

The Connection Between Testicular Cancer, Minority Males, and Planned Parenthood

American Journal of Men's Health
2018, Vol. 12(5) 1774–1783
© The Author(s) 2018
Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/1557988318786874
journals.sagepub.com/home/jmh


Wesley B. Adams, MPH(c), BSc¹, Michael J. Rovito, PhD, CHES, FMHI¹,
and Mike Craycraft, RPh²

Abstract

Testicular cancer (TCa) is the most prevalent neoplasm diagnosed in males aged 15–40 years. Lack of access to care is a key impediment to early-stage TCa diagnosis. Health equity concerns arise, however, as poor access largely manifests within underserved male populations, therefore, placing them at a higher risk to develop late-stage TCa. Planned Parenthood Federation of America (PPFA) offers a myriad of male reproductive/sexual health care options, including TCa screening and referral services. Therefore, expanding these amenities in traditionally underserved communities may address the concern of TCa screening opportunities. An ecological analysis was performed using data from the United States Cancer Statistics, American Community Survey, and PPFA databases to assess the impact of TCa upon minority males, identify associations between PPFA services and minority males, and provide future implications on the role PPFA may play in bridging health-care access gaps pertaining to TCa screenings. Results indicate that states with higher rates of poverty and uninsured individuals, as well as specifically Black/African American males, have lower TCa incidence and limited access to screening services. PPFA service presence and Black/African American, as well as uninsured, males had a negative association but revealed positive correlations with TCa incidence. Considering the emerging TCa outcome disparities among minority males, expanding PPFA men's health services is crucial in providing affordable options to help identify testicular abnormalities that are early stage or carcinoma in situ. Many at-risk males have limited means to obtain TCa screening services. Expanding this discussion could provide a foundation for future advocacy.

Keywords

epidemiology of men's health, general health and wellness, health screening, testicular self-exam, access to care, health-care issues, health inequality/disparity

Received January 8, 2018; revised May 22, 2018; accepted May 28, 2018

Testicular cancer (TCa) is the most prevalent neoplasm diagnosed in males aged 15–40 years (Rovito et al., 2016). A total of 8,850 new cases of TCa and 410 deaths from the disease were estimated to occur in the United States in 2017 (Siegel, Miller, & Jemal, 2017). Recent surveillance indicates a universal rise in incidence throughout all demographic subsets of young adult and adolescent at-risk males (Burkhamer, Kriebel, & Clapp, 2017).

Treatment for TCa is remarkably effective, which is evidenced by an approximate 99% 5-year survival rate if diagnosed in the early stages (Stage I) of development (Howlader et al., 2015). That rate dips to 70%–75% in more advanced-stage diagnoses (greater than Stage III). Due to high survivability of the condition, which usually

occurs early in a male's lifespan, clinical and public health researchers are largely concerned with long-term morbidity issues among said survivors—a consequence of invasive treatment options (i.e., orchiectomy, retroperitoneal lymph

¹Behavioral Health Research Group, College of Health and Public Affairs, Department of Health Professions, University of Central Florida, Orlando, FL, USA

²Testicular Cancer Society, Cincinnati, OH, USA

Corresponding Author:

Michael J. Rovito, PhD, CHES, FMHI, Department of Health Professions, University of Central Florida, 12805 Pegasus Drive, HPAI Room 269, Orlando, FL 32816, USA.
Email: michael.rovito@ucf.edu



node dissection, radiation, and/or chemotherapy; Fung, Fossa, Williams, & Travis, 2015; Gilligan, 2015). Physiological complications, such as infertility, peripheral neuropathy, cardiovascular disease, and long-term pulmonary and neural toxicity, as well as psychological conditions, such as chronic fatigue, anxiety, fear of recurrence, and depression, are all prevalent conditions within the TCa survivor population, especially among late-stage survivors (Fung et al., 2015; Gilligan, 2015).

The amount of overall TCa research that exists, including, but not limited to, survivor-based studies, is limited in both amount and scope. There is a paucity of research, for example, investigating the impact of TCa on minority populations. Despite a majority prevalence among White/Caucasian males, recently emerging studies indicate drastically higher proportions of late-stage TCa diagnosis and mortality in the United States among Black/African American and Latino males, as well as those under or uninsured and/or of lower socioeconomic status (SES; Bridges, Sharifi, Razzaq, & Guinan, 1998; Kamel et al., 2016; Lerro, Robbins, Fedewa, & Ward, 2014; Markt et al., 2016; Ries, 2007; Sun et al., 2011). Furthermore, this literature suggests that Latinos will have the highest TCa incidence rate of any racial/ethnic group by the year 2026. Contextual influences, further, which restricts access to health-care services, seem to exacerbate the risk of adverse health outcomes related to TCa in minority groups.

Access to Care for Underserved Males at Risk for TCa

Lack of access to care is a key impediment to early-stage TCa diagnosis. The literature suggests that uninsured and underinsured males are at substantially higher risk of late-stage TCa diagnosis, with education status, family income, and provider trust serving as sizable effect modifiers (Kamel et al., 2016; Lerro et al., 2014; Markt et al., 2016; Sun et al., 2011). These factors assist in materializing health equity concerns as they largely manifest within underserved male populations (Elliott & Larson, 2004; Mulye et al., 2009; Watson, 2014).

