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Blame-the-Victim Policy Narratives and State-Level Transportation Policy Decisions

FINAL REPORT

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16. Abstract

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Policy literature discusses the intersection of media, public opinion, and politics, and their impact on public policy. This study examines if media reports regarding bicyclist and pedestrian crashes appear important in shaping the policy narrative that defines the event. The research seeks to understand the effects of policy narratives on transportation policy decisions to improve the safety of vulnerable road users. The report investigates the relationship between policy narratives that cast pedestrians and bicyclists as "guilty villains" versus "innocent victims" and the policy tools used to improve safety in local communities exist.

Content analysis of different media sources generates the qualitative, coded *independent variable, Blame-the-victim,* and a qualitative, coded *dependent variable, policy tools*. The study randomly selects twelve states and gathers 767 news articles related to bicycle and pedestrian crashes for the period 2003-2015. The victim narrative appears more prevalent, but the episodic framing in the narrative indicates that the media reports the crashes as isolated issues without consideration of any environmental factors. This makes the news less important and fails to gather public opinion. The low visibility (< 10% of fatal crashes) and salience provided by the media likely results in the low rate of policy change.

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EXECUTIVE SUMMARY

Policy literature discusses the intersection of media, public opinion, and politics, and their impact on public policy. Taking the issue of active transportation, the study examines if media reports regarding bike and pedestrian crashes appear important in shaping the policy narrative that defines the event. The research seeks to understand the effects of policy narratives on transportation policy decisions to improve the safety for multiple users.

Research Question: Do positive and negative narratives of bicyclists and pedestrians influence the types of policy tools used to improve bicycle and pedestrian safety? More specifically, does a relationship between policy narratives that cast pedestrians and bicyclists as "guilty villains" versus "innocent victims", and the policy tools used to improve safety in local communities exist? If so, what are the implications for those that possess the expertise, knowledge and commitment to enhance safety in local communities?

Research Objectives:

1.) Assess and classify the policy narratives present in a random sample of twelve states from 2003-2015.

2). Assess and classify the policy tools used to improve bicyclist and pedestrian safety in a random sample of twelve states.

3). Test the statistical association between the policy narratives that emerge and the policy tools used in twelve states based on a set of predetermined hypotheses.

4). Identify strategies that experts and advocacy groups can use to improve the likelihood that scientific evidence enters into the policy decision-making process.

Methodology: The study uses a mixed-methods research design to analyze qualitative coded data where the primary data is the policy narratives that spread through the media. Content analysis of different media sources generates the qualitative, coded *independent variable, Blame-the-victim,* for the analysis. Content analysis also generates a qualitative, coded *dependent variable, policy tools*. The study randomly selects twelve states from four regions as specified by the Federal Highway Administration (FHWA) of United States and gathers news articles related

to bicycle and pedestrian crashes for the period 2003-2015. Altogether, the researchers coded this qualitative data by analyzing the contents of 767 articles and conducted content and sentiment analyses of the media articles. After looking for policy changes pertaining to bicyclists and pedestrians for each of the twelve states and coding them, the team uses logistic regression analysis to test several research hypotheses to determine if a statistical association exists between the type of media narratives that emerge in a given state and the policy tools that result, while controlling for economic, political and local factors that may influence policy tool selection.

Findings & Conclusions: The study finds that the victim narrative remains more prevalent in crashes. Furthermore, the episodic frame appears more prevalent in the narrative, which suggests reporting of the crashes as isolated issues without consideration of any environmental factors which makes the news less important and fails to gather public opinion. The low rate of policy changes in the states studied may be a result of the low visibility and salience provided by the media. The sentiment analysis suggests that almost none of the media accounts reflect a positive tone and a majority reflect a negative tone, which may be connected to media accounts related to fatalities. Overall, neither bicyclist nor pedestrian crashes regularly appear in media accounts; however, the media reporting of bicyclist crashes occurs significantly more often as a proportion of total fatal crashes than pedestrian crashes. The logistic regression results also indicate that pedestrians and adults (31-75) increase the likelihood of victim characterization. The probability of policy change also has a positive relationship with crash reporting rate, which supports the need to increase media attention to enact policy changes and a conservative political culture. For the third model, only city population appears to influence the likelihood of infrastructure change.

Recommendations:

1. Crashes involving bicyclists and pedestrians need more visibility in media reporting. People involved in crashes need to report to law enforcement agencies and local media needs to report such incidents for informing the public. This may lead to a greater public and political awareness of the safety needs of bicyclists and pedestrians.
2. Although bicycle and pedestrian advocacy organizations are present at the local, state, and national levels, they must be actively involved in crash reporting and educating and informing the public about bicycle and pedestrian laws and safety issues. They must be involved in the policy making as well.

3. The impact of media portrayal and other factors on infrastructure change may benefit from a greater sample size, but the city's size appears to be the only factor impacting the likelihood of infrastructure improvement, which indicates the need to increase the emphasis on bicycle and pedestrian facilities for smaller communities, which may require grant programs.
4. Seek to identify the causes of bicyclists being characterized as victims at a much lower rate. Investigate the role, if any, this plays in infrastructure and policies for bicyclists. For this, the sample size of bicyclist crashes with identified locations needs to increase.
5. Counter to expectations and the emphasis placed on the safety of child pedestrians and bicyclists in policy (e.g. school zones) and infrastructure (e.g. safe routes to school), the media accounts portray children (5-20) and young adults (21-30) as villains at a much greater rate than adults (31-75). Older adults greater than 76 years old receive similar treatment by the media. These biases require further investigation, and stand in sharp contrast to those four years of age and less, whom the media portrays as victims almost eighty-five percent of the time.
6. Future investigations should try to examine the negative tone associated with the media accounts more closely and identify the factors influencing or causing the article tone.

INTRODUCTION AND BACKGROUND

Vehicles, pedestrians, and cyclists all want access to move from point A to point B in a safe manner. However, often in policy battles, some interests win out over others, and who wins may not always yield the safest policy outcome. Even in the area of transportation planning and policy, despite the tremendous amount of dollars invested in research to improve the understanding of what works to improve pedestrian and bicycle safety, often non-rational forces shape what actually happens in the local community. Policy narratives, defined as value-laden, stories, images, and metaphors, may exert a powerful influence on policy decision-making and may help to explain why scientific knowledge and expertise does not always influence what happens on the streets of local communities. This research seeks to understand the effects of policy narratives on state-level transportation policy decisions to improve the safety of multiple users. The research investigates the influence positive and negative narratives of bicyclists and pedestrians have on the types of policy tools used to improve bicycle and pedestrian safety. Specifically, the study tries to identify a relationship between policy narratives that cast pedestrians and bicyclists as "guilty villains" versus "innocent victims", and the policy tools used to improve safety in local communities. Finally, the study investigates the implications for those that possess the expertise, knowledge, and commitment to enhancing safety in local communities.

Policy tools represent the actions, instruments or means that governments can take to address a particular problem. The choice of a policy tool often reflects the problem's definition. While policy narratives have been found to have an effect on problem definition in environmental policy, less is known as to the effect of narratives on transportation policy. Anecdotes from bicycling advocacy groups expose the emergence of policy narratives that adopt a "blame the victim" storyline and portray bicyclists and pedestrians as "guilty villains". Victim-blaming happens right away in the media when a crash is covered. For example, questions or assumptions such as "were they wearing a helmet", or "were they wearing reflective clothing" automatically begin to point the blame towards the bicyclist or pedestrian rather than the infrastructure or the actions of a vehicle (Giddings, 2015). In this way, the account begins to describe a bicyclist as being at fault, and/or neglecting to follow the rules, which shapes the

problem as one of controlling the reckless behavior of bicyclists. Such narratives begin to shift the alternative solutions to those that can efficiently and effectively improve bicyclist behavior, rather than a more comprehensive view of the contribution of motorists, road facilities, or other factors to the problem.

Policy Narratives and Policy Tools

Several instruments, or policy tools, can be utilized to create healthy, livable transportation environments that support the needs of bicyclists and pedestrians along with motorists. The toolkit contains solutions that can improve the safety of transportation infrastructure, motorist behavior, and bicyclist and pedestrian actions and behavior. However, in the policy decision-making realm, narratives and the underlying values become intertwined with facts to influence problem definition and produce an emphasis on certain types of tools to address safety. Thus, the tools selected from the toolkit may emphasize or seek to address the behavior of one segment of the population by identifying them as the cause of the event. For example, casting bicyclists and pedestrians as "guilty-villains" may suggest a propensity to select one set of policy tools and this may be different than the policy tools selected if the target population is cast as "innocent victims". When target populations are constructed in a negative light, policy choices may undersubscribe benefits to that population, be symbolic in nature or place over restrictive burdens on the population to change their behavior (Schneider & Ingram, 1993, 2005). In this case, the selected policy tools may restrict the behavior of bicyclists and pedestrians, and yield no action, overly restrictive rules on bicyclists or pedestrians, or a reduction in the infrastructure available on the roadways for their use.

Conversely, when bicyclists and pedestrians are perceived as innocent victims, it is plausible to hypothesize that policy tools will target enhancing their safety by taking actions to curb motorist behaviors as well as address the features of the pedestrian and bicycling infrastructure. When target populations are constructed in a positive light, policy tools that reduce the burdens on the population are more likely. Examples, in this case, include improved safety infrastructure such as bike lanes, traffic calming devices, reduced speed limits, wider sidewalks, protected bike lanes, and sidewalks or a whole host of additional infrastructure investments that allow pedestrians and bicyclists to use the roadway but enhance their safety.

Research Questions

This research seeks to understand if a relationship between the media portrayal of the behaviors of bicyclists and pedestrians and the policy tools that result to improve their safety exists. Specific research objectives include:

1) To assess and classify the policy narratives present in a random sample of twelve states from four regions for the period 2003-2015.

2) To assess and classify the policy tools used to improve bicyclist and pedestrian safety in a random sample of twelve states.

3). To test the statistical association between the policy narratives that emerge and the policy tools used in twelve randomly selected states based on a set of predetermined hypotheses.

4). To identify strategies that experts and advocacy groups can use to improve the likelihood that scientific evidence enters into the policy decision-making process.

