

# Transgender Individuals' Cancer Survivorship: Results of a Cross-Sectional Study

Ulrike Boehmer, PhD <sup>1</sup>; Jessica Gereige, MD<sup>2</sup>; Michael Winter, MPH<sup>3</sup>; Al Ozonoff, PhD<sup>4,5</sup>; and Nfn Scout, PhD<sup>6</sup>

**BACKGROUND:** Transgender individuals' cancer prevalence and transgender cancer survivors' health needs have received scarce attention. The current study compared transgender and cisgender individuals' cancer prevalence and described the health needs of transgender cancer survivors. **METHODS:** The authors used Behavioral Risk Factor Surveillance System data on 95,800 cisgender and transgender individuals who self-reported a cancer diagnosis. Using multiple logistic regression, they estimated cancer prevalence and calculated odds ratios with 95% confidence intervals of physical, psychological, overall health, and health behaviors of transgender survivors compared with cisgender survivors. **RESULTS:** After adjusting for confounders, transgender men had a significantly higher (>2-fold) number of cancer diagnoses compared with cisgender men, but not cisgender women. Cancer prevalence among gender nonconforming individuals and transgender women was not significantly different from that of cisgender men and cisgender women. Gender nonconforming survivors had significantly greater physical inactivity, heavy episodic alcohol use, and depression compared with cisgender men and cisgender women. Transgender men survivors were significantly more likely to report poor physical health and greater medical comorbidities and were less likely to report smoking compared with cisgender men and cisgender women. Transgender women survivors were significantly more likely to report diabetes compared with cisgender men and cisgender women and were more likely to report cardiovascular disease compared with cisgender women. **CONCLUSIONS:** Clinicians should be aware of the higher prevalence of cancer among transgender men and a potential survivorship bias among transgender individuals. Transgender survivors have considerable variation in their risk profile. Clinicians and health services can target gender nonconforming survivors' depression and health behaviors to improve survival and should address the complex comorbidities of transgender men and transgender women. *Cancer* 2020;126:2829-2836. © 2020 American Cancer Society.

**KEYWORDS:** cancer prevalence, cancer survivorship, comorbidities, disparities, gender minority, risk behaviors, transgender.

## INTRODUCTION

A recent estimate of the size of the transgender population in the United States proposes that 1.4 million adults self-report as transgender.<sup>1</sup> Transgender people are a diverse population comprised of individuals who reject a binary gender (eg, gender nonconforming) or who report a gender identity that is different from their assigned sex at birth.<sup>2</sup> In contrast, cisgender people (ie, nontransgender individuals) are defined as individuals whose assigned sex at birth is concordant with their gender. There are multiple reasons why concerns about transgender individuals' potentially higher cancer burden have been raised.<sup>3-5</sup> Transgender individuals have a high prevalence of human papillomavirus and HIV infections,<sup>5-7</sup> which are linked to approximately 15.4% of all cancers worldwide,<sup>8</sup> including cervical, anal, and AIDS-related cancers. Compared with cisgender individuals, transgender individuals are reported to have higher smoking rates<sup>9</sup> and elevated alcohol use.<sup>6</sup> To the best of our knowledge, transgender individuals' other lifestyle factors that may affect cancer prevalence, treatment, and survivorship (eg, physical activity) have hardly been explored to date.<sup>10</sup> Lifestyle behaviors are thought to cause approximately 42% of cancers.<sup>11</sup> These disparities by gender identity are compounded further within the context of cancer detection, in that transgender individuals report lower cancer screening rates compared with their cisgender peers.<sup>12-15</sup>

Case reports of cancer in transgender individuals<sup>5</sup> and recent epidemiologic studies have suggested that disparities in cancer incidence exist, with some cancers occurring more frequently among transgender individuals.<sup>16-19</sup> For example, Nash et al used national cancer registry data and found that, compared with cisgender peers, adult transgender individuals have a higher incidence of infection-related cancers. These are defined as cancers of the anus; base of the tongue and/or tonsil; cervix; liver and/or bile duct; oropharynx, hypopharynx, and/or pharynx; lymphomas (Hodgkin and non-Hodgkin); and Kaposi sarcoma.<sup>17</sup> Similarly, an analysis of a longitudinal insured cohort demonstrated higher risks of breast,

**Corresponding Author:** Ulrike Boehmer, PhD, Department of Community Health Sciences, Boston University School of Public Health, 801 Massachusetts Ave, Crosstown Center, Boston, MA 02118 (boehmer@bu.edu).