Lack of knowledge and awareness of TCa can furthermore impact stage diagnosis, as well as general screening service utilization. Recent research associated (a) lack of knowledge and awareness in the patient population and (2) a lack of competency-to-treat in the provider population to delayed TCa diagnoses among male subpopulations (Cronholm, Mao, Nguyen, & Paris, 2008; Huyghe et al., 2007; Öztürk, Fleer, Hoekstra, & Hoekstra-Weebers, 2015). This lack of knowledge, combined with socioeconomic pressures, places underserved males at a higher risk to develop late-stage TCa, which ushers in the concern of higher mortality and worse quality of life compared to their White/Caucasian counterparts.

Consequently, the role of community safety net providers (SNPs) in initiating TCa screening for at-risk males is a critical intervention needed to decrease the current disparity in TCa mortality and late-stage incidence. Nationally, Planned Parenthood Federation of America (PPFA) is an important body to consider in bridging this gap of care and may offer potential solutions to health inequity concerns present within young adult underserved men, as it relates to TCa.

PPFA and Male Health Services

PPFA is a national mainstay SNP for reproductive and sexual health services (PPFA, n.d.; Topulos, Greene, & Drazen, 2015). As of 2014, PPFA provided upward of 4.67 million sexual and reproductive services, globally. Of the 2.84 million services offered within the United States, 79% were provided to patients at or below 150% of the poverty line (PPFA, 2015).

Though typically conjectured as a female-specific sexual/reproductive/family planning service system (Lawrence & Ness, 2017; Topulos et al., 2015), PPFA offers a myriad of male reproductive/sexual health care options, including but not limited to erectile dysfunction, jock itch, infertility, premature ejaculation, prostate cancer, vasectomy procedural services, as well as TCa screening and referral services (PPFA, n.d.). These services are intermittently, not universally, offered throughout PPFA facilities. Furthermore, facilities providing male-specific services many times do not provide all the aforementioned amenities, most notably, TCa-related services.

Current Study

No current or past research has focused on the effectiveness of such TCa screening services on early-stage diagnoses among minority, underserved males. Insufficient research, furthermore, exists studying the effects of such screening among the general population, as a whole. This gap in research is a predominant concern throughout current public health officials, especially within the United States Preventive Services Task Force, as evidenced by their respective “D” rating for testicular self-examination (TSE) and clinical screening efforts for TCa in asymptomatic males. Nevertheless, certain organizations, such as the American Cancer Society (ACS), while respecting TSE promotional pushback by not offering an official recommendation, still promote routine testicular examination in the clinical setting (ACS, 2018). Especially in males at increased risk of TCa incidence (e.g., those with family history of TCa, cryptorchidism, and testicular microlithiasis, among others), regular screening, at the very least in the clinical setting, should be further

promoted (Hu, Baird, & Meyers, 2018; Parenti, Giorgi, & Albello, 2014; Piltoft et al., 2017). In the context of the current study, emerging data suggest an undue burden of morbidity and mortality related to TCa is affecting men of color; therefore, it is pertinent to begin the discussion of how to assist in alleviating this concern and how to increase screening efforts among at-risk males of these socioeconomic and racial demographic subsets (Sun et al., 2011). These disparate testicular health outcomes manifesting within U.S. minority male populations present a unique opportunity for public health officials and organizations to promote early TCa screenings within underserved male populations via PPFA's male-specific services, as well as advocate further involvement of community health centers and federally qualified health centers alike.

The purpose of this study is threefold: (a) to assess the impact of TCa upon subpopulations of at-risk, underserved males; (b) to identify any preliminary associations between PPFA services and minority males; and (c) to provide future implications on the role PPFA may play in bridging health-care access gaps pertaining to urogenital health information and services, including TCa screenings. Ultimately, an expansion in such services could decrease the likelihood of advanced cancer detection and thus promote optimal wellness among TCa survivors, particularly among traditionally underserved males.

Methods

A descriptive correlation and regression analysis was performed using 2014 data from United States Cancer Statistics (USCS), ACS, Health Resources & Service Administration (HRSA), and PPFA databases. Bivariate Pearson r correlation coefficient analyses were performed to discern general associations, if present, between TCa impact indicators (i.e., incidence and mortality), state demographics (i.e., race, poverty, insured status, and Medically Underserved Area [MUA] score) and PPFA facility presence, as well as total services offered. All significant correlations, subsequently, were further assessed through a multiple linear regression model. Prior to this step, all variables involved were assessed for normality, homoscedasticity, linearity, and independence (multicollinearity).

In the final regression model, TCa incidence was assessed as the outcome variable of interest. Prior to model interpretation, normality was assessed via P-P plots in addition to Shapiro-Wilks and Kolmogorov-Smirnov statistical analysis. Homoscedastic assumptions were confirmed via scatterplot review, while further residual assessment included standard residual value and Cook's Distance statistic evaluation. Finally, multicollinearity was assessed during bivariate

correlational analyses, as well as in the actual final model through each individual predictor Variance Inflation Factor (VIF) value. Once confirmed, multiple linear regressions were performed to further assess the statistically significant correlations generated in bivariate analysis. These coefficients were used to determine to what extent TCa incidence was associated with SES and race indicators, and, furthermore, if PPFA service totals complimented such correlations.