Significance of Research

As noted on the Transportation Research Center for Livable Communities' (TRCLC) website, "the central mission of this Center is to engage in research that helps to achieve more balanced, affordable and environmentally sustainable transportation systems for all…" This research contributes knowledge to the decision-making process and the role media reporting has on influencing transportation policies that facilitate access and safety for all users. The study investigates the challenges practitioners and advocates face in informing the policy decision-making process and strategies that they might adopt to improve their potential to influence policy outcomes. The report also identifies the factors that affect the likelihood of the vulnerable road users in bicycle and pedestrian crashes' characterization as a victim rather than a villain.

THEORETICAL FRAMEWORK

The study adopts the agenda-setting theory to examine the effects of narratives and policy tools on policy changes with respect to bicyclists and pedestrians. The agenda setting theory, developed by McCombs and Shaw (1972), suggests that media can set the agenda on issue discussions by the process of selection, omission, and framing of news reports. This theory, originally used in communication studies to explain mass media influence on political agendas, can be applied to other fields such as public policy and transportation. In 1963, Bernard Cohen (pp.13) states that the press "may not be successful much of the time in telling people what to think, but it is stunningly successful in telling its readers what to think about." In their study of a local election, McCombs & Shaw (1972) apply content analysis and documented a high correlation between media agenda and the public agenda. They conclude that the research supports that the mass media tell people not only what to think about but how to think about it.

Two levels in the agenda-setting process exist – in the first level, media coverage influences what one thinks about, and in the second level, media reporting not only influence how one thinks but also frames the issues that one is thinking about thereby further influencing the audiences' views and perspectives. In other words, while the first level of agenda setting focuses on the perceived importance of the issues, the second level focuses on the perceived importance of the attributes of issues (Weaver, 2007; McCombs, 2005; Ghanem, 1997). Media frame, according to Tankard et al (1991, pp.3) represents "the central organizing idea for news content that supplies a context and suggests what the issue is through the use of selection, emphasis, exclusion, and elaboration." Gamson and Modigliani (1987) argue that framing gives meaning to the events reported using metaphors, exemplars, catchphrases, depictions, and visual images to suggest the issue. Thus, framing is the selection of aspects of perceived importance and making them more salient to the audience in such a way that it promotes 1) a particular issue or definition; 2) a causal interpretation; 3) a certain moral evaluation; 4) a recommended solution (Entman, 1993). Iyengar (1991) further clarify framing by distinguishing between episodic and thematic news frames. Episodic framing is event-oriented and "depicts public issues in terms of concrete instances" (Iyengar, 1991, pp.14) such as bicycle crashes. Thematic frames, on the other

hand, places issues "in some general or abstract context and takes the form of a 'takeout' or a 'backgrounder' report directed at general outcomes or conditions" (Iyengar, 1991, pp.14) such as the road or visibility conditions or infrastructure for bicyclists or pedestrians. However, Iyengar notes that episodic framing is more consistent with visual media. Nonetheless, these frames can influence both public opinion and political decision-making.

In the extant research, the framing aspect of the agenda-setting theory is of importance because media reports represent the study's independent variables. The research team examines the media narratives regarding how the media frames the issue of bicycle and pedestrian crashes and the consequent influence of such narratives on public policies for bicyclists and pedestrians.

LITERATURE REVIEW

Policy Narratives and Problem Definition

Crashes between bicyclists/vehicles and pedestrians/vehicles elicit emotions, opinions, and values about what ought to be the "best" policy intervention. The details, reports, accusations, and opinions expressed surrounding crashes shape the policy narrative that defines the event. Policy narratives construct stories about an issue or event, complete with a beginning, middle, and end; a sequence of events and positions; and characters, plots and causal relationships (Roe, 1994; Shanahan et al., 2008). Narratives have the potential to influence how a problem is framed (problem definition), prioritize potential alternatives for action, and preferred policy tools for action (Stone, 2001; Shanahan et al., 2011).

Narratives that blame bicyclists and pedestrians for not behaving appropriately, i.e., not taking safety precautions or causing crashes, do much more than tell a story. The narratives define the problem, not as one of motorist behavior or the transportation infrastructure, but rather the fault of the non-motorized party. The character assumed by target populations in the narrative often cast them in a positive or negative light. Common characters in policy narratives include victims, heroes, or villains (Stone, 2001; McBeth et al., 2005). The hero is cast as the potential 'fixer' of the problem. Heroes are often pitted against villains, who are portrayed as the entity responsible for the harm or policy problem. Victims can be innocent, i.e., portrayed as one who is harmed by a specific policy problem. Or, victims can be guilty, portrayed as one who caused the event to happen, thus they are blamed for it, and their guilty behaviors must be restricted or penalized. Through narratives, target populations are constructed, and often done so in a positive, 'deserving' or negative, 'undeserving' light.

Media and Problem Definition

Policy scholars have debated the role of media in the policy change process. Some (Baumgartner & Jones, 1993; Iyengar, 1997; Stone, 2001; Kingdon, 2003) argue that media reports on policy issues transmit multiple policy preferences thereby serving as conduits for policy actors. Others (Sabatier & Jenkins-Smith, 1993), however, argue that media's reporting on issues suggest their

preferences through their narratives, and thereby, contributes to the policy process. A study (Shanahan et al., 2008) to determine media's role finds differences between the national and local media narratives, and suggest that media acts as a contributor in the policy change process. The media's reports on crashes between bicyclists/vehicles and pedestrians/vehicles can influence or reinforce public's beliefs surrounding this issue (Shanahan et al., 2011). These reports represent narratives that can be utilized by policy actors involved with the governance of bicycles, motor vehicles, and pedestrian issues to influence policy debates or policy outcomes (Heikkila et al., 2014; Jones & McBeth, 2010).

Crash Characteristics

In 2015, a majority of US bicyclist-motor vehicle fatalities occur in urban areas (70%) and at non-intersections (61%) (NHTSA, 2017). Sullins et al. (2014) evaluates Los Angeles County data on bicycle-related trauma patients between 2006 and 2011 below 18 years of age and finds that less than twelve percent wear helmets despite education efforts. Billiot-Grasset et al. (2015) organize bicyclists into common configurations, and define "five groups of cyclist accident [crash] victim emerged, distinguished by the type of cycling." Further, alcohol is involved either for the motor vehicle operator or for the bicyclist in 37 percent of all fatal bicycle crashes in 2015 (NHTSA, 2017).

Risk of Collisions at Signalized Intersections:

According to Wang and Nihan (2004), most bicycle-motor vehicle (BMV) crashes occur at intersections; therefore, they determine the causalities of these crashes and potential mitigation strategies. In another study from 1986 to 1991, Garder et al. (1994) determine that 57% of the intersection BMV crashes result from the turning movements of motor vehicles and bicyclists are at fault in most cases. Wang and Nihan (2004) classify crashes at intersections into three types: 1. Collisions between bicycles and through motor vehicles; 2. Collisions between bicycles and left-turning motor vehicles; and 3. Collisions between bicycles and right-turning motor vehicles. Summala et al. (1996) note that bicycle crashes in Helsinki, Finland, predominately appear to be type 3 crashes when a "driver was turning right and a cyclist was coming from the right."

Wang and Nihan (2004) determine that the type 1 crashes occur when at least one of the parties disregards a red indication. They find that strict enforcement of traffic laws in central business districts reduces crash occurrence rates, but pedestrian overbridges increase crashes. Higher bicycle volumes and the "ratio of left-turning motor vehicle volume to total motor vehicle volume" appear to decrease type 2 crashes.

Both studies find that type 3 crashes happen more often at sight-obstructed intersections and less often at intersections with adequate sight distances. Summala et al. (1996) attribute the difference in crash rates between type 2 and type 3 crashes to the visual scanning habits of drivers derived from threats from motor vehicles. Summala et al. (1996) recommend countermeasures that promote more care from motor vehicles and draw attention to the likely cycle paths through infrastructure and education. Considering these factors the best way to reduce crashes appears to be addressing visibility and approach problems. These studies transpired during a period when BMV crashes occurred mostly at intersections, and bicyclists received the primary blame for the crashes. However, data from 2015 show that three percent of the fatal crashes occur in bicycle lanes and sixty-one percent occur at non-intersections. The change in crash location and the change in attitudes towards active modes from the era of the aforementioned studies reflect changes in the research community and some jurisdictions.

Cyclist Behavior:

Billiot-Grasset et al. (2015) investigate bicyclist behavior and construct a typology of cycling crashes that includes infrastructure, cyclist behavior, and other road users. Using both detailed accidents studies and accident prototypes, combined with medical databases and surveys, the authors conducted a thorough study on the matter. They identify "17 recurring accident configurations, paving way for targeting accident-risk prevention programs for each case." A lack of riding experience increases the likelihood to collide with obstacles or fall due to a lack of control. Combined with properly infrastructure maintenance, cyclist experience and speed control represent key strategies to reduce injuries.

Billiot-Grasset et al. (2015) find that the use of alcohol, lack of attention, poor visibility (which can be avoided with "reflective bands on roadside objects" contribute to crashes. Also, for leisure

cycling, overconfidence in one's riding ability and poor maintenance contribute to crashes. Using protective wear, better awareness of intersection risks, high visibility clothing, observing safety measures, and avoiding speeding, can all help diminish crashes. Finally, crash prevention methods need to be tailored to the age group being targeted. Considering the above, the behavior of the cyclist plays a key role in the policy outcomes and crash countermeasures.

Road Characteristics:

Nyberg et al. (1996) indicate that most BMV crashes in Sweden involve a single-vehicle and bicycle and investigate the role different road surfaces play in those crashes. The major road surface factors contributing to these injuries involve "poor maintenance including snow/ice, wet leaves, and gravel on the roadway; bad road surface which included cracks, holes, uneven paving and a steep lateral slant." Their study concludes that poor road maintenance causes more than half the crashes. Overall, three largely seasonal road surface factors contribute to bicycle crashes, and cause different types of injuries (Nyberg et el., 1996). Therefore, improved winter road maintenance and bicycle accommodating infrastructure can reduce crash rates and injuries. Bicycle friendly curbs in particular appear necessary; at a minimum, a curb must always be lower than the distance between a pedal and the ground (Nyberg et al., 1996). Improving the quality of road surfaces also appears necessary; therefore, the study imposes the necessity of "politicians and people in charge of traffic planning to accept the challenge to create a traffic environment where the safety and passability of cyclists is integrated into city traffic life" (Nyberg et al., 1996). Bicycles need to be given as much importance as other vehicles.

