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Organizational networks in road safety: case studies of U.S. Vision Zero cities

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Abstract

Objective: Each year, more than 30,000 deaths occur on U.S. roads. Recognizing the magnitude and persistence of this public health problem, a number of U.S. cities have adopted a relatively new approach to prevention, termed Vision Zero (VZ). VZ has been adopted by more than 30 U.S. cities and calls for creating a transportation system that ensures no road traffic crash results in death or serious injury. A core component of VZ is strong multi-disciplinary and multi-sector stakeholder engagement, and cities adopting VZ often establish a VZ coalition to foster stakeholder collaboration. However, there is little information on the structure, development, and functioning of coalitions working to achieve VZ and on tools available to study and evaluate such coalition functioning. We sought to describe the characteristics of prominent U.S. VZ city coalitions and context surrounding VZ uptake and advancement in these cities. Moreover, we demonstrate use of network analysis as one tool for exploring the structure of inter-organizational relationships in coalitions.

Methods: We conducted case studies of four prominent U.S. VZ city coalitions in 2017–2018. We summarized coalition members' characteristics and responses to questions about their cities'

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VZ adoption, planning, and implementation. We asked each coalition member to provide information on their contact frequency, perceived productivity, and resource sharing with every other coalition member in their city and used network analysis techniques in two cities to understand the structures and relationships in coalitions.

Results: Findings indicated that government agencies generally constituted the majority of coalition members and often played central roles in terms of coalition network contact, productivity, and resource flow. Other emerging similarities regarding coalition establishment and VZ implementation included the need for political support, the importance of formal plan development, and increased collaboration and cooperation among partners.

Conclusions: Organizational network analyses, enriched with coalition member interviews, can elucidate key aspects of coalition creation, attributes, and relationship structure. The case studies of leading VZ coalition networks presented here highlight the use of these tools. Ultimately, understanding associations between VZ network structures and attributes and road safety outcomes could help inform effective coalition adoption, implementation, and maintenance so as to optimize safety outcomes.

Keywords

road safety; injury; Vision Zero; network analysis

INTRODUCTION

While progress has been made in reducing road traffic-related deaths over the last few decades, the U.S. consistently experiences some of the highest death rates of all Organization for Economic Co-operation and Development (OECD) countries (Sauber-Schatz, 2016; WHO, 2018). Each year, more than 30,000 deaths occur on U.S. roads and another 2 million people are nonfatally injured. Recognizing the magnitude and persistence of this public health problem, a number of U.S. states and cities have adopted new road safety initiatives over the last several years in an attempt to curb the burden of road traffic injury and death. One popular approach has been Vision Zero (VZ).

VZ calls for creating a transportation system that ensures no road traffic crash results in death or serious injury (Belin et al. 2012; Fahlquist 2006; Johansson 2009; Kim et al. 2017; OECD 2008; ITF 2016; VZN 2018a). Several countries, including Sweden, Australia, New Zealand, and the Netherlands, have adopted some version of this approach (Belin et al. 2012; Johansson 2009; Kim et al. 2017; OECD 2008; OECD 2016; Wegman & Aarts 2006). Generally, although not always explicitly stated, VZ applications align with Safe Systems principles. Other terms, such as Sustainable Safety and Systemic Safety, are also sometimes used (OECD 2008; ITF 2016; Wegman & Aarts 2006). While the terminology varies by city or country, the same underlying principles often apply—to create a system in which no crash-related death or serious injury is considered acceptable, the system must encourage safe road user behaviors (e.g., through modifications to social and physical environments, policies) but also forgive inevitable human errors (e.g. through roadway design that manages speed and potential collision impact angles, vehicle design) (Belin et al. 2012; Johansson 2009; Kim et al. 2017; OECD 2008; ITF 2016; VZN 2018a; Wegman & Aarts 2006).

Furthermore, it is recognized that establishing such a system requires strong multi-disciplinary and multi-sector stakeholder engagement to holistically address the many interacting elements involved and to support a shared responsibility for road safety (Belin et al. 2012; Fahlquist 2006; Johansson 2009; Kim et al. 2017; OECD 2008; ITF 2016; VZN 2018a; VZN 2017).

