ORIGINAL ARTICLE

Cancer-Related Mortality in People With Mental Illness

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Context: There is a 30% higher case fatality rate from cancer in psychiatric patients even though their incidence of cancer is no greater than in the general population. The reasons are unclear, but if increased cancer mortality were due to lifestyle only, cancer incidence should be similarly increased. Other hypotheses include delays in presentation, leading to more advanced staging at diagnosis, and difficulties in treatment access following diagnosis.

Objective: To assess why psychiatric patients are no more likely than the general population to develop cancer but are more likely to die of it.

Design, Setting, and Patients: A population-based record-linkage analysis compared psychiatric patients with the Western Australian population, using an inception cohort to calculate rates and hazard ratios. Mental health records were linked with cancer registrations and death records from January 1, 1988, to December 31, 2007, in Western Australia.

Main Outcome Measures: Metastases, incidence, mortality, and access to cancer interventions.

Results: There were 6586 new cancers in psychiatric patients. Cancer incidence was lower in psychiatric patients than in the general population in both males (rate ratio=0.86; 95% CI, 0.82-0.90) and females (rate ratio=0.92; 95% CI, 0.88-0.96), although mortality was higher (males: rate ratio=1.52; 95% CI, 1.45-1.60; females: rate ratio=1.29; 95% CI, 1.22-1.36). The proportion of cancer with metastases at presentation was significantly higher in psychiatric patients (7.1%; 95% CI, 6.5%-7.8%) than in the general population (6.1%; 95% CI, 6.0%-6.2%). Psychiatric patients had a reduced likelihood of surgery (hazard ratio=0.81; 95% CI, 0.76-0.86), especially resection of colorectal, breast, and cervical cancers. They also received significantly less radiotherapy for breast, colorectal, and uterine cancers and fewer chemotherapy sessions.

Conclusions: Although incidence is no higher than in the general population, psychiatric patients are more likely to have metastases at diagnosis and less likely to receive specialized interventions. This may explain their greater case fatality and highlights the need for improved cancer screening and detection.

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Mortality rates in psychiatric patients are much greater than in the general population,[1-17] including Nordic countries where longstanding egalitarian health and welfare policies might be expected to facilitate treatment access.[1,6,8,9,13] Chronic physical disorders such as cardiovascular disease and cancer are the main cause,[8,10-12] accounting for 10 times the absolute numbers of suicide in one study but receiving far less attention.[11,18] In cancer, overall mortality is higher in psychiatric patients, even though the incidence is similar to that in the general population.[10,14,15,17] The disparity between incidence and mortality is most marked for several common sites such as prostate and colorectal cancers. Possible explanations might be delayed diagnosis or lack of access to screening, leading to more advanced staging at diagnosis, and reduced access to or use of appropriate treatments after diagnosis.

Cancer survival is dependent on both early diagnosis and access to effective therapies. Certain populations, including those of lower socioeconomic status, immigrants, those with poor literacy skills, and those living in rural areas, may not have easy access to screening or diagnostic services and therefore may be more vulnerable to morbidity and mortality associated with cancer. This includes fecal occult blood testing, endos-

Table 1. Western Australian Data Sources

Data Source	Data Obtained
Hospital Morbidity Data System	All inpatients receiving treatment in a public or private hospital in Western Australia
Mental Health Information System	All patients who have had contact with state-run community-based or outpatient mental health services in Western Australia or who have been psychiatric inpatients of any public or private hospital in the state
Western Australian Cancer Registry	All admissions to public or private hospitals and nursing homes; pathology reports for cancer specimens from pathology laboratories; data on people who die of cancer or patients with cancer who die of other diseases, from linkages to mortality files of the Registrar of Births, Deaths, and Marriages (see below) as well as hospital and pathology data
Registrar General's Death Registration Data	All death registrations in Western Australia including cause
Australian Bureau of Statistics	Estimated resident population for all of Western Australia

copy, colonoscopy, and sigmoidoscopy.[19,20] Further inequities have been demonstrated for treatment services. Individuals with low income, for example, are more likely to receive emergency, as opposed to elective, treatment of chronic diseases[16] and less likely to receive specialist procedures such as palliative radiotherapy.[21]

There has been less work on the effect of psychiatric illness on access to cancer care.[22] People with severe mental illness, including depression, are less likely to receive routine cancer screening,[23,24] but there is little information on access to specialist services following diagnosis.[25] If people with psychiatric illness are less likely to have screening, this may result in more advanced disease at presentation.

This study investigated to what extent the increased mortality from cancer in psychiatric patients was associated with later presentation, as marked by advanced disease at cancer diagnosis. The study also investigated whether, once diagnosed, there was equity of access to surgery, radiotherapy, and chemotherapy, determined by whether use matched need as implied by incidence and mortality. We used administrative data from Western Australia (WA) to measure both incidence and mortality rates from cancer in a geographically defined population of people with mental illness and compared them with those in the general population of WA, a state of approximately 2 million people with universal health care and population-wide coverage of cancer registration and use of mental health services.

