Life Expectancy and Causes of Death in a Population Treated for Serious Mental Illness

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Objective: **This cross-sectional mortality linkage study describes the prevalence of specific fatal disease and injury conditions in an adult population with serious mental illness. The large sample of decedents and the use of multiple-cause-of-death data yield new clinical details relevant to those caring for persons with serious mental illness.** ***Methods:*** **Age-adjusted frequency distributions and years of potential life lost were calculated by gender and causes of death for persons in the population of 43,274 adults served by the Massachusetts Department of Mental Health who died between 1989 and 1994. Means and frequencies of these variables were compared with those for persons in the general population of the state who did not receive departmental services and who died during the same period.** ***Results:*** **A total of 1,890 adult decedents served by the department of mental health were identified by electronic linkage of patient and state vital records. They had a significantly higher frequency of deaths from accidental and intentional injuries, particularly poisoning by psychotropic medications. Deaths from cancer, diabetes, and circulatory disorders were significantly less frequently reported. On average, decedents who had been served by the department of mental health lost 8.8 more years of potential life than decedents in the general population—a mean of 14.1 years for men and 5.7 for women. The differential was consistent across most causes of death.** ***Conclusions:*** **Findings in this study are consistent with previous findings identifying excess mortality in a population with serious mental illness. The high rate of injury deaths, especially those due to psychotropic and other medications, should concern providers. (*Psychiatric Services* 50:1036–1042, 1999)**

Researchers and health professionals have long observed that psychiatric patients have reduced life expectancy (1–18). Controlled studies of patient populations have quantified this risk in the United States and abroad, and the reported standardized mortality ratio—the ratio of deaths in the patient population to the number that would be expected in the general population—has ranged from 1.7 to 5 (3–12). Studies of general populations have also confirmed the increased risk of death associated with serious mental illnesses, especially schizophrenia, major affective disorder, and substance use disorders (13–17).

Recently Felker and associates (18) reviewed mortality and morbidity findings and recommended development of models of primary care specific to psychiatric patients. However, samples in studies to date have typically been too small to guide such development in any detail. The last large-scale published study of mortality in the United States analyzed 331 deaths among 5,412 patients admitted to a single facility between 1972 and 1981 (6). None have examined data on multiple causes of death, which have been available in all states only since 1989.

The study reported here used a cross-sectional survey of an administrative patient registry linked electronically to vital records to provide data on deaths over the six-year period from January 1989 through December 1994. The study objectives were to update findings on the mortality of persons with serious mental illness and to provide greater detail on causes of excess mortality. The findings were intended to focus on specific health risks likely to be encountered by primary care and mental health professionals treating the most disabled populations.

Methods

Study design and data sources

The Massachusetts administrative patient registry was linked electronically to vital records for 43,274 per-

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sons age 18 and older who used inpatient, residential, or case management services of the State Department of Mental Health (DMH) between July 1985 and October 1994. To be eligible for these intensive services, a person needed to have a diagnosis of at least one "serious or long-term mental illness" other than mental retardation or substance abuse, although these disorders may also have been present. In addition, there must have been evidence of serious dysfunction, such as a risk of danger to self or to others or the inability to care for oneself as a result of the mental disorder (19–21).

Data for inpatients were entered into the patient registry starting in July 1985, and data for patients receiving residential and case management services were added beginning in 1988. Cases were included in the study whether or not the individuals continued to receive services from the department of mental health over the study period. In about 45 percent of cases the primary diagnosis was schizophrenia or schizoaffective disorder, and 37 percent of the sample had a major affective disorder. This breakdown of diagnoses was based on internal agency reports. However, because treatment diagnoses were not uniformly available at the time of this study, we did not analyze mortality by psychiatric disorder.

