

Geographic and Temporal Comparisons of ATV Deaths in West Virginia, 2000-2008

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Abstract

During the 9-year period from 2000-2008, West Virginia experienced 301 deaths related to All-terrain Vehicles (ATVs). The distribution of ATV deaths across the top 20 counties in West Virginia accounted for nearly seventy percent of the ATV-related deaths during the 9-year study period. Time-of-day was a significant predictor of population-based rates, and a 34% decrease in the fatality rate from 2.94 in 2006 to 1.93 in 2008 occurred. We opine that the decline in ATV mortality is possibly due to better enforcement of the (WV Code Chapter 17F), mandatory ATV regulations passed by the West Virginia State Legislature in 2004. Improved safety vigilance and ATV operator adherence to manufacturers' safety guidelines may have also contributed to the decreasing incidence of ATV deaths. While the current downward trend is most welcome, more attention should be directed towards high-risk behaviors including alcohol and drug abuse and driving on paved surfaces.

Introduction

Previous research has described the epidemiology and characteristics of ATV-related mortality in West Virginia.¹⁻⁶ During the decade of the 1990s, West Virginia had the second highest number of ATV deaths (124) compared to all other states, and a fatality rate of 0.7 deaths per 100,000 population; a rate significantly higher than any other state.² Adolescents and the elderly were identified as high-risk subgroups.^{4,5} Based on death certificate information, West Virginia has experienced at least 301 ATV-related deaths from 2000 through 2008.

About one-fourth of these deaths have occurred in children less than 18 years of age; 95% of the victims were not wearing helmets and 15% were passengers. About one-third of ATV crashes have occurred on surfaces not intended for safe ATV use including public roads, streets and highways. States, such as West Virginia with no ATV safety requirements (prior to 2004), experienced an ATV-related fatality rate double that of states with some level of ATV safety regulation.²

A March 2008 *Morbidity and Mortality Weekly Report* article reported that lower socioeconomic status, lower level of education attained, and single or divorced marital status were associated with higher rates of ATV-related deaths in West Virginia from 1999-2006.⁷ To date, little has been done to describe geographic and temporal patterns of ATV deaths across West Virginia, particularly in those counties which account for most of the state's ATV

Table 1. Distribution and rate of ATV-related deaths by County, 2000-2008.

County	Deaths	Proportion of Deaths	2004 Population	Fatality Rate per 100,000
Kanawha*	20	6.64%	195,218	1.14
McDowell*	17	5.65%	24,726	7.64
Mingo*	15	4.98%	27,389	6.09
Monongalia	14	4.65%	83,918	1.85
Fayette*	12	3.99%	47,049	2.83
Lincoln*	12	3.99%	22,564	5.91
Raleigh*	12	3.99%	79,175	1.68
Cabell*	11	3.65%	94,801	1.29
Jackson	11	3.65%	28,477	4.29
Wyoming*	11	3.65%	24,698	4.95
Logan*	9	2.99%	36,502	2.74
Roane	8	2.66%	15,359	5.79
Boone*	8	2.66%	25,721	3.46
Hampshire	7	2.33%	21,542	3.61
Marion	7	2.33%	56,453	1.38
Mason*	7	2.33%	25,941	3.00
Putnam	7	2.33%	53,836	1.44
Braxton	6	1.99%	14,950	4.46
Calhoun	6	1.99%	7,415	8.99
Mercer*	6	1.99%	62,070	1.07
Other 35 Counties	95	31.56%	860,540	1.23
State	301	100.00%	1,808,344	1.85

* located in southern third of state

Table 2. Population-based ATV fatality rates, 2000-2008

Year	Deaths	Fatality Rate (per 100,000)
2000	15	0.77
2001	20	1.14
2002	27	1.52
2003	35	2.07
2004	32	1.83
2005	39	2.11
2006	52	2.94
2007	45	2.56
2008	36	1.93
Total	301	1.85

deaths. Therefore, the purpose of this report was to identify the top 20 counties in West Virginia for ATV mortality, and determine if temporal features such as month, day-of-

week, or time-of-day may influence mortality patterns from 2000-2008.

Methods

Death certificates, obtained from the West Virginia State Registrar, for the 301 ATV-related deaths that occurred in West Virginia from 2000-2008 were reviewed. Information related to the county where the fatal crash occurred, year, month, day-of-week and time-of-day were recorded and entered into an Excel spreadsheet. Time-of-day was grouped as early morning (Midnight - 5:59 am), morning (6:00 am-11:59 am), afternoon (Noon - 5:59 pm) and evening/night (6:00 pm-11:59 pm). Months were grouped in seasons: Spring (March, April, May), Summer (June, July, August), Fall (September, October, November), and Winter (December, January, February). Days-of-week were grouped as

weekday (Monday-Thursday) or weekend (Friday-Sunday).

R statistical software was used to fit the count data into a Poisson regression model using population-based ATV mortality rates as the response variable and the seasons, times of day and weekend versus weekday as predictor variables. Separate models were fitted for seasons, time-of-day and weekend versus weekday. Rates were calculated using U.S. Census Bureau data;⁸ the WV and county populations for 2004. The midpoint in the 9-year study period was used as denominator values.