<sup>1</sup>Department of Community Health Sciences, Boston University School of Public Health, Boston, Massachusetts; <sup>2</sup>Section of Pulmonary, Allergy, Sleep, and Critical Care, Department of Medicine, Boston Medical Center, Boston, Massachusetts; <sup>3</sup>Biostatistics and Epidemiology Data Analytics Center, Boston University School of Public Health, Boston, Massachusetts; <sup>4</sup>Division of Infectious Diseases, Boston Children's Hospital, Boston, Massachusetts; <sup>5</sup>Department of Pediatrics, Harvard Medical School, Boston, Massachusetts; <sup>6</sup>National LGBT Cancer Network, Providence, Rhode Island

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endocrine, infection-related, and smoking-related cancers among transgender individuals compared with cisgender men and a higher risk of lymphatic and hematopoietic cancers compared with cisgender women.<sup>18</sup> In contrast, to the best of our knowledge, the cancer prevalence among transgender populations has not been researched thoroughly.

In the United States, an estimated 16.9 million cancer survivors were alive in 2019, and this number is projected to increase to 26.1 million by 2040. Concerns have been voiced regarding the health care system's preparedness to deliver survivorship care to the increasing volume of cancer survivors.<sup>20</sup> Efforts currently are underway to prepare for the delivery of high-quality cancer care to increasing numbers of diverse survivors, including underserved populations.<sup>21</sup> Meanwhile, the number of transgender survivors is unknown, which makes this focus on transgender survivorship timely.

Survivorship care aims to minimize the long-term and late physical and psychological effects of cancer. This is accomplished in part through recommendations for cancer survivors to have healthy lifestyle behaviors, including not smoking, exercising regularly, and drinking alcohol in moderation. Lifestyle behaviors and the mental and physical quality of life of transgender cancer survivors are unexamined questions, despite research demonstrating that transgender individuals have worse health behaviors<sup>6,9</sup> and worse mental and physical health compared with cisgender individuals.<sup>22</sup> The declared goal of the health care system is to deliver equitable high-quality care to all survivors, taking the diversity of survivors' needs into account.<sup>21</sup> Currently, the needs of transgender individuals with cancer are not known. This is an important gap in knowledge and may indicate that the health care system fails transgender survivors. In a recent survey, approximately 80% of oncology providers self-reported lacking knowledge about transgender health and needing education.<sup>23</sup> Therefore, describing the health behaviors and physical and mental conditions of transgender survivors is important and may alert clinicians to the needs of these individuals.

The Behavioral Risk Factor Surveillance System (BRFSS) data of the US population is to our knowledge the first federal surveillance system to release a population-based probability data set that includes gender minorities. Using this cross-sectional data, we performed a secondary data analysis. The first objective of the current study was to determine the cancer prevalence of transgender compared with cisgender individuals. The second objective was to identify transgender cancer survivors'

quality of life, physical conditions, mental conditions, and health behaviors compared with cisgender survivors.

## MATERIALS AND METHODS

The current study used existing public use data and therefore was considered nonhuman subjects research.

### *Study Population*

We pooled 2014 to 2018 BRFSS data, using those from states that collected data regarding sexual orientation and gender minority status. This resulted in data from 37 US states and Guam. We then restricted the analytic sample to individuals who responded to the question, "Do you consider yourself to be transgender" with "no," "yes, transgender male-to-female," "yes, transgender female-to-male," or "yes, transgender gender nonconforming" and also responded to the question, "Have you ever been told that you have cancer, other than skin cancer?" with "yes" or "no." All refusals and answers of "don't know" and "not sure" for either question were excluded. This resulted in a sample of 955,469 individuals. Because we categorized cisgender respondents into men and women, we removed cisgender individuals with unknown or missing sex, which resulted in a final analytic sample of 954,908 respondents: 950,811 cisgender and 4,097 transgender individuals.