Table 1

Characteristics of the population of adults served by the Massachusetts Department of Mental Health (DMH) between July 1985 and October 1994 and of the general Massachusetts adult state population in 1990

Characteristic	DMH population[1] (N=43,274)	General population[2] (N=4.7 million)
Male (%)	57.1	48.0
White (%)	78.9	90.0
Black (%)	10.1	5.0
Hispanic origin (%)	5.0	4.6
Age (years)		
Median	39	40
Mean	42	43
Persons age 16 and older who are employed (%)	7.6	63
Persons age 15 and older who never married (%)	70.1	33
Persons age 25 and older with less than a high-school education (%)	44.0	20

[1] Age 18 and older; Massachusetts Department of Mental Health patient registry
[2] Massachusetts population age 18 and older, U.S. Bureau of the Census, 1990

Death certification and vital records linkage

Each state maintains electronic records of all deaths occurring within the state. The records originate with the U.S. Standard Certificate of Death and include data on place of death, whether an autopsy was performed, and the presence of up to 20 medical conditions originally noted by a certifying physician. Medical conditions are reviewed by state nosologists and coded in standard *ICD-9-CM* nomenclature, after which records are subjected to electronic editing to remove duplicate or invalid codes and to assign a single underlying cause of death (22,23). The underlying cause is the condition judged, in the context of all valid contributing causes, to have initiated morbid events leading ultimately to death.

The DMH registry was electronically matched with state death files for the six-year period from January 1989 through December 1994. Access to patient records by the first author was authorized by the department's institutional review board for the protection of human subjects for matching purposes only. Matching was based on iterative comparisons of names, sex, birth dates, and Social Security numbers, followed by manual inspection of complete records to eliminate false positives. All personal identifying data were removed from the resulting analytic files.

Coding of cause of death

One data file based on underlying cause of death was created, with one record per decedent (N=322,806). A second file containing one record for every mentioned condition was also created. This file therefore contained more than one record per decedent when multiple causes of death were reported (N=819,588). Codes for cause of death were grouped using the Clinical Classification for Health Policy Research (24), a system that combines all *ICD-9-CM* codes into 18 broad classes and 260 clinically related conditions. The classification was expanded to include *ICD-9-CM* E codes, which are used when the underlying cause of death is injury. E codes specify the manner in which an injury occurred—accident, suicide, homicide, and undetermined—while the nature of the injury, such as poisoning, is captured by codes already included in the classification.

Life expectancy

To provide a measure of relative excess mortality, we estimated years of potential life lost relative to current life expectancy for each decedent. Unlike life expectancy at birth, which does not change, current life expectancy is the mean survival age for a living cohort of each age and sex. Years of potential life lost is thus always a positive value and approaches zero at advanced age. This method has been used routinely by the Centers for Disease Control and Prevention (CDC) since 1982 to report the relative burden of disease and injury (25). Various methods of measuring years of potential life lost have been adopted as alternatives to standardized mortality rates to assess the impact of specific causes of death (26,27). For this study the number of years of potential life lost was derived for each decedent based on current life expectancy in the U.S. in 1992 (28).

Age adjustment

The state's non-DMH population was used as the standard for comparison of expected frequencies and years of potential life lost. Because

Table 2

Clinical classes of underlying cause of death among male and female decedents age 18 and older served by the Massachusetts Department of Mental Health (DMH) and in the non-DMH population, 1989–1994