In Australia, the states fund general and psychiatric hospitals as well as community mental health services, while federally funded Medicare pays for visits to family physicians and community specialists. Medicare covers all Australian residents, although copayment may be necessary. More affluent individuals may also buy health insurance for private-sector treatment.

METHODS

DATA SOURCES

This was a population-based record-linkage analysis of the WA Data Linkage System. Individual patient records are linked by probabilistic matching, using the Automatch software package (Matchware Technologies), as there are no unique identification numbers in the core data sets. Name, residential address, date of birth, and sex were used in the probabilistic matching, which is based on estimating the probability that any 2 records represent the same person (or event) while allowing for the possibility of errors or changes in the identifying information. We used the following data sets: the Hospital Morbidity Data System, Registrar General's Death Registration Data, Mental Health Information System, and WA Cancer Registry (**Table 1**).

The project identified all psychiatric patients in WA who presented with cancer. We used the case definition for psychiatric disorder validated by the Public Health Agency of Canada for use in administrative databases.[26] This is any contact with a health service with an *International Classification of Diseases, Ninth Revision* (*ICD-9*) diagnosis of 290-319 or *ICD-10* equivalent. We also included postpartum mental disorders (*ICD-9* code 648.4), suicide, and nonaccidental injury (*ICD-9* codes E950-959) as well as contact with the mental health system not covered by these *ICD-9* chapter 5 diagnoses to ensure comparability with previous work.[10,12,14]

We restricted the cohort to patients whose first contact with mental health services occurred between January 1, 1988, and December 31, 2007. The start of follow-up was the date of each patient's first contact with mental health services. Patients were censored at the occurrence of the event under study or December 31, 2007. We compared their outcomes with those of the general population through the calculation of age- and sex-standardized rates, which were then adjusted for confounders using multivariate analyses (see "Statistical Analysis"). Inception cohorts have greater validity owing to the inclusion of all the follow-up time at risk, thereby reducing the risk of survivorship bias.[27]

We collected basic information on cancer treatment, including whether chemotherapy or radiotherapy was commenced within 90 days of cancer diagnosis, number of chemotherapy or radiotherapy sessions, and whether the tumor was surgically removed.[28,29] In WA, chemotherapy as a day patient is recorded within the Hospital Morbidity Data System. We also collected information on time from diagnosis to surgery.

DATA QUALITY

Data quality in epidemiological research can be assessed through the precision of the disease estimate, the control of confounders, and the degree of selection and information bias.[30] In this study, the precision of the disease estimate was maximized through the size of the WA Data Linkage System data set, which covers 2 million residents.[31] Selection bias was minimized through coverage of all public and private inpatient admissions as well as public outpatient and ambulatory care contacts with mental health services across the state.[31] Information bias was reduced through the use of aliases and phonetic spelling in probabilistic linkage protocols to minimize linkage failures due to name changes and spelling variants.[31] Cross-linkage with the other databases within the system further aided the identification of identity errors. Loss to follow-up due to death was reduced by linkage to mortality data, while loss to follow-up through emigration was minimized by the state's geographical isolation and economic growth. This has led to population flow into

rather than out of the state.[31] Checks of data integrity include the ratio of the number of new cancer diagnoses registered to the number of cancer deaths (mortality to incidence ratio).[32] If trends in incidence, mortality, and migration are constant, the ratios should remain steady. All-cancer mortality to incidence ratios for 2008 were similar for males and females (0.32 and 0.29, respectively), and mortality to incidence ratios have been relatively stable in recent years.[32] In another example, hospital morbidity data were checked against 1050 clinical records at 7 hospitals. This found 87% agreement with the data in the Hospital Morbidity Data System.[33] A further study checked the consistency of recording fixed personal characteristics such as sex across different data sets for the same person. Sex was consistently recorded across all records for 98.5% of the study population and date of birth (to an exact same date) was consistent for 83.3% of records.[10] Lastly, linking different registers covering the same population increases the chance that variables not available in one database may be available in another, thereby maximizing the ability to control for confounders.[31] In a study of linked hospital morbidity, mental health, and mortality data, no record had a missing principal diagnosis. The least complete sociodemographic variable was still present in 99.99% of records.[33]

