of all sectors. Health agencies and organizations often reference area health rankings in order to focus health improvement on areas of greatest need (Oliver, 2010). While there are established methods for ranking large geographic areas, such as U.S. regions, states, counties (Erwin et al., 2011; Kanarek et al., 2011; Rohan et al., 2009), and zip codes (Johnson, 2004), there are fewer that focus on prioritizing smaller geographic units of analysis such as neighborhoods. Additionally, there are no studies that describe methods to select priority neighborhoods based on prostate cancer outcomes.

The majority of studies designed to test or implement community-based prostate cancer interventions selected priority neighborhoods not on prostate cancer outcomes, but on the demographic characteristics that have been shown to correlate with prostate cancer outcomes. African American race and socioeconomic status are two variables that researchers commonly used to describe high risk neighborhoods (Jandorf et al., 2007; Singh et al., 2002; Freeman et al., 2011), select individuals (Fleisher et al., 2016), neighborhood sites (Luque et al., 2010; Husaini and Reece, 2008; Holt et al., 2009; Drake et al., 2010) or neighborhood focus-areas for community-based prostate cancer interventions (Driscoll et al., 2008). While studies have been performed to identify and compare cancer outcomes at the neighborhood level for educational interventions (Alcaraz et al., 2009), no metrics have been established for neighborhood-based prioritization that incorporate multiple prostate cancer outcomes. Such a metric would be very helpful for organizations tasked with selecting neighborhoods in which to perform prostate cancer prevention interventions.

In general, cancer researchers interested in prioritizing geographic areas for cancer-prevention activities have used individual cancer outcomes, such as cancer mortality or morbidity measures at the regional (Hebert et al., 2009; Wagner et al., 2012) or zip code (Rowel et al., 2005) levels or multiple outcomes and small area analyses at the census tract level (Kerner et al., 1988; Beyer and Rushton, 2009). Identifying area-based prostate cancer mortality and incidence rates is helpful for describing the distribution of prostate cancer outcomes themselves, but using single outcome measures alone cannot adequately or comprehensively portray the comparative burden of prostate cancer at the neighborhood level. When dealing with small units of analysis such as census tracts, mortality rates generated may be unstable due to small numbers of prostate cancer mortality events. Using prostate cancer incidence data may result in census tracts selected under a detection bias (in which access/utilization of healthcare may contribute to higher prostate cancer incidence in some areas compared to others). Tumor aggressiveness also does not correlate perfectly with higher prostate cancer mortality rates. Therefore, a combination of prostate cancer severity indicators is needed to identify areas with sufficient numbers of prostate cancer cases with a high probability of poor outcomes.

In this study, we present an aggregate metric, composed of multiple prostate cancer outcomes that could be used to prioritize and select neighborhoods on which to focus efforts for community-based prostate cancer interventions. This article describes the process through which we calculated this metric, the PCa composite score, for neighborhoods in Philadelphia; discusses the demographic characteristics associated with the census tracts having the highest 25 PCa composite scores; and identifies the neighborhoods that would have been chosen if the identification was based not on prostate cancer outcomes, but on known sociodemographic correlates of prostate cancer outcomes, race or income.

## 2. Methods

### 2.1. Data sources

The primary data source for prostate cancer cases was the Pennsylvania Cancer Registry (PCR) (Pennsylvania Department of Health, 2017). The PCR is a statewide data system that collects information about new cases of cancer diagnosed in PA. The registry provides demographic and tumor-specific information about all diagnosed cases of cancer in PA. The PCR has earned Gold Certification from North American Association of Central Cancer Registries (NAACCR), which denotes achieving 95% or higher completeness, for all years of data available except 2001 (not certified) and 2012 (silver certification; 85% or higher completeness) (North American Association of Central Cancer Registries, 2018).

We also used demographic data from the 2010 U.S. Census. The U.S. Census- designated unit of analysis that we used to define neighborhoods is the census tract (CT) which is composed of about 4000 individuals. Studies show that CTs perform well as a geographic unit of analysis to identify patterns in associations between risk factors and cancer incidence (Krieger et al., 2002). We used CTs to quantify prostate cancer-related health outcomes because accurate population data is accessible for CTs and this could be used for standardized rate calculations. Additionally, we downloaded demographic data and Tiger/Line shapefiles for CTs from the U.S Census Bureau website (U.S. Census Bureau, 2016).

### 2.2. Sample

Philadelphia was chosen as the population from which we would conduct this analysis because it is the most racially and socioeconomically diverse county in Pennsylvania. Additionally, because of high population density, Philadelphia has the highest incidence by census tract in the state. We acquired patient-level data for all prostate cancer diagnoses and deaths from 2005 to 2014 for Philadelphia, PA from the PCR (N = 10,806). We cleaned the data to correct misspellings and data omissions. Individuals not residing in Philadelphia county, without address data, or only P.O. Box data were removed from the dataset (Final N = 10,750). Using Environmental Research Systems Research Institute (ESRI)'s ArcGIS software version 10.2, we geocoded the patient addresses. Of the 10,750 individuals in the dataset, we were able to match 10,621 (98.8%) patients to existing addresses. Using mapping software and geographic boundaries established for the U.S. Census 2010, we aggregated patients by CT in Philadelphia ($N = 384$). For analysis, we chose to focus only on CTs in which 300 or more men at least 35 years of age resided (based on the 2010 Census), so that sufficient numbers of men could be available to benefit from potential neighborhood-based initiatives to reduce the burden of prostate cancer.

### 2.3. Measures

We treated prostate cancer stage as a binary variable, with 0 representing localized disease (T1/T2), and 1 representing regional to distant disease (T3/T4). We treated the prostate cancer grade variable as binary with 0 representing well to moderately differentiated tumors (Gleason score 2–6) and 1 representing poorly differentiated to undifferentiated tumors (Gleason score 7–10). For each patient, we created an aggressiveness variable based on individuals' cancer grade and stage. We treated aggressiveness as an ordinal variable with 0 assigned to individuals with both low stage and low grade, 1 for individuals with either high stage or high grade, and 2 for people with both high stage and high grade tumors. To identify the CTs with the highest percentage of African American residents, we used the Percent- One Race- Black or African American variable from the 2010 decennial census. To identify CTs with the lowest income, we used the inflation-adjusted Median Household Income in dollars 5 year estimates (2010–2014) from the

American Communities Survey.

### 2.4. Statistical analyses

We focused on three prostate cancer outcomes to quantify at the CT level: standardized incidence rate (SIR), standardized mortality rate (SMR), and mean aggressiveness. Using the number of men at least 35 years of age from the U.S. Census data as our denominator, we identified crude prostate cancer incidence and mortality rates by CT. We used Surveillance Epidemiology and End Results (SEER) data for the 2010 U.S. population as the reference to age-adjust the incidence and mortality rates for each CT. For eligible Philadelphia CTs (i.e., those containing 300 or more men at least 35 years of age in the 2010 Census), we then identified the mean aggressiveness for all patients within each CT. We centered and scaled the SIR, SMR and mean aggressiveness variables by their respective means and standard deviations across all the eligible CTs. The PCa composite variable was constructed by adding the centered and scaled SMR, SIR, and mean aggressiveness variables, thus giving equal weight to each of these three components in the composite. This PCa composite outcome variable was used as the main index for characterizing CTs based on their prostate cancer outcomes and we used it to identify the eligible Philadelphia CTs with the highest prostate cancer outcomes burden.

### 2.5. Neighborhood comparison

We chose to focus on the neighborhoods in Philadelphia with the highest PCa composite scores in order to characterize the geographic location and demographics of these neighborhoods. In order to show the degree of neighborhood overlap in prioritization of neighborhoods by the composite and other reasonable candidate variables, we selected the top 25 neighborhoods based on having the highest composite scores and the highest associated risk as estimated by two other variables commonly linked to prostate cancer risk in communities: percentage of African American residents and median household income. That is, we respectively ordered neighborhoods in Philadelphia based on having the 25 highest composite scores, the 25 highest percentages of African American residents, and by having the 25 lowest median household incomes.

## 3. Results

### 3.1. Incidence

Among the 384 CTs in Philadelphia, 360 had at least 300 males over the age of 35. Among the 360 CTs, the mean number of incident prostate cancer cases from 2005 to 2014 was 29.04 (Standard Deviation (SD) = 15.4); min = 2, max = 90). The mean SIR among CTs was 1.19 (SD = 0.40; min = 0.13, max = 2.43).

### 3.2. Mortality

Among the 360 CTs, 270 had at least one prostate cancer death from 2005 to 2014. The mean number of deaths among all CTs was 1.82 (SD = 1.71; min = 0, max = 7). The mean SMR was 0.66 (SD = 0.72; min = 0, max = 5.13).

### 3.3. Aggressiveness

For each of the 360 CTs we calculated the mean aggressiveness of the cases within the CT. Among the CTs the (mean) mean aggressiveness was 0.47 (SE = 0.13; min = 0.08, max = 1.00).

### 3.4. Prostate Cancer Composite Score

After centering and scaling the SIR, SMR, and mean aggressiveness variables by their respective means and standard deviations, we summed these measures to calculate the PCa composite score for each CT. The mean PCa composite score was 0 (SD = 2.12; min = −5.23, max = 8.64). We provide a histogram to further describe the distribution of the PCa composite score among all CTs (Fig. 1).

