

Original Research

Predictors of annual prostate-specific antigen (PSA) screening among black men: results from an urban community-based prostate cancer screening program

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Abstract

Background and objective: Black men have an increased risk of prostate cancer mortality compared with any racial or ethnic group. Further, research on prostate cancer prevention and control messaging focusing on Black men is limited. Community screening events are successful in attracting members from high-risk groups, like Black men, and are a valuable source to collect cancer screening and health promotion data. Therefore, the authors examined data of Black men attending a community-based PCa screening event to evaluate predictors of annual PCa screening, and identify sub-populations of Black men needing targeted cancer prevention messaging.

Methods: Black men attending PCa screening events in St. Louis, MO 2007--2017 were eligible. Participants completed either a mail-in or on-site survey at the time of their screening to collect information on annual screening history. We analyzed sociodemographic factors, having a first-degree relative with a history of PCa, healthcare utilization characteristics, and predictors of annual PSA screening. Logistic regression analysis was used to assess the association between predictors and annual PSA screening.

Results: Data was analyzed from 447 respondents. One-third of the residents did not know their cancer family history status. Older age and having a primary healthcare provider predicted an annual prostate cancer after attending the PCa community screening event. In the fully adjusted model, all ages older than 45 years were 2--4 times more likely to have an annual PCa screening. Having a healthcare provider also predicted an annual PCa screening (OR: 4.59, 95% CI: 2.30--9.14).

Conclusion: Regardless of sociodemographic and family history factors, older Black men and those with a primary physician are more likely to have an annual PSA screening. Cancer prevention promotion efforts for Black men should target mechanisms that facilitate family cancer history conversations to engage younger Black men. Also, additional health promotions efforts are needed to educate Black men without a primary healthcare provider.

Keywords

Cancer screening; Prostate-specific antigen; Prostate cancer; Health promotion; Vulnerable populations; African-Americans; Community health education

1. Introduction

Prostate Cancer (PCa) is the most frequently diagnosed cancer and the second leading cause of cancer death among men in the United States [1–3]. Black race is a major risk factor for PCa. Although PCa incidence and mortality has declined nationally since the 1990s, in 2016 PCa was reported as the leading site for new cancer cases for Black men [3]. Further, Black men have the highest incidence and mortality rate of any racial or ethnic group in the United States from this disease [4].

To address persistent PCa disparities among Black men, community cancer screening events have shown promise for connecting medically underserved patients to healthcare resources and health promotion information [5–7]. Community cancer screening events are partnerships between healthcare systems and community stakeholders to provide free or reduced-cost screenings and cancer education for members of the local community. An example of an established community-based screening program that provides free PSA screenings and PCa prevention and disease education in the St. Louis, MO city and metropolitan area is the Prostate Cancer Community Partnership (PCCP), an academic-community partnership within the Siteman Cancer Center's Program for the Elimination of Cancer Disparities (PECaD) [8].

For men >50 years old with an average risk of PCa and men >45 years old with a high-risk of PCa, current screening recommendations by the United States Preventive Service Task Force (USPSTF) encourages shared decision making before undergoing a prostate-specific antigen (PSA) screening [9, 10]. Numerous investigations report that men with a primary healthcare provider are more likely to engage in shared decision making conversations regarding the appropriateness of annual screenings [11, 12]. However, there is limited evidence of other predictors of annual screenings for high-risk populations. To this end, we used data from a subpopulation of Black men attending a community-screening event to investigate the predictors of annual PSA screening. The objective of this study is to determine the prevalence and factors associated with annual PSA screening in a cohort of Black men participating in a community-screening event.

2. Methods

2.1 Study sample and design

Study participants attended community screening events provided by PCCP of PECaD, an academic-community coalition of investigators and physicians from Washington University School of Medicine in St. Louis, Barnes Jewish Hospital, and community partners from the St. Louis, MO metropolitan area [8]. The PECaD program uses community-based participatory approaches to provide cancer education, prevention, and management strategies to residents of the St. Louis metropolitan area. Community screening events are hosted at community organizations (e.g., church health fairs, public libraries, community

centers) and aim to provide cancer education, free-PSA screening, and connections to follow-up care for positive PSA tests [8].