CLASSIFICATIONS OF MENTAL DISORDERS AND CANCERS

Among the psychiatric cases, we used a hierarchy of last available vs earlier diagnoses and inpatient vs outpatient care, reflecting increasing data reliability. A principal psychiatric diagnosis was assigned to each patient who had contact with mental health services using the following procedure. The final diagnosis in a care episode was taken to allow for revision of preliminary diagnoses during a period of observation or treatment. Diagnoses prior to 2000 were mapped from *ICD-9* to *ICD-10*. The last occurring psychiatric diagnosis across the episodes was then assigned as the principal diagnosis according to a diagnostic hierarchy. If an earlier diagnosis was higher in the hierarchy than the last recorded diagnosis, the earlier diagnosis was taken as the principal diagnosis. The hierarchy gave precedence to organic and psychotic disorders, allowed for conditions such as substance dependence to be considered as potential comorbidities, and then gave preference to conditions within chapter 5 in *ICD-9*, or equivalent. Nonspecific disorders outside chapter 5 in *ICD-9*, or equivalent, came last.

Preference was given to diagnoses made in inpatient treatment units over diagnoses from outpatient clinics or psychiatric residential units. The most recent inpatient diagnosis took precedence over the most recent outpatient diagnosis even if the admission predated any outpatient contact. These procedures were designed to allow more specific psychiatric diagnoses to take precedence over less specific diagnoses and so that an underlying condition was favored rather than a nonspecific symptom or event. In practice, more than 75% of patients had only 1 diagnosis within their entire history of contacts with the Mental Health Information System, so the hierarchy was needed to make a classification decision about only a small number of complex cases.

Cancers were classified using the *International Classification of Diseases for Oncology* classification of diseases at the 3-digit level. This follows the same system used for classifying cancers by the WA Cancer Registry. The specific sites selected for further analysis were the most frequent cancers in males and females.

STATISTICAL ANALYSIS

We initially calculated the age- and sex-standardized rates per 100 000 person-years for mortality and cancer incidence, including metastases at diagnosis, for anyone meeting the Public Health Agency of Canada case definition of psychiatric disorder.[26] In the case of mortality, the primary outcome was death from all causes (all-cause mortality) to take into account deaths occurring as a complication of cancer, such as pneumonia in the context of lung cancer. We also undertook sensitivity analyses looking at patients for whom cancer was coded as the primary cause (cancer mortality).

We used direct standardization, the standard weights being taken from the average population distribution of WA from January 1, 1988, to December 31, 2007. Direct standardization has several advantages. These include ease of interpretation, reproducibility given access to the standardized weights, and comparability of rates across studies and across groups within the same study.[34] Direct standardization therefore allowed comparisons of mortality and cancer incidence given that each group was adjusted to the same standard. Recognizing that direct standardization can potentially become unstable when working with very small cell sizes, we took the precaution of repeating the analysis using indirect standardization.

Patients were included in the study if their first contact with mental health services was between January 1, 1988, and December 31, 2007. The period at risk began at the time of this initial contact. Patients were censored at death or December 31, 2007.

Rates of cancer incidence, metastases, and mortality for the nonpsychiatric population were calculated in the same way, using the file of all cancer registrations from January 1, 1988, to December 31, 2007. Denominators were taken from estimated resident population data.

Rate ratios (RRs) were then calculated to compare the age- and sex-standardized rates for patients with mental health services contact prior to cancer diagnosis vs those in the general population who did not have psychiatric contact. Rates were also calculated for each cancer site, so a cancer diagnosis at one site did not censor the time at risk for any other site. In addition, we calculated RRs for each psychiatric diagnosis and for cases that had ever occurred in inpatients.

Cox proportional hazards regression was used to examine risk factors for cancer among psychiatric patients. These were expressed as hazard ratios (HRs), with risk periods being calculated in the same manner as for the analysis of rates. Factors in the model were principal psychiatric diagnosis, age, sex, type of care received, cumulative length of stay in inpatient care, and socioeconomic status. As in previous work,[14] socioeconomic status was assigned to the collection district or residential postal code of each patient using the Socioeconomic Indices for Areas produced by the Australian Bureau of Statistics.[35] Collection districts, to which more than 80% of addresses in the study were geocoded, were used in preference given that they are the smallest geographical area used by the Australian Bureau of Statistics.[33] Therefore, they have greater validity than postal codes.[36] Socioeconomic Indices for Areas gave a ranking to each collection district or postal code based on data collected in the 1996 census.

Proportional hazards regression was also used to examine case fatality, adjusting for the same variables as incidence. In this model, all patients (both psychiatric and nonpsychiatric) who had a cancer diagnosed between January 1, 1988, and December 31, 2007, were included. Risk commenced at the date of cancer diagnosis, and patients were censored at death or December 31, 2007. We used the same techniques to study time to surgery, adjusting for the presence of metastases, as well as patient demographic characteristics and clinical features.

