ORIGINAL RESEARCH

Wisconsin Firearm Mortality, 2000-2014

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ABSTRACT

Background: Despite low firearm mortality rates in Wisconsin, overall firearm fatalities continue to rise in recent years. In 2013, the statewide age-adjusted death rate due to firearms was 9.6 per 100,000 persons, the highest mark since the new millennium. This raises not only public safety concerns, but also raises questions regarding ongoing gun violence.

Objectives: To describe the population and geographic characteristics of firearm mortality rates on population and geographic characteristics in Wisconsin.

Methods: Mortality data for firearm deaths caused by suicides, homicides and other death intent were obtained from the Wisconsin Interactive Statistics on Health (WISH) query system from 2000 through 2014. The probability of firearm fatality was analyzed through log-linear Poisson regression models to assess the variations of firearm mortality risks in relation to a person's sex, age, race/ethnicity, and region.

Results: Firearm violence is responsible for 14% of injury-related deaths in Wisconsin. Seventy-two percent of firearm-related deaths were attributed to suicides; the majority of decedents were white men aged 45 years or older. The proportion of homicides by gun to all homicides increased from 63% in 2000 to 72% in 2014. Disproportionally high firearm homicides were found among black men aged 18 to 34 years in southeastern Wisconsin, accounting for 38% of the entire gun-related murder deaths.

Conclusion: Our study shows that the association of the demographic and geographic characteristics with mortality rates differs among suicides, homicides and the other intent. Understanding characteristics associated with firearm related-deaths is the first step toward addressing them.

INTRODUCTION

In 2013, the nation's overall age-adjusted firearm mortality rate was 10.3 per 100,000 population compared to 10.4 per 100,000

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who died from motor vehicle traffic accidents,[1] despite the fact that 90% of American households have access to motor vehicles versus only one third of American households owning a gun.[2,3] Along with public safety and criminal justice concerns, the public health community has increasingly recognized gun violence as a serious public health problem. Over 30 years ago, the director of the Centers for Disease Control and Prevention (CDC)) advocated for addressing violence as a public health issue.[4] Firearm-related injuries and deaths affect not only health care expenditures, but also societal productivity and general well-being from the loss of lives and the creation of a climate of fear.[5,6]

There has been growing concern about increasing gun-related deaths in Wisconsin. Although the state has shown lower firearm mortality rates than the national average and other Midwestern states (with the exception of Minnesota and Iowa),[1] over the past 15 years the overall firearm-related mortality in Wisconsin has continued to rise. In 2013, the statewide age-adjusted death rate due to firearms was 9.6 per 100,000 persons, reaching the highest mark since 2000.

Literature on firearm violence indicates that gun-related fatalities have fluctuated over time and related to economic hardship, population composition, access to firearms, and mental/behavioral-related disorders.[7-9] This prompted our interest in assessing geo-demographic factors that might be responsible for Wisconsin's rising deaths due to firearms.[10-12] Our goal is to contribute empirical information essential to the future development of gun safety policies and programs that will educate the public on the responsible use and storage of firearms and may reduce firearm mortality throughout the state. To gain a better under-

standing of the relationship between firearm deaths and population characteristics, we assessed the pattern of the gun-related mortality rates by the reason (homicide, suicide, and other) of deaths, age, sex, race/ethnicity, and region in Wisconsin.

METHODS

This study examined the patterns of firearm-related death rates in Wisconsin from 2000 through 2014 (the latest year data were available). Mortality data were obtained through Wisconsin Interactive Statistics on Health (WISH) query system, based on population death certificate records maintained by the Wisconsin Department of Health Services. Because WISH is a statewide public use database available in the public domain and does not contain personal identifiable information, this study is exempted from the University of Wisconsin Institutional Review Board prior approval requirements.

