The Extent and Nature of Motor Vehicle and Buggy Crashes

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Abstract: Crashes involving motor vehicles and buggies are often catastrophic for the drivers and passengers of the buggies. Recent safety recommendations focus on making buggies more visible; however, this strategy may not address the primary causes of buggy and motor vehicle crashes. To understand what safety recommendations might be most effective, we must understand the scope and nature of these crashes. We used *The Diary,* a monthly Amish periodical, to gather information on crashes between motor vehicles and buggies from 2015 through 2022. Crashes are reported by Amish scribes from across the United States and Canada. We recorded the victim demographics, the result of the crash for the victims, the cause of the crash, and the point of impact. Over one quarter of the crashes resulted in a serious injury or death. Crashes due to motor vehicle driver error are the most common, and these crashes are likely to be rear-end impacts. When Amish buggy drivers are at fault, broadside hits are most common. Implementing signage or flashing lights in areas with high buggy traffic can make motor vehicle drivers more aware. Infrastructure changes such as widening of roads could allow horses, buggies, and motor vehicles to travel together more safely. Moreover, automobile technological changes provide a potential safeguard against rear-end buggy crashes through safety features that automatically warn drivers of obstructions in front of their vehicles.

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While many studies on speed differentials leading to crashes focus on pedestrians and cyclists, fewer studies focus on crashes with buggies. Buggy traffic may be more localized than pedestrian or cycling traffic; however, the injuries and safety implications are just as critical. In fact, as more communities worldwide promote healthful behaviors like walking and cycling (Antón-González et al., 2023; Värnild et al., 2023), the Amish population in the U.S. continues to grow and expand to new areas. The expansion of slow-moving vehicles into more geographical regions that do not have the infrastructure to deal with the slow-moving traffic increases the risk of crashes.

Crashes between buggies and motor vehicles are primarily constrained to areas with Amish populations, as buggies are the primary mode of transportation for Old Order Amish groups.

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This slow-moving transportation emphasizes separation between Amish groups and worldly technology and limits access through transportation (Nolt, 2016). There are, however, risks associated with relying on horses and buggies for transportation, especially as buggies travel on roads populated with motor vehicles.

While the largest Amish settlements are located in three states—Pennsylvania, Ohio, and Indiana—the population is growing, and new settlements are being established across the U.S. (Donnermeyer & Anderson, 2014, 2015; Donnermeyer & Cooksey, 2010). Motor vehicle drivers from regions not accustomed to sharing the roads with horse-drawn vehicles may put buggy passengers at risk. The resulting injuries from motor vehicle and buggy crashes can be severe (Aaland & Hlaing, 2004; Gilliam et al., 2008; Gorucu et al., 2017). One only needs to preview news headlines from Amish communities to see the tragedy that results from crashes involving buggies and motor vehicles. For example, in the buggy accidents section of the Amish America website (https://amishamerica.com/category/buggy-accidents/), article titles read, "Buggy Accident Claims Lives of Two Amish Toddlers," "Amish Baby Loses Life After Driver Attempts to Pass, Hits Buggy," and "Eight Children Left Orphaned After VA Buggy Crash."

The first step to developing appropriate safety strategies is understanding the extent and nature of motor vehicle and buggy crashes. Research on these crashes utilizes various data sources, each with strengths and limitations. Studies that use data from the Department of Transportation (DOT) report on the type of crash, the severity of the injury, and the number of people involved (Anderson, 2014; Gorucu et al., 2017; Kinzenbaw, 2008). These studies are limited by geographical area, usually to a specific state. Hospital or trauma records are commonly used to assess injury type and severity resulting from buggy and motor vehicle crashes but are limited to a single hospital location (Aaland & Hlaing, 2004; Forward et al., 2010; Jones, 1990; Morgan et al., 2022; Strotmeyer et al., 2019; Vitale et al., 2006; Whitney et al., 2022). Some researchers have used Amish periodicals to assess the extent and seriousness of buggy and motor vehicle crashes (Dewalt, 2022; Dewalt & Bradley, 2013; Hubler & Hupcey, 2002). (Amish periodicals include reports from scribes—people who live in Amish communities and report on the community happenings—which can be helpful to gauge a broader scope of buggy crashes.) These studies, however, inconsistently report information about the crashes. Dewalt (2022), for example, reports on mortality, while Hubler and Hupcey (2002) focus on children's injuries. Dewalt and Bradley (2013) provide a more comprehensive overview of crashes, encompassing injuries and death across a span of ages; however, the data is more than a decade old.