More than 30 U.S. cities have adopted VZ (VZN 2018b), and many of these cities have established VZ coalitions to foster increased multi-disciplinary and multi-sector stakeholder engagement. Coalitions are an established approach for organizing diverse partners to plan, implement, and sustain programs or initiatives, recognizing that implementation and success of many initiatives would often not be possible through the work of a single entity (Butterfoss et al. 1993). Coalitions have many benefits, including allowing for efficient exchange of expertise, knowledge, and resources between key partners which may, in turn, increase the effectiveness of programs or initiatives. While such diverse stakeholder collaboration is a core component of many public health and injury prevention initiatives (Butterfoss et al. 1993), as well as a core VZ tenet (VZN 2018c), there is little information on VZ coalitions' establishment, structures, and inner workings. An understanding of how VZ coalitions and collaborations are created, structured, and function can ultimately provide insights on coalition performance and attributes that could contribute to optimal VZ and road safety-related outcomes (Berkowitz & Wolff 2000). Organizational network analysis provides an ideal tool for exploring the structure and internal collaborations within VZ coalitions; it can help us expand from examining attributes of individual organizations to understanding the strength of relationships between organizations and ultimately how those relationships affect outcomes (Harris et al., 2008; Krauss et al., 2004; Luke & Harris 2007; Merrill et al., 2008; Valente et al., 2007).

Therefore, the specific objectives of this study were to 1) describe the types of stakeholders involved in prominent U.S. VZ city coalitions, 2) examine the context surrounding VZ uptake and advancement in these cities, and 3) demonstrate use of network analysis as one tool for exploring the structure of inter-organizational relationships in VZ coalitions. Specifically, we provide a detailed examination of select, leading VZ cities as case studies, with the intent that this demonstration will serve to encourage similar organizational network analyses in order to grow the evidence base on effective VZ and road safety coalition creation and maintenance.

METHODS

This study collected information from coalition members in four leading U.S. VZ cities and used network analysis techniques in two cities to understand the structures and relationships in coalitions. This study was approved by the University of North Carolina's Institutional Review Board.

Selection of Cities and Participants

Guided by Diffusion of Innovations theory (Rogers 2003), our research team recently completed a survey to determine the extent to which VZ had spread or diffused among road safety professionals throughout the U.S. (Evenson et al. 2018; LaJeunesse et al. 2018).

Using our information about diffusion intensity, we identified four leading VZ cities that we thought were particularly worthy of detailed study, principally, because these cities were regarded as popular opinion leaders by road safety experts in cities across the U.S. To learn more about VZ coalitions in these leading cities, we conducted structured phone interviews with coalition leaders in each city to obtain information on communications, productivity, and resource sharing in each coalition network.

We used a fixed-list sampling scheme to identify core VZ coalition members in each of the four cities (Doreian & Woodard 1992). To construct this list, a leading expert from the VZ Network, a non-profit committed to advancing VZ efforts in cities across the U.S. (VZN 2018a), was first interviewed and asked about key VZ informants in each of the four cities. Specifically, we inquired about who, in each city, was most familiar with and involved in the VZ work of that city. In late 2017, each of the four city key informants was then interviewed to determine which organizations comprised the core VZ coalition membership in their city. To support this process, we first generated a roster of potential organizations likely involved in each of the VZ coalitions based on publicly available VZ documents, such as plans and progress reports, and then asked the key informants to: 1) list other organizations that should be included; 2) remove those who were no longer actively engaged in the city's VZ work; and 3) provide a primary contact person for those agencies where contact information was missing. We stressed the need to identify the core group of organizations actively involved in the city's VZ work.

After generating a final roster for each city, we contacted each coalition member via email to schedule a structured phone interview. We attempted to reach each coalition member three times before coding the member as a non-responder. Response rates by city ranged from 22% to 86%. During the telephone interviews, coalition members were asked about their city's VZ uptake and coalition creation, as well as about their relationships with other core coalition members in terms of contact frequency, productivity, and resource sharing, consistent with previous network analyses (Harris et al. 2008; Krauss et al. 2004). All interviews were conducted between November 2017 and March 2018, and each interview took, on average, 45 minutes to complete. Additional information about the qualitative and quantitative measures derived from the interview questions is detailed below, and the full survey can be found in the appendix.