Figure. Age-specific Firearm Mortaily Rates by Intent in Wisconsin: 2000-2014

Overall firearm mortality was reported based on the age-adjusted death rate against the year 2000 standard US population. Firearm-related fatality was identified using the International Classification of Disease-10th Revision (ICD-10) code set developed for CDC's injury mortality reports (ie, suicide: X72-X74; homicide: X93-X95, U01.4; others - unintentional, legal intervention, and undetermined: W32-W34, Y35.0, Y22-Y24).[3] The intent of death analyzed in the study included the suicide, homicide, or other category. Unintentional, legal intervention and undetermined causes of death were grouped into the other intent category. Age intervals for descriptive analysis include ≤17 years, 18 to 24 years, 25 to 34 years, 35 to 44 years, 45 to 54 years, 55 to 64 years, and ≥65 years. The geographic variable consisted of 5 major regions specified by Wisconsin Department of Health Services. To best approximate firearm fatality on race and ethnic groups, this study classified the population into 4 racial/ethnic groups: Hispanic, non-Hispanic white, non-Hispanic black, and other. American Indian, Asian, and other ethnicities are aggregated into the other race category due to small numbers to produce stable rates in each group.

To better characterize the pattern of firearm mortality, we further applied multivariate log-linear Poisson regression models to assess the effects of population characteristics on firearm-related fatalities by homicide, suicide, and other intent.[13] The regression analysis reconstructed the age groups into 5 levels: ≤17 years, 18 to 24 years, 25 to 34 years, 35 to 44 years, 45 to 54 years, and ≥55 years. Individuals aged 55 and older were merged into an age group to ensure sufficient observations for statistical modeling.
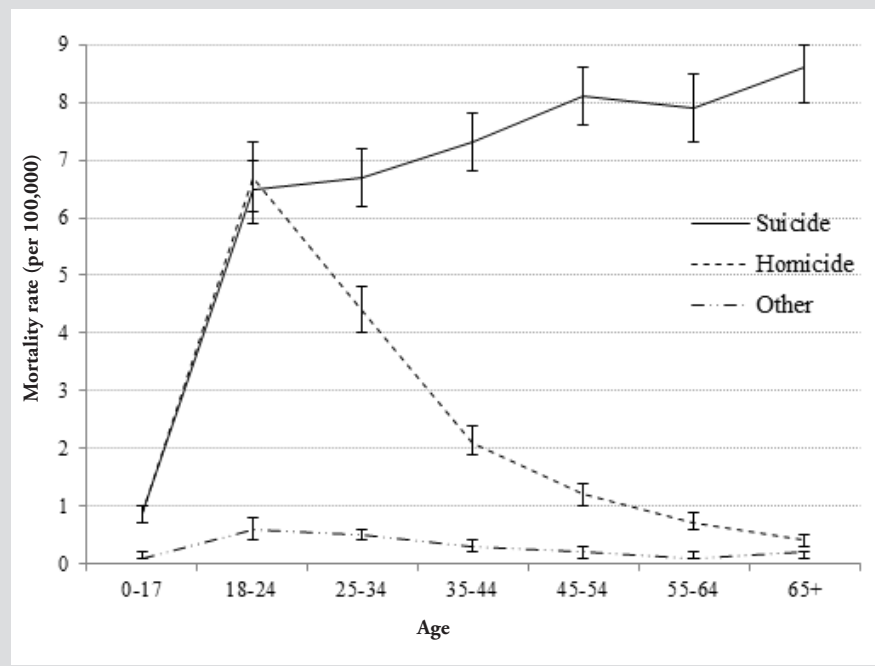
The backward reduction process was applied to eliminate factors with the least impact on the overall fit of the model, until the most parsimonious model for the mortality rate was identified. Contrast analysis also was performed to calculate relative risks (or risk ratios) and confidence intervals of firearm mortality in order to compare the likelihood of gun deaths among levels of a specific characteristic. All of the statistical analyses were performed using PROC GENMOD procedure (SAS Institute Inc).