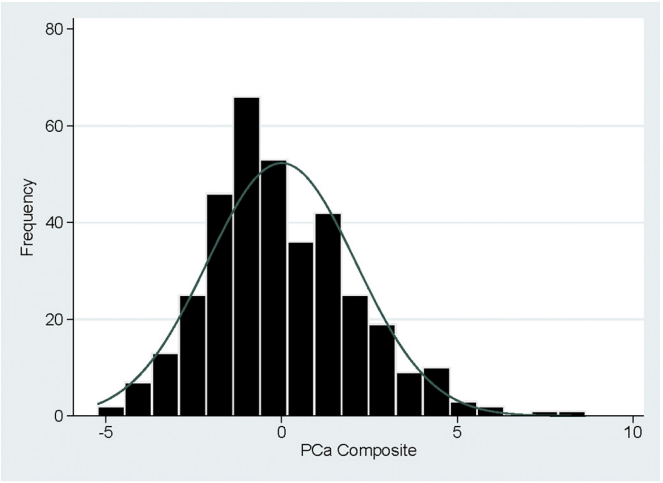


**Fig. 1.** Distribution of PCa Composite Score among Census Tracts in Philadelphia: 2005–2014 ($N$ = 360).

### 3.5. Neighborhood prioritization and comparisons

Fig. 2 displays the 25 neighborhoods with the highest PCa composite scores, representing those with the worst prostate cancer outcomes among Philadelphia CTs from 2005 to 2014. The vast majority of the CTs with the highest 25 PCa composite scores clustered in one of five planning districts in Philadelphia; Upper North, Upper Northwest, North, Lower North, and West Philadelphia.

Table 1 characterizes the CTs with the 25 highest PCa composite scores, highest percent African American residents, and lowest median household incomes in Philadelphia. The mean PCa composite score among the 25 highest CTs was 4.65, whereas the mean PCa composite scores among the CTs with the highest percent African American residents and lowest median incomes were 2.08 and 1.19, respectively. Among the CTs with the highest 25 PCa composite scores, the majority of residents were African American (Mean = 85.5%), but this proportion was less than the mean among CTs with the highest 25% African Americans (96.1%). Additionally the CTs with the highest 25 PCa composite scores had a high average median income ($27,070) compared to the average among CTs with the lowest 25 median household incomes in Philadelphia ($15,441). Seven of the CTs with the highest 25% African American residents were also CTs with the highest PCa composite score. Only five of the CTs with the lowest 25 median incomes were also CTs with the highest PCa composite scores. There was only one CT in the top 25 for all 3 criteria (Tract 09500 in the West planning district).

Fig. 3 shows the geographic locations of the CTs with the highest PCa composite scores, the highest percent African American residents and lowest median incomes, respectively.

## 4. Discussion

In this study, we described a novel approach to identifying neighborhoods with the highest burden of prostate cancer outcomes and compared these neighborhoods to those with high proportion of African American residents, and low median household income. Using our PCa composite score, we identified the 25 Philadelphia neighborhoods that experienced the highest prostate cancer burden during 2005–2014, and

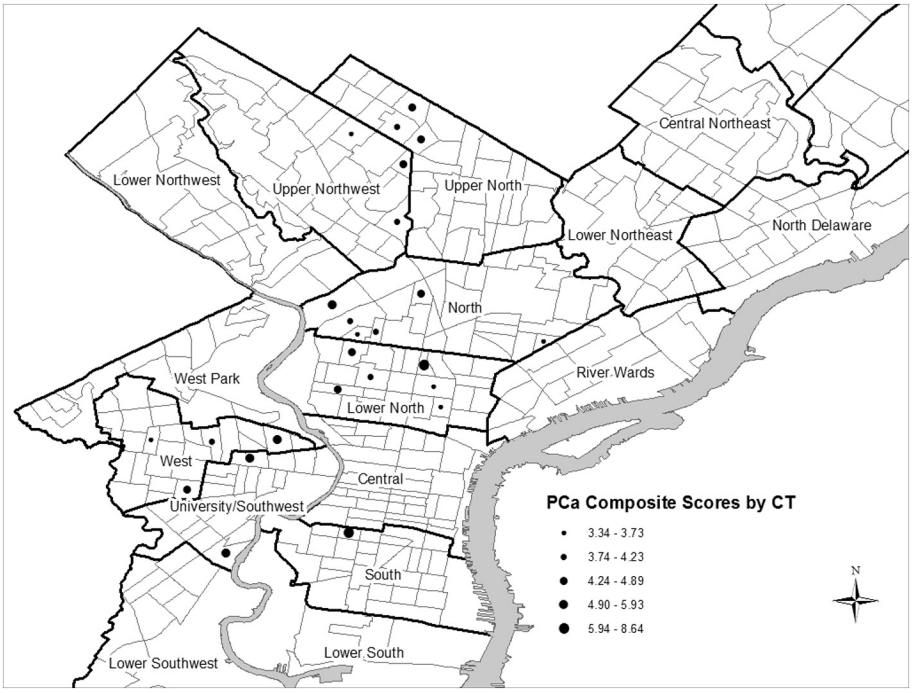


**Fig. 2.** Census Tracts (CTs) in Philadelphia with the Highest 25 Prostate Cancer Composite Scores: 2005–2014.

showed that they are predominantly clustered in the Upper North, Upper Northwest, North, Lower North, and West Philadelphia planning districts. Many of the neighborhoods that make up these planning districts have high proportions of African Americans and high rates of poverty. However, we showed that if the neighborhoods in which to focus a prostate cancer-related intervention were chosen based solely on either the highest proportion of African Americans or lowest median incomes, the neighborhoods would be much different from those we identified using the PCa composite score, and many would not have exhibited the worst burden of prostate cancer-related outcomes.

Our results show that it is important to consider not only neighborhood demographics, but actual neighborhood-based prostate cancer

**Table 1**
Census Tracts in Philadelphia with the Highest Prostate Cancer Composite Scores, highest percent (%) African American Residents and lowest median household incomes: 2005–2014.

| | Highest PCa composite scores | | | | Highest % African American | | | | Lowest median household income | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rank | Tract | PCa composite score | % African American | Median household income ($) | Tract | PCa composite score | % African American | Median household income ($) | Tract | PCa composite score | % African American | Median household income ($) |
| 1 | 02100 | 8.64 | 80.1 | 43,269 | 26600 | 1.88 | 97.0 | 39,500 | 15102 | 1.61 | 96.6 | 12,241 |
| 2 | 16600 | 7.86 | 75.6 | 15,855 | 16902 | 1.68 | 96.8 | 21,035 | 16300 | −0.01 | 18.4 | 12,343 |
| 3 | 09200 | 5.93 | 77.1 | 20,357 | 15102 | 1.61 | 96.6 | 12,241 | 16400 | 1.62 | 41.7 | 12,436 |
| 4 | 06900 | 5.69 | 94.8 | 18,077 | 16901[a] | 4.89 | 96.5 | 25,292 | 19501 | 0.68 | 16.8 | 12,791 |
| 5 | 10800 | 5.29 | 87.3 | 15,392 | 10200 | −0.50 | 96.5 | 13,183 | 13900 | −0.46 | 82.5 | 12,865 |
| 6 | 17000 | 5.23 | 75.9 | 25,299 | 07102 | 2.25 | 96.4 | 28,286 | 10200 | −0.50 | 96.5 | 13,183 |
| 7 | 16901 | 4.89 | 96.5 | 25,292 | 08102 | 0.49 | 96.4 | 32,478 | 10600 | 2.12 | 90.2 | 13,342 |
| 8 | 20102 | 4.68 | 93.3 | 32,748 | 17100[a] | 4.15 | 96.3 | 28,811 | 16500 | −0.03 | 91.4 | 14,894 |
| 9 | 26500 | 4.60 | 96.1 | 36,818 | 09400 | 2.89 | 96.3 | 16,753 | 17702 | −1.54 | 21.2 | 14,907 |
| 10 | 24900 | 4.58 | 95.3 | 31,838 | 26500[a] | 4.60 | 96.1 | 36,818 | 10800[a] | 5.29 | 87.3 | 15,392 |
| 11 | 26302 | 4.52 | 95.0 | 40,152 | 26400[a] | 3.84 | 96.1 | 39,145 | 15300 | 0.48 | 45.4 | 15,609 |
| 12 | 08000 | 4.49 | 84.3 | 31,337 | 17202[a] | 3.45 | 96.1 | 21,875 | 17500 | 1.13 | 31.6 | 15,743 |
| 13 | 14900 | 4.39 | 95.2 | 25,685 | 15101 | −0.83 | 96.1 | 21,000 | 16600[a] | 7.86 | 75.6 | 15,855 |
| 14 | 24500 | 4.23 | 93.1 | 27,556 | 17201[a] | 3.93 | 96.0 | 21,096 | 10700 | 0.11 | 95.1 | 16,105 |
| 15 | 10400 | 4.14 | 93.8 | 28,750 | 09500[a] | 3.71 | 96.0 | 16,383 | 12201 | −2.27 | 37.9 | 16,107 |
| 16 | 17100 | 4.15 | 96.3 | 28,811 | 08200 | 2.69 | 95.8 | 38,617 | 15200[a] | 4.06 | 94.2 | 16,195 |
| 17 | 15200 | 4.06 | 94.2 | 16,195 | 26700 | 2.02 | 95.8 | 32,593 | 09500[a] | 3.71 | 96.0 | 16,383 |
| 18 | 17201 | 3.93 | 96.0 | 21,096 | 16800 | 1.54 | 95.8 | 27,574 | 17601 | 0.21 | 11.7 | 16,531 |
| 19 | 26400 | 3.84 | 96.1 | 39,145 | 06500 | 1.75 | 95.7 | 24,350 | 09400 | 2.89 | 96.3 | 16,753 |
| 20 | 37700 | 3.73 | 49.4 | 22,181 | 26301 | 1.53 | 95.6 | 40,808 | 24100 | 1.61 | 80.5 | 16,985 |
| 21 | 09500 | 3.71 | 96.0 | 16,383 | 11200 | 0.52 | 95.6 | 23,936 | 19700 | −1.44 | 35.4 | 17,457 |
| 22 | 25400 | 3.57 | 87.1 | 45,602 | 26100 | 0.19 | 95.5 | 49,156 | 17602 | −3.54 | 18.1 | 17,729 |
| 23 | 17701 | 3.36 | 31.5 | 23,385 | 08101 | −0.12 | 95.5 | 24,759 | 03600 | −0.58 | 59.9 | 18,019 |
| 24 | 17202 | 3.45 | 96.1 | 21,875 | 07000 | 2.55 | 95.4 | 26,685 | 06900[a] | 5.69 | 94.8 | 18,077 |
| 25 | 14500 | 3.34 | 60.6 | 23,664 | 08302 | 1.28 | 95.4 | 30,075 | 14100 | 0.96 | 76.1 | 18,086 |
| Mean | | 4.65 | 85.5 | 27,070 | | 2.08 | 96.0 | 27,698 | | 1.19 | 63.7 | 15,441 |