Qualitative Measures

We asked each coalition member open-ended questions about both their specific organization and the larger coalition's VZ efforts. Specifically, coalition members were asked about their organization's role within the VZ coalition, how their organization's involvement in the initiative may have changed over time, the coalition's transition from planning to action with respect to VZ work, and which agencies they felt were most responsible for advancing the city's VZ efforts.

Quantitative Measures

Using previously established relational constructs (Harris et al. 2008; Krauss et al. 2004), we asked each coalition member to provide information on their contact frequency, perceived

productivity, and resource sharing with every other coalition member in their network. Specifically, we provided each coalition member with a roster listing all of the other organizations in the coalition and asked them: 1) how often their organization had VZ-related contact with each organization on the roster (response choices: none, annually, quarterly, monthly, a few times per month, weekly, a few times per week) ("contact frequency"); 2) how productive they felt their relationship was with each organization related to VZ (response choices: no contact, very unproductive, somewhat unproductive, neutral, somewhat productive, very productive) ("perceived productivity"); and 3) whether they shared any resources with each organization related to VZ (responses choices: no resources shared, share personnel, send money to, receive money from, other resource sharing) ("resource sharing").

Contact frequency: For the contact frequency relational construct, we coded responses from 0 to 6, such that "no contact" was assigned a 0 and "a few times per week" was assigned a 6. After coding, we created an undirected measure, assigning one code for each pair's level of contact. For example, we assumed that if organization A reported contact with organization B, then B had contact with A. When one organization in a pair was missing data, we used the response from the non-missing organization. When both organizations provided responses, we averaged responses; responses were nearly always similar. When data from both organizations were missing, the connection was set to 0 (i.e., "no contact"). For the few instances in which this occurred, this assumption was likely acceptable, given that other (non-missing) coalition members generally reported weak or no relationships with the missing organizations in the coalition networks.

Perceived productivity: For the perceived productivity construct, we coded responses from 0 to 5, such that "no contact" was assigned a 0 and "very productive" was assigned a 5. However, for this construct, we retained a directional measure (i.e., perceived relationship of A to B could be different than that of B to A). In instances where there was missing information for one of the organizations in a pair, we allowed the response given by the non-missing organization to stand in for the missing one. Similar to the contact frequency measure, in the few situations in which data was missing for both organizations in a pair, we did not create a connection. Given the size of the networks, more complex imputation procedures were not appropriate. Additionally, similar to the contact construct, members generally reported weak productivity with the missing organizations.

Resource sharing: Finally, for the resource sharing construct, we created an undirected measure and collapsed responses to "any resource sharing" vs. "no resource sharing" (i.e., a binary measure). Similar to the contact frequency construct, when one organization in a pair was missing data, we used the response from the non-missing organization. When data was missing from both organizations, the connection was set to "no resource sharing." When both organizations provided responses, we erred on the side of resource sharing, if there was a disagreement between the two responses.

Analysis

We summarized responses to qualitative, open-ended questions by city, illustrating perspectives on VZ adoption, planning, and implementation. Using the quantitative relational construct data, we conducted social network analyses (Luke & Harris 2007). Due to low response rates, organizational network analyses were not completed for two of the cities. Therefore, we only examined the networks of the two cities for which we had more complete data (i.e., those labeled as Cities 1 and 2).

We used both visual displays and node-level measures to examine the inter-organizational relationships and primary leaders within these two networks. We calculated node sizes (i.e., number of organizations a given organization was connected to) and several weighted measures of node centrality (Butts 2008; Harris et al. 2008; Krauss et al. 2004; Luke & Harris 2007; Luke 2015). Centrality relates to the node's overall importance in the network and can be measured in several ways, including by node degree, closeness, betweenness, and as an eigenvector measure. Briefly, a node's degree is a measure of the node's number of connections, weighted by the strength of those connections. Closeness refers to the distance each node is to every other node; betweenness measures how often a given node lies on the shortest path between pairs of other nodes; and an eigenvector measures how well connected a node is to other well-connected nodes. Together, these measures provide insight into the leaders of the network, who controls information flow across a network, and the extent of organizations' visibility across the network. A glossary of key network terms and additional information on the insights each measure provides is available in the appendix. All network measure analyses were completed in Kumu (2018).

