

# *The culture of traffic safety in rural America*

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## Overview

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Whereas most traffic crashes occur in urban areas, the rates of *fatal crashes and traffic fatalities* (per capita and per vehicle mile) are higher in rural areas. The distinction between rural and urban areas is, therefore, an important delineation in any policy discussion about traffic safety. In particular, efforts to distinguish between rural and urban traffic safety should focus on those factors that increase the risk of fatal outcomes in rural areas. Notably, several aspects of the rural road environment can be characterized as hazardous. For example, several road design elements of rural roads, such as high speed limits, narrow shoulders with ditches, and the absence of median barriers can increase the risk of fatal crash types, such as head-on and rollover crashes. Moreover, the low population density and geographic isolation of rural communities can increase detection, response, and travel time for emergency medical services, thereby reducing crash survivability. In addition, the *human factors* associated with common impairment states and driving behaviors amongst rural drivers are also significant contributors to rural fatal crashes. The social forces that enable these human factors are embodied in the culture of rural communities. Indeed, comparisons of traffic safety performance between different countries have highlighted the importance of social attitudes, safety behaviors, and traffic safety policy in reducing fatal traffic crashes (Page 2001). Thus, it is necessary to consider the human factors associated with fatal rural crashes together with the relevant *socio-cultural context* of rural communities. Only by understanding the psychological and social factors that define the rural safety culture may it then be possible to develop human-centered and culturally sensitive programs to improve traffic safety in rural America.

## Introduction

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The World Health Organization (WHO) estimates that 1.2 million people each year are fatally-injured worldwide in traffic crashes with a global cost of \$518 billion (Peden et al. 2004). Indeed, the WHO has projected that road traffic injuries will be the third leading cause of death and disability worldwide by the year 2020 (Peden et al. 2004). Similarly, the National Safety Council has reported that traffic crashes are the most common source of fatality resulting from unintentional injury for all age groups up to 75 years (NSC 2002).

In this context, traffic safety is a major public health issue for all motorized regions of the world. In particular, those areas defined as “rural” within a country tend to have the fatality rate (Brown, Khanna, and Hunt 2000) as well as lower economic indicators and lower population densities compared to urban areas (USDA 2006; Clark 2003).

Whereas differences in safety attitudes and reported behaviors between cultures of different countries have been considered (Lajunen, Parker, and Summala 2004), less attention has been given to contemporary definitions of rural and urban “culture” within a country that are conceptually relevant to traffic safety and able to elucidate the relationship between cultural beliefs, driving behavior, and associated crash risk. Admittedly, given the diversity of rural and urban areas, it is difficult to frame a reliable and valid definition of culture without regressing to overgeneralizations and stereotypes. None-the-less, the importance of understanding the contribution of belief structures engendered in a culture is paramount to understanding, predicting, and modifying the safety attitudes, driving behaviors, and traffic safety policies that are guided by cultural beliefs (Rothe and Elgert 2003). Indeed, traffic safety policy directed at the issue of rural fatal crashes must encompass and reflect the defining characteristics of rural culture in order to be both effective and accepted within rural communities. Toward that end, we need to develop an appropriate conceptual framework to define culture and apply this to a model that relates cultural variables to safety outcomes in order to support the rationale and contextually embedded development of traffic safety policies for rural America.

This chapter will compare traffic safety between rural and urban areas within the USA. The purpose of this analysis is to identify the nature of the fatal crashes and identify those factors that can be attributed to the higher fatality rate in rural areas. Specifically, this chapter will attempt to focus on the notion of a “rural traffic safety culture” that fosters attitudes and driving behaviors that increase the risk of fatal crashes in rural communities.

## Defining “rural”

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Logically, the central thesis of this chapter is dependent on the meaning of “rural”. The meaning can be considered both as a classification applied to locations (rural) and as a continuum characterizing individuals (rurality) (Deavers 1992). As summarized in Table 1, there are several attributes that can be used to positively classify rural locations or describe the rurality of population cultures (Bealer, Willits, and Kuvlesky 1965; Deaver 1992; Miller and Lullof 1981; Roth and Elgert 2003; Weisheit, Falcone, and Wells 2006; Wilkinson 1991).<sup>1</sup> In the United States, rural regions account for 75% of the land mass (Coben 2006) with 17% of the population is classified as rural (Coben 2006).