[a] Also one of the census tracts with the highest 25 PCa composite scores.

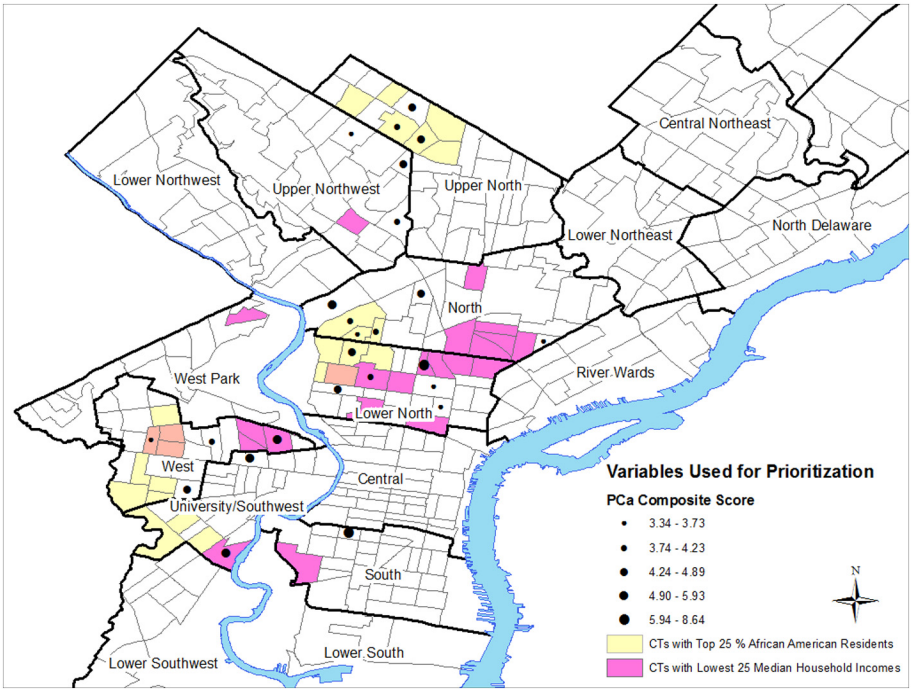


**Fig. 3.** Location of and Overlap among CTs in Philadelphia with the Highest PCa Composite Scores, Highest Percent African Americans, and Lowest Median Household Incomes: 2005–2014.

outcomes when choosing priority areas for interventions. While a robust literature supports correlations between neighborhood-level race (Zeigler-Johnson et al., 2011) and socioeconomic factors (Sanderson et al., 2006; Du et al., 2006; Yu et al., 2014) with prostate cancer morbidity and mortality, these neighborhood demographic factors should not be used solely when an intervention's goal is to reduce the burden of prostate cancer among residents of the most at-risk neighborhoods.

A reason for the use of race and socioeconomic status as a proxy for prostate cancer outcomes is that comprehensive prostate cancer outcome data at the neighborhood level are accessible only by data requests through cancer registries, and require multiple years of data to be interpretable. Local cancer control programs may not have easy access to cancer registry data due to the complex application process. Cancer registries do not cover all populations in the U.S. and the timeliness and accuracy of such registries vary (Swan et al., 1998; Izquierdo and Schoenbach, 2000). On the other hand, the U.S. Census system provides easily accessible, comprehensive and accurate demographic information at the local level. The ease and accessibility of this information may be the biggest reasons for use of demographics to prioritize local cancer control activities.

Ordering of census tracts using a PCa composite score determined by combining prostate cancer health outcomes is an accurate approach to prioritizing neighborhoods for prostate cancer-based prevention initiatives. The PCa composite score is a better metric for ordering neighborhoods than other methods that have been used because it is based on multiple important prostate cancer outcomes. If the objective of an intervention is to improve cancer outcomes, then the best way to choose where to intervene is to identify the areas that are experiencing the worst outcomes. We have determined that racial composition or median household income variables are not appropriate surrogate markers for CTs experiencing the greatest prostate cancer burdens in Philadelphia (i.e. Philadelphia neighborhoods with the highest SIR, SMR, and/or incidence of aggressive disease at diagnosis).

Other types of area-based prioritization metrics, such as the County Health Rankings, are used to catalyze community health improvement efforts, and increase media attention about local health outcomes (Rohan et al., 2009). In addition to these functions, our PCa composite score can be used by agencies, organizations, and health systems that provide area-based cancer control programming both inside (Pennsylvania Department of Health, n.d.) and outside Pennsylvania (National Cancer Institute, 2018). Our methods can be used to help focus resources on the neighborhoods that have exhibited the worst burden of prostate cancer, and ultimately to decrease prostate cancer disparities among neighborhood residents.

In addition to prioritizing neighborhoods, our PCa composite scores may provide new tools for surveillance and for examining the impact of population-based cancer prevention interventions. Furthermore, our methods of creating composite scores based on SIR, SMR, and mean aggressiveness could be used to describe the burden of other cancers at the neighborhood level, and inform local cancer prevention initiatives.

Our study is not without limitations. Although consistent Gold Certified status indicates that PCR data overall is 95% complete, NAACCR does not include prostate cancer as part of completeness assessments, due to the small proportion of men whose disease does not progress, and receive treatment only from private outpatient urology practices (which in many states are not required to report cases). Although we cannot determine how many cases this would represent, PCR officials have reported to us that the prostate cancer-specific data is no less than 80% complete, and a report for 2008–2012 shows high prostate cancer-specific completeness for Pennsylvania and Philadelphia County (Pennsylvania Department of Health, 2015).

Due to the small numbers of mortality events per CT in our sample, mortality rates per CT are unstable and right-skewed. Therefore, using SMRs alone to characterize prostate cancer burden in neighborhoods would not be adequate. But, because we use these measures as one of three components in the PCa composite score, the distortion caused by mortality instability and skewness at the CT level is mitigated. As an alternative to mean-centering and standard deviation-scaling the components, we considered constructing an all-rank-based PCa composite that would assign essentially the same distributions for each SIR, SMR and mean aggressiveness which would reign in any extreme values. An all-rank-based approach to prioritizing neighborhoods then could have the advantage of down-weighting the influence CTs with unusually high

mortality events could have on the composite. Although we could have dampened the influence of the SMRs by the all-rank-based approach, we chose not to because of the comparative importance of mortality in assessing prostate cancer burden. Due to the high comparative survival rates of those diagnosed with prostate cancer, mortality is much more indicative of the group-level burden of prostate cancer compared to incidence. High incidence rates may be the result of access to community-based screening resources and/or early detection of biologically indolent disease, not due to high grade or aggressive disease. Mortality, therefore, is much more indicative of the burden of prostate cancer among communities, compared to incidence, and likely to have somewhat higher influence on the PCa composite scores, in general.

Ideally, neighborhoods selected for prostate cancer interventions would equally be receptive and supportive of prostate cancer-screening interventions. But, in the real world, the success of cancer screening interventions depend on community buy-in, participation, and willingness of community agencies to host and recruit men for cancer prevention interventions. While our PCa composite score identifies the neighborhoods that should be the focus of efforts, it does not predict the success of intervening in these priority neighborhoods.

### 4.1. Conclusion

Using our PCa composite score, we identified the neighborhoods in Philadelphia with the 25 worst prostate cancer outcomes during 2005–2014, and showed that these neighborhoods were not the same neighborhoods with the highest percentage of African Americans, or the lowest median household incomes. Public health decision-makers should use the PCa composite score when tasked to prioritize and select a limited number of neighborhoods for prostate cancer-prevention and control efforts, instead of choosing neighborhoods based solely on characteristics such as high percentage African American residents or low income.