RESULTS

Coalition Characteristics

The four leading VZ city coalitions varied in size (n= 7 to 23 core members) and distribution of multi-sector representation (Table 1). In all four networks, government agencies were viewed as the primary leaders (e.g., departments of transportation, public health, police). Government agencies also comprised the largest proportion of coalition membership in all but one city (City 4), where non-profit organizations had the greatest representation.

Qualitative Findings

While perspectives on VZ adoption, planning, and action varied by city, there were also several similar findings, including coalition members' reports of 1) the importance of political support for VZ adoption and implementation, 2) the need for action plan development and metric tracking, and 3) increased collaboration and cooperation among a diverse range of partners (Table 1). Coalition members also discussed changes in road safety project selection and implementation, as a result of VZ adoption.

In two of the cities, government agencies advocated for VZ adoption, and over time, mayors and other political leaders adopted VZ action plans and allocated funding for road safety improvements (Table 1). However, in the other two cities, adoption took more of a top-down approach; mayors initiated and directed city staff to develop VZ action plans and strategies.

In all cities, coalition members noted that VZ initiatives inspired increased collaboration and cooperation among governmental and non-governmental agencies. Moreover, members generally reported that coalitions expanded over time to include increasingly diverse agencies and that inter-agency partnerships strengthened over time. Enhanced inter-agency collaboration was often made possible through the support of high-level elected officials, such as mayors and council members.

Coalition members also reported that, as a result of VZ adoption, decision-makers dedicated funding to new types of road safety projects and programs, such as automated speed enforcement and corridor safety improvements (Table 1). Coalition members often cited such actions as evidence that VZ had moved from planning to action. In three of the cities, coalition members reported that safety projects and programs increased in volume and diversity. Members also reported that changes were often focused on the built environment and roadway design and less focused on vehicle travel time efficiencies and individual behavior change.

Quantitative Network Findings

We used social network analysis to analyze and depict coalition member relationships. Figures 1 and 2 display contact, productivity, and resource sharing networks for Cities 1 and 2, respectively, and Tables 2 and 3 provide node sizes and weighted measures of node centrality for each of the networks.

In City 1, the lead agency in the network was represented as Node A; this was the city's key VZ informant and recognized as the leader of the coalition. The lead agency consistently represented the most central node in terms of network contact, perceived productivity, and resource sharing (Table 2; Figure 1). The lead agency had the most control over information and resource flows in the network (betweenness) and was the most capable of spreading information quickly throughout the network (closeness). The lead agency viewed its relationships with network partners as productive and vice versa (i.e., highest in-degree and out-degree measures). In terms of resource sharing, the lead agency was the only agency to share money with other network partners. No partners shared personnel; however, there were several instances of network partners sharing "other" resources (specific data not displayed in table). Generally, government and non-profit partners played more central roles in the network with respect to the three types of network linkages examined (i.e., contact, productivity, resources), as compared to industry partners.

In City 2, the lead agency was also one of the most central across all three network types examined (Table 3; Figure 2). In terms of contact frequency, it had the highest control over information (betweenness) and could spread information the easiest (closeness). However, it was not as unaided or distinct in its centrality, as in City 1. Several of the other government coalition members also had high measures of centrality, particularly with respect to network productivity (e.g., Nodes F, E, and D). In terms of resource sharing, the lead agency (Node A) was involved in the most resource sharing in the network but was closely followed and supported by other coalition members. Most resource linkages were related to sharing personnel or "other" resources, and no partner reported sharing money with any other partner.