Narratives on Crash Prevention Methods:

Many advocates as well as local government administrators have indicated major challenges to creating a balanced transportation system include informing conversations and making sure that important research and evidence enters into the decision-making process.

Simson and Mineiro (1992) determine methods of preventing to bicycle crashes. They divide the crash prevention methods into four categories: 1. the cyclist; 2. other road users; 3. Environmental factors; and 4. bicycle mechanical defects. They observe that younger cyclists mostly have crashes with single vehicles, and as age increases, the number vehicles involved in

one accident with a bicycle also increase. Also, the majority of children's crashes happen on roads rather than on public grounds. With these results, they suggest compulsory formal training for children. According to a report by Teisch et al. (2015), bicycle crashes represent the main reason for emergency room visits by children. This information can influence which "child safety initiatives" can be much more successful and help prevent such crashes from reoccurring in the future (Teisch et al., 2015). To address the crashes caused by other road users, the study suggests campaigns to bring awareness to drivers about cyclists, which matches the earlier findings related to BMV crashes at intersections. Lastly, the study emphasizes the importance of helmet use. Fahlstedt et al. (2016) investigate helmets protecting bicyclists from fatal injury during crashes, and conclude that wearing a helmet significantly reduces the chances of both brain injuries (including concussions) and skull fractures. The reduction of skull fractures with helmets is higher than brain injuries.

METHODOLOGY

Research Design

The research design uses a mixed-methods design that utilizes quantitative techniques to analyze qualitative, coded data from news articles pertaining to bicycle and pedestrian crashes. The media, including traditional print sources, television, and social media, act as a conduit or a contributor of policy narratives (Shahanan et al., 2008). Therefore, the unit of analysis is the news articles on bicycle and pedestrian crashes in 12 randomly selected states. The team planned to investigate the media accounts associated with the bicyclist and pedestrian fatality crashes occurring in fifty cities over a twelve year period. Unfortunately, few news articles related to those crashes could be identified in those cities; this likely results from the low proportion of fatal bicyclist (< 2%) and pedestrian (14%) crashes receiving media attention. As an alternative methodology, the research team samples states from different regions of the country. The Federal Highway Administration (FHWA) website, identifies four regions: northeast, southeast, middle and west. The team randomly selects three states from each region using the Excel "randbetween" and "vlookup" functions.

Northeast: Connecticut, Delaware, District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, and Vermont.

Southeast: Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Puerto Rico, South Carolina, Tennessee, Virgin Islands, Virginia, and West Virginia.

Mid-America: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Oklahoma, South Dakota, Texas, and Wisconsin.
West: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

The final list of selected states are Maine, Pennsylvania, Vermont, Georgia, North Carolina, Tennessee, Indiana, Nebraska, Wisconsin, Arizona, Idaho and Washington.

After defining these states, the research team collects bicyclist and pedestrian crash information reported in news articles from the Lexis Nexis from 2003-2015. For each location, news articles provide the following information: Crash Type (Bicycle or Pedestrian), Media source (local, Statewide, National), Crash Date, Crash Results (Fatal or Non-Fatal), City, State, Age, Gender, Characteristics of People Involved in a Crash, Location Characteristics, Weather, Tone (Victim or Villain), Summary of Accident, Cause of Crash, and Street Address.

The researchers also collect the total fatal crash data for bicyclists and pedestrians in the study sample from the National Highway Traffic safety Administration (NHTSA). These data can be combined with the media account data to generate a crash reporting rate. The crash reporting rate considers the period from 2007 to 2015 (See Appendix 1 for a state sample of crash reporting).

The study uses content analysis of different media sources to generate the qualitative, coded *independent variable, Blame-the-victim,* for the analysis. Content analysis also generates a qualitative, coded *dependent variable, policy tools*. As noted earlier in the theoretical section, framing of the news articles remains critical to the analysis in this study; however, some subjectivity occurs in the data collection while scoring hundreds of news articles (Tankard et al., 1991).

To address this issue of reliability and credibility, the researchers apply multiple approaches to analyze the data: First, the team uses content analysis to code the data from news articles to conduct a narrative analysis to assess victim/villain frames in twelve states. Second, the researchers use a machine based learning software to conduct sentiment analysis to supplement human coding of the news articles. Third, the qualitative coded data is merged with data obtained from secondary data sources that will be used to create control variables for local characteristics. Fourth, the study uses site mapping via Google Maps to conduct infrastructure analysis. Fifth, team analyzes the selected states websites for information on policies and searches for any changes during this period. Sixth, research team links the coded data with data on economic condition and political culture, gathered from multiple sources such as Census data and state

level data. Seventh, the study conducts hypotheses tests to assess the relationship between victim or villain narratives with the policy tools implemented. Finally, using logistic regression, the researchers model the following three factors:

- Identify the factors that influence the likelihood of people being victim;
- Identify the likelihood of infrastructure change; and
- Identify the likelihood of policy change in different locations.

Narratives have defined components that allow the researchers to analyze whether or not the media accounts present the victims in a negative or positive light. A codebook diminishes the level of subjectivity that occurs in content analysis as it provides a systematic way to code the narratives. Table 1 shows the coding methods for assessing the news articles.

Table 1. Data Collected from News Articles

Data	Obtained	Analysis
Year		Direct
Accident Type	Was it a Pedestrian or Bicycle Crash?	Direct
Media Source	Was it a local, regional, state, or national news article?	Direct
Accident Date		Direct
Accident Results	Was it a fatal or non-fatal accident?	Direct
City		Direct
State		Direct
Age		Direct
Gender		Direct
Tone	Victim or Villain	Content
Frame	Was the article framed as a thematic or episodic article?	Content
Street 1		Direct
Street 2		Direct

Additional data collected includes each state's economic conditions and political culture. Economic conditions include population growth from the 2000 to 2010 Census. The unemployment level, poverty rate, and revenue base have been generated from the 2010 Census. All this data is collected from the Census Bureau website for the states in the sample. In order to assess political culture, the researchers obtain data from the Census Bureau website and the Pew Research Center. The study defines a state as progressive or conservative based on five factors, see Table 2. States with a high median income, high percentage of individuals with degrees in

higher education, low percentage of adults in a Christian religion, high percentage of non-traditional households, and the state's preference for a Democratic Party affiliation receive a code of progressive. States with a low median income, low percentage of individuals with degrees in higher education, a high percentage of adults in a Christian religion, low percentage of non-traditional households, and the state's preference for a Republican Party affiliation receive a code of conservative.

Table 2. Political Culture Determination

	Median Income	Education Level	Religious	Nontraditional Households	Party Affiliation	Political Culture
State	Based on 2012-2016 ACS Data, Mean Household Income	Based on 2012-2016 ACS Data, Bachelor Degree or higher	Based on Data from Pew Research Center, Percentage of Adults in Christian Religions	Based on 2012-2016 ACS Data, Unmarried-Partner Same-Sex Relationships	Based on Data from Pew Research Center, 2014	Progressive or Conservative

Narrative Analysis of Media Coverage

In order to assess the amount of media coverage in the news, the research team collects news articles from the Lexis Nexis Database from 2003 to 2015. In total, the study codes and analyzes 776 articles, see Table 3. In most cases, the data comes directly from the news article. The researchers provide a summary in the database for each article, along with any additional information that might aid in the coding of other analyses.

Table 3. Crash and Article Count by State

State	# of Articles	# of Crashes Mapped
Arizona	3	0
Georgia	59	11
Idaho	21	4
Indiana	61	12
Maine	60	9
Nebraska	16	2
North Carolina	19	4
Pennsylvania	432	50
Tennessee	2	0
Vermont	0	0
Washington	68	14
Wisconsin	26	5

Under the theoretical framework of agenda setting, content analysis represents a popular methodology (Liu et. al. 2010; Craft and Wanta, 2004; McCombs, 1972). Coding for tone, requires an individual read the article and note certain keywords. When the article includes phrases such as "the car hit the bicyclist" or "was struck by a vehicle," it receives a code of victim. When the article includes phrases such as "the bicyclist hit the car" or the "bicyclist struck the car," it receives a code of villain. The study uses content analysis to determine all article framing; see Table 4 for a more detailed explanation.

Table 4. Coding of Frames

Framing Format		Articles Coded	% of Total
Thematic	Characterization is general (e.g., road or visibility conditions or infrastructure for bicyclists or pedestrians)	179	23%
Episodic	Characterization is specific (e.g., bicycle or pedestrian crashes)	583	75%
Neutral	Unclear characterization of the crash	14	2%
Total		**776**	**100%**

The content analysis from each article gathered from local, regional, and national media identifies themes that point to the victim or villain narrative. The coding also identifies episodic and thematic frames, which characterize the issue of bicycle or pedestrian crashes in the article as specific (episodic) or generic (thematic). Table 4 indicates that a majority of the news articles rely on episodic framing, which is consistent with the findings of Collins et al. (2006). The study hypothesizes that a positive relationship exists between the strength of the blame the victim narratives and policy tools that aim to restrict the actions of bicyclists or pedestrians or aim to educate pedestrian or bicyclists. Specific hypotheses include:

Bicycle Safety Policy Tools:

When compared to narratives that portray bicyclists as innocent crash victims, the study team believes that blame-the-victim narratives will result in actions that either result in no change or seek to change or restrict the behavior of bicyclists.

Specifically, the following hypotheses will be tested:

H1a: *Blame-the-Victim* narratives will result in fewer new miles of bicycle lanes.

H1b: *Blame-the-Victim* narratives will result in no policy changes.

H1c: *Blame-the-Victim* narratives will result in fewer safety modifications or adjustments to the vehicular roadway.