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## Conflict of interest

The authors declare no potential conflicts of interest.

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# Racial and Ethnic Trends in Prostate Cancer Incidence and Mortality in Philadelphia, PA: an Observational Study

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## Abstract

**Background** To learn more about local prostate cancer (PCa) disparities, we conducted descriptive analyses of the role of race and age in PCa using the Pennsylvania Cancer Registry data for Philadelphia (2005–2014).

**Methods** We focused on the most prevalent race/ethnic groups: white (33%), black (44%), and Hispanic (9%). Outcomes included PCa rates, tumor stage, and tumor grade. Percent change was used to describe changes in age-adjusted incidence and mortality rates. Frequency tables and logistic regression models were used to describe trends in proportions of advanced PCa by race and time. Race-by-time interaction terms were retained in the models if statistically significant.

**Results** PCa incidence was highest for black men over time. Incidence rates declined over time for all race groups (− 28% for white men to − 38% for Hispanic men). PCa mortality rates declined in a less universal manner (− 5% for blacks to − 32% for whites). Each year, odds increased across all race groups for advanced tumor stage (4% each year among white and Hispanic men and 9% each year among black men) and for advanced tumor grade (4% each year among white and black men and 23% each year among Hispanic men). Among younger men, black men experienced significantly increased odds of advanced tumor stage each year (8%) and Hispanics experienced significantly increased odds of advanced tumor grade each year (30%).

**Conclusions** Black men remain at highest PCa risk relative to other racial/ethnic groups in Philadelphia. Younger black and Hispanic men are at particular risk for advanced PCa at diagnosis.

**Keywords** Prostate cancer trends · Philadelphia · Race/ethnicity

## Introduction

Prostate cancer (PCa) is the most common malignancy among men. [1] There were 180,890 incident PCa cases in the USA in 2016 and an estimated 26,120 PCa deaths. Disparities in PCa are well-documented. US incidence and mortality rates are highest for black (African American) men (204/100,000 incidence, 44/100,000 mortality) than for white men (122/100,000 incidence, 19/100,000 mortality) or Hispanic men (107/100,000 incidence, 17/100,000 mortality). Asian-American men are least likely to develop PCa (63/100,000 incidence, 9/100,000 mortality). [2]

Causes for this variability in PCa incidence and mortality are multifactorial. Biological and genetic factors may account for some disparities among race/ethnic groups. Based on autopsy studies, more black men have latent PCa prior to age 40

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(37%), compared to white (9%) and Asian (4%) men. The age at which 50% of men have latent PCa also varies by race: age 90 for Asian men, age 80 for white men, and age 60 for black men. [3] Racial disparities in survival among patients with localized PCa also have been documented. [4] Other factors affecting PCa incidence and mortality may include screening patterns, timely access to quality treatment, environmental factors, and demographic/behavioral characteristics of the at-risk and patient populations.

Changing PSA screening recommendations also may affect trends in PCa incidence and mortality. In 2012, the United States Preventive Services Task Force (USPSTF) recommended against routine PSA screening of all healthy men. [5] Consequently, PCa screening rates have declined in recent years but appear to be highest among black men. Hispanic men have been reported as least likely to have PCa testing compared to non-Hispanic whites and blacks. [6, 7]

Because of many factors affecting disease rates, PCa burden can vary considerably by state, county, and even census tract. [8] As a result, using national or state data rather than locally based data to examine trends and associations can lead to different conclusions and may have little relevance for local health policies. Because little is known about local PCa trends in Philadelphia County (where some of the highest prostate cancer rates in Pennsylvania have been observed) [9], we studied PCa trends among residents of Philadelphia (2005 to 2014). These rates may reflect major changes in the racial/ethnic composition of the city, including a more than doubling in the percentage of Asian, Hispanic, and mixed race residents over the last two decades. [10] The goal of this study was to describe recent PCa trends in Philadelphia and to determine if similar trends are observed among race/ethnic groups. Observed increases in PCa incidence, advanced disease, or mortality among specific race/ethnic groups in the local area will help us to target high-risk populations for future interventions.

## Methods

The study aim was to determine if recent PCa trends differ among race/ethnic groups in Philadelphia, PA. This observational study based upon the Pennsylvania Cancer Registry data was approved by the Institutional Review Board (IRB) at Thomas Jefferson University (Philadelphia, PA). The IRB reference number is 15G.337.

### Sample

The study sample for this project comprised incident PCa patients with information collected from 2005 to 2014 by the Pennsylvania Cancer Registry. For this analysis, we focused on the race/ethnic groups accounting for the highest number of PCa cases in Philadelphia (i.e., people identifying themselves as white, black, or Hispanic). These groups account for 91% of the Philadelphia population. [10] They were also selected because incidence and mortality rates typically were unavailable due to small sample sizes for other groups, including Asian, Native American, mixed race, and other race.

### Study Outcomes

#### Rates

We examined incidence and mortality rates based on data available from the Pennsylvania Cancer Registry at the Pennsylvania Health Department website. The Enterprise Data Dissemination Informatics Exchange (EDDIE) is an interactive tool available on the Health Department Website to compute disease rates. [11] We used this tool to obtain age-adjusted incidence and mortality PCa rates for each year from 2005 to 2014 for blacks, whites, and Hispanics. Rates were calculated annually as the number of new cases divided by the number at risk during the year. Rates were expressed per 100,000 of the population and provide the burden of a disease on the general population for each year. As a result, cancer rates can be influenced by changes in the general population (number of men in the population is based on census data) as well as by changes in the number of cancer cases.

#### Proportions

We generated proportions for PCa incidence, advanced stage (regional and distant), and advanced grade (Gleason score $\geq 7$) at diagnosis. Proportions were defined as the number of incident cases divided by the number of all cases at the time of interest. Proportions can be used to describe the characteristics of cancer or a cancer population. Compared to rates, proportions are interdependent measures, but are also influenced by clinical and demographic changes in a population. Because we obtained data from the PA Cancer Registry to examine proportions of advanced stage and grade (incidence and mortality rates were obtained from the EDDIE website), we were able to determine if trends in advanced disease were similar among older and younger men. This was important because early United States Preventive Services Task Force recommendations against PSA screening targeted only older men, and national studies have reported differences in PCa outcomes by age group. [12, 13]

### Data Analysis

We described the study sample by computing frequency tables and chi-square statistics for categorical variables. Continuous variables were presented as medians with comparisons across race/ethnic groups by Kruskal-Wallis tests. We calculated

percent change in PCa rates from 2005 to 2014 using the following equation: Percent Change = $((Rate_y + Rate_{y-1}) - (Rate_x + Rate_{x+1}))/(Rate_x + Rate_{x+1}) \times 100$. Logistic regression models were used to evaluate trends in proportions over time across and between the race groups. [14] Odds ratios were estimated in these models of race (i.e., black and Hispanic indicator variables) and time (number of years passed between 2005 and year of diagnosis) while adjusting for the patient's age at diagnosis and the change in their race group's percentage of the Philadelphia population from what it was in 2005 to the year of their diagnosis. Race-by-time interactions were considered in each logistic regression model and retained if statistically significant at the 0.05 level. The adjusted parameter estimates for race, time, and any retained interaction terms from these models were used to characterize and determine the significance of any shifts in outcome odds by race over time.

**Availability of Data and Material** Incidence and mortality rates for these analyses are available via the EDDIE system (http://www.statistics.health.pa.gov/StatisticalResources/EDDIE/Pages/EDDIE.aspx#.WjajnGfJTCs). Additional data can be obtained by contacting the PA Cancer Registry.

## Results

### Demographics

There were 10,802 PCa patients included in the 2005–2014 Philadelphia registry dataset. The men ranged from 31 to 103 years of age with a median age of 65 years. The majority of patients were either black ($n = 4711$, 44%), white ($n = 3575$, 33%), or Hispanic ($n = 993$, 9%). The remainder was Asian (2%), other race (1%), or unknown race (12%). These groups were included only in analyses of rates that are denoted "All cases." More than half (54%) of patients in the three major race/ethnic groups were diagnosed with an advanced-grade tumor. However, only 17% were diagnosed with advanced-stage disease, of which 6% were distant stage.

Table 1 presents a comparison of demographics among PCa patients across the three major race/ethnic groups in Philadelphia. White patients were significantly older on average than black patients (age 67 vs. 64, $p < 0.001$) who were significantly older than Hispanic patients at diagnosis (age 64 vs. 63, $p < 0.001$). Advanced tumor grade was least prevalent among white patients (49%) compared to other groups (58% of black patients, $p < 0.001$; 55% of Hispanic patients, $p = 0.003$). Advanced tumor stage was most prevalent among black patients (21%) compared to other groups (16% for white and Hispanic patients, $p < 0.001$). Distant tumor stage was significantly different among all groups, with Hispanics having the lowest prevalence (3%) and black patients having the highest prevalence (9%, $p < 0.001$).

### Trends by Race

#### Incidence and Mortality Rates

Figure 1a–b shows trends in prostate cancer incidence and mortality rates in Philadelphia. At every point in time, PCa incidence was highest for black patients. For all 3 groups, PCa incidence decreased over time, ranging from a 28% decrease for white patients to a 33% decrease for blacks and a 38% decrease for Hispanic patients. Mortality rates also decreased during this time period. The overall decrease in mortality for all patients was 14%. The largest decrease occurred for white patients (− 32%), and the smallest decrease for black patients (− 5%). The number of deaths each year was too small to calculate stable mortality rates among Hispanics, so those results were omitted.