DISCUSSION

Organizational network analyses, enriched with coalition member interviews, can elucidate key aspects of coalition creation, attributes, and relationship structure. The case studies of leading VZ coalition networks presented here highlight the use of these tools. Ultimately, when combined with public health outcome data (e.g., fatal crashes), these analyses could guide coalitions toward structures and operations that might help improve their reach and crash outcomes. Findings from these case studies indicated that government agencies played central roles in terms of network information flow, productivity, and resource sharing with one or a small group of government agencies having the most control over information and resource flow in the network. Qualitative findings further highlighted the benefit of political support in establishing VZ, the importance of action plan development, and increased collaboration and cooperation among partners.

While this analysis was limited to a small number of VZ city coalitions, our findings provide a methodological example for future studies and initial basis for further hypothesis testing. In our case studies of network structure soon after VZ initiation, one or more government agencies tended to play highly central roles, driving information and resource flow, while other types of coalition partners generally demonstrated peripheral roles. Previous research indicates that highly centralized networks with hierarchical, top-down approaches may provide the ideal structure for tightly managing tasks (Merrill et al. 2008), potentially proving most effective for implementation and mobilization of coalitions during initial establishment. However, research also suggests that top-down structures can run the risk of overburdening those at the center over time, while under-utilizing key skills of peripheral partners (Merrill et al. 2008). The extent to which these structures drive effective VZ establishment, implementation, and short-term outcomes deserves further study.

Additionally, given that networks are rarely static over time, longitudinal tracking of network structure and outcomes is warranted. Valente et al. (2007) suggest that while highly central and dense structures may be beneficial to establish foundational partnerships, over time, such a structure could become a liability by restricting the ability of the network to draw on new ideas and resources. Consistent with the theory of weak ties, established coalitions that gradually shift to less dense and less centralized structures over time might be better poised to access new resources and ideas from a broader range of potential partners through a greater number of weaker relationships (or ties) (Granovetter 1973). Additional work is needed to longitudinally examine structures that can establish and sustain VZ coalition member cohesiveness while protecting against insular thinking over time.

In addition to initial similarities in network structure among these case examples, we also found emerging similarities with respect to partner diversity and context surrounding VZ uptake and implementation that deserve further exploration. Specifically, while government agencies appeared to largely drive initiation and implementation of the initiative, diverse sectors were represented in all four city coalitions examined. Given that engineering improvements are a primary element of creating safer roads under the VZ model, city government leadership is both expected and critical. However, in most contexts, other sectors (e.g., non-profits) are perhaps equally critical, likely serving key roles in community

engagement and fostering a VZ-accepting culture for implementation of new road safety projects. Future work exploring the specific types and activities of non-governmental organizations involved in effective VZ uptake is warranted.

Finally, the importance of political support in VZ adoption and implementation, formal VZ plan development, and increased collaboration and cooperation among coalition partners was often cited. These findings are consistent with several components of the VZ Network's guidance on elements that can contribute to a strong foundation for VZ success, which include political commitment, stakeholder collaboration and cooperation, action plans, and multidisciplinary leadership (e.g., diverse stakeholder representation within coalition) (VZN 2018b). Each of these recurring themes, both from the VZ Network's experience with coalitions across the U.S. and our case study findings, deserve further attention with respect to their role in helping cities achieve their VZ goals. Given the role of government agencies and importance of political acceptance, specific research on the level and intensity of political support associated with successful VZ initiation and maintenance is a particularly important research direction.

This study was subject to at least three limitations. First, network-level indices were not calculated given that we analyzed network data on two cities; however, future analyses with larger samples should compare and contrast network-level measures, in addition to node-level measures, with coalition outcomes. Second, missing data is a limitation in nearly all social network analyses. To minimize its potential impact on inferences, we did not analyze network data from two of the coalitions for which there was large amounts of missingness. Third, our qualitative findings represent important perspectives of coalition members but not all perspectives, or necessarily a representative sample of perspectives, from each city. Due to small sample sizes, we provided a summary of findings by city, highlighting some key results. With larger sample sizes, thematic content analysis would have been warranted with a goal of seeking theme saturation (Guest et al. 2006). Still, our results provide key insights and suggest similar findings by city that warrant further exploration with larger samples.

