Collaborative Sciences Center for ROAD SAFETY

FINAL REPORT

Structures of Stakeholder Relationships in Making Road Safety Decisions

November 16, 2018

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16. Abstract

Traffic fatalities on U.S. roadways have risen in recent years. Researchers surmise that secular trends such as an aging population, migration to urban areas, rising use of high-profile sports utility vehicles (SUVs) and trucks, and rates of opioid use and abuse, among others, all interact in complex ways to produce traffic injuries and deaths. To uncover and accelerate productive cross-sector collaboration and effective safety countermeasure implementation, the R1 project research team drew upon Diffusion of Innovations theory and strategies to "design for diffusion" to devise a three-phase exploratory study. In the project's first phase, the team surveyed a diverse group of road safety professionals to assess their awareness and involvement in Vision Zero programming and to identify U.S. municipalities that serve as opinion leaders in road safety. In the second phase, the team carried out a content analysis of early-adopting cities' Vision Zero action plans in the interest of learning how cities frame their safety issues and how they propose to address them. In the third and final phase of this project, the research team interviewed professionals working in opinion-leading U.S. cities to understand respondents' relationships with other organizations in their cities' Vision Zero coalitions in terms of these relationships' frequency, patterns of sharing, and perceived productivity. Through these phases, the team was able to identify several opinion-leading and boundary-spanning U.S. cities, all of which operated Vision Zero programs. The team also elucidated the structure and function of two of the opinion-leading cities' Vision Zero coalitions. Findings from this project provide direction for future research and road safety intervention work.

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Abstract

Traffic fatalities on U.S. roadways have risen in recent years. Researchers surmise that secular trends such as an aging population, migration to urban areas, rising use of high-profile sports utility vehicles (SUVs) and trucks, and rates of opioid use and abuse, among others, all interact in complex ways to produce traffic injuries and deaths. To uncover and accelerate productive cross-sector collaboration and effective safety countermeasure implementation, the R1 project research team drew upon Diffusion of Innovations theory and strategies to "design for diffusion" to devise a three-phase exploratory study. In the project's first phase, the team surveyed a diverse group of road safety professionals to assess their awareness and involvement in Vision Zero programming and to identify U.S. municipalities that serve as opinion leaders in road safety. In the second phase, the team carried out a content analysis of early-adopting cities' Vision Zero action plans in the interest of learning how cities frame their safety issues and how they propose to address them. In the third and final phase of this project, the research team interviewed professionals working in opinion-leading U.S. cities to understand respondents' relationships with other organizations in their cities' Vision Zero coalitions in terms of these relationships' frequency, patterns of sharing, and perceived productivity. Through these phases, the team was able to identify several opinion-leading and boundary-spanning U.S. cities, all of which operated Vision Zero programs. The team also elucidated the structure and function of two of the opinion-leading cities' Vision Zero coalitions. Findings from this project provide direction for future research and road safety intervention work.

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List of Key Terms

Boundary spanning: measured using a concept known as “betweenness centrality” or the number of times a city lies on the shortest path between two other cities.

Diffusion of Innovations: a theory that helps explain how, why, and under what conditions new ideas, concepts, and technologies spread through a culture over time.

Opinion leadership: measured using a concept known as “in-degree centrality” or the number of times other cities in the U.S. city network nominated one city as a source of advice in the realm of traffic safety.

Organizational network analysis: a method to calculate and visualize how resources, information, and decisions flow across organizations affiliated with one another in a coalition.

Safe Systems: an approach to road safety that adapts the structure and function of the transportation system to the complexities of human behavior; manages the kinetic energy transferred among road users; treats road user safety as the foundation of all system interventions; and fosters the creation of a shared vision, coordinated action, and systems perspective.

Socio-metric survey: a method used to measure advice-based relationships between individuals, organizations, and municipalities.

Vision Zero: a strategy to eliminate all serious and fatal traffic injuries, while enhancing population-level mobility and access.

Introduction and Background

Traffic fatalities on U.S. roadways have risen in recent years. Complex, inter-related changes in demographics and migration to urban areas, increased economic activity and greater vehicle miles traveled, and other trends have all contributed in direct and indirect ways to increases in traffic deaths.

Prevailing methods for understanding and addressing safety problems involve redesigning vehicle and roads and enforcing safe road user behavior (Hakkert & Gitelman, 2014). Yet a growing number of U.S. cities are incorporating more comprehensive, safe systems approaches to road safety. Such systems recognize the complexity of the roadway system and are designed to accommodate human error, manage traffic speeds through self-explaining road designs, and provide safety-related feedback to road users (McAndrews, 2013). Still, many road safety professionals have yet to consider safety issues in a systematic fashion. And given the rather experimental nature of "Vision Zero" programs—campaigns seeking to achieve zero fatal and severe roadway injuries with the next couple of decades—it remains to be seen whether, how, and under what conditions Vision Zero-adopting cities will significantly improve road user safety.