#### Proportions

Figure 2 shows the trends in the annual proportions of patients diagnosed with PCa by the major race/ethnic groups in Philadelphia (2005–2014). To summarize results from logistic regression models, each year over this period, the odds of a PCa case being white did not change significantly (OR = 0.99; 95% CI = 0.97–1.00, $p = 0.105$), being Hispanic declined 5% (OR = 0.95, 95% CI = 0.93–0.97, $p < 0.001$), and being black increased 3% (OR = 1.03, 95%CI = 1.02–1.05, $p < 0.001$).

Figure 3 shows the trends in annual proportions of patients with advanced tumor stage at PCa diagnosis over time by race/ethnicity. Logistic regression models of these data adjusted for age and changes in the population-level racial

**Table 1** Demographics of Philadelphia prostate cancer patients: major race groups

| Characteristics | White (ref) ($n = 3575$) | Hispanic ($n = 993$) | $p$ value | Black ($n = 4711$) | $p$ value |
|---|---|---|---|---|---|
| Median age (year)* | 67 | 63 | *< 0.001* | 64 | *< 0.001* |
| % Advanced tumor grade (Gleason ≥ 7) | 49 | 55 | *0.003* | 58 | *< 0.001* |
| % Advanced tumor stage* (regional or distant) | 16 | 16 | 0.796 | 21 | *< 0.001* |
| % Distant tumor stage* | 6 | 3 | *< 0.001* | 9 | *< 0.001* |

Italicized $p$-values are statistically significant ($p < 0.05$)

*Significantly different Hispanic vs. Black

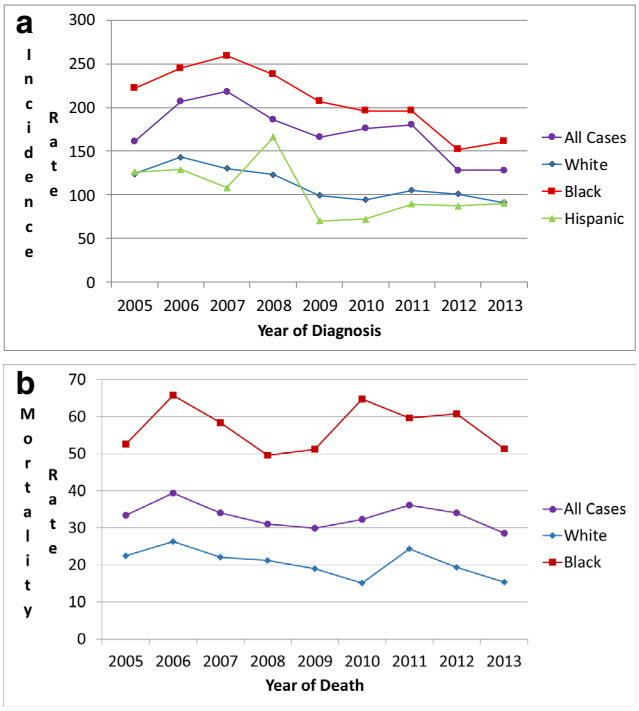


**Fig. 1** Trends in Age-adjusted Incidence and Mortality Rates (Philadelphia, per 100,000). **a** Percent change in incidence rates = − 31% for all cases, − 28% for white cases, − 33% for black cases, and − 38% for Hispanic cases. **b** Percent change in mortality rates = − 14% for all cases, − 32% for white cases, − 5% for black cases, and not calculated for Hispanic cases

composition of Philadelphia over time suggest that the odds of advanced tumor stage at diagnosis increased significantly across all race groups: 4% each year among white and Hispanic men ($OR_{time} = 1.04$, 95% CI = 1.00–1.09, $p = 0.04$), but 9% among black men ($OR_{interaction} = 1.05$, 95% CI = 1.00–1.10, $p = 0.048$). (Table 2).

Figure 4 shows the trends in annual proportions of patients with advanced tumor grade at PCa diagnosis over time by race/ethnicity. Modeling suggests that whites and blacks experienced a significant 4% annual increase in the odds of

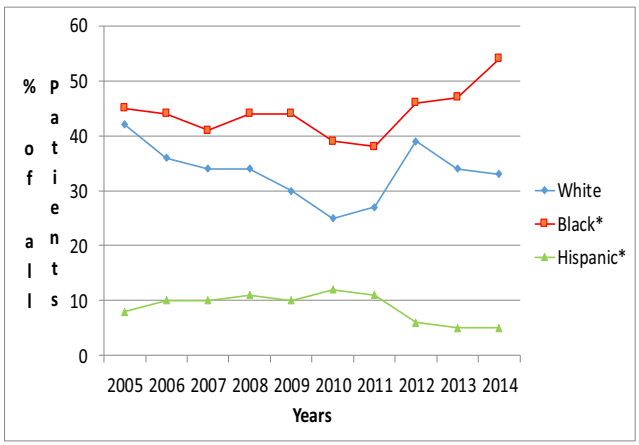


**Fig. 2** Proportion of race/ethnic groups among all prostate cancer diagnoses per year (Philadelphia, $N = 9279$). *Significant trend over time

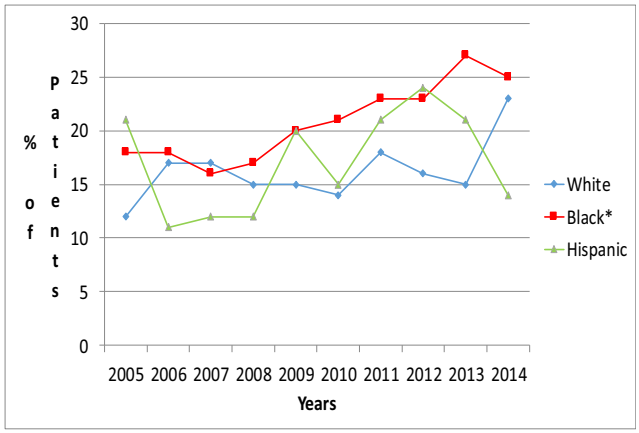


**Fig. 3** Proportion of high-stage prostate cancer cases (Philadelphia, $N = 8515$). *Significant trend over time

advanced-grade PCa at diagnosis ($OR_{time} = 1.04$, 95% CI = 1.01–1.08, $p = 0.02$) while Hispanics experienced a 23% annual increase in the odds of advanced grade over time ($OR_{interaction} = 1.18$, 95% CI = 1.08–1.29, $p < 0.001$). (Table 2).

Among older patients (age ≥ 65), there were significant increases each year in the odds of advanced stage (OR = 1.10, 95% CI = 1.05–1.16, $p < 0.001$) (Fig. 5), as well as the odds of advanced-grade tumor at diagnosis (OR = 1.09, 1.05–1.13, $p < 0.001$) (Table 2, Fig. 6).

Among younger patients (age < 65), only black men experienced significantly increased odds of advanced tumor stage, at a rate of 8% each year ($OR_{time} = 0.99$, $p = 0.79$; $OR_{interaction} = 1.08$, 95% CI = 1.01–1.16, $p = 0.02$) (Fig. 7). Similarly, only the Hispanic men among younger patients experienced significantly increased odds of advanced grade, at a rate of approximately 30% each year ($OR_{time} = 1.02$, $p = 0.42$; $OR_{interaction} = 1.27$, 95% CI = 1.12–1.44, $p < 0.001$) (Table 2, Fig. 8).

## Discussion

Our results showed that black men in Philadelphia continue to be at highest risk for PCa incidence, mortality, and advanced stage/grade, even after changes in PCa screening recommendations and advances in PCa management. While there were significant decreases in PCa incident rates over time for all race/ethnic groups, the decline in PCa mortality was much less for black men compared to white men. Black men comprised increasing proportions of incident cases in the city from 2005 to 2014. During the same period, the proportion of new Hispanic cases decreased and the proportion of new white cases was relatively stable. Alarmingly, the odds of PCa diagnoses at advanced tumor stage or grade among all older patients in the city appear to be on the rise by 10 or 9% per year, respectively. And while the proportions of these advanced PCa diagnoses were generally stable over time among patients

**Table 2** Associations of race/ethnicity with advanced prostate cancer (odds ratios and 95% confidence intervals)

| Outcome | Subgroup | Black | Hispanic | Time (years) | Time × Black interaction | Time × Hispanic interaction | Age (years) | Population change in race (%)[a] |
|---|---|---|---|---|---|---|---|---|
| Advanced grade | All | 1.48*** (1.32, 1.66) | 0.78 (0.59, 1.04) | 1.04* (1.01, 1.08) | – | 1.18*** (1.08, 1.29) | 1.02*** (1.01, 1.02) | 0.95 (0.87, 1.03) |
| | Older (≥ 65) | 1.62*** (1.39, 1.88) | 1.03 (0.79, 1.34) | 1.09*** (1.05, 1.13) | – | – | 1.04*** (1.02, 1.05) | 1.05 (0.96, 1.14) |
| | Younger (< 65) | 1.40*** (1.19, 1.64) | 0.74 (0.49, 1.10) | 1.02 (0.97, 1.07) | – | 1.27*** (1.12, 1.44) | 1.01 (1.00, 1.02) | 0.90 (0.80, 1.01) |
| Advanced stage | All | 1.20 (0.96, 1.51) | 0.90 (0.69, 1.16) | 1.04* (1.00, 1.09) | 1.05* (1.00,1.10) | – | 1.00 (1.00, 1.01) | 1.08 (0.99, 1.17) |
| | Older (≥ 65) | 1.45*** (1.19, 1.77) | 0.53** (0.34, 0.84) | 1.10*** (1.05, 1.16) | – | – | 1.05*** (1.04, 1.07) | 1.10 (0.97, 1.24) |
| | Younger (< 65) | 1.05 (0.76, 1.44) | 1.26 (0.90, 1.77) | 0.99 (0.94, 1.05) | 1.08* (1.01, 1.16) | – | 0.98** (0.97, 1.00) | 1.05 (0.94, 1.17) |