We analyzed data from Black men who attended a PECAD community-based screening event during 2007–2017. As depicted in Fig. 1, participants attending a screening event from 2007–2011 received a mail-in PCa information survey in 2011, and those attending an event after 2011 received an on-site survey at the time of their screening. Data collections for the current study used data from both on-site screening and mail-in surveys. Demographic and contact information were collected at the time of the screening to allow a study staff member or provider to re-contact participant's information regarding their PSA screening results and potential next steps. All participants completed an informed consent form at the community screening event. The study received approval by the Washington University Institutional Review Board (approval number: 201105114).

2.2 Measures

The current analysis included only participants who identified as African American/Black and did not have a history of PCa at the time of survey completion. The outcome of this analysis was an annual PSA screening. For the survey item, "When was your last PSA test (at a community event or physician's office?)", participants replying "within the last year" are considered having an annual PSA screening. Other possible responses included, "within the last 2 years", "more than 2 years", and "never".

The study predictors are PCa risk, sociodemographic, and healthcare utilization factors. In the current study, PCa risk factors include age at the time of the survey and a first-degree relative with a history of PCa (Yes/No). Sociodemographic characteristics include education status (some high school, high school or GED, some college, Bachelor's degree and or higher), annual household income (<\$19,999, \$20,000 to \$49,999, \$50,000 to \$79,999, and >\$80,000), and marital status (divorced/separated, married/living with a partner, widower, never married/single, or refused). Healthcare utilization characteristics include primary care doctor (Yes/No) and health insurance status (private, Medicaid, military, Medicare, other, no).

2.3 Statistical analysis

Logistic regression analysis was used to assess the association between each predictor and a history of PSA screening. Predictors of interest included family history, age, education, income, insurance status, survey type, and having a primary doctor. Each predictor was evaluated in unadjusted (crude OR) and adjusted models (Models 1–3). Survey type was included in all models to control for the different methods of survey completion. Adjusted model 1 included family history, age, and survey type. Adjusted model 2 was additionally adjusted for socioeconomic predictors including education and income. Adjusted model 3, included all variables from models 1 and 2 as well as, insurance and primary care doctor. All analyses were conducted using SAS 9.4 (SAS Institute Inc.,

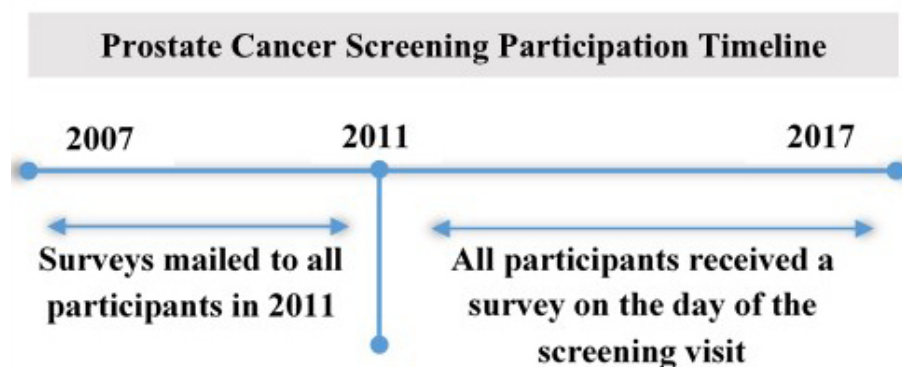


FIG. 1. Timeline of the completion of a prostate cancer screening information survey. Mailed-in or on-site completion.

Cary, NC, USA). All hypothesis testing is based on two-tailed tests and a significance level of 0.05 was used for all analyses.

3. Results

3.1 Characteristics of survey respondents by family history of prostate cancer

A total of 447 Black men completed a survey during the screening event period from 2007–2011 (Table 1). Of these men, 45% reported not having a family history of prostate cancer, 28% reported having a family history of prostate cancer, and 27% reported not knowing if they had a family history of prostate cancer. Most men in the study had a PCa screening in the last year, more than a high school education, an annual income of $>$ \$49,999, a primary care doctor, and insurance. Almost 63% of the overall population was $>$ 50 years old. Almost 54% of the overall population was married or living with a partner.