In keeping with the diffusion of Vision Zero initiatives among U.S. cities, researchers, and practitioners have surveyed the array of strategies Vision Zero-adopting cities have employed and documented these strategies' known efficacy at reducing the chance and impact of fatal and severe traffic injuries (e.g., see Fleisher, Wier, & Hunter, 2016). Other researchers have studied the design principles of safe systems and have offered examples of specific safety countermeasures that can be applied to a variety of contexts (e.g., modern roundabouts, speed humps, pedestrian refuge islands, curb extensions, automated speed cameras) (Kim, Muennig, and Rosen, 2017).

Further developing our understanding and use of effective safety countermeasures is necessary and worthwhile. Nonetheless, as an inherently multi-disciplinary field, the road safety profession tends to lack a deep understanding of the social, economic, political, and demographic contexts in which safety strategies and countermeasures are conceived and applied. Specifically, we know little of the structure of the cross-sector relationships among actors and organizations responsible for making transportation safety decisions.

The purpose of this project was to reveal potential new partners for engagement in transportation safety, identify U.S.-based individuals, organizations, and municipalities with high degrees of influence in road safety, and to explore the structure and function of organizational networks among opinion-leading cities' Vision Zero coalitions.

Key Research Questions

Through this R1 project, the team developed three key research questions:

1. Which U.S.-based organizations and actors are involved in influencing the safety of cities' transportation systems?
2. How do these organizations and actors make transportation safety decisions?
3. Which U.S. municipalities serve as opinion leaders in the realm of road user safety?

Theoretical Approach

In developing the scope and procedures for this project, the R1 research team incorporated implementation science methods such as social network and organizational network analysis (Northridge, & Metcalf, 2016) into its design. We did this to help us elucidate the diffusion of Vision Zero programming among diverse

road safety professional groups and U.S. cities, as well as to depict the structure of cross-sectoral networks in select cities' Vision Zero initiatives. Drawing upon Diffusion of Innovations theory (Rogers, 2003) and more recent work on "designing for diffusion" (e.g., Dearing et al., 2017), we conceived of this project as being composed of a set of three inter-dependent phases, each of which would inform the methods and questions used in subsequent phases (Table 1).

	Phase I	Phase II	Phase III
Purpose	To uncover the diffusion of awareness of and involvement in Vision Zero initiatives among road safety professionals To identify influence among U.S. professional groups whose work addresses traffic safety issues	To better understand the landscape of Vision Zero planning among early-adopting U.S. cities	To examine leading Vision Zero cities as case studies toward encouraging similar organizational network analyses
Methods	Administer a socio-metric survey to professionals employed in engineering, planning, public health, law enforcement, and emergency medical services [EMS]	Adapt coding categories and content analysis methods from Evenson, Satinsky, Aytur, and Rodriguez (2009)	*Quantitative network analysis:* Ask each coalition member to provide information on their contact frequency, perceived productivity, and resource sharing with every other coalition member in their network *Qualitative exploratory analysis:* Ask questions about the evolution of agencies' involvement in cities' VZ initiatives and the perceived timing of cities' transformation from planning to action with their VZ program implementation
Relevance to Safe Systems	*Step A*: Identify areas and professional groups to engage with Vision Zero messaging	Describe how cities have defined safety problems, detailed plans for performance management, and	Consider how city government leadership is critical, as engineering improvements are a

	Step B: Guide intervention teams in facilitating exchange of best practices among seekers and sources of road safety advice. Researchers could work with opinion leaders to seed evidence-based road safety countermeasures and procedures to inspire advice-seeking municipalities to adopt these evidence-based safety strategies	employed systemic safety approaches	primary element of creating safer roads Illustrate how other sectors (e.g., non-profits) are equally critical, serving leadership roles in community engagement and fostering a Vision Zero-supportive culture

Table 1. *Project phases, their purpose, methods used, and relevance to a Safe Systems approach to road safety.*

Phase I: Discern diffusion of Vision Zero and identify influential actors

Part A: Explore practitioners' awareness of Vision Zero

Purpose. To uncover the diffusion of Vision Zero among road safety professionals through their awareness of the concept and whether they were involved in implementing Vision Zero programming in their municipalities.

Methods

Sample. The survey sample consisted of road safety professionals who may have been involved with Vision Zero, including planning, engineering, public health, law enforcement, and emergency medical services (EMS). According to the Vision Zero Network (2017), these groups tend to constitute the core professional constituency of cities' Vision Zero programs. In gathering the sample, the research team consulted membership directories (American Public Health Association, Association of Pedestrian and Bicycle Professionals, Transportation Research Board committees) and conference lists (Lifesavers National Conference on Highway Safety Priorities).

Survey and Analysis. We developed an online survey, which we administered in June and July 2017 via Qualtrics survey software. Participants were asked if their professional work involved understanding or addressing road user safety. If they indicated, "yes", they were prompted to respond to what year they learned of Vision Zero, whether their municipality had a Vision Zero campaign, and whether they were involved in the campaign. The survey asked all participants to identify their field of work, length of time in the field, and the name and location of their work organization.