*Statistically significant at the 0.05 level; **statistically significant at the 0.01 level; ***statistically significant at the 0.001 level

[a] Change in a given patient's race group's percentage of the Philadelphia population from what it was in 2005 to the year of their diagnosis

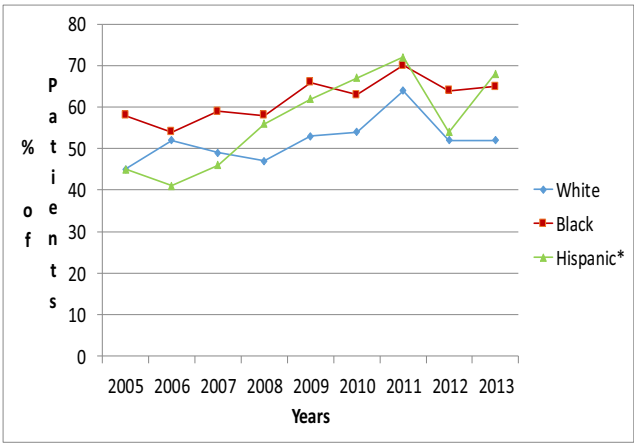


**Fig. 4** Proportion of advanced-grade prostate cancer cases (Philadelphia, $N = 7741$). *Significant trend over time

under 65, each year the odds of advanced stage rose by 8% among younger black patients and advanced grade rose by 30% among younger Hispanic patients.

In recent decades, US national prostate cancer incidence and mortality rates have declined overall, while remaining highest among Black men compared to other groups. A recent study of national data showed this decline among all race/ethnic groups. Highest incidence rates were observed for blacks (184.3/100,000) and for older men (age 75+, 459/100,000) compared to other groups of men. The authors also showed a significant decrease for localized PCa and a significant increase in distant-stage PCa for younger men (age 50–74), in particular. These trends were documented following the United States Preventive Service Task Force (USPSTF) recommendations against routine PCa screening. The authors suggested that other studies were needed to validate their findings. [13] In our study, we were able to take an additional step to examine race/ethnic and some age-related differences in PCa trends at a local level. Our findings for Philadelphia were similar to national trends during this time period, although the incidence rates for Hispanic men were slightly lower and the mortality rates for black men were higher than national rates. Higher mortality (with slower decline in mortality rates)

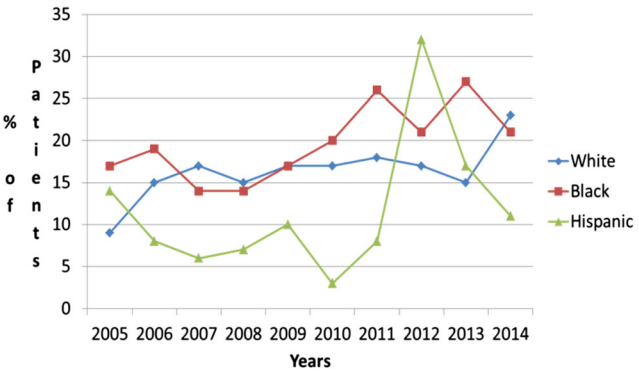


**Fig. 5** Proportion of advanced-stage prostate cancer cases ≥ age 65 (Philadelphia, $N = 4191$)

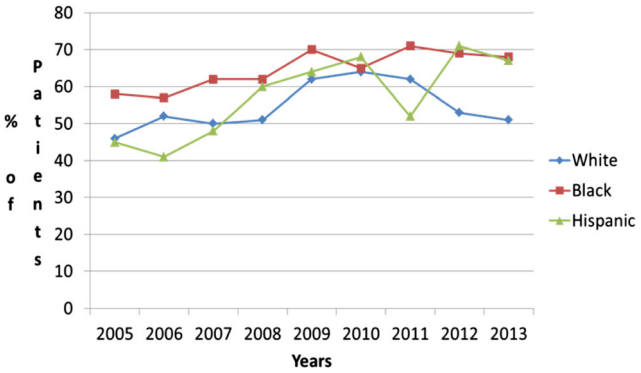


**Fig. 6** Proportion of advanced-grade prostate cancer cases ≥ age 65 (Philadelphia, $N = 3815$)

among black patients may be related to more aggressive disease and the possibility that some black men may be less likely to undergo definitive treatment for diagnosed cancers. [14] Few investigators have examined recent trends in PCa at the local level, so it is unclear how similar our Philadelphia findings may be to other large cities in the USA.

## Demographic Changes

The race/ethnic trends that we observed in PCa incidence and advanced disease at diagnosis may result from changes in local demographics, as well as changes in the prostate health care arena. Over the last 20 years, Philadelphia has experienced ongoing movement of white populations to suburban areas, resulting in a city that is majority black with significant increases in the percent of Hispanic, Asian, and other/mixed race populations. In 1990, Philadelphia's residential composition was 52% white, 39% black, 6% Hispanic, 3% Asian, and < 1% other race. Twenty years later, the composition changed to 37% white, 42% black, 12% Hispanic, 6% Asian, and 2% other race. [10] The increased proportion of minority populations with a high risk for PCa may influence the trend toward aggressive disease at diagnosis.

National data do not reflect such local changes in demography. Studying the local epidemiology rather than relying solely on national data can provide clear details about who are the most at risk for advanced disease in the population and may provide contextual information about risk factors and best methods for intervention to reduce PCa deaths and related disparities in a changing clinical and demographic environment. This issue is especially important to address because PCa mortality rates are projected to increase over the next 30 years, particularly among Hispanics and blacks, as a result of an aging population (PCa diagnoses and aggressiveness increases with age) and a growing population of racial/ethnic minorities that may be at increased risk for more aggressive PCa. [15]

## Changes in PSA Screening

In the past two decades nationally, various changes in screening, diagnostics, and treatment have occurred simultaneously, making it difficult to disentangle which factors have played a role in trends of PCa incidence and mortality. [16, 17] Racial/ethnic differences in trends in PCa rates may be related to differences in PSA screening patterns. [13]

A major change in prostate-specific antigen (PSA) screening recommendations resulted in conflicts over the importance and clinical utility of the PSA test and may have impacted PCa trends in the last decade. In 2008, the USPSTF recommended against PSA screening of men over age 69 and in 2012 recommended against PSA screening of all healthy men. The Center for Disease Control was among the institutions that support this recommendation. The current draft recommendation from the USPSTF is that men ages 55–69 should be informed about risks and benefits of PSA screening. Then,

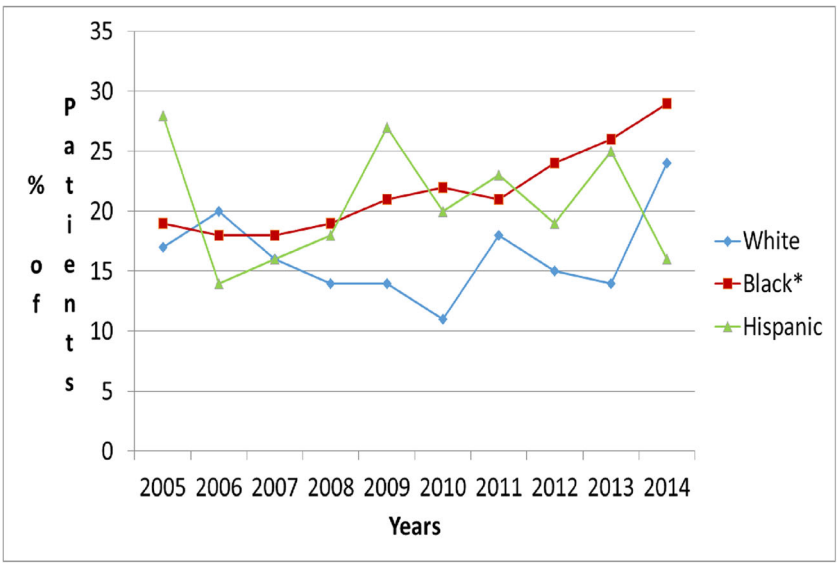


**Fig. 7** Proportion of advanced-stage prostate cancer cases < age 65 (Philadelphia, $N = 4324$). *Significant interaction with time