### *Measures*

Because biological sex is linked to some cancers (eg, cervical or prostate cancer), we created a 5-level gender variable from the variables of sex and gender minority status, which resulted in 1877 transgender women, 1344 transgender men, 876 gender nonconforming individuals, 410,422 cisgender men, and 540,389 cisgender women. We included sociodemographic characteristics with a known association with cancer (age, race/ethnicity, educational level, marital status, and annual household income),<sup>24-26</sup> retaining BRFSS response categories or combining categories to avoid small cell sizes. Because poor access to medical care contributes to undiagnosed cancer or a delayed diagnosis,<sup>27</sup> we also considered dichotomous (yes/no) responses to: 1) not having health insurance; 2) lacking a trusted physician; and 3) avoiding medical care because of costs.

To estimate cancer prevalence, we relied on yes versus no responses to the question, "Have you ever been told that you have cancer, other than skin cancer?"

Outcomes for cancer survivors consisted of BRFSS items that are well-established measures of physical, mental, and overall health and health behaviors.

To capture physical and mental conditions, we used yes versus no responses to questions asking, “have you ever been told you have (condition)?” Because diabetes and cardiovascular disease are particular concerns for transgender individuals<sup>28</sup> and also affect cancer treatment and survival, we used yes versus no responses to the question regarding diabetes and to 3 questions about heart attack, coronary heart disease, and stroke, which we combined into cardiovascular disease. Similarly, because depression is an important concern among transgender individuals,<sup>28</sup> we used yes versus no responses to the question concerning depression. Overall health status distinguished those respondents who reported their general health as fair or poor versus those reporting their health as good or better. Physical and mental health statuses were derived from respondents’ reports of the number of days within the preceding 30 days during which their physical or mental health was not good. Consistent with earlier studies, we dichotomized both poor physical or mental health days into  $\geq 14$  days as an indication of frequent physical/mental distress versus infrequent distress, which was defined as  $\leq 13$  days.<sup>29</sup> Because a healthy lifestyle is strongly recommended for cancer survivors, we included measures of current smoking, defined as smoking cigarettes every day or some days; no physical activity and/or exercise during the past 30 days other than regular job; and heavy episodic alcohol drinking, defined as  $\geq 4$  drinks on at least 1 occasion within the past 30 days for women and  $\geq 5$  drinks on at least 1 occasion within the past 30 days for men.

### Statistical Analysis

All statistical analyses were performed using SAS statistical software (version 9.4; SAS Institute Inc, Cary, North Carolina) and considered the complex sampling design of the BRFSS, performing weighted analyses that used the raking weights provided with the BRFSS data set. Because the current data set was derived from 5 separate BRFSS data years, we adjusted the sampling weights for states that collected multiple years of gender identity data to ensure that states were represented proportionally. We calculated weighted frequencies and standard errors for categorical variables and means and standard errors for continuous variables, performing nondirectional statistical tests. We computed odds ratios (ORs) with 95% confidence intervals (95% CIs) using multiple logistic regression for each dichotomous outcome. Bivariate analyses of cancer and the sociodemographic and access-to-care variables demonstrated

significant associations. Therefore, we considered the sociodemographic and access-to-care variables as confounders in all logistic regressions.

### RESULTS

The demographic characteristics of BRFSS respondents are presented in Table 1. On average, all respondents were in their 40s, yet gender nonconforming individuals were the youngest with an average age of 40 years. The majority of all respondents reported white race and/or ethnicity. Transgender men and transgender women had the lowest educational attainment and all transgender groups had the lowest income with  $>40\%$  of each of the 3 transgender groups reporting  $< \$35,000$  in income. The 3 transgender groups were the least likely to report being married. Transgender men and women were most likely to report being without health insurance. The three transgender groups were more likely to report having unmet medical needs because of costs compared with cisgender men and cisgender women and being without a regular physician compared with cisgender women, but not cisgender men. The cancer prevalence rates ranged from 9.7% for transgender men who most frequently reported a diagnosis of cancer to cisgender men who had the lowest rate (5.6%). When focusing on cancer survivors only (results not shown), the 3 transgender groups comprised 0.37% of all cancer survivors, with transgender women making up the largest percentage (0.18%) followed by transgender men (0.13%), and with the gender nonconforming individuals forming the smallest group (0.06%).

