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Prevalence of and factors associated with mammography and prostate-specific antigen screening among World Trade Center Health Registry enrollees, 2015–2016

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ABSTRACT

To compare the prevalence of mammography and prostate-specific antigen (PSA) testing in 9/11-exposed persons with the prevalence among the US population, and examine the association between 9/11 exposures and these screening tests using data from the World Trade Center Health Registry (WTCHR) cohort. We studied 8190 female and 13,440 male enrollees aged ≥40 years at survey completion (2015–2016), who had a medical visit during the preceding year, had no self-reported breast or prostate cancer, and did not have screening for non-routine purposes. We computed age-specific prevalence of mammography (among women) and PSA testing (among men), and compared to the general population using 2015 National Health Interview Survey data (NHIS). We also computed the adjusted prevalence ratio (PR) and 95% confidence interval (95% CI) to examine the relationship between 9/11 exposures and screening uptakes using modified Poisson regression. Our enrollees had higher prevalences of mammogram and PSA testing than the US general population. 9/11 exposure was not associated with mammography uptake. Proximity to the WTC at the time of the attacks was associated with PSA testing in the age 60–74 group (PR = 1.06; 95% CI = 1.00–1.12). Among rescue/recovery workers and volunteers (RRW), being a firefighter was associated with higher PSA testing than other RRW across all age groups (40–49: PR = 1.45, 95% CI 1.16–1.81; 50–59: PR = 1.33, 95% CI 1.22–1.44; 60–74: PR = 1.14, 95% CI 1.06–1.23). Screening activities should be considered when studying cancer incidence and mortality in 9/11 exposed populations.

1. Introduction

Several studies of cancer among persons who were directly exposed to the World Trade Center terrorist attacks on September 11, 2001 (9/11) in New York City (NYC) have found a slight excess in the incidence of cancer overall (Li et al., 2012, 2016; Solan et al., 2013; Zeig-Owens et al., 2011). Excess breast cancer rate among civilians exposed to WTC disaster has been reported (Li et al., 2016), and excess cases of thyroid and prostate cancer have been found in several different cohorts (Boffetta et al., 2016), and associated with higher levels of 9/11-related exposures (Moir et al., 2016; Solan et al., 2013).

One common characteristic of these types of cancer is that they are detectable by screening. The US Preventive Services Task Force (USPSTF) recommends biennial screening mammography for women aged 50 to 74 years (Siu, 2016), but has discouraged PSA screening for prostate cancer since May 2012 (Moyer et al., 2012). Because federally-funded health care for 9/11-exposed persons is available through the World Trade Center Health Program (WTCHP), it is likely that persons who survived the 9/11 attacks have better access to medical care, and thus are offered cancer screening more often than the general population. For instance, health assessments including complete blood counts and prostate-specific antigen (PSA) test are offered every 12–18 months in the Fire Department of NYC (FDNY) (Boffetta et al., 2016; Zeig-Owens et al., 2011) to all participating male firefighters aged 45 years or older since 9/11 (Moir et al., 2016). Full medical exams including breast cancer screening are offered to non-FDNY exposed rescue/recovery workers who were enrolled in the World Trade Center Health Consortium (WTCHC) (Boffetta et al., 2016). It is unknown whether the observed excess in cancer incidence among 9/11-exposed persons is attributable to more rigorous screening of this population than of the general population.

We wished to examine whether 9/11-exposed persons underwent screening for cancer more frequently than the general population. We focused on screening for breast and prostate cancer because an

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increased incidence of each has been reported in previous WTC studies, and well-established national screening guidelines exist for both. We assessed the prevalence of screening for these two cancers among the World Trade Center Health Registry ("WTCHR") enrollees to provide information on cancer screening in this population, and examined associations of 9/11-related exposures with mammography and PSA screening.

2. Methods

2.1. Study population

The WTCHR has been described in detail elsewhere (Brackbill et al., 2009; Farfel et al., 2008). Briefly, between September 12, 2003 and November 24, 2004, 71,431 people completed a computer-assisted (95%) or in-person (5%) enrollment interview on demographics, exposures incurred during and after the WTC disaster, and health information. WTCHR enrollees include rescue/recovery workers and volunteers (RRW) and community members not involved in rescue/recovery (Farfel et al., 2008). Since the enrollment survey (Wave 1), the Registry has conducted three follow-up surveys (Waves 2–4) via mail, website, or telephone interview to collect updated health information. The adult response rate for Wave 2, Wave 3, and Wave 4 was 65.2%, 60.4%, and 51.6%, respectively.

