Suicide and cancer: a gender-comparative study

W. S. Kendal*
Division of Radiation Oncology, The Ottawa Hospital Regional Cancer Centre, Ottawa, Ontario; The Ottawa Hospital Research Institute, Ottawa, Ontario, Canada

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Background: Persons with cancer commit suicide more frequently than those without, and males generally commit suicide more frequently than females. A population-based analysis of cancer patients was carried out here, comparing suicide risk between the genders, to elucidate the features specific to each gender.

Patients and methods: A total of 1.3 million cancer cases from the Surveillance, Epidemiology, and End Results program were analyzed. Cox proportional hazards models were fitted to personal, tumor-related, and social variates.

Results: A total of 265 female and 1307 male suicides were enumerated, reflecting 0.04% and 0.19% from each gender, and providing an overall hazard ratio for male suicide of 6.2 [95% confidence interval (CI) 5.4–7.1]. Females with colorectal (P = 0.01) and cervical (P < 0.0001) cancers showed decreased suicide rates. Males with head and neck cancers (P < 0.0001) and myeloma (P = 0.02) had increased rates, whereas rates were decreased in males with lung cancer (P = 0.01), liver (P = 0.01), brain tumors (P = 0.04), and leukemia (P = 0.007). The hazard ratio associated for male suicide with distant metastasis was 2.84 (95% CI 2.49–3.24); for married status, 0.46 (95% CI 0.39–0.54); and for African-American ancestry, 0.24 (95% CI 0.17–0.34)—comparable ratios were seen here for female suicides. In head and neck cancers, with both genders analyzed together, the suicide hazard was increased if surgery was contraindicated (3.0, 95% CI 1.3–6.8), but not if refused.

Conclusions: The high-risk patient was male, with head and neck cancer or myeloma, advanced disease, little social or cultural support, and limited treatment options. Oncologists and allied health professionals should be aware of the potential for suicide in cancer patients and their associated risk factors.

Key words: cancer, gender, suicide

introduction

Each year in America about 1.4 million new cancers will be diagnosed [1], 570,000 persons will die of cancer [1], and another 1700 persons with cancer will commit suicide [2]. The causes underlying suicide are many [3]: in the general population, mental illness and substance abuse figure prominently [4, 5]. Male gender is a risk factor [6, 7] that can apparently affect other risk factors [3]. It remains unclear exactly how having cancer might influence suicide risk, and how gender differences might modulate these effects.

A number of studies have corroborated an increased rate of suicide among cancer patients. In Finland, suicides by female and male cancer patients were 1.9 and 1.3 times that of the general population [8]. In Connecticut [9] and Estonia [10], male cancer patients committed suicide at a higher rate, particularly just after diagnosis of their cancers; the rate in females was comparable to the general population. Swedish [11, 12], Swiss [13, 14], Italian [15], Japanese [16], Norwegian [17], and Danish [18] studies have all noted higher rates for both genders, maximal within the first few months of diagnosis.

Notwithstanding existential and quality of life (QoL) issues which might prompt suicide [19–21], psychological autopsy of cancer suicides commonly reveals affective disorders, a sense of loss, prior experience with cancer or debilitating disease, and inflexible personality traits [22]. Suicides in terminally ill patients seem to differ from those during cancer remission, the latter group exhibits higher frequencies of personal/familial mental disorder, as well as prior suicide attempts [23, 24].

In the general American population, males commit suicide about four times more frequently than females [25], although females will admit to attempts three times more frequently [26]. Comparatively little is known about how gender differences interplay with cancer suicide. A gender-comparative study of suicide in cancer patients could improve our understanding of the underlying factors, and possibly influence preventative and social policies. The Surveillance, Epidemiology, and End Results (SEER) registry [2] provides population-based data regarding the pathology, disease extent, treatment, social factors, and causes of death among individuals with cancer in the United States. This database was employed here to characterize gender-specific risk factors for suicide in cancer patients, with the aim to ascertain those most in need of supportive and preventative help.
patients and methods

study cohorts and data

The study population was derived from the April 2004 release of the November 2003 submission to the SEER 9 Public-Use population-based registry [2]. Data were retrieved from individuals with invasive cancer from all SEER anatomic sites that were diagnosed from 1973 to 2001. The study population was initially restricted to individuals with a single primary cancer, to better correlate suicide risk with each particular site. A further analysis of head and neck cancers included multiple primary cancers.