RESULTS

In 2000-2014, about 14% (6,966 cases) of all injury-related deaths in Wisconsin were caused by firearms. The statewide age-adjusted firearm mortality was 8.1 per 100,000 persons, ranked fourth among all injury-related deaths in Wisconsin during 2000-2014, after falls (13.9 per 100,000), motor vehicle crash (11.7 per 100,000), and accidental poisoning (11.2 per 100,000).

The vast majority of firearm fatalities were due to suicides and homicides, accounting for more than 97% of the total firearm deaths since the new millennium. In 2000-2014, 48% of the 10,510 suicides and 64% of all homicides (2,692 cases) in the state were due to firearms. Overall, the number and rate of gun deaths by suicide consistently outnumbered homicides and other reasons in the past decade.

Overall Firearm Mortality

The overall firearm morality rates in suicide, homicide, and other intent by demographic characteristics are presented in Table 1. Individuals who died by firearms were predominately

Table 1. Firearm-related Death Count and Rate by Intent and Demographic Characteristics					
	Suicide		**Homicide**		**Other Intent**	
	#	**Rate[a]**	**#**	**Rate[a]**	**#**	**Rate[a]**
Total Deaths	5,020	5.8 (5.6-6.0)	1,723	2.1 (2.0-2.2)	223	0.3 (0.2-0.3)
Sex						
Male	4,534	10.4 (10.4-11.1)	1,409	3.3 (3.2-3.5)	203	0.5 (0.4-0.6)
Female	486	1.1 (1.1-1.2)	314	0.8 (0.7-0.8)	20	0.0 (0.0-0.1)
Race/ethnicity						
Hispanic	42	1.0 (0.7-1.3)	131	3.0 (2.5-3.5)	9	0.2 (0.1-0.3)
White	4,752	6.6 (6.4-6.8)	529	0.7 (0.7-0.8)	160	0.2 (0.2-0.3)
Black	141	2.6 (2.2-3.1)	1,007	18.8 (17.6-20.0)	45	0.8 (0.6-1.0)
Other	85	3.2 (2.5-3.8)	56	2.1 (1.5-2.6)	9	0.4 (0.2-0.7)
Region						
Southern	942	5.9 (5.5-6.2)	123	0.8 (0.6-0.9)	33	0.3 (0.2-0.4)
Southeastern	1,495	4.8 (4.6-5.1)	1,381	4.4 (4.2-4.7)	93	0.3 (0.2-0.4)
Northeastern	1,138	6.3 (5.9-6.6)	89	0.5 (0.4-0.6)	41	0.2 (0.2-0.3)
Western	839	7.4 (6.9-7.9)	69	0.6 (0.5-0.7)	39	0.3 (0.2-0.5)
Northern	605	8.2 (7.6-8.9)	61	0.8 (0.6-1.0)	17	0.2 (0.1-0.3)
Age group[b]						
0-17	172	0.9 (0.7-1.0)	171	0.9 (0.7-1.0)	27	0.1 (0.1-0.2)
18-24	545	6.5 (5.9-7.0)	562	6.7 (6.1-7.3)	50	0.6 (0.4-0.8)
25-34	718	6.7 (6.2-7.2)	476	4.4 (4.0-4.8)	53	0.5 (0.4-0.6)
35-44	858	7.3 (6.8-7.8)	252	2.1 (1.9-2.4)	35	0.3 (0.2-0.4)
45-54	1,013	8.1 (7.6-8.6)	151	1.2 (1.0-1.4)	26	0.2 (0.1-0.3)
55-64	704	7.9 (7.3-8.5)	69	0.7 (0.6-0.9)	13	0.1 (0.1-0.2)
≥65	974	8.6 (8.0-9.1)	42	0.4 (0.3-0.5)	19	0.2 (0.1-0.2)
Year						
2000	304	5.6 (5.0-6.3)	111	2.1 (1.7-2.4)	16	0.3 (0.2-0.4)
2001	315	5.7 (5.1-6.4)	133	2.4 (2.0-2.8)	25	0.5 (0.3-0.6)
2002	308	5.5 (4.9-6.1)	122	2.2 (1.8-2.6)	15	0.3 (0.1-0.4)
2003	310	5.5 (4.9-6.1)	137	2.5 (2.1-2.9)	19	0.4 (0.2-0.5)
2004	305	5.4 (4.8-6.0)	92	1.7 (1.3-2.0)	12	0.2 (0.1-0.3)
2005	301	5.3 (4.7-5.9)	160	2.9 (2.4-3.3)	13	0.3 (0.1-0.4)
2006	299	5.3 (4.7-5.9)	110	1.9 (1.6-2.3)	15	0.3 (0.1-0.4)
2007	335	5.8 (5.1-6.4)	132	2.3 (1.9-2.7)	18	0.3 (0.2-0.5)
2008	343	5.8 (5.2-6.5)	78	1.4 (1.1-1.7)	19	0.3 (0.2-0.5)
2009	344	5.8 (5.2-6.5)	103	1.9 (1.5-2.3)	9	0.2 (0.1-0.3)
2010	377	6.4 (5.7-7.0)	105	1.9 (1.5-2.3)	17	0.3 (0.2-0.5)
2011	349	5.9 (5.3-6.5)	85	1.6 (1.3-1.9)	7	0.1 (0.0-0.2)
2012	346	5.8 (5.2-6.4)	123	2.3 (1.9-2.7)	10	0.2 (0.1-0.3)
2013	436	7.3 (6.6-8.0)	115	2.1 (1.7-2.5)	16	0.3 (0.1-0.4)
2014	348	5.7 (5.1-6.3)	117	2.1 (1.7-2.5)	12	0.2 (0.1-0.3)