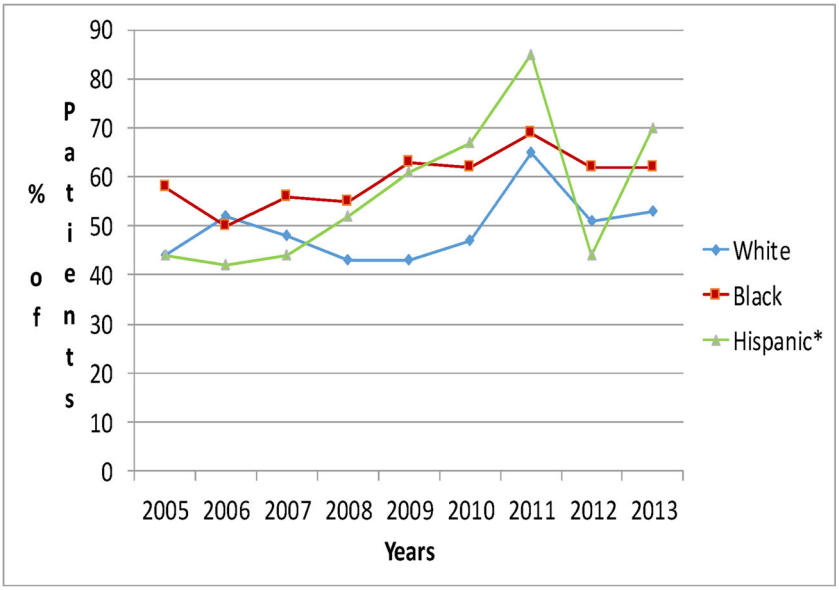


**Fig. 8** Proportion of advanced-grade prostate cancer cases < age 65 (Philadelphia, $N = 3926$). *Significant interaction with time

men should make an individualized decision about whether or not to screen. [5] Professional organizations (American Urological Association and American Cancer Society) have recommended moving toward more shared decision making and targeting high-risk men for (PSA) testing rather than universal screening. [7, 18, 19]

Conflict continues today over the capacity of PSA screening to save lives but at the cost of high rates of overdiagnosis and overtreatment of indolent tumors. [20] Many PCa tumors are low-grade and slow-growing with a long natural history. The median survival of such tumors without treatment can approach 15–20 years. [21] The risk of PCa-specific death in a screened population is even low for patients with adverse clinical features. [22] But early PCa detection may reduce morbidity and mortality associated with advanced disease, particularly if active surveillance protocols rather than active treatments are used for low-risk patients. [17, 19, 23–26] In many developed nations during the PSA era (since the late 1980s), PCa incidence and the proportion of low-stage cases increased, likely due to improved surveillance/screening. PCa-specific mortality rates decreased over the same time period, perhaps due to earlier PCa diagnosis and improved treatment for advanced PCa. [16, 17, 21, 22, 27, 28]

Despite often conflicting recommendations, the general practice in the USA is that PCa screening is still a relevant part of many men's medical care. [18, 29] Recently, researchers have observed similar patterns of PSA testing between black and white men. Hispanic men have been reported as least likely to have PCa testing compared to non-Hispanic whites and blacks. [6, 7] Some reports suggest significant decreases in PSA screening in the general population over the last few years. [13] Lower rates of PSA testing could result in delayed diagnosis and increasing trends of advanced disease at diagnosis that we observed in our study.

To learn more about the percent of men undergoing PCa screening in recent years, our group recently examined data from the Public Health Management Corporation Community Health Database survey, which includes men age 45+ from Philadelphia and the 4 surrounding counties in Southeastern PA ($N = > 5000$ men each year). [30] Preliminary results showed a significant 9% decrease in prostate cancer screening over time (71% in 2008, 70% in 2010, 68% in 2012, and 62% in 2015). In the Philadelphia cancer registry dataset, we observed that younger patients were more likely to present with more advanced PCa at diagnosis. Younger age along with early stage and grade at diagnosis typically have a positive impact on PCa outcomes. [16, 31] Therefore, educational and screening efforts targeting high-risk younger men may decrease PCa disparities and provide a window of curability. [17] The lingering problem is that we are not certain which PCa tumors will progress and which will remain relatively slow-growing, since treatment may cause significant morbidity [18].

## Changes in PCa Diagnosis and Clinical Care

Other recent changes in the care of PCa patients are related to improved diagnostics and treatments. The increase in PCa incidence in the 1990s in the USA was largely attributed to increased PCa awareness and diagnostic improvements (transrectal ultrasound imaging and thin needle biopsy). [16, 27] Since that time, PCa mortality has decreased for all stages and most age groups. This was likely the result of the stage/grade shift resulting from PSA testing and more precise staging from improved imaging techniques. [32] Changes in pathological interpretation over time also contributed to PCa grade migration. [28] Treatment advances have included the use of genomic panels for prognosis and treatment selection based

on tumor biology, robotics for surgery, more precise radiation therapy, active surveillance for low risk disease, and new chemotherapy protocols for advanced disease. [7, 32–35] Improved treatment modalities may decrease risk for complications and improve PCa outcomes, quality of life, and survival. [20, 33–35] These advances have made personalized PCa treatment more of a reality for many patients. [35]

### Limitations

A limitation in the interpretation of these study results is that the study is descriptive in nature. While descriptive studies cannot provide evidence of causation, they can provide insight into demographic trends and generate hypotheses. Underestimation of cases also may be a limitation of conventional incidence rates. We were not able to account for prevalent cases with the current registry dataset. While conventional incidence rates intend to reflect new cases of cancer in a given year, the numerator can include second or later cancers, and the denominator typically does not remove those previously diagnosed and no longer at risk for a first cancer at the site of interest. Risk-adjusted incidence rates (RAIRs) allow for removal of prevalent cases from the calculation of incidence rates and are likely to be a better reflection on PCa burden in the USA. Results of a study using SEER data showed that although the magnitude of risk for developing PCa increased using RAIRs versus conventional incidence rates, the trends in PCa did not differ significantly by method of rate calculation. The reason may be that multiple primary cases of PCa are rare, so the numerator used in conventional calculations do not vary much with RAIRs. However, changes in the denominator were greater for black and older men, for whom prevalence in the general population would be higher than other groups. [36] The tumor stage recorded in the cancer registry could be clinical or pathologic, depending on the patient. There may be less accuracy with clinical staging which does not rely on extraction of the prostate for complete pathologic analysis of the gland. We also were unable to assess health-related behaviors, comorbidities, or patient socioeconomic status with the current dataset. These factors may be associated with risk for PCa incidence, advanced PCa, as well as PCa-specific mortality. [8, 37, 38] With smaller numbers of patients, it was more difficult to assess mortality rates among Hispanic men, as has been the case in other cancer registries. [39] Additionally, because of low numbers and insufficient data, we were only able to examine aggregated data and not subsets of our race/ethnic groups. Although a strength of our study is that we were able to adjust for changes in the prevalence of major race/ethnic groups in Philadelphia over time, patterns of cancer incidence and mortality are known to differ by country of origin and may be driven by rates of screening and lifestyle patterns. These differences have been studied in Hispanic populations [40], but may also be true for other race/ethnic populations in the USA.

## Conclusions

Our study showed that contrary to national trends, racial disparities in PCa are widening in Philadelphia. Younger Black and Hispanic men are at particular risk for advanced PCa at diagnosis. By understanding recent local trends in PCa, effective interventions can be developed to focus on patients across the cancer care continuum. Continuing surveillance of all men is needed to determine if trends toward high-risk PCa will continue and how mortality rates and other poor PCa outcomes might differentially affect race groups over time or be curbed by well-planned, targeted interventions.

**Authors' contributions** CZJ acquired data; was responsible for the study concept/design, analysis, and interpretation; and drafted the manuscript. SK assisted with data analysis and interpretation and revised the manuscript. RM revised the manuscript. TR was responsible for the data analysis and revised the manuscript. AL revised the manuscript. KG was responsible for the study concept and revised the manuscript.

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### Compliance with Ethical Standards

**Conflict of Interest** The authors declare that they have no conflict interests.

**Ethics Approval and Consent to Participate** This observational study based upon Pennsylvania Cancer Registry data was approved by the Institutional Review Board (IRB) at Thomas Jefferson University (Philadelphia, PA). The IRB reference number is 15G.337. Informed consent was waived by the review board.

**Abbreviations** PCa, Prostate cancer; USPSTF, United States Preventive Services Task Force; EDDIE, Enterprise Data Dissemination Informatics Exchange; PSA, Prostate specific antigen; RAIRs, Risk-adjusted incidence rates



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# EMPaCT

**Empowering Men About Prostate Cancer Together**

## Project EMPaCT

"A Neighborhood-Based Intervention to Reduce Prostate Cancer Disparities Among African-American Men" is a three-year study funded by the U.S. Department of Defense through its Prostate Cancer Research Program. It brings together a multi-disciplinary team of medical researchers and community engagement experts. Between June 2017 and January 2018, the study enrolled 240 Philadelphia men. The goal was to learn more about the best ways to share information and educate men about prostate cancer.

The study focuses on four areas of Philadelphia (some containing multiple neighborhoods) with disproportionately high rates of advanced prostate cancer, seeking to understand some of the factors that put men who live there at risk. At the same time, we created men-only information sessions to raise awareness about prostate cancer and help men make informed decisions about their health.

Each man attended a health education session in one of four Philadelphia neighborhoods: Northwest; North; Southwest; and West. (See complete list of neighborhoods on p.3) In addition to learning more about prostate cancer and general health, men who attended the sessions were encouraged to discuss their particular need for screening with their primary care doctors. Participants filled out surveys before and after attending a session.