The Wave 4 adult survey, administered March 2015 through January 2016, was the first Registry survey to inquire about cancer screening. Therefore, Wave 4 participants (n = 36,864) were eligible for this study. We excluded participants who were younger than 40 years old at the time of the survey (n = 3005), had not have a medical visit for routine check-up within the past 12 months (n = 7426), and missing age or answers for each screening question (n = 1926). On Wave 4, we asked "When did you last visit a doctor for a routine check-up that was not for a specific injury, illness, or condition?" The answers include "Within the last 12 months", "Over a year ago but less than 2 years ago", "2 or more years ago but less than 5 years ago", "5 or more years ago", and "Never in my life". Those who answered "Within the last 12 months" were considered as having a medical visit for routine check-up within the past 12 months, and therefore included in the study sample. For the screening questions, we asked "In the last 12 months, did you have a mammogram (for women) or a PSA test (for men)?" If participants answered "Yes" to the question, we further asked the purpose of their most recent screening test (i.e., as "part of routine examination", "because of a problem", "other reason", or "don't know"). The screening questions were adapted from the Cancer Control Supplement of the 2010 National Health Interview Survey (NHIS) (US Department of Health and Human Services, 2010). We excluded those who had screening for reasons other than routine examination to avoid the over-estimation of screening activity (n = 1323, including 374 women and 949 men). We also excluded women with self-reported breast cancer (n = 688) and men with self-reported prostate cancer (n = 866). The inclusion and exclusion criteria were adapted from a study that examined the PSA screening test in NHIS sample (Drazer et al., 2015). Our final sample for analysis included 21,630 participants, with 8190 women and 13,440 men.

The study was approved by the Institutional Review Board (IRB) at the New York City Department of Health and Mental Hygiene. The Centers for Disease Control and Prevention and New York City DOHMH IRBs approved the overall Registry protocols. Verbal consent was obtained from the participants at enrollment.

2.2. Study variables

The outcome variables of interest were self-reports of having a mammogram (for women) or PSA testing (for men) as "part of a routine examination" in the past 12 months.

The 9/11-related exposure variables were collected at Wave 1. These included Registry eligibility group, a dichotomous variable referring to either RRW or community members; proximity to the WTC site on 9/11 morning, defined as being south of Chambers Street in lower Manhattan on the morning of 9/11; and dust cloud/debris exposure on 9/11, defined as being outdoors in the dust and debris cloud resulting from the collapse of the WTC towers on 9/11.

Covariates included socio-demographic variables at Wave 4 (age, race/ethnicity, marital status, education level, household income, smoking status, and body mass index (BMI)), history of any clinician-diagnosed mental health disorders (PTSD, anxiety or depression), as previous literature reported under-utilization of screening for persons with mental health issues (Carney and Jones, 2006; Park et al., 2010), ever received services from WTCHP clinics, and family history of breast or prostate cancer. Family history of cancer was self-reported. We solicited this information using a skip pattern question structure. We asked "Has your biological father ever had cancers?" If yes, a follow-up question on type(s) of cancer is asked. The same method was used for asking cancer history of biological mother, biological brothers/sisters (include half-brothers/sisters but not step-brother/sister), and any other blood relatives. We categorized biological parents or siblings as first degree relatives, all other blood relatives as second degree or further, and all others who reported none as no family history.

2.3. Statistical analyses

All analyses were performed using SAS software (SAS Institute, Cary, NC, v9.4). Statistical significance was set at a 2-sided alpha = 0.05 level. We computed the prevalence of mammography and PSA testing in the last 12 months by socio-demographic variables, family history of cancer, and various types of WTC exposures. We described and compared the age-specific prevalence of cancer screening by level of family history using Pearson's chi-squared test.

We also compared the age-specific prevalence of each screening in the last 12 months to the general population using 2015 NHIS data (CDC, 2015). NHIS is a nationally representative cross-sectional survey sample of the civilian non-institutionalized population. The NHIS sampling design involves stratification, clustering and over sampling of specific sub-groups. We extracted age, sex, type of cancer diagnosed, and times of most recent routine medical visit from the "sample adult" dataset, time of most recent PSA testing and reason for testing from the "sample cancer" dataset (CDC, 2015) to compute prevalence of mammography and PSA testing in the NHIS sample with comparable inclusion criteria. We incorporated sampling weights to adjust for the complex survey design (CDC, 2016).

We used modified *Poisson* regression with a robust error variance (Zou, 2004) to examine the associations of WTC disaster-related exposure variables with having a mammogram among women or PSA testing among men, adjusting for covariates. We stratified the analyses by age 40–49 and 50–74 years for mammography, and by age 40–49, 50–59, and 60–74 years for PSA testing.

Since high WTC exposure level has been reported to be associated with increased incidence of prostate cancer among RRW (Boffetta et al., 2016), we performed a sub-analysis of PSA testing among male RRW to explore whether rescue/recovery-specific exposures were associated with screening. Rescue/recovery-specific exposures included total number of days worked at the WTC site, date of first arrival with or without working on pile, and worker categories. Workers were categorized into the FDNY and other firefighters, NYC Police responders, sanitation workers, and all other workers, since routine health monitoring may vary between worker categories (Yip et al., 2016).

3. Results

Compared to female Wave 4 participants who were excluded, a higher proportion of female participants in the current study were non-Hispanic Black (17.7% vs 12.9%); widowed, divorced, or separated