Clinical class of underlying cause of death	Males					Females				
	DMH decedents[1]		Non-DMH decedents			DMH decedents[1]		Non-DMH decedents		
	N	%	N	%	p≤[2]	N	%	N	%	p≤[2]
Total	865	100.0	153,600	100.0	.001	1,349	100.0	167,316	100.0	.001
Natural causes	624	72.1	144,582	94.1	.001	1,220	90.4	163,149	97.5	.001
Infectious	68	7.8	5,620	3.7	.001	41	3.0	3,440	2.1	.05
Neoplasms	101	11.7	42,661	27.8	.001	185	13.7	42,820	25.6	.001
Endocrine	28	3.3	4,570	3.0	ns	42	3.1	6,000	3.6	ns
Blood	1	.1	631	.4	ns	13	.9	788	.5	.05
Mental	28	3.2	2,952	1.9	.001	74	5.5	5,097	3.0	.001
Nervous system	19	2.2	2,370	1.5	ns	23	1.7	2,253	1.4	ns
Circulatory	221	25.5	60,591	39.5	.001	534	39.6	73,648	44.0	.05
Respiratory	84	9.7	15,307	10.0	ns	227	16.8	17,586	10.5	.001
Digestive	44	5.1	5,780	3.8	.05	44	3.3	5,845	3.5	ns
Genitourinary	11	1.3	2,973	1.9	ns	23	1.7	4,052	2.4	ns
Pregnancy	na	na	na	na	na	0	—	15	.0	ns
Skin	1	.1	136	.1	ns	0	—	289	.2	ns
Musculoskeletal	1	.1	274	.2	ns	1	.1	710	.4	ns
Congenital	3	.4	270	.2	ns	3	.2	242	.1	ns
Iatrogenic	0	—	9	.0	ns	0	.0	6	.0	ns
Ill defined	1	.1	128	.1	ns	3	.2	154	.1	ns
Unclassified	13	1.5	310	.2	.001	7	.6	204	.1	.001
External causes	241	27.8	9,018	5.9	.001	129	9.6	4,167	2.5	.001
Accident	53	6.2	4,617	3.0	.001	51	3.8	2,916	1.7	.001
Suicide	111	12.8	2,200	1.4	.001	39	2.9	620	.4	.001
Homicide	12	1.4	958	.6	.01	11	.9	306	.2	.001
Undetermined	65	7.5	1,243	.8	.001	28	2.1	325	.2	.001

[1] Data for each DMH decedent are adjusted for age and sex to allow comparison with the non-DMH population.
[2] Chi square analysis, df=1

the living DMH and non-DMH populations have different age and sex distributions, valid comparisons could not be made without adjusting for this difference. Data for the DMH population were standardized following the direct standardization procedure recommended by CDC (29). Age and sex distributions for the total Massachusetts population from the 1990 census were used to approximate the non-DMH population in the following formula. Analysis weights were computed for each decedent served by the department of mental health as

$$W=P_{GP}/P_{DMH}$$

where W is the final analysis weight for each DMH case by age and sex, P_{GP} is the proportion of the total state population for each age and sex, and P_{DMH} is the proportion of the total DMH population for each age and sex. For example, young adults and males—groups that are overrepresented in the DMH population—received weights of less than one, while females and the aged received weights greater than one. The weights were applied to the data for each decedent in the DMH population and used in all analyses reported in the results section.

Statistical analysis

SAS software was used to calculate expected frequency distributions and derive associated chi square values and significance levels by cause of death (30). SUDAAN software was used to compute weighted differentials for mean years of potential life lost and associated t test values and significance levels for each cause-of-death group (31).

Results

Patient characteristics

Table 1 shows characteristics of the living population of persons served by the DMH and the living general population before the data were adjusted for age and sex. Adjustment corrected for the dominance of males in the DMH population and for any underlying differences in the age distributions; however, differences in employment, marital status, and education remained.

A total of 1,890 persons served by the DMH and 320,916 persons in the non-DMH general population age 18 and older were identified in death records for the six-year period from 1989 through 1994. After the data were adjusted, the weighted total for the DMH population was 2,214. The median age at death was 66 years for the DMH population and 76 for the non-DMH population. DMH decedents were slightly less likely to die in a hospital than decedents in the non-DMH population—49 percent versus 51 percent, not a significant difference—but were much more likely to have an autopsy (26 percent compared with 10 percent, χ^2=742, df=1, p<.001).

The average number of conditions that were reported to contribute to

death was approximately the same for each group at 2.5 per death. Mental disorders were reported as a contributing cause for 19.1 percent of the deaths of persons served by the DMH (N=423) and 8 percent of the deaths in the non-DMH population (N=25,502) (χ^2=370, df=1, p<.001). Among suicides, mental disorders were reported in only 6 percent of DMH deaths and 4 percent of non-DMH deaths.