Information retrieved for each individual from the SEER database included each individual’s sex, age at diagnosis, cause of death, race and ethnicity, marital status at diagnosis, and survival time. As well, the anatomic site, grade, and SEER summary stage for each tumor were recorded. The SEER database did not provide the marital status of the study individuals at the time of last follow-up, nor information regarding substance abuse, associated psychiatric disorders, sexual orientation, employment status, family history, financial history, or QoL.

statistical analysis

Statistical analysis was carried out with SPSS. Two retrospective cohorts were defined, distinguished by gender. An assessment was carried out for all anatomic sites together, and separately for cancers of the breast, prostate, lung and bronchus, colon and rectum, urinary bladder, corpus uteri, pancreas, kidneys and renal pelvis, stomach, ovaries, thyroid, brain, cervix uteri, liver, testis, and esophagus. As well, individuals with non-Hodgkin’s lymphoma, Hodgkin’s disease, leukemia, myeloma, and melanoma were examined as separate categories.

A number of Cox proportional hazard analyses were carried out. These provided 95% confidence intervals for the hazard ratios, \( \phi \), as well as the Wald \( \chi^2 \) test [27]. Age at diagnosis was analyzed as a continuous variable; the remaining covariates were analyzed categorically.

Because completed suicide was a relatively rare event, relative to other causes of death, an assessment of the competing hazards was included. The cumulative incidence of completed suicide was calculated as a function of time from diagnosis, and corrected for competing hazards by the method of Satagopan et al. [28].

results

Data from 1,316,762 individuals were retrieved from the SEER database (Table 1). For both genders considered together, the median age at diagnosis was 66 years with a range of 0–115 years. Female cancer patients tended to be younger at diagnosis, had a lower age at diagnosis, and had longer follow-up periods than males. The frequency of completed suicides for females was 0.02%, about one-fifth that of males; the hazard ratio for male suicide relative to females was 6.2. Females also experienced a lower death rate from other causes, when compared with the study population (Table 1). The male cohort revealed disproportionately more white and African-Americans than

<table>
<thead>
<tr>
<th>Table 1. Gender-specific population characteristics (N = 1,316,762)</th>
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<tr>
<td><strong>Females</strong></td>
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<td>Number of cases</td>
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<td>Mean age at diagnosis (years)</td>
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<td>Median follow-up (months)</td>
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<td>Vital status</td>
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<td>Alive</td>
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<td>Completed suicide</td>
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<td>Death by other causes</td>
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<td>Suicide hazard ratio</td>
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<td>Race and ethnicity</td>
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<td>White</td>
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<td>African-American</td>
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<td>Others</td>
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<td>Marital status</td>
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<td>Distant</td>
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\(^a\) t test. 
\(^b\) \( \chi^2 \) test. 
\(^c\) 95% Confidence interval.

NOS, not otherwise specified; SEER, surveillance, epidemiology, and end results.
the female cohort; more males were married at the time of diagnosis, whereas more females were widowed or divorced. For females, the cancers more frequently revealed regional nodal involvement at diagnosis; for males, they were more frequently localized or metastatic. Figure 1A provides the comparative frequencies of completed suicide by females and males, plotted against age. Suicide occurred most frequently during the adult decades. These age and gender-specific frequencies appeared to be in proportion to those seen within the general American population [29].