3.2 Predictors of annual prostate screening

In the unadjusted model, significantly increased odds of having an annual PSA screening were seen in men who were older, had more education, and had a higher income (Table 2). In the fully adjusted model (model 3), respondents aged 45 years or older were at an increased odds of having an annual PSA screening compared to those less than 45 years old. Respondents with a primary healthcare provider were also at an increased odds of having an annual PSA screening in the previous year (OR: 4.59, 95% CI: 2.30–9.14) than those who did not have a primary healthcare provider. In the fully adjusted model, having a first-degree relative with a history of PCa, an annual income greater than \$20,000, and insurance were not significant predictors of annual PSA screening for men in this cohort.

4. Discussion

To elucidate predictors that contribute to annual PSA screening for Black men, our study used data from Black male participants from an urban community-based PCa screening event. We assessed annual PSA screening, risk factors for PCa, and sociodemographic characteristics. Approximately

one-third of the respondents had an annual PSA screening in the previous year. Age and having a primary healthcare provider significantly predicted annual PSA screening in the fully adjusted model.

The current study reported that older age and having a healthcare provider predicted annual PSA screening in a sample of Black men attending a community screening event. There are mixed results on predictors contributing to regular prostate cancer screening. Our study is consistent with previous findings that Black men with history of a first-degree relative with PCa were not more significantly likely to have an annual PSA [13]. A few studies report that socioeconomic status (SES) is associated with regular screening [14–18]. However, our results show that SES factors are not predictive of prostate cancer screening among Black men. Having access to a primary care provider is the significant predictor of prostate cancer screening. SES is an important determinant to consider when addressing racial disparities across the cancer continuum; however, for screening, having a primary care provider is the most important factor.

Primary healthcare providers are the foremost cancer information resources for Black men [19–22]. Patient-provider communication about PSA screening is positively associated with PSA uptake. In light of the 2012 USPSTF recommendations, Choi *et al.* reports interprofessional differences in the perception of and preferences for recommendations other than the 2012 USPSTF's (e.g., recommendations from the American Cancer Society and the Centers for Disease Control and Prevention) between nurse practitioners, physicians, physician assistants, and registered nurses. In the same study, patients did not receive consistent messaging relevant PSA screening uptake, including the understanding that a PSA screening is an individualized choice, not all doctors recommend PSA testing, and evidence on the effectiveness of a PSA screen to save lives is inconclusive. To standardize relevant PSA screening messages between providers, a shared decision-making tool has the potential to aid patient-provider communication regarding the risks and benefits of prostate cancer screening [23, 24].

Understanding of predictors of annual PSA screening among Black men can improve patient-provider communication regarding PCa screening for high-risk

TABLE 1. Population characteristics of Black men attending a community prostate cancer (PCa) screening from 2007–2017.

	Overall		No family history of PCa		Don't know family history of PCa		Has family history of PCa		P
	n = 447		n = 203		n = 121		n = 123		
	n	%	n	%	n	%	n	%	
Annual screening									
No	146	32.66	73	16.33	39	8.72	34	7.61	0.30
Yes	301	67.34	130	29.08	82	18.34	89	19.91	
Age									
<45 years old	90	20.13	40	8.95	23	5.15	27	6.04	0.12
≥45–49 years old	73	16.33	42	9.40	12	2.68	19	4.25	
≥50–64 years old	218	48.77	88	19.69	66	14.77	64	14.32	
≥65 years old	66	14.77	33	7.38	20	4.47	13	2.91	
Education									
High school graduate or less	117	26.17	45	10.07	41	9.17	31	6.94	0.06
More than high school	330	73.83	158	35.35	80	17.90	92	20.58	
Income									
≤\$19,999	158	35.35	79	17.67	44	9.84	35	7.83	0.11
≥\$20,000–\$49,999	128	28.64	61	13.65	37	8.28	30	6.71	
≥\$50,000–\$79,000	69	15.44	27	6.04	15	3.36	27	6.04	
≥\$80,000	92	20.58	36	8.05	25	5.59	31	6.94	
Has a primary doctor									
No	60	15.44	32	7.16	16	3.58	21	4.70	0.70
Yes	378	84.56	171	38.26	105	23.49	102	22.82	
Marital status									
Divorced/Separated	72	23.68	27	8.88	16	5.26	29	9.54	0.01
Married/Living with partner	164	53.95	64	21.05	46	15.13	54	17.76	
Widower	5	1.64	1	0.33	3	0.99	1	0.33	
Never married/Single	60	19.74	34	11.18	14	4.61	12	3.95	
Refused	3	0.99	0	0.00	3	0.99	0	0	
Survey administration									
Onsite survey	193	43.18	112	25.06	39	8.72	42	9.40	<0.0001
Mail-in survey	254	56.82	91	20.36	82	18.34	81	18.12	
Insurance status									
No	79	17.67	36	8.05	17	3.80	26	5.82	0.35
Yes	368	82.33	167	37.36	104	23.27	97	21.70	