After adjusting for the previously described confounders, transgender men were the only transgender group to report a significantly greater likelihood of cancer history compared with cisgender men but not compared with cisgender women. Transgender women and gender nonconforming individuals’ likelihood of cancer history was similar to that of cisgender men and cisgender women, although cancer prevalence among gender nonconforming individuals demonstrated a trend ( $P = .08$ ) toward elevated prevalence compared with cisgender men (Table 2).

In Table 3, we have provided adjusted ORs (aORs) for the physical and mental health and health behaviors of cancer survivors. Transgender men were found to have a significantly greater likelihood of poor physical health (aOR, 3.6; 95% CI, 1.2-10.8), cardiovascular disease (aOR, 4.8; 95% CI, 1.7-13.4), and diabetes (aOR, 7.1; 95% CI, 2.3-21.9) compared with cisgender

**TABLE 1.** Demographic Characteristics of the Transgender, Gender Nonconforming, and Cisgender Populations in the BRFSS, 2014 to 2018 (N = 954,908)

| Characteristics                    | Transgender Women % SE | Transgender Men % (SE) | Gender Nonconforming % (SE) | Cisgender Men % (SE) | Cisgender Women % (SE) |
|------------------------------------|------------------------|------------------------|-----------------------------|----------------------|------------------------|
| Unweighted sample size, no.        | 1877                   | 1344                   | 876                         | 410,422              | 540,389                |
| Weighted frequency, % (SE)         | 0.23 (0.01)            | 0.17 (0.01)            | 0.12 (0.01)                 | 47.80 (0.13)         | 51.69 (0.13)           |
| Sociodemographic variables         |                        |                        |                             |                      |                        |
| Mean age (SE), y <sup>a</sup>      | 45.49 (0.86)           | 43.25 (0.93)           | 38.73 (0.75)                | 47.22 (0.07)         | 49.13 (0.06)           |
| Age categories, y                  |                        |                        |                             |                      |                        |
| 18-44                              | 48.34 (2.64)           | 55.01 (2.98)           | 65.82 (4.31)                | 45.63 (0.19)         | 41.97 (0.18)           |
| 45-64                              | 34.53 (2.45)           | 27.53 (2.55)           | 22.78 (3.83)                | 34.88 (0.17)         | 34.83 (0.16)           |
| ≥65                                | 17.13 (1.61)           | 17.46 (2.12)           | 11.40 (1.85)                | 19.49 (0.13)         | 23.20 (0.13)           |
| Race/ethnicity                     |                        |                        |                             |                      |                        |
| Non-Hispanic white                 | 56.87 (2.66)           | 57.16 (3.17)           | 56.61 (5.13)                | 63.63 (0.20)         | 63.42 (0.18)           |
| Non-Hispanic black                 | 14.17 (1.82)           | 17.41 (2.63)           | 13.74 (3.35)                | 10.73 (0.12)         | 12.25 (0.12)           |
| Non-Hispanic other                 | 10.14 (1.43)           | 6.07 (1.35)            | 10.66 (3.48)                | 8.37 (0.13)          | 7.92 (0.13)            |
| Hispanic                           | 18.82 (2.36)           | 19.36 (2.81)           | 18.99 (3.58)                | 17.27 (0.18)         | 16.41 (0.16)           |
| Education                          |                        |                        |                             |                      |                        |
| ≤High school                       | 61.02 (2.45)           | 55.48 (3.00)           | 46.73 (5.25)                | 43.88 (0.19)         | 40.14 (0.18)           |
| Some college/technical school      | 25.46 (2.19)           | 32.07 (2.89)           | 35.36 (4.92)                | 29.88 (0.18)         | 32.78 (0.17)           |
| College graduate/graduate school   | 13.52 (1.39)           | 12.45 (1.41)           | 17.91 (3.03)                | 26.23 (0.14)         | 27.08 (0.14)           |
| Annual household income            |                        |                        |                             |                      |                        |
| <\$35,000                          | 46.70 (2.62)           | 44.00 (2.99)           | 41.75 (4.82)                | 29.03 (0.17)         | 34.56 (0.17)           |
| \$35,000-\$74,999                  | 17.82 (1.67)           | 16.54 (1.80)           | 14.78 (2.24)                | 25.56 (0.16)         | 22.93 (0.15)           |
| ≥\$75,000                          | 20.38 (2.43)           | 19.72 (2.86)           | 22.22 (3.97)                | 32.30 (0.17)         | 25.36 (0.15)           |
| Missing data <sup>b</sup>          | 15.10 (1.81)           | 19.74 (2.55)           | 21.25 (6.10)                | 13.11 (0.13)         | 17.15 (0.14)           |
| Marital status                     |                        |                        |                             |                      |                        |
| Married/unmarried couple           | 45.41 (2.61)           | 41.59 (3.00)           | 40.95 (4.80)                | 57.86 (0.19)         | 54.29 (0.18)           |
| Single/never married               | 33.67 (2.64)           | 37.05 (3.06)           | 41.89 (5.48)                | 26.34 (0.18)         | 20.45 (0.16)           |
| Widowed/separated/divorced         | 20.92 (1.93)           | 21.36 (2.30)           | 17.15 (3.19)                | 15.80 (0.13)         | 25.26 (0.14)           |
| Access to care                     |                        |                        |                             |                      |                        |
| Without health insurance           | 20.90 (2.67)           | 18.24 (2.28)           | 13.15 (2.42)                | 13.23 (0.14)         | 10.40 (0.12)           |
| Without a personal physician       | 25.26 (2.77)           | 26.42 (2.69)           | 19.03 (2.76)                | 26.44 (0.18)         | 16.04 (0.14)           |
| Unmet medical care because of cost | 19.92 (2.45)           | 25.27 (2.99)           | 17.36 (2.67)                | 11.62 (0.12)         | 14.26 (0.13)           |
| Outcome                            |                        |                        |                             |                      |                        |
| Ever diagnosis of cancer           | 6.81 (1.10)            | 9.69 (2.58)            | 7.62 (2.81)                 | 5.57 (0.07)          | 8.39 (0.09)            |