From this summary, it is apparent that a precise definition of rural is illusive because this term can be based on different attributes and applied to either locations or populations.<sup>2</sup> However, the single most common definition is *demographic*, although the criterion can be arbitrary and not represent the essence of rurality (Bealer et al. 1965; Miller and Luloff 1981; Wilkinson 1991; Weisheit et al. 2006). There is also considerable diversity *between* areas defined as rural as well as changes over time *within* rural areas (Deavers 1992; Weisheit et al. 2006). As a result, “an

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<sup>1</sup> Rural definitions are considered “positive” by prescribing specific attributes (e.g., a county with no city greater than 5000 people) or “negative” by inferring attributes that are not defined as urban (e.g., areas not defined as metropolitan). Positive definitions are preferred because they have meaningful content (i.e., they describe specific attributes rather than simply representing excluded areas), are sensitive to rural diversity, and are independent of definitions of urban (Weisheit et al. 2006).

<sup>2</sup> There is also some contradiction in the use of population attributes both as an independent variable (defining rural and urban) and as a dependent variable (describing the nature of populations defined as rural based on other defining attributes) (Bealer et al. 1965; see also Footnote 6 of Miller and Luloff 1981).

accurate and useful definition of what is rural needs to accommodate the diversity of current conditions and development prospects among rural areas” (Deavers 1992, p. 189). However, despite this ambiguity “there is something to the idea of ‘rural’ that distinguishes it in intuitively and sociologically important ways from what is called ‘urban’” (Weisheit et al. 2006, p. 193).<sup>3</sup>

*Table 1. Common attributes for definitions of "rural" and "urban" areas.*

<b>Dimension</b>	<b>Rural</b>	<b>Urban</b>	<b>Comments</b>
<b>Demographic</b> (attributions to locations)	Low population size and density; geographic isolation; outside boundary of urban area or urban cluster.	Urbanized area or urban cluster. <sup>4</sup>	There are some explicit definitions that stipulate a threshold for rural places in terms of population or density. However, these thresholds are not universally applied.
<b>Economic</b> (attributions to locations and populations)	Low economic indicators; economic simplicity (single industry, restricted labor diversity, limited functional differentiation); no longer predominately farming and agriculture.	High economic indicators; economic complexity (multiple industries, diverse labor, and differentiation of functionality).	Equating rural with farming and agriculture is no longer valid in modern society. <sup>5</sup>
<b>Social structure</b> (attributions to populations)	Intimate, informal, and homogeneous forms of social interaction; small but dense social linkages <sup>6</sup> ; social order maintained by social bonds; limited social resources (e.g., hospitals).	Distant, formal, and heterogeneous forms of social interaction; small and less dense social linkages; social order maintained by formality and laws; plentiful social resources (e.g., public transportation).	
<b>Cultural</b> (attributions to populations)	Reluctance to share local problems; distrust of government; traditional, conservative, provincial, slow to change; fatalistic, deterministic.	Modern, liberal, responsive to change.	The rural culture classification can be viewed as a personal attribute (rurality) that is independent of current location and occupation. <sup>7</sup>

<sup>3</sup> For this reason, Weisheit et al. (2006) concede that rural may best be described as a “sensitizing concept” that does not possess definitive attributes or prescribe specific interpretations, but rather provides a general reference to guide the direction of scientific inquiries and perspectives of what is relevant (see Blumer 1953).

<sup>4</sup> The Census Bureau (Census 2006) defines an “urbanized area” as a “large central area and adjacent densely settled census blocks” with a total population of at least 50,000. Similarly, “urban clusters” have populations of at least 2,500 people.

<sup>5</sup> For example, manufacturing is a larger source of employment in rural areas with less than 10% of the rural labor force involved in farming (Weisheit et al. 2006).

<sup>6</sup> Intimate and distant refer to the physical proximity between acquaintanceships. Density in this context refers to the extent of inter-relationship between people acquainted with each other in a community (Weisheit et al. 2006). A small population in which everyone is related or knows each other can be described as a small network with a high “density of acquaintanceship.” Conversely, a few people related to each other in a larger population can be described as a small network with a low density of acquaintanceship.

<sup>7</sup> For example, Miller and Luloff (1981) distinguished between rural and urban cultural classifications based on a composite measure of attitudes and beliefs for three cultural issues: civil liberties, abortion, and racial segregation.

# Rural traffic safety

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Traffic safety in rural areas is both quantitatively and qualitatively different from urban areas in terms of the risk of a crash, type of crash, and contributing factors associated with the crash (NHTSA 1996).

## Crash risk

Crash risk is expressed as a function of exposure relative to population of travel. In terms of crashes per capita, despite the fact that only 17% of the US population is classified as rural (Coben 2006), 58% of all fatal crashes and 60% of traffic fatalities were recorded in rural regions of the US between 1993 and 2004 (Burgess 2005). Thus, fatal crashes and traffic fatalities in rural areas are 3.5 times more prevalent than expected on the basis of the percentage of the total population that is classified as rural.<sup>8</sup> Indeed, Brown et al. (2000) estimated that the rate of fatalities *per 100,000 population* was more than 4 times higher for rural crashes ( $42.71 \pm 4.3$ ) than for urban crashes ( $10.43 \pm 1.51$ ) over a twenty-year period. In term of crashes per mile traveled, the rate of fatal crashes *per 100 million vehicle miles traveled* (MVMT) during rural travel was nearly double the rate for urban travel between 1993 and 2004 even though less than half (39%) of the total vehicle miles traveled are on rural roads (Burgess 2005).