In terms of access to other treatments, we used multiple regression to study the effect of psychiatric status on the num-

Table 2. Place of Residence and Socioeconomic Status of Patients With Cancer With and Without Contact With Mental Health Services

Characteristic	Contact With Mental Health Services: No. (%) Yes (n = 6586)	No (n = 128 865)	Odds Ratio (95% CI)
Residence in regional or rural area	2043 (31.0)	31 771 (24.7)	1.38 (1.30-1.45)
Socioeconomic status, quintile			
Highest	882 (13.4)	21 145 (16.4)	1 [Reference]
Second highest	1112 (16.9)	24 601 (19.1)	1.25 (1.15-1.36)
Third	1206 (18.3)	25 036 (19.4)	1.16 (1.06-1.26)
Second lowest	1592 (24.2)	30 575 (23.7)	1.07 (0.99-1.19)
Lowest	1794 (27.2)	27 508 (21.3)	1.56 (1.44-1.70)

ber of chemotherapy sessions. We adjusted for the same variables as for access to surgery. Sensitivity analyses were carried out of the effect of omitting cancers where chemotherapy was least likely to be used (prostate, malignant melanoma, uterine, thyroid, kidney, lip, gum, mouth, and brain cancers).

RESULTS

INCIDENCE

There were 135 442 new cases of cancer, of which 6586 occurred in people with mental illness. The psychiatric patients who developed cancer had a mean (SD) age of 64.3 (17.7) years, compared with a mean (SD) age of 63.2 (16.0) years among patients with cancer and no psychiatric history. Among the psychiatric patients, 3147 (47.8%) were male. Psychiatric patients with cancer were more likely to live in regional or rural areas and more likely to live in areas in the bottom 20% of socioeconomic status than the general population who developed cancer (**Table 2**). The age-standardized incidence rate for cancer in psychiatric patients was 368 per 100 000 person-years compared with 417 per 100 000 person-years in the general population. This equated to an RR of 0.88 (95% CI, 0.85-0.91). Overall cancer incidence was lower for psychiatric patients than for the general population in both males and females (**Table 3**).

In terms of specific sites, incidence in psychiatric patients was higher only for lung cancers in males and females as well as those of unknown primary site in males (Table 3). At all other cancer sites, incidence was either the same as in the general population or, in the case of colorectal, melanoma, prostate, or breast cancers, lower (Table 3).

In terms of specific psychiatric diagnoses, all-site cancer rates were elevated in males with alcohol or drug disorders (**Table 4**) and both male and female patients with other psychoses (*ICD-9* codes 293, 294, 297-299) (Table 4). Statistically significantly lower cancer incidence rates were observed in males with affective psychoses, stress or adjustment reactions, and nonspecific psychiatric diagnoses (Table 4).

On Cox regression, the risk of cancer was higher in males than females (HR = 1.21; 95% CI, 1.16-1.28), and cancer risk increased with age. We found no significant association of cancer incidence with socioeconomic status. Using nonspecific psychiatric diagnoses as the reference category, patients with dementia had a reduced risk of cancer (HR = 0.72; 95% CI, 0.62-0.83), as did those with schizophrenia (HR = 0.80; 95% CI, 0.67-0.95). By contrast, patients with the following diagnoses had an increased risk: depression (HR = 1.20; 95% CI, 1.05-1.38), neurotic disorders (HR = 1.20; 95% CI, 1.04-1.38), and alcohol or drug disorders (HR = 1.26; 95% CI, 1.08-1.46). Similarly, patients who had spent more than 3 months as an inpatient had a 20% lower risk of cancer incidence compared with those treated as outpatients only (HR = 0.79; 95% CI, 0.71-0.88).

MORTALITY

A total of 3056 psychiatric patients diagnosed as having cancer died during the study period, of whom 1569 (51.3%) were male. All-cause mortality was elevated in both males and females (Table 3 and Table 4). The same pattern was seen for cancer mortality (eTable, http://www.jamapsych.com).

All-cause mortality was highest for melanoma, colorectal cancers, and cancers of unknown primary site. For males, rates were also particularly high for prostate, other urological, and lung cancers; for females, rates were higher for gynecological and upper gastrointestinal tract cancers (Table 3). Cancer-specific mortality was high for gynecological (RR = 1.26; 95% CI, 1.01-1.58), prostate (RR = 1.51; 95% CI, 1.25-1.83), and other male urological (RR = 1.38; 95% CI, 1.06-1.80) cancers. Rates were also high for melanoma (RR = 1.47; 95% CI, 1.01-2.14) and colorectal cancer (RR = 1.54; 95% CI, 1.30-1.82) in females and for those of unknown primary site in males (RR = 1.49; 95% CI, 1.21-1.84).

By principal psychiatric diagnosis, patients with dementia, an alcohol or drug disorder, schizophrenia, other psychoses, and depression had the highest all-cause and cancer mortality RRs (Table 4 and eTable).