Data Sources

The USCS program is a surveillance system composed of the Center of Disease Control and Prevention (CDC)-funded National Program of Cancer Registries program (NCPR) and the National Cancer Institute (NCI)-funded Surveillance, Epidemiology, and End Results Program (SEER) databases—select SEER registries are also concurrently funded by the CDC. The NCPR program relays a highly reliable and valid database; less than 5% of incident cases were obtained from death certification, alone, while less than 3% of cases were missing sex, age, and race demographics. SEER database statistics are widely considered the gold standard for cancer incidence research and evaluation—more information about this database can be found at <https://seer.cancer.gov/>. Incidence data for this program are collected through 20 separate registries, established by both the NCI and CDC. Mortality data are collected through individual death certificates within the CDC's National Center for Health Statistics, coordinated through the National Vital Statistics System, and is reflected within the USCS system. Further information regarding the USCS database can be found at www.cdc.gov/uscs.

USCS data were used to extract TCa incidence and mortality rates, per 100,000, throughout each individual state. Each rate was age-adjusted to the 2,000 U.S. standard population. All conversion and age-adjustment procedures were completed prior to data access by the USCS Working Group. This, alongside 2014 demographic estimates through the ACS, generated yearly through statewide US Census Bureau community surveying, was used to assess the ecological implications of SES and racial indicators upon TCa incidence and mortality trends.

Data for an additional covariate, the state MUA index score average, were obtained from the online HRSA government database. Data from this organization are completely open for public use and can be accessed at <https://datawarehouse.hrsa.gov/tools/analyzers/hpsafind.aspx>. An MUA, as defined by the HRSA, is an area suffering from low primary care providers, high infant mortality, high poverty, and/or high elderly populations (HRSA, 2018). After analyzing such variables, the HRSA grants a geographical area a score from 0 to 100, "0" representing

an extremely underserved area, and “100” deeming the area not underserved. As it pertains to the current study, data regarding MUA service area scores were obtained and averaged to yield state-specific MUA scores. These scores were used concordantly with the previously mentioned variables as indicators for decreased health-care access per state.

Data regarding state-specific PPFA facility totals, as well as both general male health and TCa-specific services offered through them, were collected through the individual PPFA organization websites. Research and verification of general male health and TCa-specific services offered was performed and cross-referenced by two researchers to ensure consistency in measurement. PPFA data were analyzed along with both USCS and ACS data to determine relationships between TCa impact indicators, community racial, and SES makeup, and PPFA services offered, per state.

Covariates

State-specific demographic covariates used in the current study included male population totals, as well as health insurance coverage (e.g., uninsured and insured), public insurance coverage (e.g., Medicaid and VA health-care coverage), poverty rates (e.g., population residing at federal poverty line), and state-specific MUA score averages. Race variables comprised state-specific non-Hispanic White, Black/African American, Hispanic Latino, Asian, American Indian/Alaska Native, and Pacific Islander population proportions. Extracted data were 5-year estimates from ACS 2014 databases and were specific to males aged 18–44 years. Participants were further categorized by age into 7- and 10-year tertiles (e.g. 18–24, 25–34, 35–44).

All state values were weighted and controlled for population size discrepancies prior to analysis. Remaining variables included state PPFA general men’s health services (MHS) and TCa-specific services (TCS) offered (PPFA)—proportionate to state male population size, ages 18–44 years—as well as TCa incidence and mortality rates per 100,000 (USCS).

All states within the United States were assessed, excluding Puerto Rico and the District of Columbia. Forty-nine states were included in the final analysis. Incidence rates for Nevada over the 5-year measurement period were excluded as their respective registry did not meet the data quality criteria set by the USCS surveillance system.

Results

Geographic Trends

Over the cumulative measurement period, from 2010 to 2014, crude 5-year estimate TCa incidence totals were highest in populated states of California, Texas, New York, and Florida. When controlled for population size,

however, Montana, Wyoming, New Hampshire, and Nebraska were among the leading states in TCa incidence rates per 100,000 men.

Uninsured rates were highest in Texas, Florida, Georgia, New Mexico, and Mississippi for males ages 18–44 years. Though state poverty rates and state MUA averages among this subset were more dispersed, a similar trend can be seen in the U.S. southeast and central regions. State population rates of 18–44 Black/African American males favored a similar southeast U.S. clustering tendency. Latino American populations were highest in New Mexico, California, and Texas. Alaskan Native/Native American, Asian, and Pacific Islander/Hawaiian Native populations were dispersed indiscriminately.

TCa incidence, along with certain SES and racial population geographic distributions, appears to be associated. Black/African American, impoverished, uninsured populations, as well as states with lower MUA scores, seem to comprise states with lower TCa incidence (Table 1).

TCa Impact Indicators, Insurance, Poverty, and MUA Score

Bivariate analyses further supported this observation, indicating a strong negative correlation between TCa incidence and higher uninsured rates, as well as a moderate correlation with state MUA average score (Table 1). Specifically, regions with higher rates of uninsured males, and low state MUA average, consistently reflected negative correlations with incidence. This relationship was persistent throughout all tertiles, as well as total uninsured rates for the entire population age range. Poverty rates, though not as strongly correlated, also reflected statistically significant negative associations within two of the three age groups and the total population age range pertaining to TCa incidence.