[a]Age-adjusted mortality rate per 100,000 persons, and its 95% CI.
[b]Age-specific mortality rate per 100,000 persons, and its 95% CI.

Table 2. Final Log-linear Model of Firearm Mortality Risks				
Factor	**df**	**Suicide**	**Homicide**	**Other**
Sex	1	3724.5[a]	6.2[b]	174.1[a]
Age	5	568.1[a]	1012.4[a]	61.8[a]
Race[c]	3	156.3[a]	2338.8[a]	49.4[a]
Region	4	28.1[a]	34.7[a]	
Year	11	32.6[a]	77.8[a]	
Sex x Age	5		37.4[a]	
Sex Race[c]	3		160.7[a]	
Age x Region	20	40.3[a]	46.2[b]	
Race[c] x Region	12	30.5[a]		

[a]$P<0.01$, [b]$P<0.05$.
[c]Race represents the race/ethnicity factor.

male, regardless of the type of intent. Among racial/ethnic groups, whites showed a greater age-adjusted death rate from suicide, whereas African Americans and Hispanics had much higher mortality rates from homicide. The suicide-intent firearm death rate was significantly greater than firearm death rates by homicides and other intents in the southern, northeastern, western, and northern regions in Wisconsin. The southeastern region had the highest firearm-related homicide rate in the state.

Large variations in gun-related fatality were found across age groups (Figure). For individuals younger than 24 years old, statistics showed a slightly lower firearm-related mortality rate in suicide than in homicide. Individuals aged 18 to 24 years had the highest death rate from firearm homicide and the rate rapidly declined from 6.7 to 1.2 per 100,000 persons with increasing age until age 44 years. The firearm homicide death rate continued to decrease at a slower pace for people older than 45 years, in contrast to the increasing firearm suicide rate among older adults.

Multivariate Log-linear Regression

The results of the log-linear regression models for the effects of year, sex, age, race/ethnicity, and region on the gun-related suicide, homicide, and other intent mortality rates are provided in Table 2. Both the suicide and homicide rates fluctuated over time. The individual's sex showed a substantial effect on the firearm suicide rate. Age and race/ethnicity had strong effects on the firearm homicide rate.