On Cox regression, male sex, older age, and lower socioeconomic status were associated with higher all-cause mortality (**Table 5**). After adjusting for demographic factors, there was a 41% higher mortality rate following cancer diagnosis (**Figure 1**). The HR was 1.20 (95% CI, 1.15-1.26) when restricted to cancer mortality. The results for individual sites were very similar to those in the unadjusted analyses. The highest all-cause mortality occurred in patients with schizophrenia (HR = 1.96; 95% CI, 1.67-2.31) as well as those with an alcohol or drug disorder (HR = 2.08; 95% CI, 1.85-2.35), with a similar pattern for cancer mortality.

METASTASES

The proportion of patients with cancer who had metastases at presentation was significantly higher in psychiatric patients (7.1%; 95% CI, 6.5%-7.8%) compared with the general population (6.1%; 95% CI, 6.0%-6.2%). Of specific cancer sites, more psychiatric patients with breast

Table 3. Cancer Incidence and All-Cause Mortality of Psychiatric Patients as Compared With the Rates of the Sex- and Age-Matched General Population

	Cancer Incidence		Mortality	
Cancer Site	No.	Rate Ratio (95% CI)	No.	Rate Ratio (95% CI)
Males				
Prostate	652	0.84 (0.76-0.92)	247	1.91 (1.68-2.18)
Colorectal	356	0.89 (0.78-0.99)	176	1.49 (1.28-1.74)
Malignant melanoma	285	0.72 (0.61-0.86)	77	1.93 (1.54-2.44)
Lung	406	1.11 (1.01-1.22)	296	1.24 (1.11-1.40)
Kidney, bladder, or urinary tract	191	0.95 (0.81-1.12)	98	1.59 (1.30-1.96)
Stomach, pancreatic, or esophageal	202	1.04 (0.90-1.19)	132	1.14 (0.96-1.36)
Unknown primary site	151	1.43 (1.27-1.61)	118	1.56 (1.30-1.89)
All cancers[a]	3147	0.86 (0.82-0.90)	1569	1.52 (1.45-1.60)
Females				
Breast	903	0.92 (0.85-0.89)	225	1.27 (1.11-1.45)
Colorectal	362	0.82 (0.74-0.94)	200	1.61 (1.39-1.86)
Malignant melanoma	333	0.84 (0.73-0.96)	72	1.69 (1.32-2.16)
Lung	301	1.28 (1.17-1.41)	214	1.09 (0.95-1.26)
Uterine, ovarian, or cervical	296	0.91 (0.80-1.04)	118	1.42 (1.18-1.72)
Kidney, bladder, or urinary tract	110	1.15 (0.83-1.59)	54	0.91 (0.69-1.20)
Stomach, pancreatic, or esophageal	164	0.94 (0.78-1.13)	121	1.23 (1.03-1.48)
Unknown primary site	165	1.09 (0.93-1.28)	135	1.23 (1.03-1.47)
All cancers[a]	3439	0.92 (0.88-0.96)	1487	1.29 (1.22-1.36)

[a] Includes lower-incidence cancers not listed here.

Table 4. Cancer Incidence and All-Cause Mortality of Patients With Specific Psychiatric Disorders as Compared With the Rates of the Sex- and Age-Matched General Population

	Incidence		Mortality	
Psychiatric Disorder	No.	Rate Ratio (95% CI)	No.	Rate Ratio (95% CI)
Male				
Dementia	685	1.19 (0.85-1.68)	473	1.72 (1.57-1.89)
Alcohol or drug disorders	391	1.18 (1.06-1.31)	219	2.10 (1.84-2.40)
Schizophrenia	129	0.79 (0.61-1.02)	72	2.21 (1.75-2.78)
Affective psychosis	358	0.85 (0.75-0.98)	129	1.08 (0.91-1.28)
Other psychoses	302	1.14 (1.01-1.28)	165	1.75 (1.50-2.04)
Neurotic disorders	260	0.91 (0.79-1.06)	120	1.37 (1.14-1.63)
Personality disorders	35	0.74 (0.48-1.15)	14	1.69 (1.00-2.85)
Stress or adjustment reaction	267	0.79 (0.65-0.95)	83	0.95 (0.77-1.18)
Depressive disorder	423	1.04 (0.93-1.17)	204	1.48 (1.29-1.69)
Nonspecific diagnosis	102	0.54 (0.35-0.83)	30	0.96 (0.67-1.37)
Total[a]	3147	0.86 (0.82-0.90)	1569	1.52 (1.45-1.60)
Females				
Dementia	714	0.84 (0.61-1.14)	539	1.41 (1.29-1.54)
Alcohol or drug disorders	123	1.16 (0.97-1.39)	55	1.91 (1.47-2.49)
Schizophrenia	146	0.97 (0.81-1.16)	75	1.77 (1.41-2.22)
Affective psychosis	459	0.91 (0.81-1.02)	132	1.08 (0.91-1.28)
Other psychoses	227	1.59 (1.29-1.97)	146	1.81 (1.54-2.14)
Neurotic disorders	419	0.96 (0.87-1.07)	147	1.08 (0.92-1.27)
Personality disorders	27	1.09 (0.73-1.65)	9	1.43 (0.74-2.75)
Stress or adjustment reaction	396	0.92 (0.79-1.06)	93	0.90 (0.73-1.10)
Depressive disorder	538	0.97 (0.88-1.07)	197	1.29 (1.12-1.48)
Nonspecific diagnosis	188	0.81 (0.65-1.02)	42	0.84 (0.62-1.14)
Total[a]	3439	0.92 (0.88-0.96)	1487	1.29 (1.22-1.36)