Underlying cause of death

The distribution by sex and underlying cause of death for each person is shown in Table 2. DMH decedents had a disproportionately high frequency of deaths from external causes, which include accidents, homicides, suicides, and unexplained injuries. The proportion of males in the DMH population with an external cause of death was almost six times higher than the proportion of males in the non-DMH population with an external cause of death (27.8 percent compared with 5.9 percent, χ^2=688, df=1, p<.001). For females served by the department of mental health, the proportion of deaths from external causes was nearly four times that for females in the non-DMH population (9.6 percent compared with 2.5 percent, χ^2=270, df=1, p<.001).

Males in the DMH population also had a significantly higher frequency of deaths from infectious and digestive disorders and a significantly lower frequency of deaths from neoplasms and circulatory disorders than males in the non-DMH population. Females in the DMH population were significantly more likely to die from infectious and respiratory disorders and significantly less likely to die from neoplasms and circulatory disorders compared with females in the non-DMH population.

Table 3 summarizes differentials in years of potential life lost by underlying cause of death. Overall, the difference in means between decedents served by DMH and others was 8.8 years (t=65.5, df=1, p<.001). Differentials in years of potential life lost were positive for males and females across all causes of death for which the comparisons were statistically significant. For males in the DMH population, external causes accounted for 39.3 percent of the aggregate years of potential life lost, compared with 13.6 percent for males in the non-DMH population. For females in the DMH population, external causes accounted for 19.1 percent of aggregate years of potential life lost, compared with only 5.3 percent for females in the non-DMH population.

Table 3

Difference in mean years of potential life lost by clinical class of underlying cause of death among male and female decedents age 18 and older who were served by the Massachusetts Department of Mental Health (DMH), 1989–1994

Clinical class of underlying cause of death	Males		Females	
	N years	p≤[1]	N years	p≤[1]
Total	14.1	.001	5.7	.001
Natural causes	10.5	.001	4.2	.001
Infectious	8.5	.001	9.2	.001
Neoplasms	6.3	.001	1.5	.001
Endocrine	11.8	.001	6.8	.001
Blood	8.5	ns	.6	ns
Mental	16.9	.001	7.5	.001
Nervous system	18.0	.001	3.5	.01
Circulatory	9.7	.001	5.1	.001
Respiratory	6.7	.001	4.9	.001
Digestive	11.2	.001	6.2	.001
Genitourinary	2.9	.01	4.7	.001
Pregnancy	—	—	—	—
Skin	4.1	ns	—	—
Musculoskeletal	12.0	.001	10.7	ns
Congenital	12.2	.001	.8	ns
Ill defined	34.2	ns	4.5	ns
Unclassified	4.7	.001	–2.5	ns
External causes	7.5	.001	10.2	.001
Accident	6.1	.001	2.4	.01
Suicide	8.4	.001	9.3	.001
Homicide	.9	ns	10.8	.001
Undetermined	1.9	.001	–5.1	.001

[1] Based on the difference between weighted mean years of potential life lost for DMH decedents minus the mean for non-DMH decedents analyzed using Student's t test. The statistic was not computed where the number of cases was less than two.

Multiple causes of death

Multiple causes of death are all conditions judged to have contributed to death and reported on the death certificate. Among the 1,890 DMH decedents, a total of 5,577 conditions were mentioned, and 814,011 conditions were mentioned for 320,916 non-DMH decedents. Tables 4 and 5 show conditions reported in the DMH population at significantly higher or lower rates than expected. Chi square statistical significance was based on the hypothesis of homogeneity of the DMH and non-DMH populations. Table 4 shows conditions overrepresented in the DMH population with ten or more observed mentions and a statistical significance of <.01. Table 5 shows conditions underrepresented in the DMH population with ten or more expected mentions and a statistical significance of <.01.