These data demonstrate that rural areas consistently have a higher risk of *fatal crashes and traffic fatalities* in all years and for most US states (Brown et al. 2000; Burgess 2005; NHTSA 2004). Admittedly, because of the large number of *non-fatal crashes* in urban areas (IIHS 2006), the total incidence for all crashes may be higher in urban areas (Zwerling et al. 2005, Table 2). Thus, the critical question is not why rural areas have more crashes, but why rural crashes are predisposed to be fatal (Zwerling et al. 2005). Accordingly, it is necessary to examine the types of rural crash that are fatal and identify the factors that increase the fatality risk in rural crashes.

## Crash type

Table 2 lists the distinctive characteristics of rural fatal crashes; that is, research has demonstrated that these characteristics significantly differentiate between rural and urban fatal crashes (Burgess 2005; GAO 2004; NHTSA 1996, 2004; Coben 2006; Muelleman and Mueller 1996; TRIP 2005; Zwerling et al. 2005). This characterization suggests that rural crashes typically include high-risk driver groups with vehicle maneuvers that can lead to high-impact crash types resulting in severe vehicle damage and occupant injury. This propensity for fatal crash types in

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People were classified as a “conservative” rural type if they were in the lower quartile for all three factors. Conversely, people were classified as a “liberal” urban type if they were in the upper quartile for all three factors. These cultural classifications were then compared to a rural and urban demographic definitions using size of place of current residence. This analysis indicated that (1) a “pure” cultural type (consistently being in the defining quartile across all three factors) existed only for a small sample (12%); and (2) current residency did not match the cultural classification. For example, 9% of rural residents had an urban cultural type and 83% of urban residents had a rural culture type.

<sup>8</sup> This assertion assumes that all drivers and occupants of vehicles involved in rural crashes are themselves rural residents. Indeed, data provided by Blatt and Furman (1998) indicate that most rural fatal crashes involve rural residents (and that most rural residents involved in fatal crashes were traveling on rural roads).

rural areas may result from single and combined factors related to the driver, vehicle, and road environment. For example, more fatal crashes may occur in rural areas because older drivers susceptible to fatal injury are involved in more rural crashes compared to urban crashes. Also, more fatal crashes may occur in rural areas because of the higher incidence of trucks that can be prone to roll-over fatalities on curves due to their high center of gravity and the higher incidence of motorcycles that have less occupant protection than other vehicle types.

Table 2. Distinctive characteristics of fatal rural crashes compared to urban fatal crashes.<sup>9</sup>

Characteristic	Rural fatal crash
Driver demographic	Young (see Footnote 10) or old ( $\geq 65$ years)
Vehicle type	Light truck, heavy truck, motorcycle
Vehicle maneuver	Curve
Crash description	Head on; single-vehicle off-roadway (SVOR); vehicle rollover; Animal impact (Figure 1)
Road environment	Highway; county road; loose/gravel surface (Figure 1)
Occupant ejection	Ejected; dead at scene
Vehicle damage	Severe deformity, towed from scene

## Rural crash factors

Several factors have been identified to explain the high incidence and differentiating characteristics of fatal rural crashes (Whylic and Kimball 1997).

### Road environment

There are several attributes of the rural road environment that increase the risk of fatal crashes: population density, geographic isolation, and road design (also see “other” factors in Figure 1). Together, these environmental factors not only increase the perceptual, cognitive, and response demands that may prompt a crash (Khorashadi, Niemeier, Shankar, and Mannering 2005), but also introduce hazardous physical elements of roadway design that can increase the severity of the crash outcome (GAO 2004).

First, the population density in rural areas tends to be lower and more geographically isolated than in urban areas (Clark 2003; Weisheit et al. 2006), which implies the need for longer travel distances within rural communities. For example, Kmet and Macarthur (2006) cite research indicating similar *percentages* of children in rural and urban areas that are driven to school in

<sup>9</sup> In interpreting this table, it should be noted that some studies differentiate attributes by comparing the percentage of rural and urban cases with an attribute (e.g., Burgess 2005; Muelleman and Mueller 1996) while others compare the crash risk (per 100 VMT) for an attribute in rural and urban areas (Zwerling et al. 2005). These different methods of differentiating rural and urban characteristics can lead to inconsistencies. For example, Zwerling et al., (2005; see also Kmet Macarthur 2006) demonstrate that the *fatal crash rate* per 100 million VMT is higher for young drivers (< 25 years) in rural areas whereas Meulleman and Mueller (1996) demonstrate that a significantly higher percentage of fatal crashes in urban areas involve young drivers ( $\leq 25$  years).