Abbreviations: BRFSS, Behavioral Risk Factor Surveillance System; SE, standard error.

<sup>a</sup>Age was truncated at 80 years, coding all individuals aged ≥80 years as aged 80 years.

<sup>b</sup>Missing income was considered in the analysis.

men, but a significantly lower likelihood of smoking (aOR, 0.1; 95% CI, 0.0-0.4) and heavy alcohol use (aOR, 0.2; 95% CI, 0.1-0.8) compared with cisgender men. Similarly, compared with cisgender women, transgender men had a significantly greater likelihood of poor physical health (aOR, 3.8; 95% CI, 1.3-11.3), cardiovascular disease (aOR, 9.2; 95% CI, 3.3-26), and diabetes (aOR, 8.9; 95% CI, 2.9-27.6) but a significantly lower likelihood of smoking (aOR, 0.1; 95% CI, 0.00-0.4). Transgender women had a significantly higher likelihood of diabetes (aOR, 1.9; 95% CI, 1.1-3.5) compared with cisgender men and a significantly higher likelihood of cardiovascular disease (aOR, 2.9; 95% CI, 1.6-5.2) and diabetes (aOR, 2.4; 95% CI, 1.3-4.4) compared with cisgender women. Compared with cisgender men and cisgender women, gender nonconforming survivors had a significantly higher likelihood of physical inactivity (aOR, 8.3 [95% CI, 2.9-24.0];

and aOR, 7.2 [95% CI, 2.5-20.6], respectively), heavy episodic alcohol use (aOR, 10.4 [95% CI, 2.4-45.9]; and aOR, 18.2 [95% CI, 4.1-80.5], respectively), and depression (aOR, 6.0 [95% CI, 1.8-20.7]; and aOR, 3.9 [95% CI, 1.1-13.5], respectively).