P-values <0.05 are bold.

populations and has both clinical and health promotion implications. For Black men, healthcare providers and family members are effective channels for communicating cancer information [19, 25, 26]. While 85% of this population had a healthcare provider, almost one-third of the participants did not know if they had a close family member with a history of PCa. Previous studies have reported a need to improve communication between patients and first-degree relatives [27]. This type of conversation can become challenging for providers when patients and their relatives no longer communicate because of death or social distance. Potential avenues to facilitate patient-provider communication about the risks associated with a first-degree relative with a history of PCa are decision aid tools [27], health promotion materials targeted at communication with relatives [26], or conversational approaches to ask surviving relatives.

Although this study used a sample of Black men who attended an urban, locally advertised screening event, the present sample generally had a higher representation of edu-

cated, older, partnered, Black men. Thus, our findings are not likely to be generalizable to populations beyond those represented by our sample, and future studies conducted in similar subpopulations are warranted. Our limited sample size may have also resulted in reduced statistical power, especially conclusions about associations with relatively weak magnitude, including education and insurance status as a predictor of history of PCA screening. Secondly, annual PCA screening data are retrospective self-reports among men who attended a community screening event. Men at community events may be more likely to be up to date with health screenings; however, these community events were held in several non-health related community settings including churches, community walks, and community festivals which reached a wide range of people. An additional limitation of this study is the limited sample size (n = 447). A final limitation of this study the study sample data of a subpopulation of men (n = 93) attending the screening event from 2010–2011 may be limited to reporting bias, as they may have

TABLE 2. Predictors of annual prostate-specific antigen screening history among Black men attending a community prostate cancer (PCa) screening 2007–2017 (n = 47).

Variables	Crude				Model 1 ^a				Model 2 ^b				Model 3 ^c			
	OR	UCL	LCL	P	OR	UCL	LCL	P	OR	UCL	LCL	P	OR	UCL	LCL	P
FAMILY HISTORY																
Yes	1.00				1.00				1.00				1.00			
Don't know	0.80	0.46	1.39	0.43	0.73	0.41	1.29	0.28	0.79	0.44	1.42	0.43	0.74	0.41	1.35	0.32
No	0.68	0.42	1.11	0.12	0.74	0.44	1.24	0.25	0.73	0.44	1.24	0.25	0.72	0.42	1.23	0.22
AGE																
<45 years old	1.00				1.00				1.00				1.00			
≥45–49 years old	2.72	1.40	5.29	<0.01	3.02	1.52	6.01	<0.01	3.13	1.56	6.28	<0.01	2.96	1.44	6.06	<0.01
≥50–64 years old	2.11	1.28	3.49	<0.01	2.38	1.42	4.01	<0.01	2.40	1.41	4.06	<0.01	2.05	1.18	3.54	0.01
≥65 years old	3.25	1.60	6.61	<0.01	4.62	2.19	9.76	<0.01	4.60	2.17	9.78	<0.01	3.87	1.77	8.46	<0.01
EDUCATION																
≤High School graduate	1.00				1.00				1.00				1.00			
>High School graduate	1.57	1.01	2.43	0.04					1.19	0.71	1.97	0.51	1.05	0.62	1.77	0.87
INCOME																
≤\$19,999	1.00								1.00				1.00			
≥\$20,000–\$49,999	1.77	1.08	2.89	0.02					1.44	0.84	2.48	0.19	1.42	0.80	2.51	0.23
≥\$50,000–\$79,999	2.20	1.55	5.02	0.01					1.57	0.77	3.21	0.22	1.45	0.68	3.07	0.34
≥\$80,000	2.79	1.18	4.09	0.01					2.06	1.02	4.15	0.04	1.74	0.83	3.65	0.14
INSURANCE STATUS																
None	1.00												1.00			
Has insurance	1.62	0.98	2.67	0.06									0.65	0.33	1.30	0.23
PRIMARY DOCTOR																
None	1.00												1.00			
Have a primary doctor	4.10	2.40	6.99	<0.01									4.59	2.30	9.14	<0.01
SURVEY COMPLETION																
On-site	1.00				1.00				1.00				1.00			
Mail-in	0.50	0.33	0.74	<0.01	0.42	0.27	0.66	<0.01	0.57	0.35	0.35	0.02	0.51	0.30	0.85	0.01

OR, Odds Ratios; UCL, Upper confidence level; LCL, Lower confidence level.