passenger vehicles, but a significantly higher average *travel distance and duration* is higher in the rural areas. Similarly, Gary et al. (2003) suggest that the need of residents in remote (rural) counties to access services in (distant) urban counties increases their travel exposure, with a commensurate increase in the per capita crash rate (since exposure alone may be associated with crash risk, Elvik and Vaa 2004).<sup>10</sup>

Second, the design of rural roads is generally more hazardous (GAO 2004) as well as visually complex and cognitively demanding than urban road environments (Horrey and Wickens 2003). For example, rural roads may be narrow with curves and hills that restrict sight distances and have small or absent shoulders on roadsides with ditches or obstacles such as trees and utility poles (GAO 2004). The presence of these roadway features has been statistically demonstrated to increase both the frequency and severity of specific types of fatal crashes on rural highways (Lee and Mannering 2002). Notably, in the presence of a (unintended) lane departure, the absence of a median increases the chance of a head-on collision and the absence of a shoulder increases the chance of a run-off-road crash and a vehicle rollover (GAO 2004; Lee and Mannering 2002). The hazard posed by these rural road features may also be exacerbated by reduced visibility and traction during poor weather conditions (see Figure 1).

## ***Emergency medical services (EMS)***

Low population density and geographic isolation also directly impact the performance of emergency medical services (EMS) in rural areas. Notably, crashes in isolated rural areas with low traffic volumes may take longer to detect and subsequently notify EMS (Champion et al. 1999). These population and geographic factors also may make it economically infeasible to maintain 24-hour EMS in all rural counties (Svenson, Spurlock, and Nypaver 1996). Consequently, some rural counties will either not have EMS services or will rely on volunteer emergency medical technicians (Grossman et al. 1997). As a result, EMS arrival and transport times can be longer in rural areas because travel distances are further and additional time may be required to coordinate volunteer EMT services (Grossman et al. 1997). In fact, detection, arrival, and transportation times for rural crashes are almost double those for urban crashes (Champion et al. 1999; Grossman et al. 1997).<sup>11</sup> As a result, only 7% of rural fatalities are transported to the hospital within the critical “golden hour” recommended for effective medical care after the crash in comparison to 30% of urban fatalities (Champion et al. 1999). Thus, the proximity *rather than the quality* of acute trauma care appears to be a significant factor contributing to the fatal outcomes of rural crashes (Chen et al. 1995). However, this contribution may be less than the effect of road design, driver behavior, and crash type (Donaldson et al. 2006).

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<sup>10</sup> Note that Gary et al. (2003) actually defined counties as “wet” (permitting alcohol sales) or “dry” (prohibiting alcohol sales), but admitted that these classifications were consistent with possible urban and rural classifications based on demographics.

<sup>11</sup> Furthermore, Grossman et al. (1997) report that the time at the crash scene is 16% longer in rural areas, which may result from the difficult rural geography and high severity of rural crashes (NHTSA 1996).

## Human factors

Historically, there has been more attention given to environment and EMS factors related to rural fatal crashes compared to human factors (Stevenson and Palamara 2001). Human factors can be defined in terms of the state of driver impairment and the behaviors committed by the driver.

### Driver state

Figure 1 presents the relative risk (risk ratio) that a specific driver state or driving behavior (human factors) identified with a fatal crash on a rural roadway function class compared to an urban roadway function class (2004 FARS data). Although this is a rudimentary analysis,<sup>12</sup> it does suggest that the proportion of fatal rural crashes attributed to a human factor is higher relative to the proportion attributed to fatal urban crashes. For example, the risk of driver fatigue and inattention is significantly higher in fatal rural crashes relative to fatal urban crashes (see also Donaldson et al. 2006, Table 4). It is possible that the longer travel distances associated with rural travel increases driver fatigue (Donaldson et al. 2006) and opportunities for distraction (perhaps related to fatigue). The higher prevalence of driver fatigue may also be due to commuting to jobs located outside rural areas during high-risk periods in the circadian rhythm (Ward and Smith 2000).