To further test the significance of underrepresented conditions shown in Table 5, we compared separately only cases in which death occurred in hospitals or in which autopsies were performed, circumstances where disease conditions were more likely to be detected. The overall pattern in DMH and non-DMH cases remained, with significantly fewer neoplasms and circulatory disorders among DMH decedents.

Discussion

Our purpose was to describe causes of death that distinguish a contemporary population of persons with seri-

Table 4

Clinical conditions significantly overrepresented among multiple causes of death of male and female decedents served by the Massachusetts Department of Mental Health[1]

Clinical conditions	Males				Females			
	Actual observations	Expected observations	Deviation	p≤	Actual observations	Expected observations	Deviation	p≤
Infections								
HIV infection	59	22	37	.001	13	6	7	.01
Mental disorders								
Alcohol-related disorder	25	9	17	.001	13	3	10	.001
Substance-related disorder	12	5	7	.01	—	—	—	—
Affective disorders	19	1	19	.001	21	1	20	.001
Schizophrenia and related disorders	44	2	42	.001	84	3	81	.001
Other mental conditions	—	—	—	—	35	8	27	.001
Nervous system								
Epilepsy, convulsions	40	10	29	.001	60	17	43	.001
Coma, stupor, brain damage	18	9	9	.01	28	11	17	.001
Respiratory								
Pneumonia	—	—	—	—	229	149	80	.001
Chronic obstructive pulmonary disease	—	—	—	—	141	103	38	.001
Aspiration pneumonitis	—	—	—	—	51	25	25	.001
Digestive								
Alcohol-related liver disease	16	6	9	.001	—	—	—	—
External injuries								
Intracranial injury	21	9	13	.001	14	6	8	.01
Open wounds: head, neck, trunk	29	11	18	.001	—	—	—	—
Burns	—	—	—	—	11	1	10	.001
Poisoning, psychotropic agents	27	1	26	.001	23	2	21	.001
Poisoning, other medications	101	12	90	.001	51	8	43	.001
Poisoning, other	11	3	8	.001	—	—	—	—
Other injuries	147	32	115	.001	99	26	73	.001

[1] Cases were included in the analysis if observed counts were ten or higher and the p value for the chi square comparison of actual and expected observations was less than .01.

ous mental illness from the general population. We did not set out to isolate the excess mortality specifically attributable to particular psychiatric disorders, or to establish the precise causal link between mental disorders and early death. We did not address the prevalence of nonfatal illnesses, which may have a profound impact on the quality of a life but are not captured on death certificates.

Our results are relevant to similar populations in other states, but may not apply to all persons with serious mental illness. Populations served by state mental heath departments share several characteristics associated with early death among those who never married, lived in poverty, were poorly educated, smoked, and lived in urban areas (32–34). The interaction of mental illness with these risk factors accounts for some of the results shown here. Populations who were never treated, or who received care entirely in other systems such as the Department of Veterans Affairs or the private sector, may show different outcomes.

The inclusion of an entire DMH registry eliminates sampling error, but other measurement error is possible. Undercounting deaths in the DMH population could have occurred from inconsistencies in names or other key identifiers used in matching, and deaths out of state were not included. We assume these errors do not bias the general findings.

We have described excess mortality in a population of persons with serious mental illness in three ways: frequency of the underlying cause, frequency of multiple-cause conditions, and differential life expectancy. We found high frequencies of deaths due to HIV, alcohol-related disease, and injuries as well as reduced life expectancy across all disease and injury conditions in the DMH population. The high rates of intentional and unintentional poisonings are an area of obvious concern to those who care for this population.

Tables 4 and 5 are derived from data on multiple contributing causes of death. As a new fruit of a methodological advance, these data are important, but they are challenging to interpret. For instance, respiratory disorders are overrepresented in DMH women, but not in DMH men. Similarly, diabetes mellitus without complications, while not significantly different in women, is underrepresented in DMH men—an observation that goes against most clinical experience.