In sum, using organizational network analysis, we studied the interactions and complexities of coalition relationships and roles of members in four leading VZ cities. While partners from diverse sectors were represented in the VZ city coalitions examined, government agencies appeared to largely drive initiation and implementation of the initiative in the four cities studied. Coalition members identified key components important to VZ establishment and uptake, including political support, action plan development, and increased collaboration. Additional studies that examine a wider range of coalition networks and ultimately, develop guidance and best practices regarding VZ network structure, functioning, and health outcomes (e.g., lives saved) are warranted.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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REFERENCES

Belin MA, Tillgren P, Vedung E. Vision Zero--a road safety policy innovation. Int J Inj Control Saf Promot. 2012;19(2):171–179.

Berkowitz B, Wolff T. The Spirit of the Coalition. American Public Health Association; 2000.

Butterfoss FD, Goodman RM, Wandersman A. Community coalitions for prevention and health promotion. Health Educ Res. 1993;8(3):315–330. [PubMed: 10146473]

Butts CT. Social network analysis with sna. J Stat Softw. 2008;24(6):51. doi:10.18637/jss.v024.i06

Doreian P, Woodard KL. Fixed list versus snowball selection of social networks. Soc Sci Res. 1992;21:216–233.

Evenson KR, LaJeunesse S, Heiny S. Awareness of Vision Zero among United States' road safety professionals. Inj Epidemiol. 2018;5(1):21. [PubMed: 29736881]

Fahlquist JN. Responsibility ascriptions and Vision Zero. Accid Anal Prev. 2006;38(6):1113–1118. [PubMed: 16876759]

Granovetter MS. The strength of weak ties. AJS. 1973;78(6):1360–1380.

Guest G, Bunce A, Johnson L. How many interviews are enough?: an experiment with data saturation and variability. Field Methods. 2006;18(1):59–82.

Harris JK, Luke DA, Burke RC, Mueller NB. Seeing the forest and the trees: using network analysis to develop an organizational blueprint of state tobacco control systems. Soc Sci Med. 2008;67(11):1669–1678. [PubMed: 18722038]

International Transport Forum (ITF). Zero road deaths and serious injuries: leading a paradigm shift to a Safe System. OECD Publishing, Paris; 2016. 10.1787/9789282108055-e

Johansson R Vision Zero – Implementing a policy for traffic safety. Saf Sci. 2009;47(6):826–31.

Kim E, Muennig P, Rosen Z. Vision zero: a toolkit for road safety in the modern era. Inj Epidemiol. 2017;4:1. [PubMed: 28066870]

Krauss M, Mueller N, Luke D. Interorganizational relationships within state tobacco control networks: a social network analysis. Prev Chronic Dis. 2004;1(4):A08.

Kumu. Social network metrics. Los Gatos, GA: Kumu; 2018. Available at: https://docs.kumu.io/guides/metrics.html. Accessed December 18, 2018.

LaJeunesse S, Heiny S, Evenson KR, Fiedler LM, Cooper JF. Diffusing innovative road safety practice: a social network approach to identifying opinion-leading U.S. cities. Traffic Inj Prev. 2018; In press.

Luke DA. A User's Guide to Network Analysis in R. Springer International Publishing; 2015.

Luke DA, Harris JK. Network analysis in public health: history, methods, and applications. Annu Rev Public Health. 2007;28:69–93. [PubMed: 17222078]

Merrill J, Caldwell M, Rockoff ML, Gebbie K, Carley KM, Bakken S. Findings from an organizational network analysis to support local public health management. J Urban Health. 2008;85(4):572–584. [PubMed: 18481183]

Organization for Economic Cooperation and Development (OECD). Towards zero: ambitious road safety targets and the Safe System Approach. OECD Publishing, Paris; 2008.