Results

- The survey was sent to 1,738 professionals in engineering, EMS, planning, and public health.
- A total of 192 participants completed this portion of the survey—*more on the other portion of the survey in Part B of Phase I starting on page 10.*
    - More than half of the respondents were employed in planning or engineering.
    - Nearly 20 percent in public health or some "other" field (e.g., advocacy, academia).
    - About 6 percent were employed in law enforcement or EMS.
    - Most respondents had worked in their professional field for between one and 20 years, and more than 10 percent having worked in their field for more than 30 years.
- Nine out of 10 respondents had heard of Vision Zero.
    - Awareness of the concept was highest among those in planning and engineering fields and lower among law enforcement, EMS, and public health professionals. Further, planning and

engineering professionals reported having learned about Vision Zero earlier than did professionals in law enforcement, EMS, and public health.
    - Awareness was also highest among professionals in the South and Northeast census regions, which were followed by those in the West, and lowest among professionals in the Midwest region.
    - Those in the South region learned about Vision Zero later than those professionals in the West region.

- Among the 90 percent of participants who had heard of Vision Zero, about 40 percent of them worked in a municipality that operated a Vision Zero program, and about half of these professionals were directly involved in their municipalities' programs.

Research and practice-based implications

Road safety professional groups in the Midwest region of the U.S. might be worth targeting with Vision Zero principles. As we explore in the next section, Step B of Phase I, researchers could conduct formative evaluations to identify opinion leaders within the Midwest region toward accelerating the diffusion of Vison Zero there. Organizations and departments operating at a national level could support the diffusion of Vision Zero through the organization of nationwide conferences, virtual meetings among professionals from across the country, and dispersing targeted grant programs to demonstrate the potential of instituting robust, cross-sector Vision Zero programs in presently underserved parts of the country. Across all means of intervention, designers of Vision Zero programs should draw upon insights from Diffusion of Innovations theory, such as constructing programs that are easy to implement and try, as well as compatible with local values and norms (e.g., Rogers, 2003).

Phase I, Step A-produced research

Evenson, K. R., LaJeunesse, S., & Heiny, S. (2018). Awareness of vision zero among united states' road safety professionals. *Injury Epidemiology, 5*, 1-6. doi:10.1186/s40621-018-0151-1.

Part B: Identify opinion leadership in traffic safety among US cities

Purpose. To identify those U.S.-based individuals, organizations, and municipalities that serve as opinion leaders among professionals working the road safety realm with the intention of accelerating the implementation of effective road safety practices nationwide. Specifically, we sought to:

1. Describe the extent and nature of inter-municipal example-monitoring relationships among road safety professionals across the U.S.
2. Identify U.S. municipalities that professionals referenced as examples of effective road safety practice; and discern those municipalities that might serve as spanners of boundaries that exist between professional groups in different municipalities.

Methods

We used the same survey as described above in Step A of Phase I.

- For Part B of Phase I, in addition to questions about participants' professional title and field of work, their employment history, the survey featured questions about participants' example-monitoring behavior at the interpersonal, inter-organizational, and inter-municipal levels related to their road safety work.
- To assess inter-municipal example monitoring, we asked respondents to list up to three municipalities they monitor as it relates to road safety.
- We then constructed a social network analysis with data on 230 U.S. municipalities using Gephi, an open-source social network analysis software.
- We focused our network analysis on identifying those municipalities that emerged as "opinion leaders"—i.e., municipalities that professionals nominated as exemplary more often than other municipalities in the sample—and "boundary spanners"—those municipalities that consistently lie in the path between two other municipalities in the network.

Results

- From an initial sample of 1,738 individuals, 183 participants provided complete responses.
- Among these 183 respondents, more than 60 percent worked in planning and engineering fields. Fewer than 20 percent of respondents worked in public health, and about 10 percent worked law enforcement or EMS.
- Response rates differed according to respondents' professional field: 12.2% (117/957) planning/engineering; 6.8% (18/265) law enforcement/EMS; and 6.2% (32/516) public health. Response rates were similar across Census regions: 7.2% (19/265) Northeast; 12% (75/624) South; 7.1% (23/323) Midwest; and 12.5% (66/526) West. Response rates are slightly higher than what is calculated as we lacked information on which emails participants did not read.
- A high percentage of respondents worked in their fields for fewer than 10 years, with about a quarter of professionals having worked in the field for more than 15 years.
- Many of these professionals worked in the South and West census regions, and fewer of them worked the Northeast and Midwest regions.
- Respondents nominated an average of two municipalities whose road safety-related example they monitored.
- There were 372 ties among 230 municipalities referenced in the sample. Half of these ties cross regional census boundaries.
- This procedure revealed seven opinion-leading municipalities and four boundary-spanning municipalities (Figure 1). The seven opinion-leading municipalities included: New York, NY; Portland,

OR; Seattle, WA; San Francisco, CA; Minneapolis, MN; Washington, DC; and Boston, MA. The four boundary-spanning municipalities included: New York, NY; Portland, OR; Minneapolis, MN; and Seattle, WA.

