



UNIVERSITY OF WISCONSIN

Population Health Institute

Translating Research into Policy and Practice

Brief Report

The Burden of Excess Deaths in Wisconsin

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If people died at the same rate in every Wisconsin county as they do in the county with the lowest death rate, then close to 5000 deaths could be avoided each year.

Death rates across different groups are often compared, but measures which incorporate both risk and population size are seldom examined. Using such a measure indicates that almost 5000 deaths in Wisconsin could be avoided each year. These excess deaths are not evenly distributed across the state: although only 11 percent of Wisconsin's population resides in Milwaukee, the city accounts for 28 percent of the excess deaths that occur each year. State policymakers should consider the distribution of excess deaths across Wisconsin for planning programs, allocating resources, and targeting approaches for reaching state and local health goals.

This Brief Report is supported by the "Making Wisconsin the Healthiest State" grant from the Wisconsin Partnership Fund for a Healthy Future (Blue Cross Program).

Vol. 1, Number 2
April 2006



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Public health burden from mortality can be measured in two ways: the risk (rate) of death in a population and the observed number of deaths. Measures of risk are based on rates and allow comparisons across populations of different sizes. For example, in the year 2000 the mortality rate for those under 75 years of age in Menominee County was 765 death per 100,000 people, compared to only 306/100,000 in Dane County. Menominee County clearly has a higher risk than Dane County with a relative risk of 2.5 and a risk difference of 459/100,000. However, looking at the observed number of deaths in the two counties provides a different picture; Dane County had over 1,000 deaths occur in 2000, and Menominee County had 29.

While these measures are helpful individually, they do not provide a complete picture regarding the magnitude of the burden of mortality across population groups. In this brief report, we will discuss an approach for examining burden using a combined measure which incorporates elements of risk, population size, and number of deaths. Specifically, we will describe the measure of excess deaths and identify the distribution of the burden of excess deaths across the state of Wisconsin.

Excess deaths

Excess deaths are calculated using two primary elements: the risk difference and population size. The risk difference is the deviation of a death rate from a comparison rate, where the comparison rate is defined from that of a selected group or an established target level. For example, one might examine each Wisconsin county in comparison to the death rate of the county with the lowest (or best) rate or to some other target rate such as those specified in *Healthy People 2010*. For this brief we have chosen to use the lowest observed age-specific mortality rate among Wisconsin counties as our target rate. Since these target rates have been achieved in at least one county in Wisconsin, we suggest that the excess deaths occurring over and above these target rates are potentially avoidable.

Because a measure of excess deaths includes differences in population size across groups, this measure takes into account both the magnitude of the death rate and the size of the population living with that rate. Therefore, if two communities had equal death rates, the greatest burden in terms of the number of excess deaths would be in the community with the largest population. In the same way, if two communities had equal populations, the greatest burden would be in the community with the highest death rate.

The use of a measure such as excess deaths does not imply that areas with high death rates and small populations do not require attention. These communities face important challenges, and an upcoming report in this series will highlight health disparities across population subgroups of all sizes in Wisconsin. However, an examination of excess deaths can help to identify where the mortality burden falls in terms of numbers of excess deaths and to identify concentrated areas which may need added attention. Such information can then assist in program planning, allocation of resources, and targeted approaches for reaching state and local health goals such as those included in *Healthiest Wisconsin 2010*.¹ An examination of excess deaths alone does not illustrate the entire picture but it can provide a valuable perspective for statewide public health assessment and planning.

Calculating excess deaths

The online Wisconsin Interactive Statistics on Health (WISH)² database of the Wisconsin Department of Health and Family Services was used to gather the mortality rates and population sizes used in this brief. Data for ages up to 75 years were requested for each county by age for the time period spanning 1995-2004. Only deaths occurring up to age 75 were considered for this analysis, because a larger proportion of the deaths in younger ages are considered to be preventable and to be amenable to programs and policy interventions. Additionally, disparities observed across subgroups tend to be smallest in the oldest ages. The span of ten years (1995-2004) was selected in order to allow for the most recent data to be used while also providing a large enough time frame to avoid small sample sizes for certain counties and age groups. Because mortality rates vary greatly with age, excess deaths were first calculated for each age group in each county and then summed across counties and ages to present group-level excess death totals.