^aModel 1: Fam History, age, survey type.

^bModel 2: Model 1+ education, income.

^cModel 3: Model 2+ primary doc, insurance.

P-values <0.05 are bold.

reported the 2010 screening event as having a PSA in the last 12 months on the 2011 mail-in survey. We conducted a sensitivity analysis where the men who had a screening event in 2010 were excluded; results were consistent with our primary analysis. Notably, race is not a proxy for biological or genetic variations, and self-reported race is a social construct with complex and still unknown implications [28]. Although this study's focuses is on Black men and PCa screening, no conclusions were made about genetic or biological variations related to race or ethnicity.

5. Conclusions

Black race is a risk factor for PCa, and Black men have the highest incidence and mortality associated with this disease. The current study reports sociodemographic and healthcare utilization predictors associated with annual PSA screening among Black men. Findings from this study have clinical and health promotion implications. Information regarding the factors that are associated with annual PSA screening

for Black men has the potential to improve health education provided by community screening events for high-risk populations.

Author contributions

All authors listed have sufficiently contributed to the development, editorial changes, and final approval of the final manuscript. MWL-T conceptualized the work, interpreted of the data, and wrote the manuscript. SK conducted the data analysis and assisted with the interpretation of the data. VH conducted data analysis and assisted with drafting the manuscript. BFD acquired the data and assisted with the interpretation of the data.

Ethics approval and consent to participate

All participants completed an informed consent form. The study received approval by the Washington University Institutional Review Board (approval number: 201105114).

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Conflict of interest

The authors declare no conflict of interest.

Availability of the data and materials

The data that support the findings of this study are available from the corresponding author MWL-T, upon reasonable request.