Results

The distribution of ATV deaths across the top 20 counties in West Virginia is shown in Table 1. These counties, out of the state's 55 counties, accounted for nearly



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Table 3. Time of ATV crash as a predictor of fatality rates

Time Period	Estimate ± Std Error	Significance
Midnight – 5:59 am	-0.02 ± 0.40	NS
6:00 am – 11:59 am	0.12 ± 0.10	NS
Noon – 5:59 pm	0.16 ± 0.07	0.02
6:00 pm – 11:59 pm	-0.12 ± 0.07	NS

seventy percent (205 of 301) of the ATV-related deaths during the 9-year study period. Further, twelve of the 20 counties, which are located in the southern part of the state, accounted for over 46% of all the deaths (140 of 301). These twelve counties also accounted for about 38% of the state's population and 26% of the land area.⁸ Calhoun County, whose population ranks 50th in the state, experienced the highest population-based rate of 8.99 per 100,000 population. At the other end of the spectrum, Kanawha County ranked 1st in population with a fatality rate of 1.14, second lowest among the 20 top counties. The rate for the remaining 35 counties was 1.23 and for the entire state, 1.85.

During the first six years of the study period, deaths increased consistently from 15 in 2000 to a record high of 52 in 2006 (see Table 2). Fatality rates also increased proportionally.

Sixty-four percent of the deaths occurred on the weekend with Saturday alone accounting for a quarter of the deaths. Deaths during the Summer season accounted for about 36% of the ATV deaths. Nearly 70% (208 of 300) of the ATV deaths occurred between noon and midnight. Season and weekend versus weekday were not predictors of population-based rates. Time-of-day however, was a significant predictor of population-based rates (see Table 3). There was a residual deviance: 15.389 on 15 degrees of freedom, suggesting that

the data fit the model extremely well. During the afternoon period (i.e., noon to 5:59 pm) there was a significant proportional increase in the number of ATV deaths ($p = .02$).

Discussion

After the initial geographical analyses, one might conclude that because Kanawha County had the greatest population and the highest number of ATV-related deaths, it should follow that Kanawha would have the highest fatality rate, as well. Results presented above show that this is definitely not the case. In fact, Calhoun County, with a 2004 population less than 4% of Kanawha's and 14 fewer ATV deaths, had a fatality rate nearly eight times higher, 8.99 and 1.14, respectively. This finding supports the observation by Rodgers in his study of national ATV fatality rates from 1990-1999, where he reported that the rural nature of a state contributed to rate differences.⁹ While relatively higher rates have been observed in many of West Virginia's counties, the overall rate for the state from 2000-2008 is consistent with rates reported in earlier studies.^{1,2,9}

Even though ATV fatalities in West Virginia continue to be a local as well as a national public health concern, Table 2 shows a decline in ATV population-based fatality rates after 2006. The 34% decrease in the fatality rate from 2.94 in 2006 to 1.93 in 2008 is significant and should give us pause. We opine that the

decline in ATV mortality is possibly due to better enforcement of the (WV Code Chapter 17F), mandatory ATV regulations passed by the West Virginia State Legislature in 2004.¹⁰ Improved safety vigilance and ATV operator adherence to manufacturers' safety guidelines may have also contributed to the decreasing incidence of ATV deaths.

While the current downward trend is most welcome, more attention should be directed towards two continuing high-risk behaviors. Review of medical examiner records and toxicology data of 112 fatal ATV crashes from 2004-2006¹¹ revealed that alcohol was detected in the blood of 50% of the decedents and of those, 88% had blood alcohol concentrations at or over the legal limit of 0.08%. Drugs of abuse, including marijuana, opioid analgesics, and diazepam were identified in 21% of the deaths. The location of the crashes is also of major concern. Recent data, from a report prepared for Governor Manchin,¹² showed that at least 53% of the fatal crashes occurred on paved surfaces including streets and highways – many of which are in the counties described in this study. While some of these locations were legal for riding in accordance with the 2004 law,¹⁰ many were not. Manufacturers have continuously recommended that ATVs not be operated on paved surfaces such as asphalt and concrete. ATV tires are bulbous, with low air pressure and wide treads that do not grip well on hard surfaces like roads. Stricter enforcement of this part of the law is strongly warranted.¹⁰ In addition, the required ATV Awareness Course should be strengthened by more aggressively addressing these high-risk behaviors. If ATV operators are made more aware of these risks, then ATV mortality should continue its recent downward trend.

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contents

May/June 2010, Volume 106, No. 3

West Virginia
Medical JOURNAL
West Virginia State Medical Association

features

- 4 President's Message
- 8 Our Editor Speaks
- 9 Guest Editorial
- 36 General News
- 37 Photo montage—Haiti
- 38 SPECIALNews—Med Mal Challenge
- 39 Health System Reform—Its Impact on WV
- 42 WESPAC Contributors
- 43 WESPAC 2010 Primary Endorsements
- 44 2010 Legislative Wrap-Up
- 48 Robert C. Byrd Health Sciences Center of West Virginia University News
- 49 Marshall University Joan C. Edwards School of Medicine News
- 50 West Virginia School of Osteopathic Medicine News
- 51 Bureau for Public Health News
- 52 Physician Practice Advocate News
- 53 New Members
- 54 Obituaries
- 56 West Virginia Medical Insurance Agency News
- 59 Classified Ads
- 60 Manuscript Guidelines/Advertisers

In this issue...

Scientific Articles

- 12 A Review of the American Heart Association Revised Guidelines for the Prevention of Infective Endocarditis
- 16 A Young Male with Sudden Onset Left-Sided Weakness
- 19 Free Muscle Flap Reconstructions Using Interpositional Vein Grafts vs. Local Anastomosis: A 5-Year Experience
- 24 Successful Pregnancy Following Conservative Surgical Therapy of an Invasive Molar Gestation
- 26 Geographic and Temporal Comparisons of ATV Deaths in West Virginia, 2000-2008

Special Article

***Finding a Faster Route to Practice:
From Medical Student to
Board Certified Physician*** 30



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