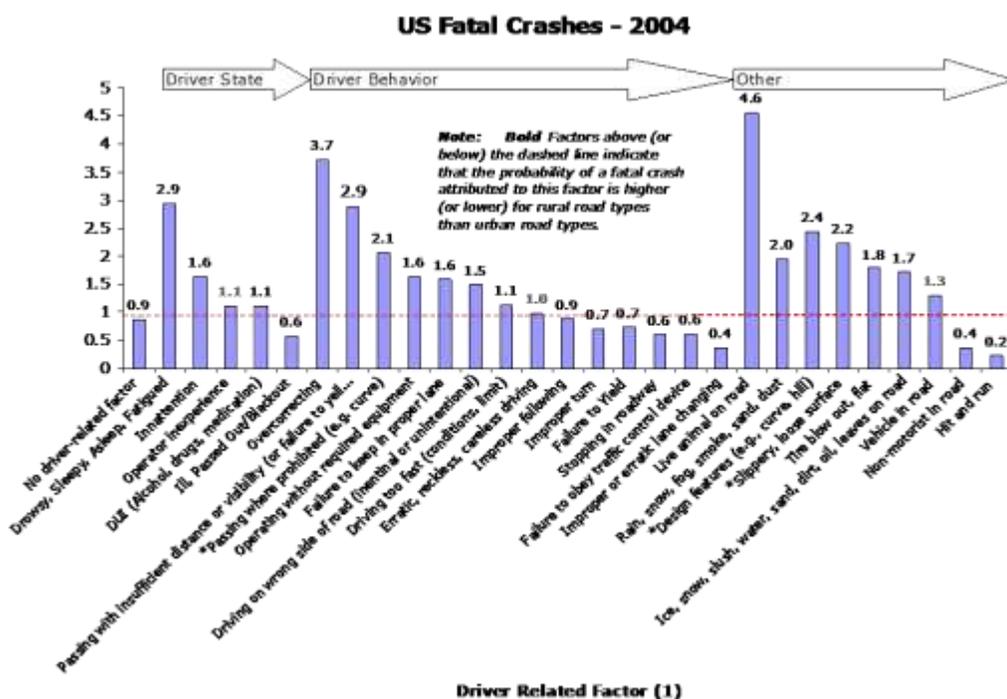


Figure 1. Risk ratios comparing the probability of attributing driver-related factors in rural and

<sup>12</sup> This analysis only considered the first “Driver Related Factor 1” data field and only presents factors representing more than 100 fatal crashes in total (\*for illustrative purposes, some attributions are included with less than 100 cases). Cases with blank entries or unknown roadway types are excluded. Relative risk was computed as the ratio between the proportion of fatal crashes on rural roads with a specific factor ( $a_{\text{rural}}/b_{\text{rural}}$ , where a is the number of fatal rural crashes with the specific factor and b is the total number of rural fatal crashes) and the proportion for the same factor on urban roads ( $a_{\text{urban}}/b_{\text{urban}}$ ). The 95<sup>th</sup> percentile confidence interval was computed to determine if the relative risk was statistically significant (i.e., confidence interval range did not include 1.0).

*urban fatal crashes (FARS 2004).*

It is notable that the relative risk of an impaired driver state resulting from alcohol, drugs, and medicines (DUI) is also significantly higher in rural fatal crashes (see also Donaldson et al. 2006, Table 4). This is consistent with previous crash analyses that indicate that the majority of all *alcohol-related traffic fatalities* (63%) occur in rural areas (GAO 2004). Moreover, the *DUI arrest rate per capita* is higher in rural counties than in larger urban counties (Weisheit et al. 2006, Figure 3.6). Thus, alcohol (and other forms of intoxication) is a significant contributing factor for fatal rural crashes. Specifically, alcohol in addition to driver fatigue and inattention are the primary human factors that contribute to single-vehicle off-roadway (SVOR) crashes (Campbell, Smith, and Najm 2003), which is a common fatal crash type in rural areas (see Table 2).

## **Driver behavior**

Driver behaviors can be classified both as a factor *contributing* to a crash and as a factor *mitigating* the severity of the crash (Whyllie and Kimball 1997). In terms of contributing factors, it is apparent from Figure 1 that “overcorrecting” is major behavioral factor for fatal rural crashes. Other high risk behavioral factors that predominate in fatal rural crashes involve unsafe passing, improper lane control, and driving on the wrong side of the road. Logically, these behaviors are related to head-on crashes, which is another common fatal crash type in rural areas (see Table 2).<sup>13</sup>

Figure 1 also shows that the relative risk of “driving too fast” is significantly higher for fatal crashes on rural road types than urban road types (see also Donaldson et al. 2006, Table 4). This rural propensity for fatal high speed crashes may be expected given that there is an intrinsic relationship between speed, crash risk, and crash severity (Aarts and Schagen 2006) considering that the design of the rural road environment (lower traffic volumes and higher posted speed limits) may afford faster driving speeds (Baystate Roads Program 2006). Consequently, most speed-related traffic fatalities (62%) are on rural roads (GAO 2004) with collector and local roads in rural areas having *speed-related fatality rates* (per 100 million VMT) that are nearly four times higher than for the same road types in urban areas (Baystate Roads Program 2006). Thus, excessive speed is a contributing human factor, especially for SVOR crashes (Campbell, Smith, and Najm 2003), which is a common fatal crash type in rural areas (see Table 2).