Multiple two-way interactions were found to be statistically significant among sex, race/ethnicity, regions, and age groups for the firearm suicide mortality and the firearm homicide mortality. The firearm mortality due to other intent was mainly affected by sex, race/ethnicity, and age groups. There were no significant interaction effects in the model for firearm mortality due to other intent.

Suicides
In 2000-2014, 72% of gun-related deaths were attributed to suicides. The trend analysis showed that the suicide rate gradually

Table 3. Risk Ratios for Firearm-related Suicides and Homicides on Age Group and Race/Ethnicity by Region									
	Southeastern		Northeastern		Northern		Southern		Western	
	RR	95% CI	RR	95% CI	RR	95% CI	RR	95% CI	RR	95% CI
Suicide										
Age group										
0-17 years	1.00		1.00		1.00		1.00		1.00	
18-24 years	15.6	10.4 - 23.4	5.96	4.23 - 8.41	5.95	4.06 - 8.72	7.41	5.09 - 10.8	7.96	5.52 - 11.5
25-34 years	15.2	10.2 - 22.7	7.10	5.04 - 9.99	5.25	3.17 - 8.69	4.63	2.94 - 7.30	7.09	4.45 - 11.3
35-44 years	13.1	8.79 - 19.5	5.48	3.46 - 8.67	5.90	3.83 - 9.10	6.39	4.07 - 10.0	6.00	3.88 - 9.28
45-44 years	14.7	9.86 - 21.8	10.3	6.76 - 15.7	10.1	6.89 - 14.8	8.54	5.71 - 12.8	5.67	3.72 - 8.63
≥55 years	16.4	11.1 - 24.3	7.39	4.97 - 11.0	7.27	4.89 - 10.8	7.54	5.12 - 11.1	7.17	5.09 - 10.1
Race/ethnicity										
White[a]	1.00		1.00		1.00		1.00		1.00	
Black[a]	0.63	0.52 - 0.76	0.27	0.06 - 1.18	1.63	0.37 - 7.1	0.70	0.34 - 1.44	0.63	0.15 - 2.71
Hispanic	0.17	0.11 - 0.26	0.45	0.19 - 1.06	0.46	0.06 - 3.44	0.54	0.25 - 1.17	0.24	0.03 - 1.78
Other	0.42	0.27 - 0.66	1.79	1.01 - 3.19	1.88	0.90 - 3.94	0.54	0.23 - 1.27	2.86	1.49 - 5.50
Homicide										
Age group										
0-17 years	1.00		1.00		1.00		1.00		1.00	
18-24 years	11.0	8.93 - 13.5	6.91	2.97 - 16.1	9.69	4.26 - 22.0	10.7	4.32 - 26.6	13.4	5.11 - 35.1
25-34 years	7.58	6.12 - 9.39	17.5	6.97 - 44.0	2.15	0.84 - 5.54	4.70	2.07 - 10.7	6.29	2.57 - 15.4
35-44 years	3.53	2.76 - 4.50	1.65	0.53 - 5.10	3.93	1.51 - 10.3	3.93	2.09 - 7.39	2.09	1.06 - 4.13
45-44 years	2.18	1.65 - 2.90	1.86	0.87 - 3.97	2.83	1.35 - 5.93	3.19	1.35 - 7.52	2.02	0.65 - 6.28
≥55 years	0.90	0.63 - 1.29	0.94	0.29 - 2.99	1.46	0.44 - 4.84	2.36	0.72 - 7.79	2.78	0.86 - 8.97

[a] Non-Hispanic whites; non-Hispanic blacks.
Abbreviation: RR, risk ratios; CI, confidence interval.

declined in the first half of the millennium, followed by an upward trend till reaching its highest point in 2013 (7.3 per 100,000 population). The firearm-related suicide rate was stable over the years, with the exception of a large spike in 2013 (Table 1).