[a] Includes attempted self-harm and other mental disorders not listed here.

cancer had metastases at presentation (6.3%; 95% CI, 5.9%-6.6%) than the general population (4.5%; 95% CI, 3.1%-5.9%). The same applied to lung cancer, with proportions of 0.6% (95% CI, 0.5%-0.7%) and 0.2% (95% CI, 0.0%-0.5%), respectively, but no other sites.

ACCESS TO SERVICES

We assessed time to surgery using Cox regression to calculate HRs and adjust for demographic and clinical variables, including the presence of metastases at presenta-

Table 5. Proportional Hazards Regression of All-Cause Mortality[a]

Characteristic	Hazard Ratio (95% CI)
Male	1.19 (1.17-1.20)
Age, y	
0-49	1 [Reference]
50-59	1.81 (1.74-1.87)
60-69	2.68 (2.60-2.77)
70-79	4.49 (4.36-4.65)
≥80	8.01 (7.76-8.27)
Residence in regional or rural area	0.98 (0.96-1.00)
Socioeconomic status, quintile	
Highest	1 [Reference]
Second highest	1.11 (1.08-1.14)
Third	1.23 (1.20-1.27)
Second lowest	1.28 (1.24-1.31)
Lowest	1.48 (1.40-1.52)
Contact with mental health services as inpatient or outpatient	1.41 (1.36-1.46)[b]
Cancer had metastasized at time of diagnosis	1.59 (1.55-1.64)
Length of inpatient treatment[c]	
No contact with mental health services	1 [Reference]
Outpatient only	1.22 (1.13-1.31)
<1 wk	1.42 (1.32-1.53)
1-4 wk	1.52 (1.42-1.63)
2-3 mo	1.53 (1.40-1.67)
>3 mo	1.44 (1.29-1.61)

[a] The proportional hazards regression adjusts for age, sex, socioeconomic status, cancer incidence, and contact with mental health services.
[b] The model restricted to cancer mortality gives a hazard ratio of 1.20 (95% CI, 1.15-1.26).
[c] Reran as a separate model with length of inpatient treatment replacing contact with mental health services.

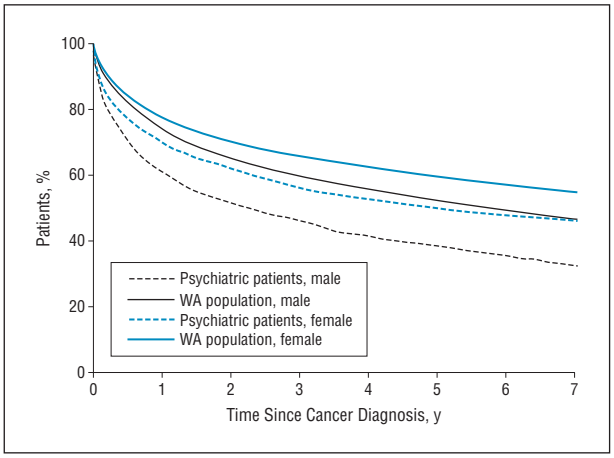

Figure 1. Survival since diagnosis of all cancers by contact with mental health services. WA indicates Western Australia.

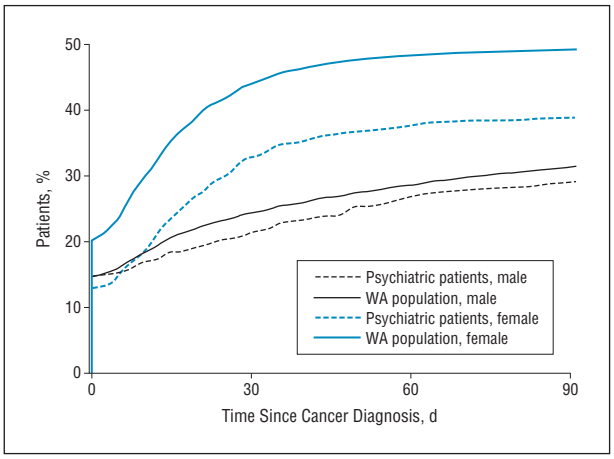

Figure 2. Time from diagnosis to surgical removal of the tumor by contact with mental health services. WA indicates Western Australia.

tion. Psychiatric patients had a reduced likelihood of surgery (HR = 0.81; 95% CI, 0.76-0.86) (**Figure 2**). Males and older people were also less likely to have surgery. We found no significant association with socioeconomic status, length of inpatient stay, or type of care received.