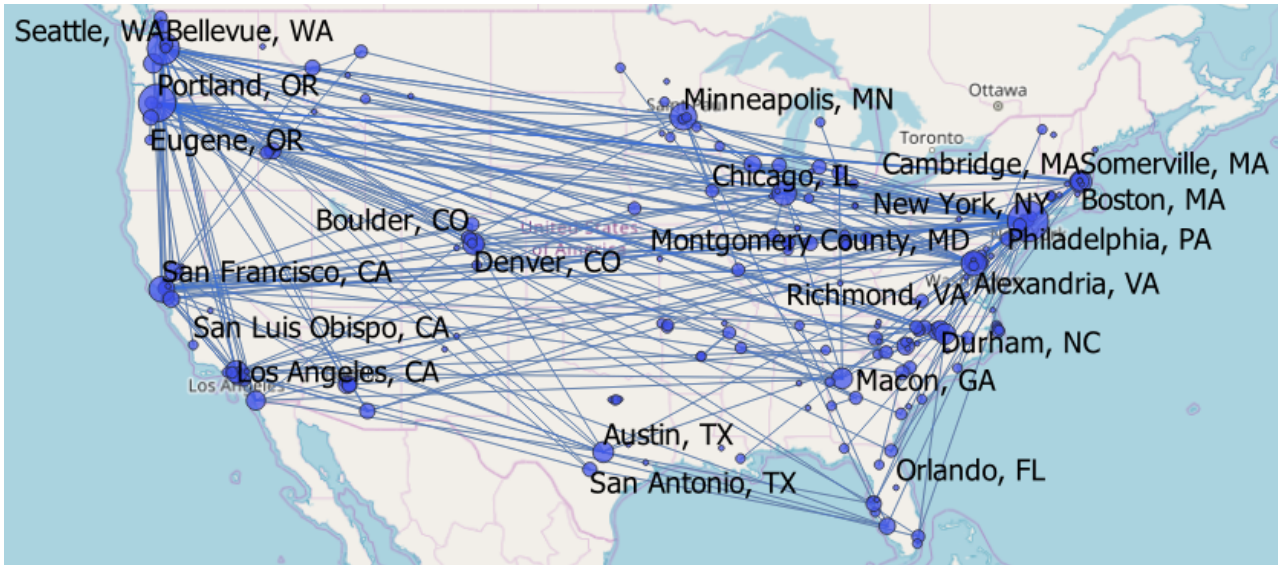

Figure 1. *U.S. inter-municipal network identifying road safety practice leaders. The size of the circles reflects cities' in-degree centrality, with larger circles indicating higher in-degree centralities. Labeled cities are ones which operate Vision Zero programs. All opinion-leading and boundary-spanning municipalities operate Vision Zero programs.*

Research and practice-based implications

Results gleaned from this effort in Part B of Phase I suggest a couple of pathways for diffusing efficacious road safety practice. For example, a myriad of effective safety countermeasures (e.g., automated speed enforcement, random driver breath testing, etc.) are rarely implemented. To advance the state of road safety practice, intervention teams could work with opinion-leading municipalities to test out effective countermeasures and widely broadcast their safety-related impacts. Since other municipalities are naturally looking to opinion leaders for inspiration, this formative evaluation could serve as a foundation upon which to rapidly spread the uptake of uncommon, though efficacious safety interventions.

Researchers could also work with boundary-spanning municipalities to broker relationships between those seeking road safety advice and those serving as opinion leaders. This targeted facilitation of best practice exchange holds promise for more rapidly diffusing those practices, policies, and countermeasures that save lives on U.S. roadways. Still, additional research is needed to identify more representative inter-municipal network structures, and to explore the ever-changing nature of road safety programming within and among U.S. municipalities.

Phase I, Step B-produced research

LaJeunesse, S., Heiny, S., Evenson, K. R., Fiedler, L. M., & Cooper, J. F. (2018). Diffusing innovative road safety practice: A social network approach to identifying opinion leading U.S. cities. *Traffic Injury Prevention, 19*(8), 832-837. doi:10.1080/15389588.2018.1527031.

Phase II: Inventory and analyze US cities' Vision Zero plans

As previously referenced, U.S. cities and regions are rapidly adopting Vision Zero and safe systems programs. Yet despite these programs' inherent appeal and growing popularity, little is known about local policies and planning processes that support traffic safety. Vision Zero action plans, for example, represent artifacts of cities' commitment to addressing traffic injuries and deaths on their road networks. To better understand the landscape of Vision Zero planning among early adopting US cities—those cities that developed Vision Zero programs before 90 percent of similarly sized cities did so—the R1 research team carried out a content analysis of all publicly available Vision Zero action plans. An exhaustive internet scan yielded 14 cities' Visions Zero action plans.