## DISCUSSION

Cisgender populations' gender differences in cancer are known. Cancer incidence and cancer mortality are higher for cisgender men than cisgender women, and cancer prevalence is slightly lower for cisgender men compared with cisgender women.<sup>30-33</sup> To our knowledge, the current study is the first to add information regarding the cancer prevalence of gender minority individuals using a representative US sample. The results of the current study indicate that transgender men have a significantly higher likelihood of a cancer history compared with cisgender men and that their likelihood of cancer is similar to that

**TABLE 2.** Multiple Logistic Regression of the Likelihood of a Cancer Diagnosis (N = 954,908)<sup>a</sup>

|   | Cancer Diagnosis<br>aOR (95% CI)    | P   |
|---|-------------------------------------|-----|
| Using cisgender men as reference        |                                     |     |
| Transgender men vs cisgender men        | <b>2.29 (1.19-4.40)<sup>b</sup></b> | .01 |
| Transgender women vs cisgender men      | 1.33 (0.92-1.93)                    | .13 |
| Gender nonconforming vs cisgender men   | 2.15 (0.92-5.00)                    | .08 |
| Using cisgender women as reference      |                                     |     |
| Transgender men vs cisgender women      | 1.67 (0.87-3.22)                    | .12 |
| Transgender women vs cisgender women    | 0.97 (0.67-1.41)                    | .89 |
| Gender nonconforming vs cisgender women | 1.57 (0.67-3.66)                    | .29 |

Abbreviation: aOR, adjusted odds ratio.

<sup>a</sup>Model was adjusted for age, race/ethnicity, educational level, income, marital status, health care coverage, having a personal physician, and medical costs.

<sup>b</sup>Bold type indicates statistical significance.

of cisgender women. The likelihood of a cancer history among transgender women and gender nonconforming individuals was similar to that of cisgender men and cisgender women.

Cancer prevalence is a product of cancer incidence and cancer mortality. Therefore, the cancer prevalence of gender minorities needs to be appreciated within the context of earlier studies that examined cancer incidence and mortality among transgender individuals.<sup>4,16-18</sup> Cancer incidence studies pointed to the higher incidence of viral infection-related cancers and specific cancer types (eg, breast) among transgender individuals.<sup>4,16-18</sup> Currently, transgender cancer mortality data are available primarily from European studies,<sup>4</sup> indicating that transgender survivors have elevated cancer mortality. The results of the current study add to this by identifying an elevated cancer prevalence among transgender men. Others have cautioned that, due to access-to-care barriers, cancer may go undetected among transgender individuals, or they may present with late-stage cancers at the time of diagnosis and therefore experience increased mortality.<sup>19</sup> The current study was unable to clarify the question of undetected cancers or elevated cancer mortality; rather, we reported on cancer survivors who were alive and acknowledged the possible presence of survivorship bias. For now, the available BRFSS data from 37 states and Guam demonstrated that transgender survivors comprised approximately 0.37% of cancer survivors. When applying this percentage to the 16.9 million US cancer survivors, one can conclude that the national estimate of cancer survivors includes an estimated 62,530 transgender survivors, comprised of an estimated 30,420 transgender women, 21,970 transgender men, and 10,140 gender nonconforming individuals. However, these findings need to be confirmed by future longitudinal studies

that follow transgender cancer survivors from the time of diagnosis and provide detailed information regarding natal sex, gender identity, and cancer site.

The second objective of the current study, the identification of transgender survivors' health risk behaviors and physical and psychological conditions, also was novel. A healthy lifestyle, including not smoking, physical exercise, and drinking alcohol in moderation, is strongly recommended for cancer survivors<sup>33-35</sup> because there is strong evidence that a healthy lifestyle increases cancer survivorship.<sup>36,37</sup> We identified considerable variations in the risk profile among transgender survivor groups. Gender nonconforming survivors, but not transgender men and transgender women, have a greater likelihood of physical inactivity compared with cisgender men and cisgender women, which puts them at risk of poor survival. Moreover, gender nonconforming survivors have high levels of heavy alcohol use and depression compared with cisgender men and cisgender women. Consistently, research has pointed to associations between depression and unhealthy lifestyle behaviors, especially physical activity and alcohol use,<sup>38</sup> suggesting that gender nonconforming survivors are an at-risk group in urgent need of complex interventions to reduce alcohol use, physical inactivity, and depression. It is interesting to note that we found that transgender women and transgender men survivors had rates of smoking, alcohol use, and depression that either were similar to or lower than those of their cisgender counterparts. These findings differ from prior noncancer studies that demonstrated that transgender individuals had higher rates of smoking and alcohol use, as well as higher rates of depression.<sup>6,9,22</sup> This may be an artifact of a survivorship bias; further studies are needed to clarify these discrepancies.

