

Figure 2 provides a comparison of the difference between the population of adults with SMI vs adults without SMI diagnoses covered under MHCP in causes of death and median age of death. The figure contains the comparison for two 5-year periods: deaths during the 2003-2007 period and deaths during the 2008-2012 period. Overall, there was no change in the median age of death for both the adults with SMI diagnoses (median age=58 for both time periods) and adults without a SMI diagnosis (median age=83 for both time periods). This shows a consistent 25-year loss of potential years of life for adults with SMI for the two time periods. In a previous study (Trangle et al) of the same population for 2003-2007, there was reported a 24 years of potential life loss between the SMI and entire MHCP population, which included the SMI population. This analysis excludes the population with SMI from the MHCP comparison population. This change in the comparison population accounts the one year difference in years lost (24 vs 25) from the previous study.

Figure 2 also lists the top six causes of death for adults with SMI during both time periods. While the median age of death did not change across the two time periods, the median age of death decreased (younger) for the five leading causes of death. For both time periods, heart disease was the leading cause of death for the adults with SMI, although the percent of deaths dropped from 18.3 percent in the earlier 5-year period to 15.4 percent during the latest time period. Cancer was the second leading cause at a little over 14 percent for both time periods. The third leading cause of death, unintentional injury, showed a large jump from 9.3 to 13 percent of deaths over the two periods. The median age of death also dropped from 45 to 44 years of age over time, while for the non-SMI population the average age of death increased from 55 to 59.5 years of age.

Across the time periods, the rank order and percent of deaths due to Chronic obstructive pulmonary disease (COPD) and suicide changed. The percent of deaths due to COPD increased from 6.1 to 8.1 percent, while the percent of deaths due to suicide dropped from 7.5 to 5.9 percent over time.

Figure 3:

Percent of deaths and median age at death by major cause of death during CY 2003 – 2012 based on Minnesota Department of Health death certificate by which SMI diagnoses the person had within 3 years of death comparison between 5-year periods

	Top 6 major cause of death for adults with SMI diagnoses	Population by diagnoses								
		Schizophrenia only			Schizoaffective only			Bipolar only		
		5 Year period			5 Year period			5 Year period		
		2003-2007	2008-2012	Change	2003-2007	2008-2012	Change	2003-2007	2008-2012	Change
Percent of deaths (order by top 6 causes for SMI 2008-2012)	Total % of deaths in top 6	59%	60%	0.6%	58%	62%	3.4%	59%	62%	2.5%
	Heart disease	20.2%	16.3%	-4.0%	18.6%	17.3%	-1.3%	15.6%	14.5%	-1.1%
	Cancer	15.0%	18.6%	3.6%	15.6%	15.7%	0.0%	11.7%	11.6%	0.0%
	Unintentional injury	5.1%	6.7%	1.6%	5.6%	8.8%	3.2%	14.8%	19.0%	4.2%
	COPD	8.6%	10.0%	1.4%	8.3%	8.8%	0.5%	3.4%	5.2%	1.7%
	Suicide	5.8%	3.8%	-2.0%	5.0%	5.2%	0.2%	10.0%	8.0%	-2.0%
	Diabetes	4.5%	4.5%	-0.1%	5.3%	6.0%	0.7%	3.8%	3.6%	-0.2%
Median age at death	Overall	66.0	66.0	0.0	59.0	59.0	0.0	52.0	53.0	1.0
	Heart disease	65.0	61.0	-4.0	57.0	55.0	-2.0	56.0	55.0	-1.0
	Cancer	61.5	64.0	2.5	56.0	60.0	4.0	60.0	58.0	-2.0
	Unintentional injury	52.0	54.0	2.0	46.0	47.0	1.0	42.0	41.0	-1.0
	COPD	67.0	68.0	1.0	75.0	66.5	-8.5	64.0	65.0	1.0
	Suicide	35.0	42.0	7.0	45.0	40.0	-5.0	41.0	40.0	-1.0
	Diabetes	73.0	62.0	-11.0	61.0	62.0	1.0	58.5	65.0	6.5