Reduced life expectancy may partly explain conditions underrepresented in the DMH population, as early death would precede the emergence of can-

Table 5

Clinical conditions underrepresented among multiple causes of death of male and female decedents served by the Massachusetts Department of Mental Health[1]

Clinical conditions	Males				Females			
	Actual observations	Expected observations	Deviation	p≤	Actual observations	Expected observations	Deviation	p≤
Neoplasms								
Colon cancer	8	28	–19	.001	27	45	–18	.01
Pancreatic cancer	—	—	—	—	3	19	–16	.001
Bronchial, lung cancer	43	76	–33	.001	—	—	—	—
Breast cancer	—	—	—	—	49	76	–28	.01
Prostate cancer	11	38	–27	.001	—	—	—	—
Secondary malignancies	11	32	–21	.001	20	48	–27	.001
Malignant neoplasm	13	33	–19	.001	29	48	–18	.01
Endocrine								
Diabetes mellitus without complications	28	59	–30	.001	—	—	—	—
Circulatory								
Heart valve disorders	—	—	—	—	8	33	–26	.001
Essential hypertension	13	34	–20	.001	57	82	–25	.01
Acute myocardial infarction	63	107	–44	.001	—	—	—	—
Coronary atherosclerosis	89	182	–92	.001	200	273	–74	.001
Cardiac arrest	87	137	–50	.001	—	—	—	—
Congestive heart failure	34	85	–50	.001	121	190	–70	.001
Acute cerebrovascular disease	24	60	–36	.001	85	144	–59	.001
Peripheral and visceral atherosclerosis	11	32	–21	.001	40	64	–25	.01
Aortic, peripheral, visceral arteriosclerosis	1	13	–12	.01	—	—	—	—
Genitourinary								
Acute renal failure	22	44	–22	.01	—	—	—	—

[1] Cases were included in the analysis if expected observations were ten or higher and the p value for the chi square comparison of actual and expected observations was less than .01.

cer and circulatory disease, which generally occur at later ages. Additional studies would help determine if underreporting of these conditions is due to inadequate detection or a true low prevalence.

Undetermined causes of death—injuries which cannot be positively judged as accidental or intentional—are remarkably high in the DMH population, even though 88 percent of such deaths were followed by autopsies. This category of undetermined causes of death has not been addressed in previous studies. Medical examiners, aided by circumstantial data from families, health care providers, and others, are able to successfully classify most injury deaths. Consequently, undetermined deaths are very rare in the general population. Such deaths reflect the social isolation and lack of medical care that place seriously mentally ill populations at risk, and reduction in the rate of these deaths would be a potential indication of improvement in these risk factors.

Of special note are rates of mental disorders reported as contributing to death. This rate for DMH decedents was more than twice that among the non-DMH decedents. Yet for this population, selected entirely for the presence of severe and disabling mental illness, we believe the death records understate the impact of these disorders. The low rates of mental disorders reported among suicides suggest this understatement is true for both the DMH and non-DMH populations. Mental health providers are not likely to have direct knowledge of patient deaths, which generally occur outside their settings or after care has ceased. Conversely, medical caregivers and death certifiers may be unaware of a history of mental illness. Even when they are aware, they may not associate a mental illness with medical conditions and subsequent death. Taken together these factors would tend to understate the effects of serious mental illness on life expectancy from death records alone.

Conclusions

The reduced life expectancies and mortality differentials reveal a health gap faced by those with serious mental illnesses. Specific causes for this gap could be identified through additional studies from other states with large patient registries that would permit multivariate analyses. Death certification is broadly available in electronic form, making large-scale studies using record linkage more feasible than in the past. The method of analysis using years of potential life lost is replicable wherever patient registries can be linked to state death records. Comparing results across mental health systems may reveal whether variation in resource levels, insurance benefits, or the organization of care can explain variation in life expectancy and cause of death. ♦

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