Regarding TCa mortality, males aged 18–24 years yield the only significant correlation among the uninsured total and tertile groups, which was a moderate positive association. There were no significant correlations between poverty and TCa mortality. The public insurance covariate demonstrated no statistically significant correlations with either TCa incidence or mortality.

TCa Impact Indicators and Race

Black/African American male population rates demonstrated the strongest association (all very strong negative relationships) with TCa incidence (total and all age tertiles; Table 2). Conversely, White non-Hispanic male populations had a moderately positive correlation with TCa incidence throughout all age tertiles. No other racial or ethnic group had any significant association with TCa incidence. TCa mortality was only significantly associated with Alaskan Native and Native American popula-

Table 1. TCa Impact and SES Indicators.

Covariate	TCa incidence	p value	TCa mortality	p value
Uninsured				
18-24	-.459*	<.001	.359	<.047*
25-34	-.465*	<.001	.311	<.089
35-44	-.429*	<.002	.333	<.067
Total	-.455*	<.001	.338	<.063
Poverty				
18-24	-.103	<.479	.326	<.073
25-34	-.343*	<.016	.321	<.079
35-44	-.424*	<.002	.328	<.071
Total	-.287*	<.046	.350	<.054
Publicly Insured				
18-24	-.029	<.842	-.215	<.244
25-34	.223	<.123	-.140	<.451
35-44	.076	<.604	-.127	<.497
Total	.107	<.107	-.166	<.372

Note. SES = socioeconomic status; TCa = testicular cancer.
*Statistically significant findings.

Table 2. TCa Impact and Minority Racial Groups.

Covariate	TCa incidence	p value	TCa mortality	p value
African American				
18-24	-.822*	<.001	-.349	<.054
25-34	-.820*	<.001	-.352	<.052
35-44	-.816*	<.001	-.352	<.052
Total	-.820*	<.001	-.351	<.053
Hispanic Latino				
18-24	-.061	<.676	.216	<.244
25-34	-.127	<.384	.201	<.278
35-44	-.100	<.494	.215	<.245
Total	-.098	<.504	.211	<.254
Asian				
18-24	-.059	<.685	-.094	<.514
25-34	-.086	<.559	-.154	<.286
35-44	-.119	<.414	-.128	<.376
Total	-.093	<.527	-.129	<.372
Hawaiian Native and Pacific Island				
18-24	-.065	<.658	.003	<.986
25-34	-.074	<.612	-.001	<.992
35-44	-.075	<.609	.012	<.932
Total	-.071	<.626	.004	<.976
Alaskan Native and Native American				
18-24	.204	<.160	.356*	<.049
25-34	.204	<.159	.362*	<.045
35-44	.195	<.178	.371*	<.040
Total	.202	<.165	.364*	<.044

Note. TCa = testicular cancer.
*Statistically significant findings.

tion groups (all moderately positive relationships). Black/African Americans, though marginally significant, showed moderately strong negative associations.

Table 3. PPFA Bivariate Analysis.

Covariate	PPFA MHS	p value	PPFA TCS	p value
African American				
18-24	-.323*	<.022	-.220	<.125
25-34	-.322*	<.023	-.216	<.131
35-44	-.319*	<.024	-.211	<.142
Total	-.321*	<.023	-.216	<.132
Uninsured				
18-24	-.341*	<.015	.224	<.117
25-34	-.272	<.056	.206	<.151
35-44	-.288*	<.043	.207	<.149
Total	-.307*	<.030	.217	<.130
Publicly Insured				
18-24	.231	<.106	-.164	<.254
25-34	.544*	<.001	-.193	<.179
35-44	.432*	<.002	-.209	<.145
Total	.427*	<.002	-.197	<.170
Poverty				
18-24	-.265	<.063	.119	<.410
25-34	-.213	<.138	-.067	<.643
35-44	-.271	<.057	.089	<.538
Total	-.262	<.066	-.015	<.915
TCa Incidence				
	.366*	<.010	.205	<.157
TCa Mortality				
	.092	<.622	.194	<.295

Note. MHS = men's health services; PPFA = Planned Parenthood Federation of America, TCS = testicular cancer-specific services; TCa = testicular cancer.
*Statistically significant findings.

TCa Impact Indicators, Demographics, and PPFA

PPFA MHS were positively correlated with TCa incidence rates, as well as with select group public insurance rates (Table 3). However, conversely, MHS rates were negatively associated with Black/African American males, as well as select age group uninsured rates. No significant correlations were present with other minority group populations. There were no significant associations between PPFA TCS rates and poverty, insurance, or TCa impact indicator covariates.

Regression Assumptions Analysis

All significant correlations from bivariate analysis were further assessed for predictive value as it relates to TCa incidence. The final predictor variables involved in the multiple regression model included non-Hispanic White, and Black/African American population-adjusted sizes, as well as state uninsured, poverty, and MUA average values. Prior to this regression, the previously mentioned assumption analyses were performed. P-P plots reflected a normal distribution, while nonsignificant Shapiro-Wilks and Kolmogorov-Smirnov statistics further assured

Table 4. Multiple Regression Model With VIF Statistics.