The most common type of buggy and motor vehicle collision reported across data sources is a rear-end crash (Aaland & Hlaing, 2004; Anderson, 2014; Dewalt & Bradley, 2013; Gorucu et al., 2017; Kinzenbaw, 2008). Broadside crashes are somewhat common (Aaland & Hlaing, 2004; Gorucu et al., 2017; Kinzenbaw, 2008), with sideswipes in the same direction and head-on collisions (Aaland & Hlaing, 2004; Anderson, 2014; Dewalt, 2022; Kinzenbaw, 2008) occurring less frequently. Anderson (2014) is one of the only scholars to examine the type of crash as it is linked to driver error, distinguishing between motor vehicle and buggy drivers. Anderson notes buggy driver error is likely to result in crashes where the driver attempted to cross or enter a main

road or make a left turn off of a main road. Anderson's data, however, is limited to Pennsylvania and is nearly two decades old.

The current study addresses gaps in the literature in several important ways. First, the data set was built from crash reports in the United States and Canada across eight years, 2015 through 2022, as reported in the accidents section of *The Diary*, an Amish periodical. Thus, it was not limited to a single state, city, or hospital. Second, the study provides information on the broad spectrum of categories of injuries reported, not just those that required hospitalization. Third, the research examines the interrelationship between the cause of the crash and the point of impact, providing helpful information to guide policy. We report the characteristics of the buggy passengers and their injuries. Additionally, we note who was at fault for the crash and the type of collision.

Methods

The Diary is a monthly publication initiated by a group of Amish men in 1969 in Lancaster County, Pennsylvania (Hostetler, 1993). The periodical started as a correspondence newspaper that shared news across groups of Old Order Amish in the U.S. and Canada. Because many Old Order Amish groups do not use technology (internet, email, telephones) to communicate, newspapers and other periodicals are important mechanisms for sharing information across settlements and communities. While no longer published by Amish individuals, the non-Amish publisher maintains strong relations with the Amish community. The periodical is published monthly and distributed primarily to Amish readers. *The Diary* includes approximately 400 scribe entries per issue. The scribes are members of Amish communities across the U.S. and Canada who write into the periodical with news of their community, including information on church services, births, deaths, marriages, and travel.

The Diary includes an accidents section where scribes report on buggy crashes and other types of incidents in their communities, including injuries on school playgrounds, work-related injuries, and fires. The section contains an average of 25 scribe entries per issue. The current study focuses on motor vehicle and buggy crashes across eight years, 2015 through 2022, as reported in the accidents section of *The Diary*. We recorded information on the buggy passenger injuries, characteristics of the buggy passengers, cause of the crash, and point of impact. We use the term *buggy* to refer to any horse-drawn vehicle. The data is limited to what the scribes knew and chose to share.

Results

There were 426 reports of crashes involving buggies and motor vehicles across the eight years. According to the reports, 868 passengers were involved. The age and sex of the victims were reported for most of the crashes, with only 82 incidents missing demographic information. Most buggy and motor vehicle crash victims were male (61.5%), suggesting that males may use buggies more consistently for travel to work or errands, while women's home-based responsibilities limit their daily travel. Table 1 reports that nearly half of the victims in buggy v. motor vehicle crashes were adults aged 26–64, for both males (48.9%) and females (50.2%). Male and female victims were

similarly represented across age categories, with young adults making up about 14% of the male victims and approximately 12% of the female victims. About 19% of the male victims and 16% of the female victims were teens. The patterns are similar for children aged 3–12. There are slightly more female victims in the toddler (ages 0–2) range as compared to male victims, 5% and 2%. Still, overall, the percentages maintain consistent patterns across age groups for male and female victims.

Table 1

Victim Demographics

	Male		Female	
Age range	*n*	%	*n*	%
Toddler: 0–2	8	1.7	16	5.3
Child: 3–12	73	15.1	42	13.9
Teen: 13–19	90	18.6	49	16.2
Young adult: 20–25	65	13.5	36	11.9
Adult: 26–64	236	48.9	152	50.2
Senior: 65 and up	11	2.2	8	2.6
Total	483		303	

Note. Not stated/missing = 82.

Studies using hospital trauma records note the severity of injuries resulting from motor vehicle and buggy collisions, as the victims of these injuries are likely to seek mainstream medical care. The scribe reports in *The Diary* present a broader scope of crashes, many of which resulted in less severe injuries. Table 2 reports the result of the crash for victims. Minor injuries were the most reported consequence, with almost 38% of victims of buggy and motor vehicle crashes indicated as having minor injuries. However, over a quarter of the victims experienced severe trauma or death as a result of the crash. Eight percent of the victims died, while over 19% experienced a serious injury. Serious injuries include a serious concussion, loss of limb, severe eye injury, extensive burn, compound fracture, or similar injuries.