Methods

To carry out the content analysis, the team adapted coding categories and analytic methods outlined in Evenson, Satinsky, Aytur, and Rodriguez (2009). This involved codifying each plan's language in the following ways: description of the city's action planning and public participation process; specified goals and objectives; analysis of exiting roadway conditions and safety trends; proposed policies and countermeasures; and process of implementing the plan's stated policies and countermeasures.

Though the team conceptualized Phase II as providing a foundation for a forthcoming Year 2 CSCRS-funded project: R17 – "Strengthening Existing and Facilitating New Vision Zero Plans," we discovered a few consistent patterns across cities' plans.

Results

Through the content analysis exercise, the team made the following preliminary discoveries:

- Most cities with Vision Zero plans described cities' traffic safety issues in a blended fashion (e.g., they defined safety problem in "global", or "whole network" terms, while also depicting specific population groups affected and specific corridors and intersections disproportionally featured in traffic injury analysis.
- Most plans included descriptions of a diverse coalition of professionals involved in developing and carrying out the plans' action items. Indeed, most cities included members of transportation engineering and planning, law enforcement, the mayor's office, transit agencies, and public health professionals in their Vision Zero coalitions.
- Few cities provided clear alignment of proposed interventions with identified safety problems. Instead, most cities reported the number of severe and fatal traffic injuries that had occurred on their street networks, then listed several intervention strategies to broadly combat the safety problem. There was little discussion on how identified interventions would theoretically address identified safety issues.
- Few cities describe plans for performance management. Instead, most city plans listed performance metrics without describing plans for responding to setbacks and intervention failures. The cities that did incorporate performance management strategies referenced actions they would take in the event that roadway injuries or deaths had not significantly declined—or even increased—over a few years' time. Such actions included re-evaluation of the intervention strategies that did not appear to effect change, removing these interventions from the cities' repertoire, and incorporating contextually appropriate countermeasures into future iterations of their Vision Zero programming.
- Few cities employ systemic safety (i.e., proactive, risk-based) approaches. Instead, most cities focused on addressing safety issues in places with crash histories.

Phase III: Conduct organizational network analysis

Purpose.

The purpose of Phase III was to draw upon findings from Phase I to take the following actions:

- Depict the type of stakeholders involved in opinion-leading U.S. cities' Vision Zero coalitions.
- Explore the political and cultural context in which Vision Zero was being conceptualized in these cities.
- Explore the structure of cross-sectoral relationships in cities' Vision Zero coalitions using network analysis.

Methods

- First, we coordinated with the director of the Vision Zero Network to identify a key point of contact within four opinion-leading U.S. cities. After considering time and budgetary constraints, the team decided to carry out the organizational network analysis with the top four opinion leading cities in terms of those cities with the highest in-degree centrality scores.
- We then reached out to these key contacts in each city and asked them to provide a list of the organizations and individuals within each organization who made up the city's core Vision Zero coalition membership.
- We contacted the identified core Vision Zero team members in each city and conducted structured phone interviews with each of them.

Quantitative measures

- Interviews focused on the various quantifiable elements of respondents' relationships with other organizations in the cities' Vision Zero coalitions, such as how often they interacted, shared resources, and how productive they felt their professional relationships with partnering organizations were.

Qualitative measures

In addition to structured questions about their relationship with other organizations in their cities' Vision Zero coalitions, we asked participants open-ended questions about:

- Their perceptions of their organization's role within their cities' Vision Zero coalitions—including the organizations they believed were most responsible for advancing their cities' Vision Zero programs.
- How their organizations' involvement in their cities' initiatives had evolved over time.
- When they perceived that their cities transitioned from planning to implementing Vision Zero programming.

Results

The four leading cities' Vision Zero coalitions comprised diverse professional and non-professional groups. Across all four cities, respondents identified government agencies as the leaders and organizers of their Vision Zero coalitions. Most cities' coalitions favored governmental entities, yet one city had a composition that favored non-profit groups.

Quantitative network findings

As the project team was able to interview a sufficiently large proportion of organizations—i.e., > 70 percent of organizations in cities' Vision Zero networks—in only two of the four cities in the original sample, two cities results are reported here. To honor participants' wishes to remain anonymous, we label these two cities, City 1 and City 2.