Seat belts are a common form of mandated restraint system in modern vehicles. In terms of mitigating factors, research has consistently documented that restraint systems such as seat belts can reduce the severity of a crash (NSC 2006). American roadside surveys of seat belt compliance have shown similar percentages of rural and urban motorists using seat belts (Coben 2006; TRIP 2005), although there is a general trend for lower compliance amongst rural motorists (Glassbrenner 2004; Transport Canada 2006). Seat belt use is also generally lower amongst drivers of pick-up trucks than other vehicle types (Coben 2006; NHTSA 2006a). Notably, this difference between vehicle types is most pronounced in rural areas (Transport Canada 2006) with seat belt use amongst pick-up truck drivers being “considerably lower” in

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<sup>13</sup> Thus, overcorrecting as a risk factor may arise when drivers—perhaps impaired—attempt to (1) recover from unsafe passing, improper lane control or driving on the wrong side of the road, (2) avoid hazards in the rural road environment, such as avoiding live animals on the roadway, or (3) respond to loss of traction or vehicle control (see “other” factors in Figure 1 and Table 2).

rural areas (54%) compared to non-rural areas (69%) (NHTSA 2006b). Furthermore, seat belt use is generally lower amongst *occupant fatalities* in rural crashes than in urban crashes (Donaldson et al. 2006; Muelleman and Mueller 1996). For example (see Figure 1), the relative risk (risk ratio) of restraint system non-use between rural and urban traffic fatalities (based on 2004 FARS data) was 1.16 (95<sup>th</sup> CI: 1.15–1.18) indicating a significantly lower probability of restraint system use in rural traffic fatalities. As a result, the percentage of fatal vehicle occupant ejections is generally higher in rural crashes than in urban crashes (Coben 2006), with most fatal ejections from pick up trucks (93%) involving occupants that were unbelted (NHTSA 2006b).<sup>14</sup>

It is important to note these discussed human factors are not “passive”. That is, in many instances, drivers knowingly accept the impairment state and deliberately engage in high-risk behaviors. This assertion can be framed in terms of a simple model of driving in which the driver is expected to perceive relevant information in the environment, decide on the appropriate response, and engage the corresponding behavior. Thus, crash risk can increase if the driver does not perceive a hazard, decides on an inappropriate response, or is unable to perform the necessary behavior (Sander and McCormick 1992).

In these terms, there is no doubt that some crashes result from the driver not perceiving a hazard in the environment such as a stopped vehicle in the lane. There may also be some cases when novice drivers cannot perform the necessary behavior correctly. However, many crashes actually result from the deliberate decision of the driver to take a risk despite perceiving a hazard and having the ability to be safe (see Figure 21-2 of Sander and McCormick 1992). For example, most cases of drinking and driving are deliberate; that is, most drivers that consume alcohol before driving are aware that alcohol impairs performance. Many cases of speeding are also deliberate; that is, most drivers that speed are aware of the posted limit and the laws enforcing speed compliance. Similarly, most cases of seat belt non-use are deliberate; that is, drivers are aware of the seat belts present in the vehicle and the laws enforcing seat belt compliance. These examples demonstrate that a significant proportion of crashes may result from the decision of the driver to take risks for some form of expected benefit (Wilde 1992). The critical issue for safety is then to determine the psychological processes that result in risky decisions and the influence that culture has on directing these processes.

## **Rural safety culture**

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From the preceding discussion it is apparent that rural fatal crashes are often the result of dangerous human factors occurring in hazardous rural road environments that impede EMS performance. In this context, it is necessary to consider the entire transportation system. Typically, safety improvement strategies for rural areas have been directed to improving road design (AASHTO 2006) and to making EMS more effective (Champion et al. 1999). In contrast, relatively less research has been directed at driver state and behavioral factors (Stevenson and Palamara 2001). In particular, there has not been sufficient attention to the cultural factors that embody rural communities (Hartley 2004) and propagate those beliefs and attitudes that promote driver acceptance of impaired states and commission of dangerous behaviors. Research to

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<sup>14</sup> These data indicate the fast speed and high severity of rural crashes have a significant impact on the effectiveness of restraint systems. The data may also suggest that (rural) drivers that decide not to use restraint systems may also be predisposed to fatal crashes.

understand the effect of culture on crash risk must first define “culture” and its influence on belief structures before modeling the effect of these structures on influencing the human factors that contribute to fatal crashes.