Table 2

Result of the Crash for Victims

Outcome	*n*	%
Death	72	8.3
Serious injuries	166	19.1
Injuries	208	24.0
Minor injuries	329	37.9
No injuries	86	9.9
Not stated	7	0.8
Total	868	

Note. A serious concussion, loss of limb, severe eye injury, extensive burn, or compound fracture, etc., was classified as a serious injury. A deep cut/gash, broken limb, mild concussion, or extensive road rash was classified as an injury. A scrape, bruise, or limp was classified as a minor injury.

Most buggy and motor vehicle collisions were reportedly caused by motor vehicle driver errors (46.5%), including general errors, speeding, impaired driving, and phone use. (See Table 3.) Over 25% of the cases where motor vehicle drivers were implicated at fault only indicated driver error of a general nature. The motor vehicle driver was reported speeding or reckless in 7% of the crashes, impaired in 6% of crashes, sun-blinded in almost 5% of cases, and using their phones in about 3% of the crashes. A much smaller percentage of crashes were reported to be errors on the part of the buggy driver (3.8%). An example of a buggy driver error was described in an entry in the May 2021 issue, where an Ohio Amish man pulled his buggy out of his driveway and failed to see an oncoming car, thus causing a wreck. Of note, horse error was slightly more common than buggy driver error. The crash reports indicate horse error in about 5% of the incidents. Weather—ice, snow, and fog—was shown to be the cause of the crash in about 1% of the cases, while less than 1% were due to mechanical problems with the buggies.

Table 3

Cause of Crash

Cause	*n*	%
Motor vehicle driver error		
Driver error, general	110	25.8
Speeding/reckless driver	31	7.3
Impaired driver	26	6.1
Sun-blinded driver	20	4.7
Phone use by driver	11	2.6
Buggy driver error	16	3.8
Horse error	23	5.4
Mechanical problem with buggy	2	0.5
Ice, snow, or fog	6	1.4
Other	14	3.3
Not listed	167	39.2
Total	426	

Note. Thirteen crashes were hit-and-runs. In two of those cases, the buggy was hit even though it was on the shoulder of the road. In a separate case, the driver did not hit the brakes at all before hitting the buggy.

Table 4 displays the cause of the wreck by the point of impact. The majority of crashes reported as motor vehicle driver error were rear-end crashes. The specific causes reported by the scribes included texting, sun blindness, drunk driving, and reckless driving. An example of a rear-end crash caused by a distracted driver occurred in Minnesota in August 2022. A family of seven in a buggy was rear-ended by a car because the driver was looking in their rear-view mirror and did not see the buggy. While fewer crashes were attributed to the buggy driver, most of these crashes are classified as broadside. Similarly, wrecks caused by horse error are most likely to be broadside impacts. For example, a crash occurred in Missouri in March 2020 when a horse stopped at a crossroads and lunged forward into the path of a truck; the horse was killed instantly. More than

15% of Amish buggy driver error and horse error crashes were head-on collisions. These findings suggest different strategies for road safety may be needed for the drivers of buggies versus the drivers of motor vehicles.

Table 4

Cause of Crash by Point of Impact

	Rear-end		Broadside		Sideswipe		Head-on		Total
Cause	*n*	%	*n*	%	*n*	%	*n*	%	*n*
Motor vehicle driver error	147	83.5	10	5.7	12	6.8	7	4.0	176
Buggy driver error	2	15.4	9	69.2	0	0.0	2	15.4	13
Horse error	0	0.0	8	72.7	1	9.0	2	18.2	11
Mechanical problem with buggy	1	50.0	0	0.0	1	50.0	0	0.0	2
Ice, snow, or fog	3	50.0	3	50.0	0	0.0	0	0.0	6

Note. Other/not listed categories are not included in the table.

Discussion

This study highlights that death and serious injury occured in over a quarter of the buggy and motor vehicle crashes reported in *The Diary.* Moreover, the scribes reported that almost 90% of the crash victims experienced an injury of some kind. Most of these injuries were classified as less than severe, which likely indicates that the victims did not seek mainstream medical care. Using scribe reports in *The Diary* allowed us to capture a broader range of crashes and injuries: most hospital trauma data reports only include the most severe injuries. The demographic characteristics of the buggy crash victims indicate most victims were adults, suggesting adults were likely driving the buggies. Scribes also reported high numbers of children injured in the crashes. Many of these children were likely to have been buggy passengers, but some may have been buggy drivers. (Amish teens and children do drive buggies and pony carts, the latter used as transportation to school in some areas.)