City 1:

- In City 1, respondents shared that one governmental department led the city's the Vision Zero coalition, serving as the most central actor in the network in terms of frequency of contact with other organizations, high levels of productivity, and sharing resources. As such, the lead organization acted as a command center, controlling the flow, content, and spread of Vision Zero-related information. For example, the lead department—as identified by other organizations in the city's Vision Zero network—shared traffic crash data and information on the timing and placement of road safety interventions with other organizations so that partners could target their own resources and communicate more effectively with their audiences.
- Perceived productivity between the lead organization and other organizations in City 1's Vision Zero coalition was largely reciprocal, with all partners reporting high levels of inter-organizational productivity. That is, participants reporting feeling that time spent with staff in partnering department was well spent and fruitful in terms of understanding their role in their cities' Vision Zero programming and the city resources at their disposal to help them perform with greater efficiency and effectiveness.
- Further, in City 1, the lead department shared money with other departments, and all departments shared data with one another. The money derived from the city's general fund and was apportioned by the cities' elected officials. As such, many of the partners the team interviewed referred to the money as a pooled fund, which represented a new way of coordinating action among city departments.

City 2:

- In City 2, though the lead department that played a central, organizing role in the flow, content, and spread of Vision Zero-related information was a governmental entity, it did not occupy as central of a position as the lead department in City 1. That is, in City 2, the decision-making power in Vision Zero programming was more evenly distributed among city departments.
- Especially when it came to respondents' reports of productive relationships with other organizations and the sharing of resources, other coalition members occupied central positions in the city's Vision Zero network.
- And in contrast with City 1, resources shared among organizations in City 2 did not involve money—as sharing money was reportedly illegal in City 2—but rather the sharing of personnel and Vision Zero-related data. For example, in City 2, two different departments paid for temporary staff to assist with logistical aspects of Vision Zero programming (e.g., scheduling meetings, taking meeting notes, etc.). The data shared across city departments involved traffic crash, count (i.e., vehicular, pedestrian, and bicycle), and automated speed camera data.

Qualitative findings

Several themes applied to the four cities:

- All respondents cited the importance of political support in inciting Vision Zero implementation.
- When asked about organizations' involvement in cities' Vision Zero programs over time, all respondents reported increases in collaboration with other agencies and modifications to project selection processes, such as using data-driven decision models, and setting aside funding to finance prioritized safety projects.

Research and practice-based implications

Considering low response rates in two cities, the research team was only able to analyze the organizational networks of the two cities with relatively complete data sets. The analysis of these two cities' organizational networks revealed several key insights and implications for future work:

- Organizational network analysis like the one employed in Phase III can relay narratives about how Vision Zero coalitions came to be, the actors involved in their functioning, and the relationships among the actors and organizations all working to improve road user safety. Developing and disseminating narratives like these can facilitate other cities' adoption and implementation of Vision Zero programming.
- It is likely that the composition and coordination of agencies within coalitions relates to the quality of the programs, policies, and countermeasures cities ultimately implement.
- In turn, cities' implementation of effective programs, policies, and countermeasures is likely to significantly improve road user safety.
- Additional research on the composition and functioning of Vision Zero coalitions is timely and critical. Longitudinal research designs that depict the evolution of coalitions over time will prove especially useful. For example, though it is evident that cities' Vision Zero programs benefit from political leadership and support, future research could complement this work by examining the role of organizations that specialize in community engagement and how these organizations and their partners can foster a culture that supports Vision Zero and prioritizes safety over speed and mobility.

Phase III-produced research

Naumann, R. B, Heiny, S., Evenson, K. R., LaJeunesse, S., Cooper, J. F., Doggett, S., & Marshall S. W. (in press). Organizational networks in road safety: Case studies of U.S. Vision Zero cities. *Traffic Injury Prevention.*

Project-wide discussion and practical implications

The National Highway Traffic Safety Administration (NHTSA) (2017) reported that between 2015 and 2016, traffic fatalities increased across nearly all segments for the population (e.g., vehicle occupants, pedestrians, bicyclists, motorcyclists, etc.). This represented a 5.6 percent year-over-year increase in fatalities and ranked among the highest yearly increases in the past 40 years. Reasons for this recent rise in fatalities is complex and ever-changing. Thus, tools, methods, and strategies to consider transportation system dynamics anew are sorely needed.

Like all dynamic systems, this project, *Structures of Stakeholder Relationships in Making Road Safety Decisions,* was designed to be iterative and adaptive. For example, the project's first phase—whereby the team sought to explore the spread of Vision Zero concept awareness and involvement, as well as to identify opinion-leading U.S. municipalities—informed the research questions developed for the project's second phase, such as which city entities were involved in the creation of cities' Vision Zero plans. Then for the project's third phase, the research team drew upon findings from Phase I to select cities with which to explore the structure and functioning of their Vision Zero coalitions' organizational networks.

Across all project phases, our intention was to draw upon knowledge of opinion-leading cities toward accelerating other cities' uptake of effective road safety practices and countermeasures. Intervention teams can conduct formative analysis in sub-national regions that could benefit from safety improvements to identify and work with opinion leaders to test out innovative road safety strategies and countermeasures and thus rapidly spread the use of tested strategies and countermeasures in other cities. Given the rather experimental nature of Vision Zero programs, it remains to be seen how Vision Zero-adopting cities will perform from a safety perspective. Organizational relationships and networks are likely to evolve over time. So too will the complexity and foci of road safety issues inside and outside of cities. For example, consider the recent diffusion of "rideables"—e.g., e-bikes, e-scooters—in cities and the likely shifting profiles of road user injury in these places. Future work should not only monitor cities' progress toward zero fatal and serious roadway injuries, but also establish surveillance systems that include an understanding of opinion leaders and boundary spanners, as well as the structure of cross-sector relationships. Monitoring system changes in this way can, over time, create transportation systems that adapt to shifting realities and road user needs, thereby making travel safer for everyone.