Comorbidities at the time of diagnosis may limit treatment options; in addition, the toxicity of cancer treatments is known to cause cardiovascular disease as a late effect, which is why many professional provider organizations have issued guidelines to manage cardiovascular disease in cancer survivors.<sup>39</sup> Data have shown that a diagnosis of diabetes prior to or after a cancer diagnosis increases cancer survivors' mortality.<sup>40</sup> Cardiovascular disease and diabetes are the most common comorbid conditions among cancer survivors, and comorbidities have a negative effect on cancer survivors' long-term survival.<sup>41</sup> An important result of the current study relates to the findings of significantly higher rates of diabetes and cardiovascular disease in transgender survivors. Transgender men were found to have 9 times the odds of diabetes and

**TABLE 3.** Adjusted Logistic Regression of Cancer Survivors' Physical and Mental Health and Health Behaviors (N = 95,800)<sup>a</sup>

|  | Poor or Fair Health              | Poor Physical Health for ≥14 Days | Cardiovascular Disease            | Diabetes                          | Current Smoker                   | Physical Inactivity               | Heavy Episodic Alcohol Use         | Poor Mental Health for ≥14 Days | Depression                        |
|--|----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|----------------------------------|-----------------------------------|------------------------------------|---------------------------------|-----------------------------------|
| Using cisgender men as reference, aOR (95% CI)   |                                  |                                   |                                   |                                   |                                  |                                   |                                    |                                 |                                   |
| Transgender men                                  | 0.62<br>(0.18-2.15)              | 3.61 <sup>b</sup><br>(1.21-10.76) | 4.77 <sup>c</sup><br>(1.70-13.40) | 7.08 <sup>c</sup><br>(2.29-21.86) | 0.09 <sup>c</sup><br>(0.02-0.38) | 2.47 <sup>d</sup><br>(0.86-7.11)  | 0.20 <sup>b</sup><br>(0.05-0.84)   | 0.44<br>(0.09-2.10)             | 0.62<br>(0.16-2.32)               |
| Transgender women                                | 0.47 <sup>d</sup><br>(0.21-1.04) | 0.63<br>(0.33-1.22)               | 1.47<br>(0.81-2.66)               | 1.92 <sup>b</sup><br>(1.05-3.51)  | 0.69<br>(0.25-1.96)              | 1.33<br>(0.60-2.95)               | 1.37<br>(0.44-4.25)                | 1.23<br>(0.48-3.17)             | 1.64<br>(0.86-3.16)               |
| Gender nonconforming                             | 1.71<br>(0.45-6.58)              | 0.73<br>(0.20-2.67)               | 2.58<br>(0.45-14.84)              | 2.48<br>(0.44-14.19)              | 0.36<br>(0.09-1.45)              | 8.33 <sup>c</sup><br>(2.89-23.99) | 10.38 <sup>c</sup><br>(2.35-45.9)  | 1.49<br>(0.41-5.38)             | 6.02 <sup>c</sup><br>(1.75-20.73) |
| Using cisgender women as reference, aOR (95% CI) |                                  |                                   |                                   |                                   |                                  |                                   |                                    |                                 |                                   |
| Transgender men                                  | 0.77<br>(0.22-2.67)              | 3.81 <sup>b</sup><br>(1.28-11.33) | 9.24 <sup>c</sup><br>(3.29-25.97) | 8.92 <sup>c</sup><br>(2.89-27.55) | 0.10 <sup>c</sup><br>(0.03-0.43) | 2.13<br>(0.74-6.12)               | 0.36<br>(0.09-1.47)                | 0.34<br>(0.07-1.61)             | 0.40<br>(0.11-1.51)               |
| Transgender women                                | 0.58<br>(0.26-1.29)              | 0.67<br>(0.35-1.28)               | 2.85 <sup>c</sup><br>(1.58-5.16)  | 2.42 <sup>c</sup><br>(1.32-4.41)  | 0.79<br>(0.28-2.21)              | 1.14<br>(0.52-2.54)               | 2.40<br>(0.78-7.46)                | 0.95<br>(0.37-2.44)             | 1.07<br>(0.56-2.05)               |
| Gender nonconforming                             | 2.13<br>(0.55-8.17)              | 0.77<br>(0.21-2.81)               | 5.00 <sup>d</sup><br>(0.87-28.81) | 3.13<br>(0.55-17.88)              | 0.40<br>(0.10-1.64)              | 7.18 <sup>c</sup><br>(2.50-20.64) | 18.19 <sup>c</sup><br>(4.11-80.45) | 1.15<br>(0.32-4.15)             | 3.91 <sup>b</sup><br>(1.14-13.45) |