This socio-cultural context is “embedded in relationships that tie individuals to organizations, neighborhoods, families, and friends in their community” (Salmon and Mullan 1992 as cited by Hartley 2004). As discussed in relation to Table 1, rural communities tend to be more isolated with lower population densities and socioeconomic levels, but more dense social linkages compared to urban communities (Weisheit et al. 2006). These rural demographic and social structures may foster different forms of social relationships, which result in a culture that is distinct from urban areas. This rural culture can be expected to manifest different safety attitudes and driving behaviors than urban cultures.

Culture has been defined as the belief (value) structure, shared ideals, and “directives for action” that are embodied by a community (Bealer et al. 1965).

Arguably, the belief structures embedded in the prevailing culture has a significant impact on the decision making process of the driver to accept risks. Specifically, beliefs about high benefits and low costs associated with risky behavior may support decisions based on higher risk acceptance (see Figure 4.2 of Wilde 1992). Beliefs based on a fatalistic perspective that events are predetermined may reduce risk mitigation behaviors (Lund and Aarø 2003). This effect of belief structures on decision-making in the context of driving was recently demonstrated in a survey comparing the attitudes and reported behavior of rural and urban drivers conducted by the University of Minnesota based on nearly 1,600 current residents from a total of 3 urban and 3 rural counties (Rakauskas 2006). The results indicated that the rural county residents believed that not wearing a seat belt was significantly less dangerous than the urban residents. Indeed, beliefs about the dangerousness of non-use were correlated with reported frequency of non-compliance across all residents. As a result, seat belt compliance was also significantly lower amongst rural residents consistent with earlier reported data from observational studies (Eby, Vivoda, and Cavanagh 2005). Thus, beliefs that the risk of not wearing a seat is low appeared to be the basis of decisions to not to wear them. The higher non-compliance rate amongst rural residents may possibly be attributed to the fatalistic view that may be evident in rural areas (see Table 1). This view may lead to the belief that crash fatalities are inevitable, thereby reducing the apparent utility of seat belt use.

Once a culture has been defined and its influence of the formation of belief structures has been characterized, it is then necessary to develop a model for relating those belief structures to the emergence of impaired states and the commission of unsafe behaviors. The Theory of Planned Behaviors (TPB) is a commonly used framework to describe the underlying process of belief structures that influence intentional health-related behaviors (Conner and Sparks 2005) including driving behaviors such as speeding (Conner et al. in press). The TPB proposes that behaviors are the result of intentions to act based on attitudes toward the object or outcome of that behavior as well as perceptions of control and subjective norms for behavior. These psychological determinants of intention and behavior emerge from belief structures representing the perceived (1) consequence of committing the behaviors (Behavioral Beliefs), (2) expectations from significant others regarding commission of the behavior (Normative Beliefs), and (3) availability of resources to achieve the behavior (Control Beliefs). These belief structures may arise from the personality of the individual and the culture of the community (that emerges from the

relationships engendered by the demographic and social structures of the region). This model suggests that safety interventions based on the socio-cultural context should modify driver belief structures in order to naturally support safe decisions by reducing the acceptability of risk. Consistent with this proposal, Lund and Aarø (2003) conducted an extensive review of attitude modification methods to improve safe behavior in workplace and driving domains. This review demonstrated that the modification of belief and social structures through the provision of information, social norm referents, and incentive/penalty schemes can significantly improve safety behaviors and acceptance of safety interventions (see Figure 1 of Lund and Aarø 2003). Lund and Aarø (2003) conclude that there is a dynamic relationship between culture and other factors affecting safety (p. 314) that must be considered when developing safety interventions:

*“Changes in other factors tend to influence culture, and aspects of the culture may enhance or obstruct establishment of preventative measures. It is a challenge to identify cultural dimensions that may have an impact on safety practices. Such factors have to be taken into account when planning preventative action. In the long term, changes in such cultural factors may prove to be a prerequisite for effectively promoting safety with a country or culture.”*