Men had a substantially greater risk of deaths by firearm suicides than women (Risk Ratio (RR)=8.75, 95% CI, 8.00-9.58). The magnitude of the firearm suicide risks among age groups varied by geographic region in Wisconsin (Table 3). The northern, northeastern, and southern regions consistently showed the greatest suicide risk among people aged 45 to 54 years. Young adults aged 18 to 34 years and older adults tended to have a higher likelihood of dying from firearm-related suicides in the southeastern and western regions.

The effect of the racial/ethnic group on firearm suicide mortalities also differed by geographic area (Table 3). Blacks showed a lower risk of firearm-related suicides than whites, except in the northern region. Firearm-related suicide rates for Hispanics also were consistently lower than whites across all regions in Wisconsin. In the southern and southeastern regions, the non-Hispanic minority group was found with considerably lower risk of firearm-related suicide than its white counterpart. However, individuals in the other race group showed much greater firearm-related suicide rates than whites in the northern, northeastern, and western regions.

Homicides
Firearm-related homicide mortality fluctuated over the years

(Table 1). Homicide deaths by gun went up slightly from the new millennium and reached the highest rate of 2.9 per 100,000 population in 2005. The annual firearm homicide rate declined afterward, but gradually rose again since 2012.

Interaction effects between sex and age, sex and race/ethnicity, and age and region, were found on firearm homicide mortality rates. The variations of firearm homicide rates of the men and women by age group and race/ethnicity are shown in Table 4. Men aged 18 to 24 years and women aged 25 to 34 years were more likely to be homicide victims, compared to individuals in other age groups. Firearm homicide rates decreased in both men and women as they became older; however, both men and women consistently showed a greater firearm homicide rate than teens, except for those aged 55 years and older.

Black men were 20 times more likely to be firearm victims than their white counterparts, and black women were 3.2 times more likely to be firearm victims than white women. The risk of homicide by firearm for men in the Hispanic and the other ethnic groups were at least 2-fold higher than white men. Hispanic women had a lower risk of dying from firearm-related homicides than white women, though the homicide rates between Hispanic and white women were not statistically significant.

For most regions in Wisconsin, the 18 to 24 year age group had the highest gun-related homicide rate compared to other age groups, except the northeastern region where the highest firearm homicide rate occurred among individuals aged 25 to 34 years (Table 3). The likelihood of being murdered by gun usu-

Table 4. Risk Ratios for Firearm-related Homicide on Age Group and Race/Ethnicity by Sex

	Male		Female	
	RR	95% CI	RR	95% CI
Age				
0-17 years	1.00		1.00	
18-24 years	11.0	8.91 - 13.5	3.43	2.40 - 4.90
25-34 years	7.56	6.11 - 9.36	3.72	2.68 - 5.16
35-44 years	3.51	2.75 - 4.48	2.25	1.57 - 3.23
45-54 years	2.16	1.63 - 2.87	1.54	1.03 - 2.30
≥55 years	0.89	0.62 - 1.27	0.85	0.57 - 1.27
Race/ethnicity				
White[a]	1.00		1.00	
Black[a]	20.4	17.9 - 23.4	3.22	2.12 - 4.87
Hispanic	3.32	2.67 - 4.11	0.77	0.40 - 1.47
Other	2.69	1.94 - 3.74	1.31	0.67 - 2.56

[a] Non-Hispanic whites; non-Hispanic blacks.
Abbreviations: RR, risk ratio; CI, confidence interval.