Rogers EM. Diffusion of Innovations. 5th ed. New York, NY: Free Press; 2003

Sauber-Schatz EK, Ederer DJ, Dellinger AM, Baldwin GT. Vital Signs: Motor vehicle injury prevention — United States and 19 comparison countries. MMWR Morb Mortal Wkly Rep. 2016;65(26):672–677. [PubMed: 27388054]

Valente TW, Chou CP, Pentz MA. Community coalitions as a system: effects of network change on adoption of evidence-based substance abuse prevention. Am J Pub Health. 2007; 97(5):880–886. [PubMed: 17329667]

Vision Zero Network (VZN). Moving from vision to action: fundamental principles, policies and practices to advance Vision Zero in the U.S.; 2017. Available at: https://visionzeronetwork.org/wp-content/uploads/2017/11/VZN-Moving-from-Vision-to-Action.pdf. Accessed December 18, 2018.

Vision Zero Network (VZN). What is Vision Zero? 2018a. Available at: https://visionzeronetwork.org/about/what-is-vision-zero/. Accessed December 18, 2018.

Vision Zero Network (VZN). Vision Zero Cities Map. 2018b. Available at: https://visionzeronetwork.org/resources/vision-zero-cities/. Accessed December 18, 2018.

Vision Zero Network (VZN). Nine components of a strong Vision Zero commitment. 2018c. Available at: https://visionzeronetwork.org/project/9-components-of-a-strong-vision-zero-commitment/. Accessed December 18, 2018.

Wegman F, Aarts L (eds). Advancing sustainable safety: national raod safety outlook for 2005–2020. The Netherlands, SWOV Institute for Road Safety Research; 2006.

World Health Organization (WHO). Global Status Report on Road Safety 2018. Geneva, World Health Organization; 2018.

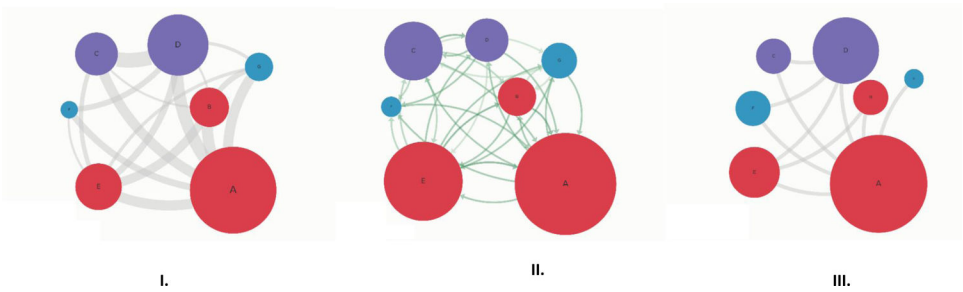

FIGURE 1.

Contact (I.), productivity (II.), and resource (III.) networks from Vision Zero City 1 Red nodes= government; purple nodes= non-profit; blue nodes= industry; size of node= weighted degree; width of connection in contact network= strength of connection; color brightness of connection in perceived productivity network= strength of perceived productivity (darker green= higher productivity)

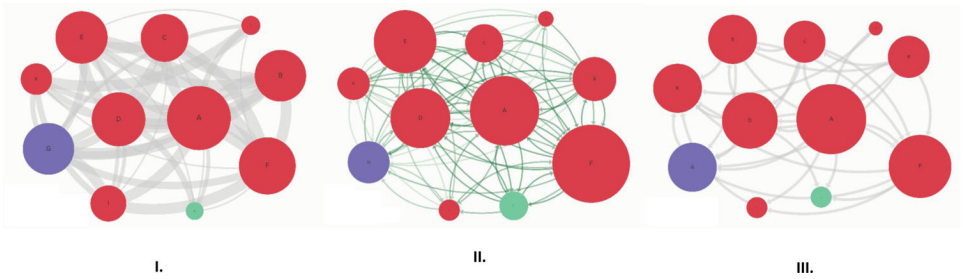

FIGURE 2.

Contact (I.), productivity (II.), and resource (III.) networks from Vision Zero City 2

Red nodes= government; purple node= non-profit; green node= other type; size of node= weighted degree; width of connection in contact network= strength of connection; color brightness of connection in perceived productivity network= strength of perceived productivity (darker green= higher productivity)

TABLE 1.