Figure 3 provides the comparison of the changes across the two time periods for each of the SMI diagnostic groups for the six leading causes of death. The figure shows the percent of causes of death and median age at death for each of the diagnoses groups: schizophrenia, schizoaffective and bipolar diagnostic groups. Adults were only included in each of these groups if they had only one of the three diagnostic groups during the 3-year period before their death. For adults with schizophrenia, there was no change in the age at death of 66. For adults with schizoaffective diagnoses, the age at death remained the same (59). The youngest age of death was for adults with bipolar diagnoses with a slight increase in age at death from 52 to 53 across the two time periods. All three groups showed an increase in unintentional injury as a cause of death across time periods. However, for adults with bipolar diagnoses unintentional injury became the leading cause of death for the latest time period. The median age at death for unintentional injury was the youngest for the latest time period for adults with bipolar at 41 years of age. The age of suicide for the population with bipolar was only a year younger at 40 years of age.

While adults with schizophrenia showed a decrease in the percent dying due to heart disease from 20.2 to 16.3 percent, the median age of death also dropped from 65 to 61 years of age. Cancer became the leading cause of death during the second time period at 18.6 percent overtaking heart disease. However, the age of cancer causes deaths increased from 61.5 to 64 years for adults with schizophrenia. While the percent of death due to diabetes for adults with schizophrenia did not change across the two time periods (4.5 percent of deaths), the median age at death decreased from 73 to 62 years of age over the period.

Figure 4:

Percent of deaths and median age at death by major cause during CY 2008 – 2012 based on Minnesota Department of Health death certificate for adults in MHCP by whether adult had an SMI diagnosis within 3 years of death. Major causes of death listed from highest percent of deaths for adults with SMI.

	Top 6 major causes of death for adults with SMI diagnoses	Population by diagnoses							
		Non-SMI diagnoses				SMI diagnoses			
		Gender			Rank	Gender			Rank
		Female	Male	Total		Female	Male	Total	
Percent of deaths (rank is among top 6 causes for SMI)	Total % of deaths in top 6	45%	54%	48%		57%	66%	62%	
	Heart disease	17.2%	17.1%	17.2%	1	13.3%	17.8%	15.4%	1
	Cancer	14.5%	19.7%	16.5%	2	16.0%	13.1%	14.6%	2
	Unintentional injury	3.7%	5.9%	4.5%	6	10.2%	16.3%	13.0%	3
	COPD	5.7%	6.3%	5.9%	4	8.6%	7.5%	8.1%	4
	Suicide	0.4%	1.5%	0.8%	12	4.4%	7.6%	5.9%	5
	Diabetes	3.4%	3.8%	3.6%	7	5.0%	4.0%	4.5%	6
Median age at death (rank is youngest to oldest in 6 causes)	Overall	86.0	76.0	83.0		62.0	55.0	58.0	
	Heart Disease	89.0	80.0	86.0	6	64.0	54.0	57.0	3
	Cancer	74.0	68.0	71.0	3	63.5	59.0	62.0	5
	Unintentional injury	82.0	52.0	59.5	2	45.5	44.0	44.0	2
	COPD	82.0	79.0	81.0	5	65.0	65.0	65.0	6
	Suicide	41.0	43.0	42.0	1	43.0	33.0	38.5	1
	Diabetes	83.0	73.0	80.0	4	65.0	56.0	61.0	4

Figure 4. In examining the difference in years of life lost between adults with SMI diagnoses and those without for CY 2008-2012, the major causes of death were reviewed. The major causes of death were groupings of the detailed causes from death certificates into 19 groupings of underlying causes of death, including a Residual category that combined a variety of causes including the undefined. **Figure 5** provides a summary from the top six underlying causes of death (excluding the Residual category) for adults with SMI diagnoses. These top six causes accounted for 62 percent of all deaths among the population with SMI diagnoses compared to 48 percent for those without SMI diagnoses. The top three causes for adults with SMI diagnoses were heart disease (15.4 percent), cancer (14.6 percent) and Unintentional injury (13.0 percent). Suicide was the fifth leading cause at 5.9 percent of the deaths for those with SMI compared to 0.8 percent of deaths for adults without SMI. However, suicide had the youngest overall age of death for adults with SMI diagnoses at a median age of 38.5 years of age. The next youngest age of death was 44 years of age due to Unintentional injury.