Table 5. Risk Ratios for Other Firearm-related Deaths

	RR	95% CI
Sex		
Male	1.00	
Female	0.10	0.06 - 0.16
Age group		
0-17 years	1.00	
18-24 years	4.24	2.68 - 6.69
25-34 years	3.60	2.29 - 5.67
35-44 years	2.10	1.27 - 3.46
45-54 years	1.63	0.96 - 2.77
≥55 years	1.37	0.83 - 2.27
Race/Ethnicity		
White[a]	1.00	
Black[a]	3.75	2.69 - 5.24
Hispanic	0.74	0.36 - 1.51
Other	1.55	0.81 - 2.94

[a]Non-Hispanic whites; non-Hispanic blacks.
Abbreviations: RR, risk ratio; CI, confidence interval.

ally declined with age, though the magnitude of change varied by region. Younger adults were about 4-fold to 5-fold more likely to die of gun-related homicides than older adults, however there were regional variations with higher risks of the firearm homicide rates persisting in the older adult population among the northern, southern, and western regions.

Other Firearm-Related Deaths
Table 5 shows the risk ratio of firearm-related mortality due to other intent. Males, young adults aged 18 to 24 years, and African Americans showed substantially greater mortality rates in each demographic category. Similar to homicides, the gun-related other-intent death rate declined with increasing age. Non-Hispanic minorities were more likely to be killed by gun than their white counterparts, due to unintentional, undetermined, or legal reasons. The other gun-related mortality did not show significant fluctuation over time.

DISCUSSION

Our study shows that, despite media attention to firearm homicides, three out of four gun-related deaths in Wisconsin actually resulted from suicide and that the preponderant risk group for firearm suicides were white men, particularly in rural regions and small towns. The statewide firearm suicide-to-homicide ratio is higher than the national ratio; gun suicides accounted for approximately 60% of the total gun deaths in the United States.[1] The disproportionate ratio may relate to contextual factors in Wisconsin, or reflect the greater number of gun homicides in other states. These trends continue the direction of gun-related suicides in Wisconsin described by Fox and colleagues 20 years ago.[14]

The number and rate of deaths by firearm suicide generally rise with age. In Wisconsin, the majority of firearm suicides were men aged 45 years or older. By age of 55, men are 10 times more likely than women to kill themselves by firearm. Research indicates a strong association between firearm suicide and access to a firearm at home in the elderly population,[10] and older adults are at a greater risk of firearm-related suicide when there is an additional history of a mental or physical illness.[15] Social isolation, especially for individuals recently losing significant relationships such as spouses or longtime companions, also increases the risk of suicide.[16]

Our data also support what has been called the "rural mortality penalty," which has demonstrated disparities between overall increased rural mortality compared to urban and suburban regions.[17] The suicide rate for rural regions in the state is almost twice that of the southeastern urban region. A recent article highlighted the increasing mortality of middle-aged white rural populations with one of the causes, an increase in suicide in men.[18] An Australian article on suicide in men showed that young rural farm workers were at greater risk from suicide by firearm; further investigation showed that access to firearms was the major variable distinguishing them from young urban men.[19]

Forty-five percent of people who died by suicide saw their primary care provider within 1 month of their death.[20] These individuals also visited primary care physicians twice as often as mental health specialists, suggesting that primary care may play a pivotal role in suicide prevention. Despite the findings of the US Preventive Services Task Force that there is no strong evidence for the effectiveness of suicide screening in adolescents and adults,[21] incorporating protocols in the patient-centered medical home for screening, intervention, and referral for depression and suicide risk may offer some hope.[22] Suicide risk management may be more effective in a collaborative model of primary care physicians with behavioral health professionals.[23]

The firearm-related homicide rate in Wisconsin remains below

the national average, but has continued to rise in recent years. The overall percentage of the firearm homicides to all homicides increased from 63% in 2000 to 72% in 2014. There is also a large racial disparity in firearm homicide prevalences, and specifically, high gun homicide rates exist among young African Americans in the southeastern region compared to other regions and races and ethnicities. This continues the trends outlined a decade ago by Shiffler and colleagues in adolescent suicides and homicides in the state, which showed the same regional distribution as our study.[12]