Model ^a		Unstandardized coefficients		Standardized coefficients		Collinearity statistics		
		B	SE	β	t	Sig.	Tolerance	VIF
I	(Constant)	5.895	1.608		3.667	.001		
	Non-Hispanic White	1.328	.570	.211	2.331	.024	.728	1.373
	African American	-6.678	.870	-.683	-7.679	.000	.753	1.328
	Poverty rate	-3.549E-5	.000	-.105	-.969	.338	.503	1.989
	Uninsured rate	-1.047E-5	.000	-.065	-.572	.570	.457	2.189
	MUA average	.010	.024	.038	.426	.672	.735	1.360

Note. MUA = Medically Underserved Area; VIF = Variance Inflation Factor.
^aDependent variable: TCa Incidence.

normality. Scatterplot assessment showed equal variance among residual values, while the maximum standard residual value and Cook’s Distance statistic were 2.140 and .518, respectively. Though independence was assumed after bivariate analysis, VIF values were all <2.00, with the exception of state uninsured rates, which had a factor of 2.189, a value still within acceptable range.

TCa Incidence Multiple Regression Analysis

Multiple linear regression analyses indicated that within the primary significant covariate associations (i.e., Black/African American population, White non-Hispanic population, uninsured status, poverty, ages 18–44 years, and state-specific MUA scores), only race was a significant predictor for TCa incidence (Black/African American population: standardized β = -.683, *p* < .001; White non-Hispanic population: standardized β = .211, *p* < .024; Table 4). The aggregate regression model, however, strongly predicted state TCa incidence (adjusted *R*² = .714). When removing race from the model, the predictive strength drops significantly (adjusted *R*² = .173). Uninsured rates expressed more predictive value for decreased TCa incidence in comparison to poverty rates (β = -.463, *p* < .0, and β = .012, *p* < .945, respectively). Mortality was not included within this portion of the analysis, as minimal variable subgroups reflected significant associations in correlational analysis.

Discussion

The presented results suggest that certain SES and race covariates are associated with TCa incidence in the United States from 2010 to 2014. Specifically, states with higher rates of poverty, uninsured individuals, and racial minority populations have lower TCa incidence. In contrast, the final regression model deduced Black/African American and non-Hispanic White population size as the only significant negative and positive predictors of the

study, respectively. Certain known biological and unexplored socioeconomic factors will be considered to better explain the racial and SES discrepancies in TCa incidence, as unearthed by the current analysis. Finally, the potential impact of PPFa in reducing known disparities present within underserved minority populations, as they relate to TCa stage diagnosis, will be explored.

Genetic Influence

TCa prevalence has a historic proclivity to White male populations. The condition, relative to other cancers, is remarkably hereditary (Skakkebaek et al., 2016). Almost 25% of Testicular Germ Cell Tumor (TGCT) risk is due to genetic predisposition, and this value could rise as further genome-wide association studies ensue (Litchfield, Shipley, & Turnbull, 2015; Skakkebaek et al., 2016). Recent findings suggest that certain p-53 response element (p-53 RE KITLG) sequence mutations—a genetic mutation predominantly found in White European populations—may increase risk and explain the pathogenesis of a large portion of TGCT cases (Zeron-Medina et al., 2013). Duly, the current study’s final regression model further supports this notion, as non-Hispanic White males were the only significant positive predictor of cancer incidence.

Explaining Black/African American Effect Size

The final regression model further infers that Black/African Americans were a significant predictor of decreased incidence. This effect was initially suspected to be a result of the aforementioned positive relationship between White men and TCa prevalence. However, surprisingly, this variable was the strongest coefficient of the model, a trend persistent even when controlling for non-Hispanic White population distribution. This finding may be the result of multiple factors. First, and most reasonably, this may be the product of study design limitation.

As an ecological, descriptive study, lack of data and analytical rigor may explain the outstanding negative effect present in the regression.

Nevertheless, if methodological error was not a significant confound, findings may suggest that other sociodemographic influences affect TCa incidence in Black/African American populations. Research has shown that major risk factors for TCa, such as cryptorchidism, microlithiasis, and infertility/fecundity, strongly affect both majority and minority males, especially those of lower SES (Bayne, Alonzo, Hsieh, & Roth, 2011; Chandra, Copen, & Stephen, 2013; Kokorowski, Routh, Nelson, & Graham, 2010; Pedersen et al., 2017). In fact, nonsurgical male infertility and fecundity may affect minority populations, specifically Black/African Americans, more than the White male majority (Chandra et al., 2013). Aside from genetic bias, TCa risk should equate to most racial groups somewhat indiscriminately.

Moreover, recent study suggests Black/African American males encounter severe barriers to TCa screening services, as evidenced by their increased risk of late-stage development (Sun et al., 2011). This same mechanism may help explain why, even in the presence of decreased non-Hispanic White population totals, Black/African American population size strongly predicts decreased TCa incidence. In this scenario, concerns of access to health care may restrict underserved Black/African American males from accessing timely care, potentiating the risk of advanced stage development and possible misdiagnosis of cancer origin. Furthermore, Black/African American populations residing in MUAs are subject to severe health-care worker/resource shortages and limiting options for genitourinary care (Mossanen et al., 2014). This shortage in expertise may also contribute to the underreporting of TCa cases within this population.

Both arguments are further supported by initial analyses yielding positive correlations between Black/African American population size and increased state uninsured rates, increased poverty rates, and decreased MUA score frequency. All variables, coincidentally, infer significant health-care access concerns, and all negatively correlate with TCa incidence (strictly in correlation analysis, however).