A couple of patterns show up in Figure 5 that help to explain the early mortality rate among adults with a SMI. heart disease and cancer are the top 2 causes of death for both adults with and without SMI and the percentages of causes of death are not strikingly different although slightly lower for adults with SMI (for both heart disease and cancer 30 percent for adults with SMI compared to 33.6 percent for adults without SMI). However for the leading 2 causes, the median age of death is much younger for adults with SMI. For heart disease the median age of death is 57 for adults with SMI compared to 86 for adults without SMI. For cancer the median age of death is 62 for adults with SMI compared to 71 for adults without SMI.

Another major difference between the populations is the much higher causes of death and age at death due to unintentional injury. The unintentional injury accounted for 13 percent of deaths for the population with SMI with a median age of death of 44 compared to only 4.5 percent of deaths and at a median age of 59.5 for those without SMI.

Figure 5:

Percent of deaths and median age at death by major cause of death during CY 2008 – 2012 by which SMI diagnoses the person had within 3 years of death.

	Top 6 major cause of death for adults with SMI diagnoses	Schizophrenia only			Schizoaffective only			Bipolar only		
		Gender			Gender			Gender		
		Female	Male	Total	Female	Male	Total	Female	Male	Total
Percent of deaths (rank is among top 6 causes for SMI)	Total % of deaths in top 6	54%	65%	60%	58%	67%	62%	58%	67%	62%
	Heart disease	13.6%	18.8%	16.3%	17.9%	16.3%	17.3%	11.9%	18.0%	14.5%
	Cancer	20.9%	16.5%	18.6%	16.6%	14.4%	15.7%	13.0%	9.8%	11.6%
	Unintentional injury	4.9%	8.4%	6.7%	4.1%	15.4%	8.8%	15.5%	23.6%	19.0%
	COPD	8.7%	11.2%	10.0%	8.3%	9.6%	8.8%	6.5%	3.4%	5.2%
	Suicide	1.6%	5.8%	3.8%	4.1%	6.7%	5.2%	7.1%	9.3%	8.0%
	Diabetes	4.3%	4.6%	4.5%	6.9%	4.8%	6.0%	4.0%	3.1%	3.6%
Median age at death (Rank is youngest to oldest)	Overall	72.0	60.0	66.0	62.0	54.0	59.0	55.0	51.0	53.0
	Heart disease	74.5	56.5	61.0	56.5	54.0	55.0	61.0	52.0	55.0
	Cancer	69.0	62.0	64.0	61.5	59.0	60.0	60.0	57.0	58.0
	Unintentional injury	53.5	54.0	54.0	56.0	46.0	47.0	40.5	41.5	41.0
	COPD	71.5	66.0	68.0	67.0	65.5	66.5	64.0	68.0	65.0
	Suicide	52.0	40.0	42.0	52.0	27.0	40.0	40.0	37.0	40.0
	Diabetes	74.0	56.5	62.0	63.5	61.0	62.0	72.0	60.0	65.0

In **Figure 5** we examined if there were any differences in cause of death and age at death due to diagnoses among the population with any SMI diagnoses. This figure analyzes the differences in gender and diagnostic groupings (schizophrenia, schizoaffective, or bipolar) by percent of deaths and median age at death. For the population with bipolar only diagnoses, the leading cause for both females (15.5 percent) and males (23.6 percent) was Unintentional injury with young ages of death (females 40.5 years and males 41.5 years). For females, this cause of death was triple the percent (15.5 percent) than those females with only schizophrenia (4.9 percent) and schizoaffective (4.1 percent) diagnoses. The age at death for those with bipolar diagnoses due to unintentional injury was 13 years younger than for both females and males with schizophrenia.

In general, the pattern regarding heart disease and cancer is that females were more likely to die from cancer while the males are more likely to die from heart disease. However, the females with schizophrenia showed a much wider difference (20.9 percent from cancer and 13.6 percent from heart disease) than the other diagnostic groupings. However the age at death for females with schizophrenia for both cancer (69 years) and heart disease (74.5 years) was for heart disease at least 12 years higher and for cancer at least 6 years higher than for females with other diagnoses. For males with schizophrenia the pattern was similar but with much smaller differences between diagnoses.