Development of the intervention was a "by and for" process, starting with focus groups with local men in the targeted age range (40-69) and demographic profile. This led to the creation of culturally relevant study recruiting materials and the ability to adapt the health-education and -promotion concepts to meet the needs and interests of the men who were recruited for participation. The project also hired and trained grassroots, community-based health educators to run the education sessions.

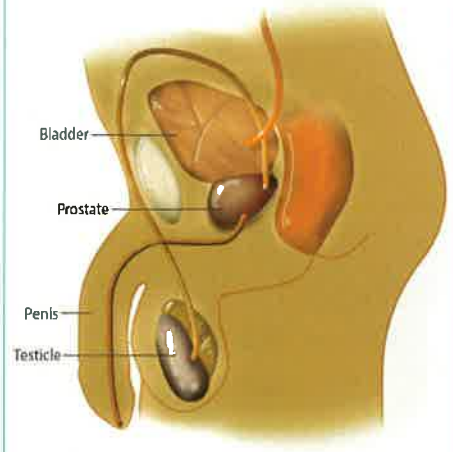
# Prostate Cancer:

Prostate cancer is one of the leading causes of cancer in men. About one in nine men will be told that they have prostate cancer at some point in their life. Most men survive prostate cancer if it is detected and treated early. Prostate cancer begins when cells in the prostate gland, which is found only in males and makes some of the fluid found in semen, grows out of control.

Currently, the exact cause of prostate cancer is not known. But it is most likely a combination of many factors. Men who have any of these risk factors should talk to their doctor:

- Have a family history of prostate cancer
- Are African American
- Have certain genes (DNA) that are more likely to cause prostate cancer

Men who may have prostate cancer can look and feel fine. However, men who have difficulty urinating, the need to urinate more often, blood in their urine, or pain when urinating should talk to their doctor. Men who have an average risk of getting prostate cancer should talk with their doctor about being tested for prostate cancer, as there are risks and benefits to having the test.




The prostate is below the bladder and in front of the rectum. The size of the prostate changes with age—in younger men, it is about the size of a walnut, but it can be much larger in older men.

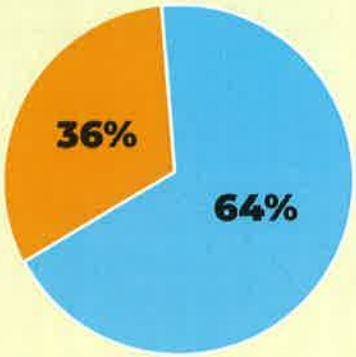
EMPaCT

## What You Need to Know to Stay Healthy

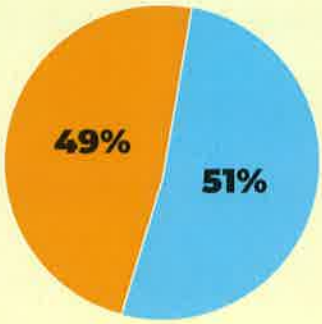
# Profile of EMPaCT Participants

## Highlights From the Survey (240 men)

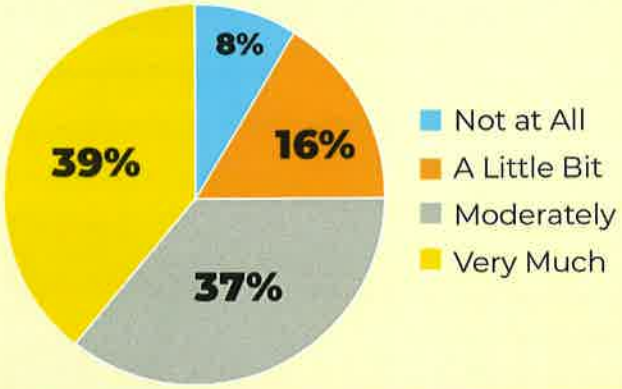
### Knows Someone Who Has Prostate Cancer



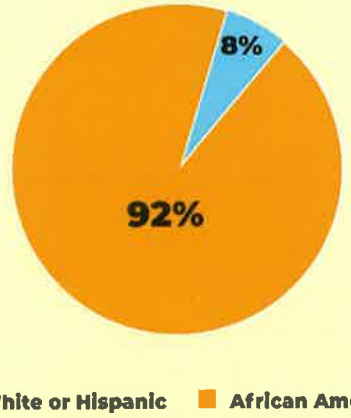

### Been Screened in the Past for Prostate Cancer




### How Concerned Are You about Getting Prostate Cancer?




### Race/Ethnicity of Those Who Attended a Health Education Session




### Participants were recruited from these Philadelphia neighborhoods

# Thank You!

## A Special "Thank You" to the Men Who Made it Possible... Our Health Educators

**Norman Gladden**
**Christopher L Brown, M.I.S.**
**Asa Anderson**
**Sylvester Hampton**
**Fredrick Holloway**
**Elton Evans III**
**John Wilson**

## Our Collaborators

**Thomas Jefferson University**

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**Project Consultants**

Earl Bowen, Jr.
David Sauls
Tara Jackson

EMPaCT
EMPOWERING MEN ABOUT PROSTATE CANCER TOGETHER

## Thanks to These Locations for Hosting EMPaCT Sessions!

Nicetown CDC Community Center,
*4340 Germantown Ave.*

Back 2 Back Barbershop,
*2620 Cecil B Moore Ave.*

Kingsessing Recreation Center,
*4901 Kingsessing Ave.*

Congregation Temple Beth'El,
*7350 Lowber Ave.*

Haverford Branch of the Free Library,
*5543 Haverford Ave.*

Congregation Kol Ami,
8201 High School Rd., *Elkins Park*

Germantown Enrichment Center,
*5722 Greene St.*

The NET Center,
*3133 Ridge Ave.*

The Southwest CDC,
*6328 Paschall Ave.*

IDAAY (Institute for the Development of African American Youth),
*5548 Chestnut St*

# Helpful Resources For Men in Philadelphia

**Community Legal Services (CLS)**
1410 W, Erie Ave, 19140 Phone: (215) 227-2400
CLS attorneys provide a full range of legal services, from individual representation to administrative advocacy to class action litigation, as well as community education and social work.

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**Germantown Life Enrichment Center**
5722 Greene St, 19144 Phone: (215) 844-3281
Provides a variety of programs for every body type and fitness level, a great place to increase good health, have fun and meet new friends.

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**United Communities Houston Center**
2029 S 8th St, 19148 Phone: (215) 468-1645
United Communities Southeast Philadelphia improves the quality of life for the multicultural community they serve by providing educational, advocacy and social programs.

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**The Enterprise Center**
4548 Market St, 19139 Phone: (215) 895-4000
Seeks to better position high-potential minority enterprises to compete in the local, regional, and global economies, by providing access to capital, capacity building, business education and economic development opportunities

---

**ACHIEVEability**
35 N 60th St, 19139 Phone: (215) 748-8800
ACHIEVEability has been breaking the cycle of poverty by helping low-income, single parent and homeless families to achieve self-sufficiency through housing.

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**Southwest Community Enrichment Center**
1341 S 46th St, 19143 Phone: (215) 386-8250
Provides counseling, an emergency food program, computer training, an art center, friendly visiting program for homebound persons living near the center and a frozen meal delivery program once a week to those who cannot cook for themselves.

---

**Philadelphia Recovery Community Center**
1701 W Lehigh Ave, 19132 Phone: (267) 233-6570
Provides resources and opportunities to reduce the impact of addiction, and trauma by providing prevention, consultation, education, advocacy, assessment, intervention and recovery support services.

---

**The Men's Resource Center**
1601 Walnut St Suite 1017, 19102 Phone: (215) 564-0488
Dedicated to helping men of every age, race, ethnicity, gender identity and sexual orientation address the current challenges in their lives and relationships and create positive change.

# Testimonials from Project EMPaCT Participants

"I was really glad that I came to the meeting—there were some questions that were finally answered for me. My father passed from it [cancer], so I got to learn some more, prepare myself.

"It helped me realize that I have to go and get screened. Everyone should go ahead and do it and not wait around or put it off."

"I liked having someone from my community speak with me who could break it down to me. I didn't know that it was more than putting a glove on and putting a finger in the rectum."

"Men are often too proud to talk about stuff like this. This got men talking about things that they don't normally talk about. I actually had tears coming to my eyes during the session."

"It was very enlightening to hear others' opinions about this, especially as it affects African American males. You see commercials on TV about medical problems, but they never address problems that afflict mostly minority groups like black men."

"It was very positive and informative. There should be more things like that in the community to bring awareness about other health issues."

EMPaCT
Empowering Men About Prostate Cancer Together

Jefferson Health.

# Annual Men's Health Day at Jefferson! Free Prostate Cancer Screenings!

**Wednesday, September 26, 2018 9am-3pm**

Jefferson Hospital, Center City Philadelphia
Bodine Building – 111 South 11th Street
(Entrance is on the corner of 11th and Sansom)

Jefferson™

**To register, please call 1-800-JEFF-NOW.**

This research study, **A Neighborhood-Based Intervention to Reduce Prostate Cancer Disparities**, is funded by a grant (PC 140667) from the U.S. Department of Defense.

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