The Wisconsin Assessment Information Manager (AIM)³ was used in addition to WISH to gather data for Milwaukee County, because it provides information separately for the City of Milwaukee and the remainder of the county. Since the data from AIM covered the years of 1993-2002, the AIM results for Milwaukee County were adjusted for changes in population size and mortality rates between the two time periods.

The target death rates were selected by age group and represented the lowest mortality rate observed among Wisconsin counties that experienced a statistically reliable number of deaths. For example, the target rate for 35 to 44 year-olds was 91 deaths per 100,000. This is the death rate

for that age group in Calumet County, the lowest of all Wisconsin counties for 35 to 44 year-olds. Based on the National Center for Health Statistics requirements for suppression of mortality data, target rates were required to be based on at least 20 deaths in order to ensure they were sufficiently reliable and stable.⁴ Although mortality data represent complete rather than sampled values, it would be inappropriate to use death rate estimates as targets which were unstable due to random variation and small sample sizes. Table 1 displays the target rates for each age group and the county on which they were based.

The risk difference describes the additional amount of risk that members of a county face compared to the target county, and it is calculated as the difference between the observed age-specific county death rate and the target rate. Multiplying the excess risk in a county by the size of the population living with this risk provides the number of excess deaths. See Table 2 for an illustration of the calculation of excess deaths for Dane County.

Burden of excess deaths across Wisconsin

There are on average about 17,700 deaths each year in Wisconsin among persons under 75 years of age (about 40% of the 46,000 deaths that occur annually among persons of all ages). Of these deaths among those under 75 years of age, 4,782 (27%) are in excess of what would be expected if every county was able to achieve the target county death rates. Table 1 shows how these excess deaths are broken down among age groups. In general, the number of excess (and total) deaths tends to increase with age, and 30% of the total excess deaths under age 75 are found in the 65-74 years age group. However, the 230 annual excess deaths observed among infants is nearly equal to the number found in the entire 10 year age group of those 25-34 years. Excess deaths also show a peak among young adults, with 261 avoidable deaths among those 15-24 years. On the other hand, the *percent* of deaths in each age group which are potentially avoidable tends to decrease with age, illustrating that differences among the counties with the highest and lowest death rates are smallest for the older age groups.

Figure 1 illustrates the distribution of total excess deaths across Wisconsin counties. Many of the counties with the largest number of excess deaths are among the largest in the state, but others are not. For example, Douglas County has a population only one-tenth the size of Dane County, yet exhibits more than one-third the number of excess deaths of Dane County. Milwaukee County has by far the highest number of excess deaths of all counties with 1650 per year, followed next by Racine County with 210 and Rock County

with 183. A complete list of the annual number of excess deaths in all Wisconsin counties can be found in Table 3.

Table 3 also displays the total number of deaths that occur annually in each county and the proportion of these total deaths which are in excess. For the state as a whole, the 4782 estimated excess deaths constitute 27% of all annual deaths under age 75. Therefore, over one-quarter of all deaths under 75 years could be avoided if every county achieved the rates of the healthiest. Three counties have excess deaths which account for less than 10% of their total annual deaths: Calumet (3%), Ozaukee (7%), and Waukesha (7%). The death rates observed in these counties are among the lowest in the state, and Waukesha and Calumet counties together served as the target rates used for half of the age groups. On the other hand, the majority of the total deaths occurring in Menominee County (63%) and the City of Milwaukee (51%) could be avoided through drastically improving mortality rates. Interestingly, these two locations fall at opposite extremes in terms of population size and are the smallest and the largest in the state.