Table 2 details the frequencies of suicidal death specific to each cancer site. Data particular to each site were compared with the suicide frequency from the remaining sites. When the pooled female and male data were analyzed, cancers of the lung and bronchus, urinary bladder, head and neck, esophagus, and myeloma revealed relatively high suicide rates, whereas the rates were lower for cancers of the breast and liver. This pattern, however, did not persist on gender-specific analysis. The suicide rates for most anatomic sites from females were essentially similar, except for colorectal and cervical cancers which revealed lower rates relative to the remaining sites analyzed from the female cohort. The suicide rates for male head and neck cancer, liver cancer, and myeloma remained elevated relative to the remaining male cohort, recapitulating the results from the pooled female and male data. The rates for cancers of the urinary bladder, esophagus, and lung and bronchus in males, however, were not elevated when compared with the remaining male cohort. Moreover, the suicide rates for male leukemia and prostate and brain cancers were actually lower than those seen with the other male sites.

The cumulative incidence of suicidal death within each cohort was then calculated and plotted versus time from diagnosis (Figure 1B). Corrections were applied here for both competing hazards and for the censoring of survivors. Male suicides occurred with higher incidence than for females throughout, and the rate was highest immediately after cancer diagnosis. In contrast, the incidence of female suicide remained more or less constant over time, as reflected by a nearly linear relationship between the cumulative incidence and time. The combined incidence of suicide within the SEER cancer population, and estimated by actuarial methods, was elevated at 24 cases per 100 000 when compared with the observed 10.6 yearly suicides per 100 000 from the general American population [30].

Proportional hazard models were constructed to determine the factors that associated with suicide within each gender (Table 3). The strongest association with suicide was with distant metastasis at diagnosis ($\phi = 2.3$). Married status at diagnosis carried with it a reduced hazard ratio ($\phi = 0.67$). Race and ethnicity provided the next strongest association: the suicide hazard was reduced for African-American females compared with white females ($\phi = 0.17$).

For males, the strongest association with suicide was with distant metastasis ($\phi = 2.8$, Table 3). Here, the intermediate stages also afforded elevated hazard ratios. As with females, divorced status carried an increased suicidal hazard. The suicide hazard for married males was significantly decreased ($\phi = 0.46$). African-American males experienced a reduced suicidal hazard, similar to that seen with females ($\phi = 0.24$). As well, the hazard ratio for suicide increased by $\phi = 1.03$/year of age in males.

Since head and neck cancers provided the highest incidence of suicide of any site, an additional proportional hazards model was constructed for this site alone (Table 4). SEER did not provide data with respect to substance abuse in this population, and thus, this covariate could not be examined. Of the available data, male gender remained the dominant risk factor ($\phi = 4.7$). If the head and neck cancer was the first primary site, the hazard for suicidal death was significantly decreased ($\phi = 0.5$) compared with cases where the head and neck tumor was not the first primary cancer. White individuals with head and neck cancers exhibited a greater suicide hazard. As well, those with distant spread in their cancer showed an increased suicidal hazard, in keeping with the earlier analyses. The suicide risk for these head and neck cancers was also increased with age and was decreased with married status.

Figure 1. (A) Proportion of completed suicides within cancer patients versus age at diagnosis. The percentage of persons who committed suicide relative to the total number diagnosed with cancer was calculated for each decade of life. The percentages of females within each decade of life were as follows (in sequence of increasing age): 0.7, 0.7, 2.0, 6.0, 13.2, 17.5, 21.9, 23.5, 12.3, and 1.98. For males the sequenced percentages were as follows: 0.8, 0.8, 1.5, 3.8, 7.3, 11.1, 30.9, 29.0, 10.5, and 1.0. Suicide appeared to be in proportion to those seen within the general American population [29].

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A number of additional covariates were included with the head and neck cancer analysis. The hazard for suicidal death increased with histological grade, in contrast to the analyses from Table 3, where it did not have any significant role in the regression models (data not provided). If cancer-directed surgery had been contraindicated, the suicide hazard was also increased. No similar significant relationships could be demonstrated between suicide and either the use, non-use, or...
refusal of therapeutic irradiation (data not provided). When the different head and neck sites were analyzed separately and compared with the index group drawn from laryngeal cancer, only those with oropharyngeal cancer revealed a statistically significant association with suicide ($p = 0.3$). Indeed, when the 32,598 laryngeal cancer cases were analyzed separately (data not provided), there was no major association with the use of either radiotherapy or cancer-directed surgery, and neither did the sequence of surgery followed by radiotherapy reveal any statistically significant association with suicidal death. For these laryngeal cancers, such surgery would likely have involved major procedures such as laryngectomy, and so, the likely functional losses did not seem associated with an increased suicide rate.