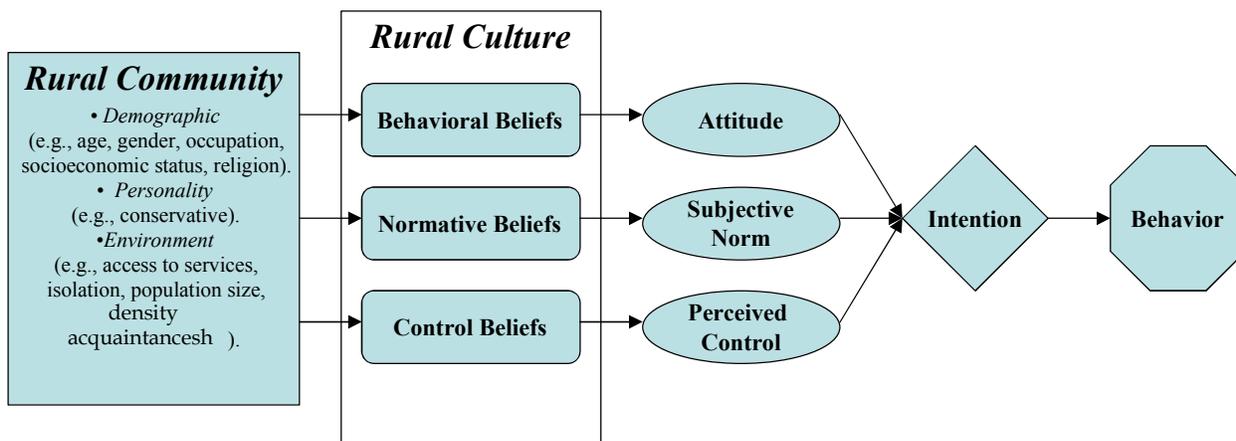


Figure 2. Possible framework related rural culture to traffic safety behaviors (adapted from Conner and Sparks 2005).

## Summary and recommendations

In summary, the risk of a crash being fatal in rural areas appears to be the joint function of drivers committing dangerous behaviors (perhaps related to an impaired state) that result in high-severity types of crash in hazardous road environments that impedes EMS access. With traffic safety aligned to public health, it is important to consider the role of the socio-cultural context in enabling safe driving attitudes and behaviors as it is for any other form of health-related behavior (Hartley 2004). Accordingly, this chapter proposes that there may be a distinctive rural safety culture embodying a belief structure, which promotes driver states and driving behavior that may not only increase crash risk, but also inhibit mitigating behavior that can reduce crash severity. Thus, in order to improve traffic safety in the rural traffic system, it is necessary to not only improve road design and EMS capabilities, but also seek interventions to reduce risks associated with human factors. The design and implementation of interventions to target these factors must

take into account the cultural context that provides the psychological impetus for rural drivers to decide to be unsafe. Toward this end, the following recommendations are made for future research in order to reduce traffic fatalities in rural communities by supporting the driver to make safe decisions and value traffic safety:

- Identify the human factors specific to the types of fatal crash most common in rural areas. This examination must also consider relationships between crash factors. This includes not only the inter-relationship between human factors (e.g., the relationship between alcohol, speed, and poor lane control), but also the relationship between human factors and environmental factors (e.g., the relationship between fatigue, overcorrection, and poor road conditions due to weather). This research should consider differences within rural areas, as well as between rural and urban areas.
- Develop a framework to describe and measure *contemporary* traffic safety cultures that are sufficiently representative of rural communities and differentiated from urban communities. This framework should articulate which regional characteristics influence cultural development and how cultures engender belief structures that are relevant to the prediction of human factors related to fatal crashes. However, “it must be recognized that precisely measuring and describing a local culture is extremely difficult and it would be a mistake to argue there is a single rural culture in the United States” (Weisheit et al. 2006, p. 40). Therefore, this framework should be flexible and not prescriptive.
- As demonstrated in Figure 2, apply this rural culture framework within a decision-making model of health-behavior to predict intentional behaviors related to fatal crash risk. The level of specificity for this model should be sufficient to identify belief structures and associated attitudes, perceptions, and norms that could be modified with socio-cultural interventions based on relevant theory and methodologies of the social and psychological sciences.
- Develop these socio-cultural interventions as community-based programs to modify unsafe behaviors. Basing these programs in the community is necessary in order to have access to the determinants of the salient belief structures and to increase community acceptance (e.g., FHWA 2006; NHTSA 2006c).

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## **Biographical statement**

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**Nicholas J. Ward** is Director of the ITS Institute's HumanFIRST Program at the University of Minnesota. This program comprises a multi-disciplinary team of University researchers and visiting scholars, utilizing a state-of-the-art driving simulator as well as instrumented vehicles for test track and field study research. The program takes a human-centered approach to improving traffic safety, focusing on the cognitive functioning of the driver as the center of the transportation system. These efforts are targeted at understanding the psychological bases of driver behavior, risk taking, and impairment in order to design safety interventions based on education, enforcement, engineering, and intelligent transportation systems. Current HumanFIRST research includes driver distraction, alcohol impairment, driver support systems, older and novice drivers, and measurement of driver safety cultures.

Ward obtained his Ph.D. in Human Factors psychology from Queen's University (Canada) with a dissertation on driver visual behavior at rural railway crossings. He then spent more than eight years conducting human factors research in transportation safety and Intelligent Transportation Systems at the University of Leeds. This research focused on driver impairment, risk perception, driver aggression, assessment of older drivers, and the design and usability evaluation of ITS applications.