This explanation, however, poses multiple issues. First and foremost, despite the highly metastatic and unpredictable characteristics of certain TGCT histological types, methods of identifying germ cell origin, including immunohistochemistry staining, radiological study, and/or tumor marker analysis, are exceptionally effective. Seldom is TCa origin misdiagnosed. Such outcomes are typically a result of the "burned-out" phenomenon, or human error; both events are exceptionally rare and would not fully explain the substantial residual relationship observed in the current model. Secondly, other

covariates, such as poverty rates, uninsured rates, and MUA scores, were essentially unremarkable in the final regression model of the current study, suggesting that these rates were more a result of racial distribution than actual TCa impact.

Though in the current model Black/African American male population size remains the largest predictor of TCa incidence, a clear explanation of this effect is unclear and warrants further investigation. We suspect that genetic factors alone, albeit significant, may not completely explain the exceptional residual effect Black/African American population size has on TCa incidence within the current model. In the context of the present study, if access to health care indeed poses a partial concern for the correct diagnoses and reporting of TCa incidence, the need for PPFA and SNPs alike is even more apparent to help limit the disparity in TCa burden present in underserved minority males, specifically Black/African Americans.

Planned Parenthood Federation of America

This conversation, in terms of burden of TCa shared among all males, not just confined to White/Caucasians, is novel and must expand to address the emerging health inequities witnessed among men of color pertaining to this disease. Moving forward, if access to care potentiates, at minimum, partial incidence discrepancy, SNPs such as PPFA are crucial in providing affordable, accessible screening services to help bridge this gap. This point is evidenced by the fact that PPFA MHS presence had a positive association with TCa incidence rates. However, as PPFA MHS presence was negatively associated with Black/African American males, as well as select age group uninsured rates, this may serve as a springboard to expand investigation into whether or not expanding such services within geographic areas with high population densities of traditionally underserved males would increase TCa incidence among these male subgroups. This would be the result of an increase in the amount of TCa screenings offered. Theoretically, if an underserved male gains access to even general MHS, health-care professionals within the PPFA setting should be capable of recognizing and addressing presenting testicular abnormalities that are early stage or carcinoma in situ.

Limitations and Future Implications

The current analysis is limited. For example, the analyses do not encompass enough data pertaining to actual service availability to provide an adequate needs assessment for PPFA. In other words, although a PPFA site lists a service is available on the website, to the extent such services are offered and to what capacity, is yet to be determined. PPFA, in spite of the previous point, generally

seems to be addressing the presented issue, as indicated by the positive association between TCa incidence and MHS rates, per state.

Results suggest that minority populations may still face geographical barriers to accessing PPFA TCa screening services, especially among Black/African American males. This relates to the issue of distribution of MHS services and population density of men of color. State PPFA services offered per state needs further critique pertaining to minority population density.

The current analysis also shows no effect of increased PPFA services, both MHS and TCS, on aggregate TCa mortality. This relationship may differ, however, if TCa mortality rates were further stratified among racial and SES groups.

The nature of the ecological study design presents many limitations and challenges to generalizability—mainly, the lack of data specificity. Though this study was able to demonstrate preliminary population trends in TCa as they relate to certain measures of SES and racial indicators, it does not specify stage of diagnosis discrepancies, as well as the individual patient characteristics of diagnoses within each state registry. Furthermore, the study time window precedes key implementations of the 2010 Patient Protection and Affordable Care Act, including the individual mandate, Medicaid expansion, and market exchanges enacted. Impact of such legislation may have further implications on TCa trends and service access not captured within the scope of this study.

Furthermore, due to time constraints of the current study, individual area MUA scores were not weighted for population size or age distribution when calculating state averages, which may have slightly confounded analyses performed with this specific variable. Nevertheless, MUA scores reflected minimal effect in the final model; therefore, the significant outcomes surfaced are not affected by this error.

Finally, this study also fails to identify current urologic services offered throughout the United States, including private and public services, outside of PPFA facilities. This aspect alone could also explain the lack of significant findings regarding PPFA services and TCa impact. Increased urologic services in an area may yield smaller PPFA service totals but still may improve TCa mortality. Presence of external services outside of PPFA may greatly confound the relationship between PPFA services and TCa impact.

Conclusion

Findings from this study warrant further investigation into the variables/mechanisms that define health disparity within underserved males, as it relates to TCa. The final regression model suggests that factors beyond the genetic forefront contribute to TCa risk within

underserved communities. We suggest that this discrepancy may be due, in part, to health-care access inequity; however, this is purely speculation and by no measure proven by the given analysis. Future research should continue to investigate the correlates of certain racial and sociodemographic variables on TCa impact and further analyze the effectiveness of SNPs, such as PPFA, in lessening the burden of disease within underserved males. Especially in respects to the current political gridlock and the potential defunding of PPFA, services offered through this SNP must be further assessed beyond the standard scope in which it is currently viewed. As it relates to the current study, the benefits of PPFA in improving screening coverage for males at risk of TCa may lower the high proportion of late-stage diagnosis within underserved males.