Of specific cancer sites, males were less likely to have a colorectal resection (HR = 0.82; 95% CI, 0.70-0.97). Females were less likely to have surgery for colorectal (HR = 0.68; 95% CI, 0.57-0.81), breast (HR = 0.74; 95% CI, 0.67-0.82), and cervical (HR = 0.73; 95% CI, 0.53-0.99) cancers. Resection rates were lowest in patients with dementia (HR = 0.70; 95% CI, 0.60-0.82), affective psychoses (HR = 0.78; 95% CI, 0.66-0.98), other psychoses (HR = 0.75; 95% CI, 0.58-0.98), and depression (HR = 0.75; 95% CI, 0.65-0.87).

Psychiatric patients also received significantly fewer chemotherapy sessions (mean, 10.3 sessions; 95% CI, 9.1-11.4) than the general population (mean, 12.1 sessions; 95% CI, 11.6-12.7). On multiple regression, the average number of sessions in psychiatric patients was reduced by 2.0 (95% CI, 1.2-2.9), with the same results when restricted to cancers for which chemotherapy was most likely to be used (mean, 2.0 sessions; 95% CI, 1.1-2.8).

There was no difference in the proportion receiving radiotherapy between psychiatric patients (6.4%; 95% CI, 5.8%-7.0%) and the general population (6.6%; 95% CI, 6.5%-6.8%). However, they were less likely to receive radiotherapy for breast (psychiatric patients: 2.6%; 95% CI, 1.5%-3.7%; general population: 4.1%; 95% CI, 3.8%-4.4%), colorectal (psychiatric patients: 1.6%; 95% CI, 0.6%-2.6%; general population: 3.9%; 95% CI 3.6%-4.2%), and uterine (psychiatric patients: 13.0%; 95% CI, 5.5%-20.0%; general population: 21.1%; 95% CI, 20.0%-22.9%) cancers (all $P < .05$).

We found no difference in our results when using indirect as opposed to direct standardization. For instance, the indirectly standardized incidence rates for all cancers were 0.84 (95% CI, 0.80-0.88) in males and 0.88 (95% CI, 0.84-0.92) in females.

COMMENT

This study suggests that although the cancer incidence in psychiatric patients is no higher than in the general population, psychiatric patients are more likely to have metastases at diagnosis and less likely to receive specialized interventions. This may explain the greater case fatality found in people with psychiatric disorder. The similarity in results between direct and indirect standardization confirmed that the cohort size was sufficient to under-

take direct standardization and that the results were robust to the choice of method.

One explanation is that cancer goes unrecognized especially among those with severe mental illness, although this may apply less to cancer than other physical diseases.[4,37-39] For instance, postmortem data from Denmark, where autopsies are common, indicate that postmortem diagnoses of previously unrecognized cancer in people with schizophrenia were rare.[39]

Another explanation is that people with psychiatric disorder receive poorer care. While there is little information on cancer care for psychiatric patients, there is extensive research on inequities in treatment access for cardiovascular disease and diabetes from the United States, Canada, Australia, and Great Britain.[10,16,22,40-46] For instance, psychiatric patients are less likely to have their weight or blood pressure measured in primary care[40] or to be assessed or treated for hyperlipidemia.[41,42] This is despite physician consultation rates being generally high among those with severe mental illness.[43] Management of physical health in secondary health services may be no better. Psychiatric patients are less likely to receive specialist procedures such as cardiac catheterizations and coronary artery bypass grafting than the general population, even though their mortality rates for the same conditions are significantly higher.[10,16] On discharge from the hospital following myocardial infarction, they are also less likely to be prescribed β-blockers and statins.[44] In some cases, unequal access to health care seems to explain much of the subsequent excess mortality.[45] Although it is possible that physicians are reluctant to offer some procedures because of the ensuing psychological stress, concerns about capacity or compliance with postoperative care, or contraindications such as smoking, this would not explain disparities in the prescription of cardiovascular medications.[44,46]

This study extends our previous work, indicating that psychiatric patients are no less likely to develop cancer than the general population but are more likely to die of it.[14,17] This pattern was particularly evident for colorectal, melanoma, prostate, and breast cancers. It is therefore unlikely that the increased mortality rate from cancer can solely be explained by lifestyle, such as alcohol or tobacco use. If lifestyle were the only cause, cancer incidence should be similarly increased. Furthermore, concurrent lifestyle would not explain our findings for melanoma. This is mainly related to childhood sun exposure,[47] and there is no evidence of any difference in such exposure in individuals who subsequently develop psychiatric disorder.[39] These findings applied to both cancer and all-cause mortality rates. The fact that all-cause mortality was higher than cancer mortality highlights that patients with cancer often have medical comorbidities and that the direct cause of death may be another illness to which cancer made them susceptible.