H1d: *Blame-the-Victim* narratives that are associated with bicycle–vehicle crashes will result in greater use of enforcement, and informational and educational campaigns targeted to improving bicyclist and pedestrian behaviors.

Pedestrian Safety Policy Tools:

When compared to narratives that portray pedestrians as innocent crash victims, the researchers expect blame-the-victim narratives to result in actions that either result in no change or seek to change or restrict the behavior of pedestrians. Specifically, the following hypotheses will be tested:

H2a: *Blame-the-Victim* narratives that are associated with pedestrian-vehicle crashes will result in fewer new miles of sidewalks.

H2b: *Blame-the-Victim* narratives that are associated with pedestrian-vehicle crashes will result in fewer safety modifications to existing sidewalks.
H2c: *Blame-the-Victim* narratives that are associated with bicycle-vehicle crashes will result in fewer safety modifications to the vehicular roadway.
H2d: *Blame-the-Victim* narratives that are associated with pedestrian –vehicle crashes will result in greater use of enforcement, and informational and educational campaigns targeted to improving pedestrian behavior.

Infrastructure Scoring

As opposed to the originally proposed methodology, site mapping requires using the news article database to locate the site. The content analysis notes any intersections the article identifies as well as any other information that may be suitable for helping the researchers locate the site on a map. Using this approach, the research team locates and maps 135 (112 pedestrian and 25 bicycle) crashes in Google Maps for the entire twelve year period. For these 135 crashes, the researchers view a time-series of maps to identify any site improvements that improve safety using an infrastructure score.

The researchers examine historical maps from the time of the crash or closest time prior to the crash to determine the infrastructure score for each location using a previously developed performance measure for evaluating infrastructure (Casey et al., 2016). They compare this score to the location's present infrastructure score to determine if any change has occurred. The aforementioned performance measures consider different criteria for determining the infrastructure scores for bicyclists and pedestrians.

Sentiment Analysis

The research team uses sentiment analysis to ascertain if any relationship between characterizing the vulnerable road users as a villain or victim and the article tone. Sentiment Analysis extracts the sentiments, expressions, and feelings of the author from any given text or document. This analysis applies Natural Language Processing (NLP) to evaluate human language and perform analytics. The researchers use a code developed in RStudio and the word dictionary 'sentimentr' (Rinker, 2018), which adds other advantages like the ability to remove valence shifters and

negators (e.g. although, not, however, and never). Sentiment analysis requires sentiment strength, which associates a positive or negative numeric value to characterize the magnitude of positive or negative sentiment associated with each word's meaning. A word bank defines the sentiment strength for each of the words that it contains where some words may be neutral and receive a score of zero. The analysis generates the sentiment strength of each sentence, which can be combined to provide an overall sentiment strength of the article. The overall sentiment strength gives the polarity of the article, i.e., whether the article is positive, negative or neutral. Figure 1 explains the data flow.

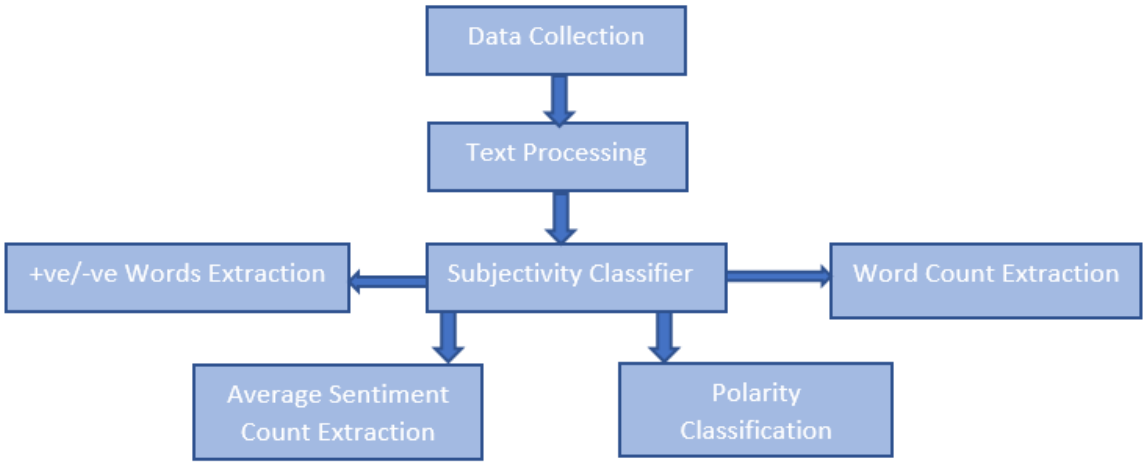

Figure 1. Sentiment analysis data flow

Policy Analysis

There are multiple processes for analyzing bicycle and pedestrian policies. The research team reviews policies regarding bicycles and pedestrians from each state's Revised Statutes website and notes when policies change or begin. A policy change implementation occurs when a change in policy happens in that year. The second phase of policy analysis looks at the policies in each state. Again, content analysis seeks to find commonalities between states and determine the policies' usefulness in preventing bicycle and pedestrian fatalities.

Data Analysis and Logit Modeling

The research team tests (Z-test) comparisons between different variables such as "Are pedestrians or bicyclists more likely to be characterized as a victim?" The study also estimates

three different models using logistic regression. Stepwise regression provides an easy method to define the significant independent variables for each model where the likelihood of crash tone (Victim vs Villain), policy change and infrastructure change represent the dependent variables. The researchers also collect the total crash data for bicyclists and pedestrians in the study sample from the National Highway Traffic safety Administration (NHTSA). These data can be combined with the media account data to generate a crash reporting rate. The crash reporting rate considers the period from 2007 to 2015. A sample with the traffic safety data of Georgia is provided in the Appendix.

FINDINGS AND DISCUSSION

The research team analyzes data collected from news articles, United States Census data, and Google maps using MS Excel, Minitab, and RStudio. In analyzing the data, the study focuses on the article content and its framing of the characters as victims or villains, the positive or negative tone used in the narrative, and the characteristics of the crashes and crash locations to answer the research questions.

Narrative Analysis

Upon examining the narrative frames, episodic framing of the crash occurs most frequently, which suggests that media reports primarily focus on the specific bicyclist or pedestrian crash. Table 5 shows that a majority (60% not accounting for the neutral role) of the news articles characterize the affected person (bicyclists or pedestrian) as a victim. However, some (28%) blame the bicyclists and pedestrians for the crash and portray them as villains in the narrative. Some articles do not provide a clear narrative position, which code as neutral.

Table 5. Narrative Analysis

Narratives	Articles Coded	% of Total
Victim	464	60%
Villain	220	28%
Neutral	92	12%
Total	**776**	**100%**

This research seeks to determine the role, if any, the news media narrative has on policy change pertaining to active transportation – pedestrian and bike friendly policies. In order to assess this, the study runs chi-squared tests (Table 6) to understand the association between episodic and thematic frames or victim and villain characterization to policy changes in states defined as progressive or conservative based on Census Data and Pew Research Center.

Table 6. Chi-Squared Tests of Association of Narratives to Policy Changes

Progressive:					
Y (categorical)	*X (categorical)*	*p-value*	*Chi2-stat*	*Df*	*N*
Policy Change Implementation	Frame	0.408	0.685924281	1	505
Policy Change Implementation	Tone	0.675	0.17571006	1	505
Conservative:					
Y (categorical)	*X (categorical)*	*p-value*	*Chi2-stat*	*Df*	*N*
Policy Change Implementation	Frame	0.0682	3.325381219	1	168
Policy Change Implementation	Tone	0.48	0.656571375	1	168

The sampled dataset shows no significant ($\alpha = 0.05$) association between frames or tones to policy changes; however, the episodic and thematic frames in conservative states demonstrate a significant association with $\alpha = 0.10$. Thus, this suggests that narrative frames or tones in the selected states have no impact on policy changes; however, the situation for at least conservative states merits further investigation.

Sentiment Analysis

Since sentiment analysis generates a score for each sentence, the results may be combined with a hypothesis test to determine the polarity (e.g. negative or positive) of a particular article. In many cases, the polarity will not be significantly positive or negative and the article remains classified as neutral. Table 7 shows that 59% of the articles have a negative tone and a single article has a positive tone. The positive article originates in Idaho, and five of the states (Georgia, Idaho, Indiana, Pennsylvania, and Washington) generate negative accounts at least half the time. Nebraska and Arizona appear to have fewer negative media accounts; however, the sample sizes in these two states remain low.

Table 7. Classification of Articles Based on Tone

State	Total # of Articles	# of Negative Articles	# of Positive Articles	# of Neutral Articles	% of Negative Articles
Arizona	3	1	0	2	33
Georgia	60	37	0	23	61
Idaho	22	12	1	9	54
Indiana	62	31	0	31	50
Maine	61	30	0	31	49
Nebraska	17	6	0	11	35
North Carolina	20	8	0	12	40
Pennsylvania	433	285	0	148	65
Tennessee	2	0	0	2	0
Washington	69	40	0	29	57
Wisconsin	27	11	0	16	40
Total	776	461	1	314	59

Table 8 gives the average number of negative and positive words and average negative and positive sentiment strength contained within the articles from each state; Table 8 also presents the average overall sentiment strength of the articles from each state. With the exception of Tennessee, which only has an inadequate sample of two media accounts, the articles from all states average a greater number of negative words and greater negative sentiment strength. The negative tone of the media accounts likely directly relate to the episodic framing and their subject matter.