References

- DeSantis CE, Siegel RL, Sauer AG, Miller KD, Fedewa SA, Alcaraz KI, *et al.* Cancer statistics for African Americans, 2016: progress and opportunities in reducing racial disparities. *CA: A Cancer Journal for Clinicians.* 2016; 66: 290–308.
- National Cancer Institute. Cancer Stat Facts: prostate cancer. 2018. Available at: <https://seer.cancer.gov/statfacts/html/prost.html> (Accessed: 1 October 2018).
- Siegel RL, Miller KD, Jemal A. Cancer statistics, 2017. *CA: A Cancer Journal for Clinicians.* 2017; 67: 7–30.
- Cancer Facts & Figures for African Americans 2011–2012. American Cancer Society. 2011.
- Patel K, Ukoli F, Liu J, Beech D, Beard K, Brown B, *et al.* A community-driven intervention for prostate cancer screening in African Americans. *Health Education & Behavior.* 2012; 40: 11–18.
- Jandorf L, Fatone A, Borker PV, Levin M, Esmond WA, Brenner B, *et al.* Creating alliances to improve cancer prevention and detection among urban medically underserved minority groups. *Cancer.* 2006; 107: 2043–2051.
- Hiatt RA, Pasick RJ, Stewart S, Bloom J, Davis P, Gardiner P, *et al.* Community-based cancer screening for underserved women: design and baseline findings from the breast and cervical cancer intervention study. *Preventive Medicine.* 2001; 33: 190–203.
- Thompson VLS, Drake B, James AS, Norfolk M, Goodman M, Ashford L, *et al.* A community coalition to address cancer disparities: transitions, successes and challenges. *Journal of Cancer Education.* 2015; 30: 616–622.
- Moyer VA. Screening for prostate cancer: U.S. preventive services task force recommendation statement. *Annals of Internal Medicine.* 2012; 157: 120–134.
- Wolf AMD, Wender RC, Etzioni RB, Thompson IM, D'Amico AV, Volk RJ, *et al.* American cancer society guideline for the early detection of prostate cancer: update 2010. *CA: A Cancer Journal for Clinicians.* 2010; 60: 70–98.
- Haider MR, Qureshi ZP, Horner R, Friedman DB, Bennett C. What have patients been hearing from providers since the 2012 USPSTF recommendation against routine prostate cancer screening? *Clinical Genitourinary Cancer.* 2017; 15: e977–e985.
- Liao JM, Ommerborn MJ, Clark CR. Association between features of patient-provider discussions and routine prostate-specific antigen testing. *PLoS ONE.* 2017; 12: e0177687.
- Drake BF, Lathan CS, Okechukwu CA, Bennett GG. Racial differences in prostate cancer screening by family history. *Annals of Epidemiology.* 2008; 18: 579–583.
- Moses KA, Zhao Z, Bi Y, Acquaye J, Holmes A, Blot WJ, *et al.* The impact of sociodemographic factors and PSA screening among low-income black and white men: data from the southern community cohort study. *Prostate Cancer and Prostatic Diseases.* 2017; 20: 424–429.
- Elewonibi BR, Thierry AD, Miranda PY. Examining mammography use by breast cancer risk, race, nativity, and socioeconomic status. *Journal of Immigrant and Minority Health.* 2018; 20: 59–65.
- Akinyemiju T, Ogunsina K, Sakhujia S, Ogbhodo V, Braithwaite D. Life-course socioeconomic status and breast and cervical cancer screening: analysis of the who's study on global ageing and adult health (SAGE). *British Medical Journal Open.* 2016; 6: e012753.
- Kangmennaang J, Onyango EO, Luginaah I, Elliott SJ. The next Sub Saharan African epidemic? A case study of the determinants of cervical cancer knowledge and screening in Kenya. *Social Science & Medicine.* 2018; 197: 203–212.
- Hall IJ, Tangka FKL, Sabatino SA, Thompson TD, Graubard BI, Breen N. Patterns and trends in cancer screening in the united states. *Preventing Chronic Disease.* 2018; 15: E97.
- Walsh-Childers K, Odedina F, Poitier A, Kaninjing E, Taylor G. Choosing channels, sources, and content for communicating prostate cancer information to black men: a systematic review of the literature. *American Journal of Men's Health.* 2018; 12: 1728–1745.
- Song H, Cramer EM, McRoy S. Information gathering and technology use among low-income minority men at risk for prostate cancer. *American Journal of Men's Health.* 2015; 9: 235–246.
- Choi SK, Seel JS, Steck SE, Payne J, McCormick D, Schrock CS, *et al.* Talking about your prostate: perspectives from providers and community members. *Journal of Cancer Education.* 2018; 33: 1052–1060.
- Drake BF, Lewis-Thames MW, Brown A, Rancilio D, Hicks V. An evaluation of follow-up activities of participants from an urban prostate cancer screening event. *American Journal of Men's Health.* 2019; 13: 155798831984435.
- Misra-Hebert AD, Hom G, Klein EA, Bauman JM, Gupta N, Ji X, *et al.* Testing of a tool for prostate cancer screening discussions in primary care. *Frontiers in Oncology.* 2018; 8: 238.
- Misra-Hebert AD, Kattan MW. Prostate cancer screening: a brief tool to incorporate patient preferences in a clinical encounter. *Frontiers in Oncology.* 2016; 6: 235.
- McCormack L, Williams-Piehot P, Bann C. Behind closed doors: what happens when patients and providers talk about prostate-specific antigen screening? Survey of the Effects of a Community-Based Intervention. *the Patient.* 2009; 2: 191–201.
- Friedman DB, Corwin SJ, Dominick GM, Rose ID. African American men's understanding and perceptions about prostate cancer: why multiple dimensions of health literacy are important in cancer communication. *Journal of Community Health.* 2009; 34: 449–460.
- Gwede CK, Davis SN, Wilson S, Patel M, Vadaparampil ST, Meade CD, *et al.* Perceptions of prostate cancer screening controversy and informed decision making: implications for development of a targeted decision aid for unaffected male first-degree relatives. *American Journal of Health Promotion.* 2015; 29: 393–401.
- Yudell M, Roberts D, DeSalle R, Tishkoff S. Taking race out of human genetics. *Science.* 2016; 351: 564–565.