Since Milwaukee County has the largest population in the state, it is not surprising that it has the largest number of excess deaths. The magnitude of excess deaths in the county is much larger than one would expect simply based on population size. Milwaukee County contains approximately 18% of the state's population but accounts for 35% of the state's excess deaths, indicating that the mortality burden in Milwaukee County is larger than expected. A closer examination of the distribution of excess deaths within Milwaukee County demonstrates that these excess deaths are also not evenly distributed throughout the county. The City of Milwaukee has 1,330 excess deaths compared to only 320 in the remaining areas of the county, demonstrating that the City has a larger burden of avoidable deaths than would be expected by population distribution alone (see Table 4).

The 4,782 annual excess deaths in Wisconsin are distributed with approximately one-third occurring in the state's rural counties, slightly over one-third in urban counties (including the areas of Milwaukee County other than the city), and just under one-third in the City of Milwaukee alone (see Table 5). Although the rural population of the state is also approximately one-third of that in the total state, the proportions of excess deaths and population are mismatched for urban counties and Milwaukee. The urban counties in the state (excluding the City of Milwaukee) contain 57% of the state's population

but only 38% of the excess deaths, indicating lower death rates in these areas. In contrast, the City of Milwaukee accounts for 28% of the total excess deaths in the state, despite the fact that it only contains 11% of the state's population. The City of Milwaukee contains not only a large concentration of excess deaths, but they appear to be occurring at much higher rates than in other areas of Wisconsin.

Conclusion

The measure of 'excess deaths' combines both risk and population size, summarizes valuable public health information, and is easy to understand. An examination of excess deaths can serve to provide a more relevant and illustrative picture of the differential burden of mortality across the state than death rates alone. Potentially avoidable deaths are found in all age groups in Wisconsin and are especially high for infants and young adults. Areas of high excess deaths are found both in large population centers and in areas with higher death rates.

The city of Milwaukee contributes 28% of the excess deaths in the state, with 38% occurring in urban counties and 34% in rural counties. Including the distribution of excess deaths across Wisconsin by age group in examinations of the mortality burden can assist in program planning, allocation of resources, and targeting approaches for reaching state and local health goals such as those included in *Healthiest Wisconsin 2010*.

Citations

1. Wisconsin Department of Health and Family Services. *Healthiest Wisconsin 2010: A Partnership Plan to Improve the Health of the Public*.
2. Wisconsin Department of Health and Family Services. Wisconsin Interactive Statistics on Health (WISH). Online at <http://www.dhfs.state.wi.us/wish>.
3. Wisconsin Department of Health and Family Services. Wisconsin Assessment Information Manager (AIM). Online at <http://dhfs.wisconsin.gov/AIM/index.htm>.
4. Klein RJ, Proctor SE, et al. Healthy People 2010 criteria for data suppression. Statistical Notes, No 24. Hyattsville, Maryland: National Center for Health Statistics. July 2002.

Table 1. Targets used and excess deaths by age group (1995-2004)

Age group	Target county	Target (lowest) rate	Average annual number of excess deaths in Wisconsin	Average annual number of total deaths in Wisconsin	Percent of Wisconsin deaths which are excess
Under 1 year	Wood	346.1	230	465	49%
1-14 years	Waukesha*	11.7	105	226	46%
15-24 years	Eau Claire	38.9	261	560	47%
25-34 years	Waukesha	53.3	232	612	38%
35-44 years	Calumet	91.0	541	1326	41%
45-54 years	Washington	228.8	817	2462	33%
55-64 years	Waukesha	635.8	1070	4038	26%
65-74 years	Pepin	1824.0	1526	8004	19%
All ages	N/A	N/A	4782	17692	27%

*Two counties had slightly lower rates than Waukesha in this age group but were excluded because they did not meet the requirements for a reliable and stable estimate (fewer than 20 deaths over 10 years).²

Table 2. Example of excess death calculation for Dane County (1995-2004)