Factors affecting firearm homicides are manifold, such as household gun ownership, income inequality, race/ethnicity, and neighborhood crime rate.[24] Research in gun regulatory laws shows licensing and background checking are correlated with lower firearm homicide rates.[25] This is of importance for Wisconsin with large gun ownership,[25] particularly when the firearm homicide rate increases by 0.9% for each 1 percentage increase in the proportion of household gun ownership.[24] Interventions that might reduce firearm-related homicides should involve regulations in firearm acquisition, storage and carrying, as well as economic and social changes that might address racial inequality. In addition, having police and public safety using a public health approach to addressing homicides has the potential to address root causes.[26]

Gun violence has been linked to mental illness such as schizophrenia, alcohol abuse disorder, or severe depression, and also has been connected with domestic violence. Primary care is likely to be the first and often only source of mental health care for most patients. Primary care clinicians should assess for firearms as a risk factor in their practices. Based on the result of the assessment, they can promptly offer counseling and/or medication essential for individuals with mental health issues (eg, depression, alcohol abuse disorders),[27] and help them access behavioral specialists and other necessary social services. Counseling could be particularly beneficial to patients showing high risk of aggressive or impulsive behaviors during vulnerable time periods.[28]

The firearm homicide rate among minority populations that is 26 times that of whites underscores ongoing statewide concerns in gun violence by race. Our analysis shows that in 2000-2014 a total of 650 black men aged 18 to 34 years were murdered by guns in southeastern Wisconsin, accounting for 38% of the entire firearm-related homicides in the state. The disproportional deaths in the minority population often are attributed to economic hardship or geo-culture of the population. Many victims are from disadvantaged neighborhoods that historically lack access to jobs, housing, educational opportunities, and health care. Individuals living in disenfranchised communities tend to repeatedly experience violent crimes nearby to their home or workplace, which affect their stress levels and risks of mental health issues and increase the likelihood of engaging in or being victimized by violent behaviors in the future.[29]

Meta-analysis on crime prevention policies and programs has shown promising effects of multidimensional community-based initiatives on reducing firearm violence and increasing community safety.[30] Many community interventions aiming to reduce firearm homicide rates incorporate firsthand insights from community members about harms associated with gun violence, allowing people to develop practical strategies and intervention plans.[25] People participating in programs with community-level components show increasing accountability and commitment to a healthy way of living.

Several data limitations may affect the findings of our study. The firearm mortality rates extracted from WISH were obtained in an aggregate level by sex, age group, race/ethnicity, geographic region, and time period, as opposed to individual-level data. The use of group data restricted our ability to control other demographic and socioeconomic factors at the individual level. Moreover, there were a relatively small number of observations in deaths due to other intent and deaths in the other racial/ethnic group. Because they could lead to possible small-estimation biases in logistics regression modeling, the results of the firearm mortality risk estimates and rate ratios should be interpreted with caution.

We also recognized analysis limitations about combining the unintentional cause with the legal and unknown causes of firearm death into 1 group. Understanding the unique pattern of the unintentional firearm fatality could help us develop more effective educational or licensing courses to improve firearm safety, especially for the recent expansion of gun access, such as concealed carrying and youth hunter mentorship program.

DISCUSSION

Firearm violence is the fourth-leading cause of injury-related deaths in Wisconsin behind falls, motor vehicle crashes, and accidental poisoning. Over 85% of firearm-related fatalities occurred among individuals younger than age 65 years, suggesting a great loss of years of potential life that could be productive and beneficial to society. Moreover, a disproportional number of gun fatalities are due to firearm suicides (72%), compared to firearm homicides (25%).

Firearm mortality imposes a wide array of health, societal, and financial problems on many vulnerable populations. Solutions will require changes in public policy and finding effective preventive strategies used by community-based clinicians, public health agencies, and public interest organizations. In the study, we hoped to show characteristics associated with gun deaths as the first step toward addressing them. More research and innovative clinical and community interventions are needed to identify high risk and determine interventions that are most effective.

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