Table 8. Article Word Counts and Sentiment Strength

State	Average # of negative words per article	Average # of positive words per article	Average negative sentiment strength per article	Average positive sentiment strength per article	Average sentiment strength per article
Arizona	198	161	-4.15	1.65	-0.29
Georgia	340	144	-4.57	1.92	-0.16
Idaho	390	214	-5.86	1.94	-0.11
Indiana	309	134	-4.51	1.95	-0.18
Maine	516	134	-2.74	1.79	-0.13
Nebraska	355	186	-5.49	2.37	-0.13
North Carolina	327	291	-4.77	3.09	-0.09
Pennsylvania	327	125	-4.79	1.59	-0.18
Tennessee	113	267	-2.26	3.13	0.1
Washington	375	207	-4.64	2.82	-0.13
Wisconsin	266	182	-4.68	2.21	-0.16

Policy Analysis

Bicycle and pedestrian policies do not play a significant role at the state level. Furthermore, they rarely change and provide minimal guidance. In fact, many policies appear remarkably similar from state to state with some even having the same verbiage. Also, many of the policies do not directly consider the bicyclist or pedestrians themselves, but rather the drivers of motor vehicles. In several states, bicyclists and pedestrians have the same rights and responsibilities as motorists and can be held as accountable in the event of a crash. This may have some credibility in explaining the victim/villain framing in the media. Only four states have policies at the state level regarding the use of helmets for bicyclists. Maine, North Carolina, and Tennessee require helmets on any person under 16. Pennsylvania requires a helmet on any person 12 and under. Other states grant local municipalities the right to create additional laws. In many cases, when a state law requiring use of a helmet does not exist, a larger city may implement a bicycle helmet law. Further study, while considering exposure rates, must be undertaken to determine if helmet policies mandated at the state level result in fewer fatality crashes.

Another policy, which establishes a distance between a motorist and a bicycle or pedestrian, may have a direct impact on fatality crashes. Some states specify a specific distance; for example, North Carolina requires only two feet, which seems small when considering speed differences. Maine, Nebraska, and Wisconsin allow a separation of three feet, which is the most common distance for many states across the nation. In contrast, Pennsylvania has established a greater requirement of four feet, which may be seen as an increased precaution to prevent crashes.

Several policies appear similar between states at the state level. One such requires headlights and reflectors for nighttime riding. In many crashes reported at night, motorists claim they cannot see riders. These policies attempt to make nighttime riding safer. State policies also include the use of hand signals, which inform motorists of a rider's intentions, when turning. Most of states only allow for riders to ride two abreast; however, North Carolina only allows single file riding on the road. Other common policies include not carrying packages while riding, no additional riders, only one seat allowed, and at least one pump brake. Only Indiana adds another policy requiring a bell or other sound device on all bicycles. This is just an extra precaution and stride states are making to ensure safe ridership.

Pedestrian policies appear more directed at the drivers, rather than pedestrians; however, some states direct policies to pedestrians and preventive measures to pedestrian crashes. Two such policies provide the right of way to pedestrians in the crosswalk and on sidewalks. All states have a pedestrian right of way statute in place. Another policy found in each state relates to the use of pedestrian control signals, which require pedestrians to obey the signals. In Georgia, cars must stop and stay stopped when a pedestrian is in any crosswalk within their periphery. Lastly, each state explicitly states that a pedestrian cannot leave the curb suddenly, which prevents a motorist from stopping.

Table 9 presents the overall crashes that may result in transportation policy changes relevant for bicyclists and pedestrians for each state. The authors expect variations in local level transportation policies especially between urban and rural areas; however, these remain less publicly available. During the study period, few changes in policies regarding bicyclists and pedestrians have occurred at the state level.

Table 9. Summary of Policy Changes

Policy Changes	Count	% Count
Change	46	6%
No Change	730	94%
Total	**776**	**100%**

Infrastructure Scoring

This project seeks to identify any infrastructure changes at crash locations after the crash to explore the relationships between the narratives and these changes. Based on the collected data, the study focuses on the crashes occurring at intersections because they have more reliable data. Bicyclist and pedestrian crashes happen at about 800 locations, only about 137 locations can be located using the media accounts and scored using Google map historical images. The infrastructure changes in 17.9 % of locations with bicyclist crashes and 18.4 % of pedestrian crash locations. Overall, infrastructure changes 28.5 % of total crashes.

Simple Statistics

The study discusses and summarizes the important findings from the collected data using simple statistical analysis. This section does not consider any articles with incomplete data; therefore, the counts may not be the same as previous tables. Analysis of the collected data (summarized in Figure 2) reveals the following:

- The news article data identifies 67.8 % of bicyclists and pedestrians as victims and 32.2 % as villains.
- For crashes with location information, 10.5 % of victims are bicyclists and 89.5% are pedestrians.
- Media accounts consistently present a victim narrative more often than a villain narrative across all regions.
- Figure 2 shows that the four regions demonstrate different percentages of crash locations (bicyclist/pedestrian) experiencing infrastructure and policy change.
- The media accounts in all states develop a victim narrative more often except in Wisconsin where the villain narrative appears more often.

- Figure 2 shows the percentage of policy change in different states and regions as well as the percentage of infrastructure change in the different regions.

Simple Statistics	
Overall Population	
Percentage of Victim in Total	67.8
Percentage of Villain in Total	32.2

Simple Statistics	
Infrastructure Population	
Percentage of Victim/Bike	10.5
Percentage of Victim/Ped	89.5
Percentage of Villain/Bike	45.5
Percentage of Villain/Ped	54.5

Simple Statistics	
Infrastructure Population	
Percentage of No Infra Change/Bike	82.1
Percentage of No Infra Change/Ped	81.6
Percentage of Infra Change/Bike	17.9
Percentage of Infra Change/Ped	18.4
Percentage of Infra Change in Total	28.5

Simple Statistics	
Policy Population	
Percentage of No Policy Change/Bike	87.0
Percentage of No Policy Change/Ped	13.0
Percentage of Policy Change/Bike	29.4
Percentage of Policy Change/Ped	70.6
Percentage of Policy Change in Total	6.0

Simple Statistics	
Percentage of Victim in Region 1	79.5
Percentage of Villain in Region 1	20.5

Simple Statistics	
Percentage of Victim in Region 2	66.4
Percentage of Villain in Region 2	33.6

Simple Statistics	
Percentage of Victim in Region 3	66.3
Percentage of Villain in Region 3	33.7

Simple Statistics	
Percentage of Victim in Region 4	63.5
Percentage of Villain in Region 4	36.5

Simple Statistics	
Percentage of victims in Georgia	62.3
Percentage of villains in Georgia	37.7
Percentage of victims in Indiana	71.4
Percentage of villains in Indiana	28.6
Percentage of victims in Nebraska	87.5
Percentage of villains in Nebraska	12.5
Percentage of victims in Maine	57.1
Percentage of villains in Maine	42.9
Percentage of victims in Pennsylvania	67.7
Percentage of villains in Pennsylvania	32.3
Percentage of victims in Idaho	95.5
Percentage of villains in Idaho	4.5
Percentage of victims in Wisconsin	41.7
Percentage of villains in Wisconsin	58.3
Percentage of victims in North Carolina	77.8
Percentage of villains in North Carolina	22.2
Percentage of victims in Washington	73.3
Percentage of villains in Washington	26.7

Simple Statistics	
Percentage of Policy Change in Idaho	18.2
Percentage of Policy Change in Washington	1.4
Percentage of Policy Change in Maine	13.3
Percentage of Policy Change in Pennsylvania	6.0
Percentage of Policy Change in Indiana	3.3
Percentage of Policy Change in Nebraska	0.0
Percentage of Policy Change in Wisconsin	0.0
Percentage of Policy Change in Georgia	3.3
Percentage of Policy Change in North Carolina	10.0

Simple Statistics	
Percentage of Infra Change in Region 1	18.2
Percentage of Infra Change in Region 2	35.7
Percentage of Infra Change in Region 3	25.9
Percentage of Infra Change in Region 4	15.0

Simple Statistics	
Percentage of Policy Change in Region 1	5.4
Percentage of Policy Change in Region 2	6.9
Percentage of Policy Change in Region 3	1.9
Percentage of Policy Change in Region 4	4.9

Figure 2. Simple Statistical Analysis of Collected Data

Crash Media Reporting Rate

Based on NHTSA data of bicyclists' and pedestrians' crashes and news article data, the crash media-reporting rate between 2007-2015 for different regions at the state and national level can be found using the following formula.

Media-Reporting Crash Rate= 100(# of reported crashes in media/ # of crashes reported by NHTSA)*

Table 10 shows the media- crash reporting rate of the studied states. Tables 11 - 14 also show the crash reporting rate of different regions. Overall, the media reports on bicyclist crashes significantly more frequently (9.2%) than pedestrians' crashes (2.0%). This trend appears in most states and all regions with the exception of Vermont, which has no media accounts of the five pedestrians and 42 bicyclist fatalities, and Nebraska, which does not have any media accounts of the fourteen bicycle fatalities. The low reporting rates seem to indicate that both bicyclist and pedestrian fatalities receive little coverage in media, which likely reflects society's apathy.

Table 10. Media-Reporting Crash Rate in the Sampled States

State	# of Bicyclists Fatalities from 2007 to 2015 based on NHTSA	# of Bicyclists Fatalities from 2007 to 2015 based on Media Data	Crash Reporting Rate for Bicyclists	# of Pedestrians Fatalities from 2007 to 2015 based on NHTSA	# of Pedestrians Fatalities from 2007 to 2015 based on Media Data	Crash Reporting Rate for Pedestrians
Pennsylvania	137	50	36.5	1336	82	6.1
Arizona	213	3	1.4	1255	0	0.0
Georgia	175	8	4.6	1451	31	2.1
Idaho	22	1	4.5	105	3	2.9
Indiana	117	13	11.1	596	15	2.5
Maine	13	4	30.8	103	10	9.7
Nebraska	14	0	0.0	92	3	3.3
North Carolina	205	5	2.4	1536	5	0.3
Tennessee	62	1	1.6	704	0	0.0
Vermont	5	0	0.0	42	0	0.0
Washington	93	13	14.0	586	10	1.7
Wisconsin	87	7	8.0	442	2	0.5
Sum	1143	105	9.2	8248	161	2.0

Table 11. Crash Reporting Rate of Region 1

State	# of Bicyclists Fatalities from 2007 to 2015 based on NHTSA	# of Bicyclists Fatalities from 2007 to 2015 based on Media Data	Crash Reporting Rate for Bicyclists	# of Pedestrians Fatalities from 2007 to 2015 based on NHTSA	# of Pedestrians Fatalities from 2007 to 2015 based on Media Data	Crash Reporting Rate for Pedestrians
Arizona	213	3	1.4	1255	0	0.0
Idaho	22	1	4.5	105	3	2.9
Washington	93	13	14.0	586	10	1.7
Sum	328	17	5.2	1946	13	0.7