Age group	Observed rate (per 100,000)	Target (lowest) rate (per 100,000)	Risk difference (Observed rate – target rate)	Population	Annual excess deaths (Risk difference x population)
Under 1 year	577.8	346.1	231.7	5,244	12
1-14 years	19.2	11.7	7.5	74,502	6
15-24 years	47.9	38.9	9.0	73,084	7
25-34 years	68.8	53.3	15.5	71,236	11
35-44 years	135.6	91.0	44.6	69,707	31
45-54 years	288.9	228.8	60.1	57,919	35
55-64 years	699.8	635.8	64.0	31,524	20
65-74 years	2031.8	1824.0	207.8	20,401	42
All ages					164

Table 3. Excess and total annual deaths by county (1995-2004)

County	Annual number of excess deaths	Annual number of total deaths	Percent of county deaths which are excess
Adams	30	102	30%
Ashland	26	68	38%
Barron	45	165	27%
Bayfield	19	65	29%
Brown	122	614	20%
Buffalo	10	49	20%
Burnett	29	84	35%
Calumet	3	94	3%
Chippewa	42	185	23%
Clark	19	104	19%
Columbia	46	181	26%
Crawford	15	63	25%
Dane	164	1026	16%
Dodge	81	291	28%
Door	21	105	20%
Douglas	66	176	37%
Dunn	17	101	17%
Eau Claire	26	230	12%
Florence	6	22	28%
Fond du Lac	69	310	22%
Forest	16	46	34%
Grant	39	166	24%
Green	22	106	20%
Green Lake	18	75	24%
Iowa	17	73	23%
Iron	12	35	34%
Jackson	24	74	32%
Jefferson	58	238	24%
Juneau	47	117	40%
Kenosha	178	511	35%
Kewaunee	13	65	21%
La Crosse	79	320	25%
Lafayette	13	57	22%
Langlade	21	84	26%
Lincoln	30	112	27%
Manitowoc	58	279	21%
Marathon	40	343	12%
Marinette	62	185	33%
Marquette	26	76	34%
Menominee	18	28	63%
Milwaukee			
City	1330	2615	51%
County	320	1207	27%

County	Annual number of excess deaths	Annual number of total deaths	Percent of county deaths which are excess
Monroe	59	160	37%
Oconto	32	129	24%
Oneida	38	158	24%
Outagamie	69	420	16%
Ozaukee	17	227	7%
Pepin	3	23	15%
Pierce	18	92	19%
Polk	36	143	25%
Portage	29	175	17%
Price	17	66	26%
Racine	210	664	32%
Richland	12	61	19%
Rock	183	559	33%
Rusk	20	64	31%
Sauk	48	187	26%
Sawyer	29	85	35%
Shawano	40	151	26%
Sheboygan	71	345	21%
St. Croix	31	166	18%
Taylor	12	61	20%
Trempealeau	26	97	27%
Vernon	25	101	25%
Vilas	24	104	23%
Walworth	68	285	24%
Washburn	19	68	28%
Washington	35	305	12%
Waukesha	70	941	7%
Waupaca	79	213	37%
Waushara	34	110	31%
Winnebago	96	463	21%
Wood	35	230	15%
Wisconsin	4782	17692	27%

Table 4. Distribution of population and excess deaths in Milwaukee County

	Population	Percent of Milwaukee County population	Excess deaths	Percent of Milwaukee County excess deaths
City of Milwaukee	570,547	64%	1330	81%
Balance of county	314,340	36%	320	19%
Milwaukee County	884,887	100%	1650	100%

Table 5. Distribution of population and excess deaths in Wisconsin

	Population	Percent of Wisconsin population	Excess deaths	Percent of Wisconsin excess deaths
City of Milwaukee	570,547	11%	1330	28%
Rural counties (n=52)	1,576,804	32%	1612	34%
Urban counties (less City of Milwaukee) (n=20)	2,841,084	57%	1840	38%
State of Wisconsin	4,988,435	100%	4782	100%

Figure 1.