To complement analysis of organizational networks, researchers could explore interactions among politics, organizational dynamics, and what scholars call "traffic safety culture"—i.e., implicit shared values, knowledge, attitudes, and behaviors relevant to traffic safety (AAA, 2007). Nævestad and Bjørnskau (2012) argue that an appropriate analytical unit to study traffic safety culture is the peer group. This is a group of people who share an identity and are who likely to influence how one another interprets safe travel behavior, hazards, and risks (Ward, Linkenbach, Keller, and Otto, 2010). Together with system thinking strategies such as cross-sector collaboration, ongoing iterative learning, and transformational leadership (Swanson et al., 2012), traffic safety culture studies can help identify leverage points, tailor interventions for targeted peer groups, and monitor system performance toward reaching zero fatal and serious roadway injuries.

Executive Summary

Traffic fatalities on U.S. roadways have risen in recent years. Meanwhile, the transportation system and the society it serves is growing increasingly complex. What is needed are systems, tools, and methods that can advance the state of road safety practice. Thus, with the aim of uncovering and accelerating productive cross-sector collaboration and effective safety countermeasure implementation, the R1 research team drew upon Diffusion of Innovations theory and strategies to "design for diffusion" to devise a three-phase exploratory study. Three key research questions guided our approach:

1. Which organizations and actors are involved in influencing the safety of cities' transportation systems?
2. How do these organizations and actors make transportation safety decisions?
3. Which U.S. municipalities serve as opinion leaders in the realm of road user safety?

Phase I. In the project's first phase, the team surveyed a diverse group of road safety professionals to assess their awareness and involvement in Vision Zero programming and identify U.S. municipalities that serve as opinion leaders in road safety. We discovered that awareness of Vision Zero was high across professional disciplines (i.e., engineering, EMS, law enforcement, planning, public health). However, planners and engineers reported being aware of Vision Zero earlier than did professionals in law enforcement, EMS, and public health. Moreover, as opposed to professionals based in the Northeast, South, and West census region, fewer respondents from the Midwest region had heard of Vision Zero, suggesting that this may be a market to engage.

In terms of identifying opinion-leading cities in the realm of road safety, a social network analysis identified seven opinion leaders and four boundary spanners. With their central positions in the network of road safety professionals, opinion leaders can help accelerate the adoption of traffic safety innovations. Boundary-spanners can complement opinion leaders with their exposure to divergent strategies and network position to facilitate exchange between seekers and providers of road safety advice.

Phase II. In the second phase of the project, the team carried out a content analysis of early-adopting cities' Vision Zero action plans in the interest of learning how cities frame their safety issues and how they propose to address them. We discovered that most cities have tended to describe their traffic safety in global, or "whole network" terms, to illustrate a high degree of cross-sector collaboration, yet one which might encourage coalition members to operate independently of one another and not in concert with identified safety issues (e.g., law enforcement focusing on distracted walking enforcement without a city's Vision Zero action plan referencing distracted walking as a safety issue).

Phase III. In the third and final phase of this project, the research team interviewed professionals working in opinion-leading U.S. cities to understand respondents' relationships with other organizations in their cities' Vision Zero coalitions in terms of these relationships' frequency, patterns of sharing, and perceived cross-sector productivity. Respondents across four opinion-leading cities cited the importance of political support in catalyzing Vision Zero implementation. Similarly, all respondents reported increases in collaboration with other agencies.

Given the high amount of missing data from two of the four cities in the initial sample, the quantitative organizational network analysis focused on the remaining two cities. In City 1, the identified lead agency was in the government, acting as a Vision Zero command center, controlling the flow, content, and spread of program-related information. Respondents across agencies in City 1's Vision Zero coalition perceived their

professional relationship with one another as productive, openly sharing information and safety-related data. In City 2, though the lead agency was a governmental entity, it did not occupy as central of a position as the lead agency in City 1. When it came to respondents' reports of productive relationships with other agencies, government agencies other than the lead occupied central positions in the city's Vision Zero coalition.

Project-related implications

Findings from this three-phase study suggest that Vision Zero and safe systems strategies can diffuse across U.S. cities in accelerated fashion. Further, though it will require more time before cities document significant improvements in road user safety, the organizational network analysis carried out in Phase III of this R1 project holds promise as an exploratory technique to employ toward identifying adaptive, resilient cross-sector partnerships. Researchers and practitioners can complement the work described here by experimenting with innovative safety practices in coordination with opinion-leading cities and organizations. Future work can also incorporate applied research on ways to develop safety supportive cultures in the spirit of ushering in a new traffic safety paradigm that adapts and conforms to the ever-shifting needs of increasingly diverse road user groups.