Acknowledgments

The authors would like to thank everyone at the Behavioral Health Research Group, Men's Health Initiative, Inc., and the Testicular Cancer Society for their tireless efforts in executing this study as well as their devotion to promoting men's health.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

References

- American Cancer Society (ACS). (2018, June 30). *Can testicular cancer be found early?* Retrieved from <https://www.cancer.org/cancer/testicular-cancer/detection-diagnosis-staging/detection.html>
- Bayne, A. P., Alonzo, D. G., Hsieh, M. H., & Roth, D. R. (2011). Impact of anatomical and socioeconomic factors on timing of urological consultation for boys with cryptorchidism. *The Journal of Urology*, *186*(4), 1601–1605.
- Bridges, P. J., Sharifi, R., Razzaq, A., & Guinan, P. (1998). Decreased survival of Black Americans with testicular cancer. *The Journal of Urology*, *159*(4), 1221–1223.
- Burkhamer, J., Kriebel, D., & Clapp, R. (2017). The increasing toll of adolescent cancer incidence in the US. *Plos One*, *12*(2), e0172986. doi:<https://dx.doi.org/10.1371/journal.pone.0172986>
- Chandra, A., Copen, C. E., & Stephen, E. H. (2013). *Infertility and impaired fecundity in the United States, 1982–2010: Data from the national survey of family growth* (National Health Statistics Reports, No. 67). Hyattsville, MD: National Center for Health Statistics.
- Cronholm, P. F., Mao, J. J., Nguyen, G. T., & Paris, R. T. (2008). A dilemma in male engagement in preventive services:

- Adolescent males' knowledge and attitudes toward testicular cancer and testicular self-exam. *American Journal of Men's Health*, 3(2), 134–140. First Published April 25, 2008. doi:https://dx.doi.org/10.1177/1557988308315071
- Elliott, B. A., & Larson, J. T. (2004). Adolescents in mid-sized and rural communities: Foregone care, perceived barriers, and risk factors. *Journal of Adolescent Health*, 35(4), 303–309. doi:https://dx.doi.org/10.1016/j.jadohealth.2003.09.015
- Fung, C., Fossa, S. D., Williams, A., & Travis, L. B. (2015). Long-term morbidity of testicular cancer treatment. *Urologic Clinics of North America*, 42(3), 393–408. doi:https://dx.doi.org/10.1016/j.ucl.2015.05.002
- Gilligan, T. (2015). Quality of life among testis cancer survivors. *Urologic Oncology*, 33(9), 413–419. doi:https://dx.doi.org/10.1016/j.urolonc.2015.05.018
- Howlader, N., Noone, A., Krapcho, M., Garshell, J., Miller, D., & Altekruse, S. (2015). *SEER cancer statistics review, 1975–2012, section 32, adolescent and young adult cancer by site, incidence, survival and mortality*. Bethesda, MD: National Cancer Institute.
- Health Resources & Services Administration (HRSA). (2018). *Primary dataset: Medically underserved areas/populations (MUA/P)*. Retrieved from <https://datawarehouse.hrsa.gov/tools/DataPortalResults.aspx>
- Hu, J. S., Baird, D. C., & Meyers, G. J. (2018). Testicular cancer: Diagnosis and treatment. *American Family Physician*, 97(4), 261.
- Huyghe, E., Muller, A., Mieusset, R., Bujan, L., Bachaud, J., Chevreau, C., ... Thonneau, P. (2007). Impact of diagnostic delay in testis cancer: Results of a large population-based study. *European Urology*, 52(6), 1710–1716. doi:https://dx.doi.org/10.1016/j.eururo.2007.06.003
- Kamel, M. H., Elfaramawi, M., Jadhav, S., Saafan, A., Raheem, O. A., & Davis, R. (2016). Insurance status and differences in treatment and survival of testicular cancer patients. *Urology*, 87, 140–145. doi:https://dx.doi.org/10.1016/j.urology.2015.06.059
- Kokorowski, P. J., Routh, J. C., Nelson, C. P., & Graham, D. A. (2010). Variations in timing of surgery among boys who underwent orchidopexy for cryptorchidism. *Pediatrics*, 126(3), E576–E582.
- Lawrence, H. C., & Ness, D. L. (2017). Planned parenthood provides essential services that improve women's health. *Annals of Internal Medicine*, 166(6), 443–444. doi:https://dx.doi.org/10.7326/M17-0217
- Lerro, C. C., Robbins, A. S., Fedewa, S. A., & Ward, E. M. (2014). Disparities in stage at diagnosis among adults with testicular germ cell tumors in the national cancer data base. *Urologic Oncology*, 32(1), 23.e15–23.e21. doi:https://dx.doi.org/10.1016/j.urolonc.2012.08.012
- Litchfield, K., Shipley, J., & Turnbull, C. (2015). Common variants identified in genome-wide association studies of testicular germ cell tumour: An update, biological insights and clinical application. *Andrology*, 3(1), 34–46. doi:https://dx.doi.org/10.1111/andr.304
- Markt, S. C., Lago-Hernandez, C. A., Miller, R. E., Mahal, B. A., Bernard, B., Albiges, L., ... Sweeney, C. J. (2016). Insurance status and disparities in disease presentation, treatment, and outcomes for men with germ cell tumors. *Cancer*, 122, 3127–3135. doi:https://dx.doi.org/10.1002/cncr.30159
- Mossanen, M., Izard, J., Wright, J. L., Harper, J. D., Porter, M. P., Daratha, K. B., ... Gore, J. L. (2014). Identification of underserved areas for urologic cancer care. *Cancer*, 120(10), 1565–1571. doi:https://dx.doi.org/10.1002/cncr.28616
- Mulye, T. P., Park, M. J., Nelson, C. D., Adams, S. H., Irwin, J. E., & Brindis, C. D. (2009). Review article: Trends in adolescent and young adult health in the United States. *Journal of Adolescent Health*, 45(1), 8–24. doi:https://dx.doi.org/10.1016/j.jadohealth.2009.03.013
- Öztürk, Ç., Fleer, J., Hoekstra, H. J., & Hoekstra-Weebers, J. M. (2015). Delay in diagnosis of testicular cancer: A need for awareness programs. *Plos One*, 10(11), 1–10. doi:https://dx.doi.org/10.1371/journal.pone.0141244
- Parenti, G. C., Giorgi, U. D., Gaddoni, E., Conteduca, V., Zago, S., Campioni, P., ... Albello, F. (2014). Testicular microlithiasis and testicular germ cell tumors: A seven year retrospective study. *Andrology-Open Access*, 3(1). doi:https://dx.doi.org/10.4172/2167-0250.1000115
- Pedersen, M. R., Bartlett, E. C., Rafaelsen, S. R., Osther, P. J., Vedsted, P., Sellars, M. E., ... Møller, H. (2017). Testicular microlithiasis is associated with ethnicity and socioeconomic status. *Acta Radiologica Open*, 6(8), 1. doi:https://dx.doi.org/10.1177/2058460117723676
- Piltoft, J. S., Larsen, S. B., Dalton, S. O., Johansen, C., Baker, J. L., Cederkvist, L., & Andersen, I. (2017). Early life risk factors for testicular cancer: A case-cohort study based on the Copenhagen School Health Records Register. *Acta Oncologica*, 56(2), 220–224. doi:https://dx.doi.org/10.1080/0284186X.2016.1266085
- Planned Parenthood Federation of America (PPFA). (n.d.). *Our health, our decisions, our moment, 2013–2014 annual report*. Retrieved from https://www.plannedparenthood.org/files/6714/1996/2641/2013-2014_Annual_Report_FINAL_WEB_VERSION.pdf
- Planned Parenthood Federation of America (PPFA). (2015). *By the numbers*. Retrieved from http://plannedparenthood.org/files/3314/3638/1447/PP_Numbers.pdf
- Ries, L. G. (2007). Cancer survival among adults: U.S. SEER program, 1988–2001. In L. A. G. Ries, J. L. Young, G. E. Keel, M. P. Eisner, Y. D. Lin & M.-J. D. Horner (Eds.), *Patient and tumor characteristics* (pp. 81–88). Bethesda, MD: U.S. Department of Health and Human Services, National Institutes of Health, National Cancer Institute.
- Rovito, M. J., Manjelienskaia, J., Leone, J. E., Lutz, M., Cavayero, C. T., & Perlman, D. (2015). Recommendations for treating males: An ethical rationale for the inclusion of Testicular Self-Examination (TSE) in a standard of care. *American Journal of Men's Health*, 12(3), 539–545.
- Skakkebaek, N. E., Meyts, E. R.-D., Louis, G. M. B., Toppari, J., Andersson, A., Eisenberg, M. L., ... Juul, A. (2016). Male reproductive disorders and fertility trends: Influences of environment and genetic susceptibility. *Physiological Reviews*, 96(1), 55–97. doi:https://dx.doi.org/10.1152/physrev.00017.2015
- Siegel, R. L., Miller, K. D., & Jemal, A. (2017). Cancer statistics, 2017. *CA: A Cancer Journal for Clinicians*, 67(1), 7–30. doi:https://dx.doi.org/10.3322/caac.21387

- Sun, M., Abdollah, F., Liberman, D., Abdo, A., Thuret, R., Tian, Z., ... Karakiewicz, P. I. (2011). Racial disparities and socioeconomic status in men diagnosed with testicular germ cell tumors: A survival analysis. *Cancer*, *117*(18), 4277–4285. doi:<https://dx.doi.org/10.1002/cncr.25969>
- Topulos, G. P., Greene, M. F., & Drazen, J. M. (2015). Planned parenthood at risk. *The New England of Medicine*, *373*(10), 963. doi:<https://dx.doi.org/10.1056/NEJMe1510281>
- U.S. Cancer Statistics Working Group. (2017). *United States cancer statistics: 1999–2014 incidence and mortality web-based report*. Atlanta: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention and National Cancer Institute. Retrieved from <http://www.cdc.gov/uscs>
- Watson, J. (2014). Young African American males: Barriers to access to health care. *Journal of Human Behavior in the Social Environment*, *24*(8), 1004. doi:<https://dx.doi.org/10.1080/10911359.2014.953416>
- Zeron-Medina, J., Wang, X., Repapi, E., Campbell, M., Su, D., Castro-Giner, F., ... Bond, G. (2013). A polymorphic p53 response element in kit ligand influences cancer risk and has undergone natural selection. *Cell*, *155*(2), 410–422. doi:<https://dx.doi.org/10.1016/j.cell.2013.09.017>