Table 12. Crash Reporting Rate of Region 2

State	# of Bicyclists Fatalities from 2007 to 2015 based on NHTSA	# of Bicyclists Fatalities from 2007 to 2015 based on Media Data	Crash Reporting Rate for Bicyclists	# of Pedestrians Fatalities from 2007 to 2015 based on NHTSA	# of Pedestrians Fatalities from 2007 to 2015 based on Media Data	Crash Reporting Rate for Pedestrians
Pennsylvania	137	50	36.5	1336	82	6.1
Maine	13	4	30.8	103	10	9.7
Vermont	5	0	0.0	42	0	0.0
Sum	155	54	34.8	1481	92	6.2

Table 13. Crash Reporting Rate of Region 3

State	# of Bicyclists Fatalities from 2007 to 2015 based on NHTSA	# of Bicyclists Fatalities from 2007 to 2015 based on Media Data	Crash Reporting Rate for Bicyclists	# of Pedestrians Fatalities from 2007 to 2015 based on NHTSA	# of Pedestrians Fatalities from 2007 to 2015 based on Media Data	Crash Reporting Rate for Pedestrians
Indiana	117	13	11.1	596	15	2.5
Nebraska	14	0	0.0	92	3	3.3
Wisconsin	87	7	8.0	442	2	0.5
Sum	218	20	9.2	1130	20	1.8

Table 14. Crash Reporting Rate of Region 4

State	# of Bicyclists Fatalities from 2007 to 2015 based on NHTSA	# of Bicyclists Fatalities from 2007 to 2015 based on Media Data	Crash Reporting Rate for Bicyclists	# of Pedestrians Fatalities from 2007 to 2015 based on NHTSA	# of Pedestrians Fatalities from 2007 to 2015 based on Media Data	Crash Reporting Rate for Pedestrians
Georgia	175	8	4.6	1451	31	2.1
North Carolina	205	5	2.4	1536	5	0.3
Tennessee	62	1	1.6	704	0	0.0
Sum	442	14	3.2	3691	36	1.0

Hypothesis Tests

This study conducts numerous proportion comparisons between different variables; for example, "Does any difference exist between pedestrians and bicyclists in the victim characterization rate?" The comparisons occur for all crashes, including those with an identifiable location. The researchers use the z-test in Minitab software to perform the hypothesis tests, which have an α of 0.05 or 95% level of significance. For each test, a P-value (< 0.05) reflects a significant difference between the variables under comparison. The study reports more than fifty hypothesis tests in Table 15.

Hypothesis Test Description

Column 1 of Table 15 shows the study level, which is statewide, regional, and national. Column 2 shows the comparison variables with most comparing bicyclist and pedestrian crashes. The population and sub group comparisons shown in column 3, for instance "Overall in Georgia, Victim," means all crashes in Georgia with people involved in a crash characterized as victims. Column 3 contains the following notations:

- Overall: All crash locations.
- Victim: Hypothesis test is on victim population.
- Policy: Locations that policy change is studied.
- No Policy Change or Policy Change: Hypothesis test is on locations where policy is not changed or policy is changed.

- Infra: Locations that infrastructure is coded.
- No Infra Change: Hypothesis test is on identified locations that experienced no infrastructure change.
- Crash Reporting Rate: Hypothesis test is based on crash reporting rate data of different regions and country.

Column 4 also shows the P-Value of each test, which is compared with $\alpha = 0.05$ to determine whether a significant difference exists between tested proportions. Column 5 indicates if this difference exists.

Hypothesis Test Discussion

At the national level, no significant difference between the proportions of victims and villains in locations with no infrastructure change and in locations with policy change exists. Bicyclists and Pedestrians experience victim characterization, policy change and crash reporting rate at different rates. For victim characterization, pedestrians experience greater rates than bicyclists. Bicyclist crashes experience policy change at a significantly greater rate than pedestrian crashes while the crash reporting rate for bicyclists remains significantly greater than pedestrians.

At the regional level, the media accounts characterize pedestrians as victims at a significantly greater rate than bicyclists in regions 2 and 3. However, infrastructure change does not appear different for bicyclists and pedestrians. In regions 2 and 4, pedestrian crashes result in a significantly greater likelihood of no policy change than bicyclist crashes. In all regions, pedestrian crashes generate media accounts at a significantly greater rate than bicyclist crashes.

At the state level, the results appear less consistent; however, victim characterization rates between pedestrians and bicyclists crashes remain significant in Indiana, Maine, and Pennsylvania. Similarly, policy change appears inconsistent; in Maine, Pennsylvania, and Georgia bicyclist crashes result in a significantly greater rate of policy change than pedestrian crashes.

Based on findings from hypothesis tests, the media accounts consistently characterize pedestrians as victims at a significantly greater rate than bicyclists. The media consistently writes articles on

bicyclist crashes at a significantly greater rate than pedestrian crashes, and policy change occurs more often in the case of bicyclist crashes.

Table 15. Results of Hypothesis Tests

Study Level	Comparison Variables	Population, Sub Group	P-value	Didfference Exists
National	Victim & Villain	Infra, No Infra Change	0.112	
	Victim & Villain	Policy, Policy Change	0.954	
	Bike & Ped	Overall, Victim	0.000	✓
	Bike & Ped	Infrastructure, Victim	0.000	✓
	Bike & Ped	Infra, No Infra Change	0.954	
	Bike & Ped	Policy, Policy Change	0.000	✓
	Bike & Ped	Regarding Crash Reporting Rate	0.000	✓
Regional	Bike & Ped	Overall in Region 1, Victim	0.585	
	Bike & Ped	Overall in Region 2, Victim	0.000	✓
	Bike & Ped	Overall in Region 3, Victim	0.000	✓
	Bike & Ped	Overall in Region 4, Victim	0.363	
	Bike & Ped	Infra in Region 2, No Infra Change	0.760	
	Bike & Ped	Infra in Region 3, No Infra Change	0.711	
	Bike & Ped	Policy in Region 1, No Policy Change	0.068	
	Bike & Ped	Policy in Region 2, No Policy Change	0.000	✓
	Bike & Ped	Policy in Region 3, No Policy Change	0.989	
	Bike & Ped	Policy in Region 4, No Policy Change	0.000	✓
	Bike & Ped	Regarding Crash Reporting Rate in Region 1	0.000	✓
	Bike & Ped	Regarding Crash Reporting Rate in Region 2	0.000	✓
	Bike & Ped	Regarding Crash Reporting Rate in Region 3	0.000	✓
	Bike & Ped	Regarding Crash Reporting Rate in Region 4	0.010	✓
State	Bike & Ped	Overall in Georgia, Victim	0.421	
	Bike & Ped	Overall in Indiana, Victim	0.001	✓
	Bike & Ped	Overall in Maine, Victim	0.048	✓
	Bike & Ped	Overall in Nebraska, Victim	0.242	
	Bike & Ped	Overall in Pennsylvania, Victim	0.000	✓
	Bike & Ped	Overall in Washington, Victim	0.844	
	Bike & Ped	Policy in Washington, No Policy Change	0.377	
	Bike & Ped	Policy in Maine, No Policy Change	0.000	✓
	Bike & Ped	Policy in Pennsylvania, No Policy Change	0.000	✓
	Bike & Ped	Policy in Indiana, No Policy Change	0.885	
	Bike & Ped	Policy in Georgia, No Policy Change	0.001	✓
	Bike & Ped	Policy in North Carolina, No Policy Change	0.068	

Building Logistic Regression Models

This study also seeks to identify the factors that influence the likelihood of people being characterized as a victim, the likelihood of infrastructure change and the likelihood of policy change in different locations. Since these three dependent variables are binary, the study estimates binary logistic regression models. Table 16 shows the complete list of independent and dependent variables; the candidate variables for each model include:

- Likelihood of being victim= f (*Crash Type, Media Source, Crash Severity, Age, Gender, Policy Implementation, Political Culture, Population, Median Income, Crash Reporting Rate*)
- Likelihood of policy change= f (*Crash Type, Media Source, Crash Severity, Age, Gender, Crash Characterization, Political Culture, Population, Median Income, Crash Reporting Rate*)
- Likelihood of infrastructure change= f (*Crash Type, Crash Severity, Media Source, Age, Gender, Crash Characterization, Median Income, Population, Crash Reporting Rate*)

Table 16. Variable Definitions

Variable	Type of Variable	Meaning	Category
Crash Type	Independent	Bicyclist or Pedestrian	Dummy
Media Source	Independent	Local, Statewide or National	Dummy
Crash Severity	Independent	Fatal or Non-Fatal	Dummy
Age	Independent	Age (Clustered in 8 Groups)	Dummy
Gender	Independent	Female or Male	Dummy
Crash Characterization	Independent, Dependent in Model 1	Victim or Villain	Dummy
Policy Implementation	Independent, Dependent in Model 2	Policy Changed or No Policy Changed	Dummy
Political Culture	Independent	Progressive or Conservative	Dummy
Population (1000s)	Independent	Population	Continuous
Median Income (1000$)	Independent	Median Income	Continuous
Crash Reporting Rate	Independent	Crash Reporting Rate	Continuous
Infrastructure Change	Dependent in Model 3	Infrastructure Changed or No Infrastructure Changed	Dummy

This research uses stepwise regression with $\alpha = 0.15$ for entering and removing variables to determine the significant independent factors. The authors use Minitab software to estimate the models.

Data Coding

The dummy variables need to be coded before running the software. Table 17 shows the coding of the dummy variables.

Table 17. Data Coding of Dummy Variables

Variable	Dummy Variables Coding
Crash Type	Pedestrian=1, Bicycle=0
Crash Severity	Fatal=1, Non-Fatal=0
Gender	Male=0, Female=1
Crash Characterization	Victim=1, Villain=0
Policy Implementation	Change=1, No Change=0
Political Culture	Conservative=1, Progressive=0
Infrastructure Change	Change=1, No Change=0

Media source also contains three dummy variables because each news article may be published in the local, statewide, or national levels. The study clusters the vulnerable road user's age into eight groups (0-4, 5-20, 21-30, 31-40, 41-50, 51-60, 61-75 and 76 or older) based on the distribution of victim characterization rates and eight variables because more than one user may be present in each crash.