Abbreviation: aOR, adjusted odds ratio.  
<sup>a</sup>Unweighted survivor sample sizes were 120 for transgender men, 177 for transgender women, 60 for gender nonconforming individuals, 34,515 for cisgender men, and 60,928 for cisgender women.  
<sup>b</sup>P < .05.  
<sup>c</sup>P < .01.  
<sup>d</sup>P < .10.

cardiovascular disease compared with cisgender women. Compared with cisgender men, transgender men's odds of diabetes were 7-fold higher and they had 4 times the odds of cardiovascular disease. Transgender women also had higher odds of diabetes and cardiovascular disease compared with cisgender men and cisgender women. Recent studies that examined transgender individuals' health irrespective of cancer<sup>22,42-44</sup> did not report elevated rates of diabetes, but did demonstrate elevated cardiovascular disease in transgender men and transgender women. Although additional studies, including longitudinal studies, of transgender cancer survivors' health behaviors and health are needed, clinicians need to be aware of the likely more complex medical care needs of transgender men and transgender women with cancer, given their poor physical health, especially their comorbid diabetes and cardiovascular disease. Taken together, the health behaviors and comorbidities of transgender survivors provide evidence that these individuals are an at-risk group for poor survival.

The current study had several limitations. Although the study data were population based, they were derived from 37 US states and Guam and therefore may not adequately represent the entire US population. The data were cross-sectional, which placed limitations on the interpretation of the cancer prevalence, in that the length of time these individuals survived their cancer diagnosis was unknown, and it also was unknown how transgender survivors' quality of life and health characteristics were impacted by their diagnosis. In addition, because surveying transgender survivors who are alive captures the healthiest survivors only, this may point to a healthy survivor bias in the current study sample. This speaks to the need for longitudinal studies with transgender individuals to replicate the findings of the current study. Furthermore, there is unknown heterogeneity in these cancer survivors in that details regarding the stage and type of cancer, age at diagnosis, the treatment history, and the survivor phase were not captured by these data. We also lacked data regarding the use of hormone therapy and gender reassignment surgery status, which may change cancer risks among transgender individuals as well as overall physical health risks, such as cardiovascular risk. Another limitation of the current study was the small sample size of transgender, especially gender nonconforming, survivors compared with the larger population, which increases the probability of type II error and thus makes the interpretation of nonsignificant results uncertain.

**Conclusions**

The findings of the current study fill an important information gap regarding transgender individuals and cancer.

The absence of comprehensive surveillance data regarding transgender individuals severely hinders research within this population group. Moreover, because of the size of the transgender population, there are too few transgender patients at cancer centers or in most health care systems to conduct transgender cancer survivorship studies. Therefore, this study speaks directly to the previously identified need to conduct more research concerning transgender cancer survivors' needs and addresses oncologists' interest in gaining more knowledge regarding the health of transgender survivors.<sup>3,23</sup> Because of the increasing volume of cancer survivors who require survivorship care, discussions currently are ongoing regarding which cancer survivors need to be followed by oncologists versus primary care physicians.<sup>21</sup> The conclusions of the current study are that transgender survivors have complex medical needs that are best addressed by a multidisciplinary team of providers to tackle transgender survivorship care within the context of diabetes, cardiovascular disease, and depression.

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#### AUTHOR CONTRIBUTIONS

**Ulrike Boehmer** conceived of the study, finalized the analysis, and led the writing. **Jessica Gereige** and **Nfn Scout** contributed to the writing. **Michael Winter** contributed to the analysis. **Al Ozonoff** guided the statistical analysis. All authors helped with the interpretation of the results and edited and approved the final article.

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