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Appendices

Appendix A – Roadway safety practitioner survey record

Q1.2 Will you be participating in our survey?
- o I do not wish to answer this survey.
- o I am willing to answer this survey.

Q2.1 Does your work involve understanding OR improving the safety of people on roadways?
- o Yes
- o No

Q3.1 Do you work in any of the following fields: (mark all that apply)
- o planning
- o law enforcement
- o engineering
- o emergency management, such as emergency medical services (EMS)
- o public health, such as injury prevention
- o I work in another field _____

Q3.2 How long have you worked in this field?
- o Less than 1 year
- o 1 to 5 years
- o 5 to 10 years
- o 10 to 15 years
- o 15 to 20 years
- o 20 to 25 years
- o 25 to 30 years
- o More than 30 years

Q3.3 What is your title?

Q3.4 What is the name of the organization you work for?

Q3.5 Where is the organization located?
- o City _____
- o State _____

Q4.1 The next set of questions will ask you to identify individuals, organizations, and municipalities that work on reducing roadway fatalities and injuries. We might map the city you are from to the city of individuals, organizations, or municipalities that you recommend.

Q4.2 Please list up to three individuals outside of your workplace whose advice you seek or work you follow with respect to their work on reducing roadway fatalities and injuries. These individuals can work for any type of US organization, including governmental, nonprofit, or for-profit entities. For each individual please provide a name, organization, and city/state.

Q4.3 Individual 1
- o Name _____
- o Organization _____
- o City, State _____

Q4.4 Individual 2

Q4.5 Individual 3

Q4.6 Please list up to three organizations outside of your workplace whose example or reputation you follow with respect to their work on reducing roadway fatalities and injuries. These can include any type of US organization, including governmental, nonprofit, or for-profit entities. For each please provide the organization's name and city/state.

Q4.7 Organization 1
- o Organization Name _____
- o City, State _____

Q4.8 Organization 2

Q4.9 Organization 3

Q4.10 Please list up to three municipalities outside of your municipality whose example or reputation you follow with respect to their work on reducing roadway fatalities and injuries. These can include urban, suburban, and rural municipalities in the US. For each please provide the city and state.

Q4.11 Municipality 1
- o City, State _____

Q4.12 Municipality 2

Q4.13 Municipality 3

Q5.1 Have you heard of Vision Zero, a municipality-led "strategy to eliminate all traffic fatalities and severe injuries, while increasing safe, healthy, equitable mobility for all?"
- o Yes
- o No

Q5.2 In what year did you first hear about Vision Zero?
- o 2012 or earlier
- o 2013
- o 2014
- o 2015
- o 2016
- o 2017
- o I don't know

Q5.3 Does the municipality where you work have a Vision Zero campaign?
- o Yes
- o No
- o Don’t know

Q5.4 Are you involved in the Vision Zero campaign in the municipality where you work?
- o Yes
- o No

Appendix B – Inter-organizational interview record

Q1 Interviewee details

- ○ Name _____
- ○ Title _____
- ○ Department/Organization/Agency _____
- ○ Years at place of work _____

Q2 What is your agency's role with regard to Vision Zero in your city?

Q3 What is your role within your agency with regard to Vision Zero?

Q4 How often does your agency/organization have contact (e.g., emails, phone calls, meetings) related to Vision Zero planning or activities with each of the other agencies/organizations listed below? [Please select one box for each agency/organization.]

	No contact related to Vision Zero planning or activities	On average, annual contact	On average, quarterly contact	On average, monthly contact	On average, weekly contact	Not sure
	○	○	○	○	○	○

Q5 Are there any agencies that are not listed here that you think should be listed based on their involvement with Vision Zero **in the past year**?

Q6 How productive do you feel that your relationship is with each of the following agencies/organizations related to Vision Zero planning and activities? [Please select one box for each agency/organization.]

	N/A, no contact with agency/ organization	Very unproductive	Somewhat unproductive	Neutral	Somewhat productive	Very productive	Not sure
	○	○	○	○	○	○	○

Q7 How productive do you feel that your relationship is with each of the following agencies/organizations related to Vision Zero planning and activities? [Please select one box for each agency/organization.]

	No resources shared	Share personnel	Send money to	Receive money from	Other resource sharing	Not sure
	○	○	○	○	○	○

Q8 Please mark the top three agencies that you feel are most responsible for advancing Vision Zero-related planning and activities in your city. [Please select up to three.]

☐ Click to write Choice 1

Q9 How has overall agency/organization involvement changed from the beginning of Vision Zero initiation in your city to today?

Q10 How did you know when Vision Zero went from "discussion and planning" to action? And what did this transition look like?

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