Model 1: Likelihood of Victim Classification

This project investigates the factors likely to affect the likelihood of victim characterization in a media report. Stepwise regression identifies age (5-20), age (21-30), age (76+), and crash type as significant variables with $\alpha = 0.15$. Table 18 shows the summary of the model output.

Table 18. Likelihood of Victim Classification Model

R-Square	9.40%			
R-Square (Adjusted)	8.55%			
Variables	Age (5-20)	Age (21-30)	Age (76+)	Crash Type
Type of Variable	Dummy	Dummy	Dummy	Dummy
Coefficient	-1.281	-0.867	-1.268	0.994
Odds Ratio	0.2777	0.4204	0.2814	2.7027
P-Value	0	0.021	0.1	0
VIF	1.17	1.16	1.1	1.04

The final utility function for victim characterization is:

$$U = 0.682 + 0.994\ \text{CrashType} - 1.281\ \text{Age (5-20)} - 0.867\ \text{Age (21-30)} - 1.268\ \text{Age (76+)}$$

Model Discussion

All variables have a Variance Inflation Factor (VIF) less than 5, which indicates no multicollinearity between the independent variables. The goodness-of-fit for this model with an adjusted R-square of only 8.6% appears rather weak; therefore, the model should not be used for forecasting and discussion focuses on the significant independent variables. An increase in sample size, especially for the significant age clusters, may improve model fit and permit validation.

While three variables ("Age (5-20)", "Age (21-30)", and "Crash Type") pass any typical significance test, "Age (76+)" does not appear as significant. The odds ratio of age (5-20) is 0.2777 and implies that the likelihood of being characterized as a villain increases by 260% when a person involved in a crash is in the age range of 5 to 20. This trend remains true in the age ranges of 21-30 (138%) and 76+ (255%). Age clearly plays a role in victim characterization by the media because it portrays adults as victims over seventy percent of the time. The media bias against the children, young adults, and older adults seems curious given their prominence in targeted infrastructure and policy. The bias may occur due to the age of the authors of the media accounts; however, this requires further investigation. Finally, the crash type's odds ratio is 2.7, which indicates that the media casts a pedestrian as a victim 170% more often than an identical bicyclist. This shows a clear bias in media accounts towards pedestrians; however, the media tends to ignore pedestrian crashes altogether.

Model 2: Likelihood of Policy Change

The second model of this research identifies the factors influencing the likelihood of policy change in each location. Stepwise regression identifies age (21-30), age (76+), crash reporting rate, media source (state), crash characterization, and political culture as significant variables with $\alpha = 0.15$. Table 19 shows the summary of the model output.

Table 19. Modeling Likelihood of Policy Change

R-Square	32.06%					
R-Square (Adjusted)	29.02%					
Variables	Age (21-30)	Age (76+)	Crash Reporting Rate	Media Source (State)	Crash Characterization	Political Culture
Type of Variable	Dummy	Dummy	Continuous	Dummy	Dummy	Dummy
Coefficient	1.469	1.441	0.1579	1.323	0.859	2.425
Odds Ratio	4.3457	4.2231	1.1711	3.7545	2.3612	11.3047
P-Value	0.03	0.112	0	0.015	0.072	0.005
VIF	1.15	1.09	4.15	1.08	1.11	3.73

The final utility function for policy change is:

U = -7.33 +0.1579 Crash Reporting Rate +1.323 Media Source (State)+1.469 Age (21-30)+1.441 Age(76+)+0.859 Crash Characterization +2.425 Political Culture

Model Discussion

All variables have a Variance Inflation Factor (VIF) less than 5, which indicates no multicollinearity between independent variables. The adjusted R-square indicates that this model has an adequate goodness-of-fit. While four variables (crash reporting rate, media source (state), age (21-30), and political culture) appear significant with $\alpha = 0.05$, age (76+) and crash characterization remain in the model with lower significance. The odds ratio of all independent variables are greater than 1 but with different values. For example, the likelihood of policy change increases (3.35 times) when a person involved in a crash is 5 to 20 years old. The odds ratio of crash reporting rate means an increase in crash reporting rate of 1% increases the likelihood of policy change 17%. The presence of crash reporting rate in the model indicates that a lack of media attention to bicyclist and pedestrian crashes negatively impacts the likelihood of policy change. Somewhat surprisingly, a location with a conservative political culture enacts policy change over ten times as often as an identical location with a progressive political culture.

Model 3: Likelihood of Infrastructure Change

This model estimates the factors impacting the likelihood of "Infrastructure Change". Stepwise regression identifies "Population" as the only significant variable. Table 20 summarizes the model results.

Table 20. Modeling Likelihood of Infrastructure Change

R-Square	5.25%
R-Square (Adjusted)	3.96%
Variables	Population
Type of Variable	Continuous
Coefficient	0.0132
Odds Ratio	1.0133
P-Value	0.044
VIF	1

The final utility function for infrastructure change is:

U = -1.634 + 0.01320 Population (In 10000s)

Model Discussion

The goodness-of-fit for this model with an adjusted R-square of only 4% appears weak, but the discussion may focus on the significant variable. "Population" appears to be the only significant factor for determining the likelihood of "Infrastructure Change". "Population" has an odds ratio of 1.0133, which implies that as population increases by 10,000 the likelihood of infrastructure change increases by 1.33%. This shows that larger population centers have a greater ability (resources) to implement countermeasures at crash locations.

Advocacy Strategies

Finally, this research seeks to identify the strategies used by advocacy organizations for improved polices in favor of bicyclists and pedestrians. The research team identifies the strategies by examining the advocacy organizations operating at the state levels. The study identifies at least one organization with the mission of bicycle and pedestrian safety for each state with the exception of Nebraska and Vermont. Table 21 shows the strategic themes derived from a content analysis of the websites of the advocacy organizations. The work initiated and implemented by each organization provides the foundation for the strategic themes. Each organization uses specific strategies to accomplish their missions.

Table 21. Advocacy Strategies

States	Advocacy Organizations	Common Initiatives	Strategic Themes	Specific Strategies
Arizona	Coalition of Arizona Bicyclists	• Collaboration with other organization and agencies • Training & Workshops for planners and law enforcement officers • Education of local government staff, bicycle & pedestrian advocates, and policy leaders • Training & workshops via annual summits • Funding local advocates • Educational Public Service Announcements on radio and TV • Training of City administrators on best practices in infrastructure design and safe transportation • Lobby and networks with state officials • Fund raise for advocacy efforts • Complete Streets policy implementation • Transportation Funding Equity • Provide leadership and inspire activism for effective policies, programs and projects • Resource for all bicyclists and pedestrians • Support local municipalities in their requests for state and federal funding • Promote events and programs statewide with dedicated communications staff • Support local educational programs • Pursue funding for statewide campaigns • Provide resources and guidance in the creation of local advocacy groups • Endorse candidates for the state legislature	• Collaboration & Networking • Education & Training • Fundraising • Lobbying	• Collaboration & Networking with other organizations, lobbyists, and policy-makers • Education & Training of Government Agencies, Administrators, law enforcement officers, and public on safe transportation • Fundraising for initiatives and supporting local bike and pedestrian groups • Endorsing candidates for states • Lobbying by calling, mailing, and personally advocating for favorable legislation • Raising awareness for bicycle and pedestrian safety
Georgia	PEDS & Georgia Bikes			
Idaho	Idaho Walk Bike Alliance			
Indiana	Bicycle Indiana			
Maine	Bicycle Coalition of Maine			
Nebraska	NA			
North Carolina	BikeWalk NC			
Pennsylvania	PA Walks & Bikes			
Tennessee	Bike walk TN			
Washington	WA Bikes			
Wisconsin	Wisconsin Bike Fed			

One key finding from the analysis of the advocacy organizations is the salience given to the Complete Streets policy initiative. Per Smart Growth America (2018), Complete Streets is a street design initiative that considers all transportation modes including pedestrians, bicyclists, motorists, and public transportation. Complete Streets policy initiative seeks to provide safe and accessible streets for all users, regardless of age or ability, which facilitates multimodal transportation. The researchers examine the implementation of Complete Streets policy in the selected states for the years 2012 and 2014 (Table 22) and find that Arizona, Idaho, and Nebraska do not have this policy in 2014. However, recently, some cities and metropolitan areas within these states have adopted the complete streets policy.

Table 22. Complete Streets Policy Implementation at the State Level

States	2012 Complete streets policy? (Y/N)	2014 Complete streets policy? (Y/N)
Arizona	N	N
Georgia	Y	Y
Idaho	N	N
Illinois	Y	Y
Maine	N	Y
Nebraska	N	N
North Carolina	Y	Y
Pennsylvania	Y	Y
Tennessee	Y	Y
Washington	Y	Y
Wisconsin	Y	Y

LIMITATIONS AND RECOMMENDATIONS

The authors acknowledge several limitations. After the attempt to match news articles to FARS data from a random sample of municipalities failed, the researchers altered the order and built the news article database before trying to identify a crash location. Due to time constraints, the research team still relies on a sampling approach; however, all media articles may be considered for future study. In some cases, the states selected in the random sample generate either no or only a small number of news articles. Vermont has no media accounts of bicycle or pedestrian crashes while Arizona and Tennessee only have three and two media accounts of bicycle or pedestrian crashes. This limits the number of articles collected and thus the overall analysis. Due to the large number of localities included in the sample using the modified methodology, the analysis only identifies population, political cultural, socioeconomic status, and policy change data at the state level.

For the infrastructure analysis, the news articles must contain enough information to locate the crash. While many articles list a street name, only a few provide an intersection, address, block number, or other identifying markers, which severely limits the number of crashes to investigate for infrastructure change after the crash, which may inadvertently introduce a bias related to the media accounts providing sufficient information to identify a location.

Lastly, the sentiment analysis uses entire news articles, which may contain additional events such as robberies, shootings, and other automobile crashes. Some articles also contain uplifting stories about the individuals involved in the crashes or even information about community events and celebrations. These uplifting or tragic additions can skew the overall sentiment of the news report; however, this appears to have at most prevented an article from being classified as negative.