While less than 10% of the crashes reported in *The Diary* were attributed to buggy driver or horse error, educational materials on roadway safety might be pertinent to the Amish population (Eicher et al., 1997; Gorucu et al., 2017; Kinzenbaw, 2008), especially considering Amish children begin driving buggies at age 13 or 14 and may not have full knowledge of safe driving techniques (Eicher et al., 1997). An emphasis on safety education in Amish schools might be particularly pertinent, but more comprehensive education is also relevant. Our results indicate wrecks where the Amish buggy driver is at fault are most likely broadside impacts, emphasizing the need for increased awareness by all buggy drivers. As Anderson (2014) notes, in some instances, buggy drivers have reduced visibility in intersections, as their driver's seat sits farther back than the driver's seat in motor vehicles. As such, infrastructure changes might be an effective strategy to curb broadside crashes. Moreover, buggy drivers need to be aware of methods to regain control when a horse becomes spooked and of the need for a safety check of the harness before taking off in a buggy. Educational programs might be offered at events focused on safety and information,

such as Farm Safety Days and Horse Progress Days. Both events cater to large Amish crowds and could effectively disseminate information across Amish groups.

Buggy driver safety education is pertinent; however, the results of the current study indicate most crashes are rear-end crashes where the motor vehicle driver is at fault. Our findings reflect the same patterns reported in research in the previous two decades, suggesting the urgent need for revisiting safety policies. In efforts to curb the number of crashes, policymakers and concerned groups often focus on buggy visibility (Dewalt & Bradley, 2013; Eicher et al., 1997; Grisso & Jepsen, 2020; James, 2001; Jepsen & Mann, 2016); however, some scholars note that visibility is not sufficient to curb collisions (Anderson, 2014). Indeed, if rear-end crashes are due to speed differentials between motor vehicles and buggies, then something more than slow-moving vehicle signs may be required to slow motor vehicle driver speed.

Research suggests distributing tips for safe driving practices and sharing the road with slow-moving vehicles is particularly useful, especially for tourism facilitators (Dewalt & Bradley, 2013; Eicher et al., 1997; Grisso & Jepsen, 2020). Motor vehicle traffic becomes exceptionally high during peak tourist season in areas highly populated by the Amish, which can increase the risk of crashes. Motorist educational materials might be distributed in hotels, restaurants, tourist information centers, and state welcome centers, and included in tourist publications. These materials should focus on reducing speed and increasing awareness of buggy traffic on roads in Amish areas. Hotels, for example, could post information about safety around buggies on their TVs. Awareness is an essential first step to safe driving practices. Areas with high tourist traffic are one potential area of focus. Another area where educational materials might be provided is where new Amish settlements are being established. Motor vehicle drivers in these areas are less likely to be aware of safe driving practices while sharing the road with horse-drawn vehicles. Finally, buggy travel often extends to heavily traveled state roads as Amish settlements expand. Motor vehicle drivers on these roads should also be made aware of speed differentials through educational materials and signage.

Limitations and Future Research

Using crash reports in *The Diary* allowed us to examine a broad scope of crashes, including those that resulted in minor or no injuries. However, our data is limited to what the scribes reported. Not all Amish communities have a scribe representative, and not all scribes who contribute to *The Diary* report on crashes. Moreover, some scribes who report on crashes may have more information about the details of the crash than others, leading to uneven details across the scribe reports. Even so, *The Diary* provides a rich and unique data source to explore buggy crashes, as it is not limited to severe injuries as are hospital reports or to police interpretations of the crash as are DOT reports. Future research should explore the differences between crashes that involve motor vehicles and buggies and crashes of buggies only and note how different characteristics implicate different safety policies. Research might also consider the nature of buggy crashes in large Amish communities compared to those in smaller Amish communities. An exploration of the buggy driver gender, with implications for horse-and-buggy control and engagement in risky

behavior, and how gender statistics compare to non-Amish crashes would be an informative pathway for future research.

Conclusions

Much research on motor vehicle and buggy crashes focuses on crashes that result in serious injuries; however, *The Diary* reports indicate many people suffer some injuries because of the crashes. While past studies emphasize the utility of educational materials for motor vehicle and buggy drivers, this is only helpful if the drivers read the information. Implementing signage or flashing lights in areas with high buggy traffic and in regions that are newly experiencing buggy traffic, such as in areas with new settlements or where district growth has led to greater use of state roads, might bring awareness to motor vehicle drivers. Even more effective would be infrastructure changes, including widening of roads, as currently exists in some areas with large Amish populations. Wide roadways allow horses, buggies, and motor vehicles to travel on the same road, providing a traffic lane specifically for Amish buggies (Dewalt & Bradley, 2013; Gorucu et al., 2017). Amish buggy lanes might be likened to bicycle lanes in areas with high bicycle traffic. This type of infrastructure emphasizes safety for all road users. Future research might explore how collision patterns change in places where structural changes have been implemented.

Automobile technological changes also present a potential safeguard against rear-end buggy crashes. Many newer motor vehicles have safety features that automatically warn drivers of obstructions in front of the moving vehicle. Advanced safety features provide the impetus to address speed differentials between motor vehicles and buggies. While our results indicate similar collision patterns compared to the last decade, tracking how recent technological changes in the automotive industry affect collision patterns might be explored in future research.

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