In common with some other studies, we found a reduced adjusted incidence of cancer in patients with dementia and schizophrenia.[48-50] Biological theories for reduced incidence in schizophrenia include a protective effect of excess dopamine, enhanced natural killer cell activity, increased apoptosis, modulation by antipsychotic drugs of cytochrome enzymes involved in mutagen activation and elimination, and neonatal vitamin D deficiency.[49-51] Some of these may be underpinned by genes that predispose to schizophrenia but protect against cancers, because relatives of people with schizophrenia also have reduced cancer incidence.[39,51] However, we also found a lower cancer incidence for patients with psychiatric disorders other than schizophrenia, making it unlikely that biological theories can be the only explanation.

Our results also cannot be solely explained by more advanced disease on presentation as marked by metastases. Although there was a modest increase in the proportion of patients with metastases for cancer overall, this did not apply to major cancer sites such as colorectal and prostate cancers where the disparities between incidence and mortality were the greatest.

These results could suggest inequitable access to appropriate care, especially given that reduced access to treatment persisted after controlling for the presence of metastases. The results may indicate action required to decrease inequity and thus improve health outcomes of psychiatric patients. This would include a greater emphasis on earlier diagnosis and better access to cancer screening for sites such as colorectal, prostate, and breast cancers. Another might be guidelines for cancer screening and treatment for psychiatric patients similar to those for cardiovascular and diabetes care.[52] Given findings that 72% of excess deaths occur in patients who have only ever seen their family doctor for their psychiatric problems,[11] collaborative arrangements with primary care may be helpful.[53]

LIMITATIONS

Ethnicity, marital status, education level, comorbidity, and disability are not recorded on the cancer registry and so could not be included in our models. However, the consistent results for all-cause and cancer mortality may suggest that comorbidity was not a major issue in this study. There was also no information on medication. Although we adjusted for socioeconomic status, our results may not be generalizable to people who receive private psychiatric treatment, especially outpatients. In addition, socioeconomic status was assigned by residential collection district or postal code rather than individual-level information. The WA Cancer Registry does not contain information on staging other than the presence or absence of metastases. Administrative data may also be subject to recording bias, especially for diagnosis and particularly in secondary fields. We therefore emphasized overall psychiatric morbidity, not subcategories or secondary diagnoses, to minimize possible bias. We were unable to study the effects of lifestyle such as diet, smoking, or alcohol and substance use. However, it is unclear how lifestyle differences could be the sole explanation for increased mortality in the presence of an incidence that was no higher than that of the general population. Although lifestyle might affect or be a contraindication for some cancer interventions, the documented disparities in cardiovascular treatments with no such contraindications suggest that this might not be the only explanation.[22,42,44,46,52] There were small cell sizes for certain cancers and psychiatric diagnoses,

so the study may have been underpowered to detect some differences in, for example, the presence of metastases or treatment access for individual cancer sites. In addition, we were able to capture data only on hospital admissions for surgery, radiotherapy, or chemotherapy. We cannot comment on access to other interventions or other private facilities. In the case of the latter, though, we are more likely to have underestimated the difference between psychiatric patients and the general population given the barriers that the former face in affording private treatment.[54] Finally, we cannot be sure of the generalizability of our findings. However, given the known international disparities in cardiovascular and diabetes care,[22,42,44,46,52] it is certainly possible that the same might apply to cancer.

IMPLICATIONS

Although the presence of metastases was no higher for prostate, cervical, or colorectal cancers, for which screening is available, this does not mean that increased screening for people with psychiatric disorders would not improve outcome. First, the presence of metastases at presentation is a crude indicator of cancer stage. Further work is indicated using cancer registry data with more details on staging than are available in the WA Cancer Registry. Second, the uptake of screening may be less important than what happens subsequently. Having identified a suspicious result, how is the information used to ensure that psychiatric patients receive the appropriate intervention? Another area for research is access to treatments that do not require hospital admission, such as tamoxifen citrate.

In terms of clinical practice, this study suggests that psychiatric patients experience similar difficulties with access to cancer care as for cardiovascular care. This may contribute to higher case fatality rates in illnesses for which the incidence is no higher than that of the general population.

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