The authors suggest several recommendations for future research. The first recommendation is the collection of media articles from all states. This additional collection will provide a thorough analysis of the media accounts of bicycle and pedestrian crash narratives across the country. This would permit a more complete assessment of regional, cultural, or political differences in the victim/villain narrative. Including local data regarding population, socioeconomic and

political culture, and policy change will permit an enhanced analysis with a more localized approach.

The study also recommends developing an algorithm to match the media accounts with the available FARS data. Enhanced matching of these media accounts will strengthen the infrastructure analysis. Many articles lack the data to confirm location, and the FARS data will supplement the article database and provide the missing locational data needed to complete this portion of the analysis more completely and with less potential bias related to the media accounts.

Other recommendations include improving the collection approach for selecting media articles. Articles can be downloaded in a different manner, which allows for the removal of all additional media reports within each article. The initial sentiment analysis, completed by researchers in the determination of victim or villain and thematic or episodic, was focused solely on the part of the article regarding the actual crash. With a more focused computer generated analysis, future research can compare both extended and focused articles. Finally, the policy analysis may benefit from collecting data from crash reports and media accounts specifically related to some of the previously discussed bicycle and pedestrian policies. As an example, identifying the specific location or type of pedestrian crash may relate to specific policies present in a locality. For bicyclists, identifying helmet use or lights may help in linking the crashes and media accounts more directly to specific local policy and education changes.

CONCLUSIONS

By using multiple tools of analysis including qualitative and quantitative techniques, the study analyzes 776 news media articles related to bicycle and pedestrian crashes. The media stories suggest that the media often portray people involved in traffic crashes as victims. Also, the narrative focuses only on the crash and not on the factors associated with the crash such as low visibility, poor road condition, texting while driving of motor vehicle. As a consequence of such narratives, the significant issues do not receive enough visibility to be part of the agenda setting process of decision-making. As agenda-setting theory suggests, the issue must receive widespread visibility and salience in order to be part of the agenda for policy changes. While policies exist at the state level, significant policies such as wearing a helmet are not mandated. The addition of such policies at the state level could go a long way to improvement of bicyclist safety. Pedestrian policies remain fairly generic and vary from state to state. Innovation in the way of technology that enhances the safety of pedestrians may be the best option for states moving forward. No policy changes for bicycle and pedestrian safety occur at the state levels. The sentiment analysis shows that the media accounts generate a tone that at least leans negative; however, only 59% of the articles appear significantly negative. This negative tone appears to directly relate to the narrative's episodic framing and subject matter. As such, these findings support the overall narrative analysis.

Four strategic themes common to all advocacy organizations emerge after conducting a content analysis of their websites. These themes include collaboration and networking, education and training, fundraising, and lobbying. Based on these themes, the report identifies the specific strategies adopted by organizations to push for favorable bicycle and pedestrian regulations as well as educating and informing the public about the benefits of active transportation. Given the weakness of media coverage, advocacy organizations need effective strategies to influence the agenda setting and policy-making process.

In sum, the approach taken to examine the influence of news media narrative of bicyclists and pedestrian crashes in policy change seems effective. The content analysis examines the victim/villain narrative and the frame of the narrative. The study's finding that the victim

narrative appears more prevalent in crashes remains consistent with previous research (Collins et al., 2006). Furthermore, the episodic frame represents the more prevalent narrative, which suggests that the media accounts report on crashes as isolated issues and tend to ignore the environmental factors, which give the news less importance and fails to gather public opinion. Overall, neither bicyclist nor pedestrian crashes regularly appear in media accounts; however, the media reporting of bicyclist crashes occurs significantly more often as a proportion of total fatal crashes than pedestrian crashes. The low rate of policy changes in the states studied may be a result of the low visibility (due to low reporting rate) and salience (due to episodic frame) provided by the media. The logistic regression results also indicate that adults (31-75) and pedestrians have a higher likelihood of being characterized as a victim. The probability of policy change also has a positive relationship with crash reporting rate, which shows that greater visibility may increase policy change, and a conservative political culture. For the third model, only population appears to influence the likelihood of infrastructure change.

Future Research

Crashes involving bicyclists and pedestrians need more visibility in media reporting. People involved in crashes need to report to law enforcement agencies and local media needs to report such incidents for informing the public. This may lead to a greater public and political awareness of the safety needs of bicyclists and pedestrians. Although bicycle and pedestrian advocacy organizations exist at the local, state, and national levels, they must be actively involved in crash reporting and educating and informing the public about bicycle and pedestrian laws and safety issues. They must be involved in policy making, too.

The impact of media portrayal and other factors on infrastructure change may benefit from a greater sample size, but the city's size appears to be the only factor impacting the likelihood of infrastructure improvement, which indicates the need to increase the emphasis on bicycle and pedestrian facilities for smaller communities, which may require grant programs. The bias against bicyclists requires more investigation, which requires identifying the causes of bicyclists being characterized as victims at a much lower rate than pedestrians. Future studies also need to investigate the role, if any, this plays in infrastructure and policies for bicyclists. For this, the sample size of bicyclist crashes with identified locations needs to increase.

Future investigations should try to examine the negative tone associated with the media accounts more closely and identify the factors influencing or causing the article tone. Counter to expectations and the emphasis placed on the safety of child pedestrians and bicyclists in policy (e.g. school zones) and infrastructure (e.g. safe routes to school), the media accounts portray children (5-20) as villains at a much greater rate than most adults (31-75). Young adults (21-30) and older adults (76+) receive similar treatment by the media. These biases require further investigation, and stand in sharp contrast to those four years of age and less, whom the media portrays as victims almost eighty-five percent of the time.

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APPENDIX

Table A.1. Sample of Traffic Safety Data of Georgia

Traffic Safety Performance (Core Outcome) Measures* For Georgia

Core Outcome Measures		Year									
		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Traffic Fatalities	Total (C-1)	1,641	1,495	1,292	1,247	1,226	1,192	1,180	1,164	1,432	1,554
	Rural	836	701	663	655	627	589	557	462	565	603
	Urban	737	688	629	592	579	603	621	702	867	951
	Unknown	68	106	0	0	20	0	2	0	0	0
Fatalities Per 100 Million VMT**	Total (C-3)	1.46	1.37	1.18	1.12	1.13	1.11	1.08	1.04	1.21	
	Rural	2.02	1.82	1.71	1.78	1.73	1.68	2.18	1.79	1.98	
	Urban	1.04	0.97	0.89	0.79	0.8	0.83	0.74	0.82	0.97	
Passenger Vehicle Occupant Fatalities (All Seat Positions)	Total	1,244	1,085	925	887	878	829	812	795	1,008	1,050
	Restrained	488	406	358	381	389	394	350	376	488	483
	Unrestrained (C-4)	637	575	456	428	422	368	377	363	411	476
	Unknown	119	104	111	78	67	67	85	56	109	91
Alcohol-Impaired Driving Fatalities (BAC=.08+)*** (C-5)		445	405	333	299	271	295	296	279	358	368
Speeding-Related Fatalities (C-6)		384	309	239	217	220	180	197	213	268	266
Motorcyclist Fatalities	Total (C-7)	163	178	140	128	150	134	116	137	152	172
	Helmeted	142	160	126	111	133	125	107	124	138	154
	Unhelmeted (C-8)	21	15	11	14	15	8	5	8	10	9
	Unknown	0	3	3	3	2	1	4	5	4	9
Drivers Involved in Fatal Crashes	Total	2,296	2,059	1,755	1,686	1,689	1,676	1,621	1,622	2,043	2,150
	Aged Under 15	3	4	3	3	6	4	0	4	3	6
	Aged 15-20	281	217	145	172	159	154	156	145	165	182
	Aged Under 21 (C-9)	284	221	148	175	165	158	156	149	168	188
	Aged 21 and Over	1,985	1,801	1,584	1,470	1,495	1,499	1,442	1,448	1,838	1,923
	Unknown Age	27	37	23	41	29	19	23	25	37	39
Pedestrian Fatalities (C-10)		154	147	152	168	130	167	176	163	194	232
Bicyclist and Other Cyclist Fatalities***** (C-11)		15	20	21	18	14	17	28	19	23	29
Observed Seat Belt Use**** (B-1)		89	90	89	90	93	92	96	97	97	97

*These Performance Measures Were Developed By The National Highway Traffic Safety Administration (NHTSA) and the Governors Highway Safety Association (GHSA) (See Publication: DOT HS 811 025)

**2016 State Vehicle Miles Traveled (VMT) Data is Not Yet Available

***Based on the BAC of All Involved Drivers and Motorcycle Riders (Operators) Only ****Georgia Data: State Survey

*****On March 11th, 2014 GHSA and NHTSA agreed on bike fatalities as a newly required performance core measure

Example Hypothesis Test

This example hypothesis test shows a significant difference between the proportions media accounts that characterize pedestrians and bicyclists as victims in the overall population.

Sample of Hypothesis Tests: Test the significance difference of proportions of pedestrians and bicyclists who are victims in overall population

p_1: proportion of bicyclists who are victims

p_2: proportion pedestrians who are victims

Table A.2. Descriptive Statistics of Example Hypothesis Test

Sample	N	Event	Sample p
Bicyclists	229	119	0.519651
Pedestrians	466	352	0.755365
Does the proportion of bicyclists classified as victims differ from proportion of pedestrians: (p_1 - p_2)			

Where:
N= Number of bicyclists and pedestrians.
Event= Number of victims in bicyclist and pedestrian populations
Sample P= The proportion of victims in the populations

The null hypothesis is the difference of the proportion of bicyclists and pedestrians who are victim is equal to 0 (H_0: p_1 - p_2 = 0). The alternative hypothesis is this difference is not equal to 0 (H_1: p_1 - p_2 ≠ 0). The results of this hypothesis test in Minitab software show that the P-Value is 0.00 which is less than alpha (0.05). Therefore H_0 is rejected, which means a significant difference exists between the proportions of bicyclists and pedestrians that the media accounts characterize as victims in the overall population.