The next analyses was to attempt to find any support for underlying risk factors for these causes of early mortality due to these causes of death. The risk factors that were considered were: 1) having a tobacco or nicotine diagnosis; 2) having a diagnosis indicating obesity or a BMI above 30; or 3) having a substance abuse diagnosis, excluding tobacco/nicotine. The analysis involved examining claims for the 3 years prior to death to see if the adult had any of these diagnoses. For the following three figures, if a person had at least one of these diagnoses during the 3 year period they were counted in the risk group.

Appendix B: Literature review

New research continues to be published reinforcing the need for Minnesota 10x10. Pertinent new literature highlights that:

- Schizophrenia is underreported as a cause of death
- Patients with bipolar affective disorders die earlier than other patients with SMI
- Substance use disorders and use of atypical antipsychotics are significant contributors to early mortality.

Poldednak⁹ utilized the National Center for Health Statistics Multiple Cause of Death database to highlight the difficulty of accurately attributing the cause of death as well as trends of death for patients with schizophrenia. The annual death rate per 100,000 for patients with schizophrenia listed as the underlying cause was small, fluctuated over time, and declined from 0.22 in 1999 to 0.13 in 2010. When he included all deaths with mention of schizophrenia, the rates increased to 14.1 percent in 1999 and declined to 10.5 percent in 2010. This decline was slower than the decline in deaths for the general population such that the proportion of US resident's death attributed to schizophrenia increased from 0.1863 percent in 1999 to 0.2739 in 2010. Most common causes of death included cardiovascular disease (27.9 percent ages 15-64 and 36.3 percent for ages 65+), followed by Neoplasms, external causes and respiratory diseases, Endocrine diseases especially in males 15 to 64. When Poldednak looked at schizoaffective psychosis as the underlying cause of death, the numbers were small (14-38/year) with only 30 deaths between 1999-2010. Death rates with mention of schizoaffective psychosis increased from 0.097 in 1999 to 0.174 in 2010.

In 2014 Laursen¹⁰ et al's review on early mortality in schizophrenia summarized a number of studies when he stated that the lives of persons with schizophrenia are between 10-25 years shorter than the general population (Denmark-11.2 years shorter; Sweden - 12 years shorter for males 15 years shorter for females; Israel – 12 years shorter; UK – 14.6 years shorter; Finland – 10-15 years shorter. Another Finnish follow-up¹¹ showed that in 1996 life expectancy at age 20 was 25 years shorter and 22.5 years shorter in 2006. Laursen's review puts the lifetime risk of suicide between 4-10 percent with the highest risk in the first year after involvement with the mental health system.

Ramsey et al noted that the odds of mortality for patients with lifetime manic spectrum episodes for patients after 26 year follow-up showed higher mortality than same age cohorts (age 30-44 years at baseline OR=1.39, 45 percent CI=[1.00, 1.93] and for 45-64 years at baseline OR=1.41, 95 percent CI[1.02, 1.95]). There was no such significant correlation for the 65 or greater at baseline. This data showed significantly higher prevalence of both alcohol and nonalcoholic drug abuse/dependence in those with greater mortality and no statistically increased rate of substance abuse/dependence in bipolar spectrum patients with normal mortality.¹²

Osby found that mortality for patients with bipolar is about 2 times higher, suicide rate 10 times higher than the general population in Sweden followed from 1973 to 1995. Suicide mortality is especially high in the first year post diagnosis.¹³

Murray-Thomas et al analyzed a large database (General Practice Research Data Base in UK 4/97-1/2001 consisting of 183,392 antipsychotic users [115,491 typical; 67,901 atypical]; 193,920 patients with schizophrenia, bipolar, dementia who did not use antipsychotics; 544,726 general population controls). They showed that risk of all-cause mortality, cardiac mortality and sudden cardiac death was highest with patients who used atypical antipsychotics followed by typical antipsychotics, followed by the above referred psychiatric patients who did not use antipsychotics and was lowered in the general population.¹⁴

Appendix C: References

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- ¹³ Osby U, Brandt L, Correia N, Ekborn A, Sparea P. Excess Mortality in Bipolar and Unipolar Depression in Sweden. *Arch Gen Psychiatry.* 2001; 58(9):844-850 doi:10.1001/archpsych.58.9.844.
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