### Discussion

It was not possible to differentiate, on the basis of the SEER data, between suicides associated with affective illness or substance abuse and those motivated by the desire for relief from terminal illness or the avoidance of being a burden to others. The SEER database did provide information regarding potential risk factors for depression in cancer, such as advanced stage [31], pancreatic cancer [32, 33], refusal of treatment [34], unmarried patients with head and neck cancer [35], and (through the documentation of marital status) a lack of family support [36]. One aim of this study had been to examine how surrogate factors such as these might relate to suicide risk. Advanced stage was one of the stronger risk factors for suicide in this analysis. On the other hand, this study showed that pancreatic cancer carried with it no more suicide risk than that experienced by the general population of cancer patients. Similarly, refusal of either surgical treatment or radiotherapy did not figure as significant risk factors in the present analysis. There was, however, a significant association of suicidal death when surgery was deemed contraindicated, a feature likely indicative of advanced tumor features or additional comorbidities. The data presented here did confirm that married status conferred a lower risk of suicide. Overall, it would seem plausible to conclude that depression played a likely role in many of the suicides from the study population. Poor prognostic features for cancer cure also associated strongly with suicide risk. Metastatic disease at diagnosis, cancer-directed surgery that could not be carried out (for head and neck cancers), high-grade tumors, or treatment contraindications, all were associated with increased risk. On the other hand, for aggressively treated patients there was no increased risk, even if the treatment might presumably have lead to major loss of function, as might occur with head and neck cancers. The head and neck cancer analysis revealed that oropharyngeal cancer was particularly associated with suicide risk. These tumors are also associated with major QoL deficiencies and depression [37, 38]. Even among persons with oropharyngeal cancer, an aggressive approach can provide improvement in their emotional functioning and QoL [37, 39].

Race and ethnicity had a significant influence on suicide risk. The suicide hazard experienced by African-Americans was decreased, consistent with the relative reduction of suicides by African-Americans in the general population [40]. Religious beliefs, family support, and a cultural rejection of suicide have been thought responsible for their decreased suicide hazard [41]. In this study, there had been a 4.8 times excess in the overall number of male suicides over females (Table 1), consistent with

### Table 3. Gender-specific proportional hazards model for completed suicides

<table>
<thead>
<tr>
<th>Covariate</th>
<th>Completed suicides by females</th>
<th>Hazard ratio (CI&lt;sup&gt;a&lt;/sup&gt;)</th>
<th>Wald statistic</th>
<th>Significance</th>
<th>Completed suicides by males</th>
<th>Hazard ratio (CI&lt;sup&gt;a&lt;/sup&gt;)</th>
<th>Wald statistic</th>
<th>Significance</th>
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<td>SEER stage</td>
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<tr>
<td>Localized&lt;sup&gt;b&lt;/sup&gt;</td>
<td>28.4</td>
<td>$P &lt; 0.001$</td>
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<tr>
<td>Direct extension</td>
<td>2.3</td>
<td>NS</td>
<td>1.4 (0.9–2.2)</td>
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<tr>
<td>Regional nodes</td>
<td>1.1</td>
<td>NS</td>
<td>1.2 (0.8–1.8)</td>
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<tr>
<td>Direct extension and nodal</td>
<td>0.2</td>
<td>NS</td>
<td>1.1 (0.6–2.1)</td>
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<td>involvement</td>
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<td>Regional NOS</td>
<td>2.2</td>
<td>NS</td>
<td>2.0 (0.8–4.9)</td>
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<td>Distant metastasis</td>
<td>27.1</td>
<td>$P &lt; 0.001$</td>
<td>2.3 (1.7–3.1)</td>
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<td>Marital status</td>
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<td>Single&lt;sup&gt;c&lt;/sup&gt;</td>
<td>20.2</td>
<td>$P &lt; 0.001$</td>
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<td>Married</td>
<td>3.9</td>
<td>0.048</td>
<td>0.67 (0.48–0.99)</td>
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<tr>
<td>Widowed</td>
<td>0.6</td>
<td>NS</td>
<td>0.8 (0.5–1.3)</td>
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<td>Divorced</td>
<td>3.5</td>
<td>NS</td>
<td>1.5 (0.98–2.4)</td>
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<tr>
<td>Separated</td>
<td>0.02</td>
<td>NS</td>
<td>1.1 (0.3–4.6)</td>
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<td>White&lt;sup&gt;d&lt;/sup&gt;</td>
<td>16.7</td>
<td>$P &lt; 0.001$</td>
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<tr>
<td>African-American</td>
<td>12.2</td>
<td>$P &lt; 0.001$</td>
<td>0.17 (0.06–0.46)</td>
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<td>Others</td>
<td>3.8</td>
<td>NS</td>
<td>1.5 (0.998–2.17)</td>
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<tr>
<td>Age at diagnosis</td>
<td>0.99</td>
<td>NS</td>
<td>1.0 (0.996–1.013)</td>
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<sup>a</sup>95% Confidence interval.
<sup>b</sup>Indicator category.
<sup>c</sup>NOS, not otherwise specified; NS, not significant; SEER, surveillance, epidemiology, and end results.

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**References**

[31] Advanced stage
[32] Pancreatic cancer
[33] Refusal of treatment
[34] Unmarried patients with head and neck cancer
[35] Lack of family support
[36] Religious beliefs, family support, and cultural rejection of suicide
[37] Emotional functioning and QoL improvement
[38] Oropharyngeal cancer
[39] Aggressive approach
[40] African-Americans
[41] Decreased suicide hazard by African-Americans

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**Footnotes**

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- [38]: Oropharyngeal cancer
- [39]: Aggressive approach
- [40]: African-Americans
- [41]: Decreased suicide hazard by African-Americans
Gender

neck cancer

soon after the diagnosis of cancer [9, 10], this observation was

[25]. Other studies have noted the rate of suicide to be highest

the 4.5 times ratio seen among the general American population

[25]. The suicide risk was decreased in females with colorectal and
cervical cancer. On the other hand, breast cancer in females
revealed a risk similar to the overall female cancer population,
a result at variance with an earlier report of an increased risk
of suicide among Danish women with breast cancer [18]. In
males, suicide risk was decreased for cancers of the prostate,
brain, liver, and leukemia. Their risk was increased for head
and neck cancer and myeloma, but a similar pattern was not
seen with females. These results for males with head and neck
cancers would seem consistent with an increased level of
psychological distress particular to this site [35]; however,
pancreatic cancer patients purportedly also suffer from
increased distress, yet no increased risk was observed here.
Similarly, an increased suicide rate has been claimed for
prostate cancer [42], but not supported in the present analysis.

Many of the extremes seen within the male cohort were not
as apparent to the female cohort. Particularly with sites at
greatest risk for male suicide, such as head and neck cancer
and myeloma, issues with respect to QoL, coping, symptom
control, and psychological distress would seem foremost [37,
43]. The lack of such findings within the female cohort could
be attributable to a lower statistical power from the almost
five-fold fewer recorded female suicides. At the same time,
however, female cancer patients likely experienced similar
problems, but they may have been less inclined to react through
self-directed violence, much as seen within the general female
population [6].

The composite picture thus obtained for suicide risk was that
of a white male, with a new diagnosis of possibly head and neck
cancer or myeloma, widowed, with widely disseminated and
perhaps high-grade disease, or maybe a history of other cancers.
In contrast, for decreased risk, one might envision a female of
African-American heritage, with perhaps colorectal or cervical
cancer, localized disease, and living with her spouse. This
high-risk picture might be associated with substance abuse,
QoL, or psychological issues framed in the context of poor
family and cultural supports, as well as associated with a poor
prognostic outlook from the cancer. If we are to help people
cope with their cancer, medical and allied health care workers
should be perceptive to the risk for suicide in all cancer
patients—particularly those individuals with high risk factors
such as poor social support, substance abuse, and a history of
mental health problems.

acknowledgements

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