Attributes of four prominent U.S. Vision Zero (VZ) coalition networks and key findings related to VZ adoption, planning, and implementation by city, 2017–2018

City	No. core coalition members in network (no. survey respondents)	Core coalition member representation (n)	Key survey findings related to Vision Zero adoption, planning, and implementation
1	7 (6)	government (3), industry (2), non-profit (2)	Political will/support: Idea initially pitched by key government agency. Involvement of mayor and key policy leaders led to adoption. Action plan: VZ adoption further solidified with launch of a formal action plan and regular coalition meetings. Increased collaboration and cooperation: New collaborations with traditional and non-traditional partners. VZ-related project implementation: Movement toward environment and design change, as opposed to individual behavior change. Other: Increased visibility of VZ initiative over time; raised profile of traffic safety issue in city.
2	11 (7)	government (8), non-profit (2), other (1)	Political will/support: Rise in fatalities spurred mayor dictate for VZ adoption. Action plan: Mayor dictate led to action plan development, metrics, and accountability. Very rapid sequence of events and pressure to quickly produce results. Organizational pressure to do more each year, and accountability for specific objectives. Increased collaboration and cooperation: Agency partnerships generally strengthened over time. VZ-related project implementation: Data driven action; selection of priority projects became more thoughtful and data driven (shift from reactive to proactive strategies). Other: "Re-branding" of lead agency with respect to VZ-related work.
3	7 (3*)	government (4); non-profit (3)	Political will/support: Mayor's executive directive passed and initiated VZ work. Political backing and high-level support allowed for sustained action and growth in VZ activities. Action plan: After executive directive, action plan/strategy put in place and changes began. Took some time to gain traction and for some agencies to understand roles. Increased collaboration and cooperation: Increased collaboration, data sharing, and community involvement. More departments/agencies involved in work. VZ-related project implementation: Enforcement and safety projects became more data driven. Other: Safety took a more prominent role in transportation projects (as opposed to other considerations like travel efficiencies).
4	23 (5)	government (8); healthcare (2); non-profit (10); other (3)	Political will/support: Government agency spent time advocating, pushing, and planning (a slow process) for VZ before city leadership adopted it. Action plan: City council then adopted action plan, and funding was allocated to priorities. Increased collaboration and cooperation: Increased collaboration and engagement among partners. VZ-related project implementation: Slow, steady process. Dedicated funding for prioritized projects finally occurred (e.g., automated speed enforcement).

*3 were from the core defined coalition network. 6 additional partners (outside of the core network) were interviewed at a later date due to core coalition members' suggestions, given that they also had important involvement and knowledge of the city's VZ efforts; their insights are included in the qualitative summaries above.

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TABLE 2.

Weighted contact, perceived productivity, and resource sharing network measures for City 1

		Type of organization (Node)						
		Gov (A)	**Gov (B)**	**Gov (E)**	**Non-profit (C)**	**Non-profit (D)**	**Industry (F)**	**Industry (G)**
Contact *	Size	7	6	7	5	7	4	5
	Weighted degree	24	11	13	12	17	5	8
	Weighted closeness	4	2.7	2.59	2.94	3.35	1.79	2.31
	Weighted betweenness	0.73	0	0	0	0	0	0
	Eigenvector	0.17	0.15	0.17	0.13	0.17	0.1	0.13
Perceived Productivity **	Size	7	5	7	7	5	5	5
	Weighted indegree	26	14	17	13	13	14	12
	Weighted outdegree	24	11	24	20	14	4	12
	Weighted closeness	4	2.98	4	3.33	3	2.33	2.7
	Weighted betweenness	0.47	0	0.05	0	0	0	0
	Eigenvector	0.19	0.14	0.16	0.13	0.11	0.13	0.14
Resource Sharing ***	Size	7	3	4	3	5	3	2
	Degree	6	2	3	2	4	2	1
	Closeness	1	0.67	0.75	0.67	0.83	0.67	0.58
	Betweenness	0.6	0	0.03	0	0.1	0	0
	Eigenvector	0.23	0.11	0.16	0.12	0.19	0.12	0.07

Gov= government;

* weighted by contact frequency;

** weighted by perceived productivity rating;

*** not weighted, binary measure

TABLE 3.

Weighted contact, perceived productivity, and resource sharing network measures for City 2

		Type of organization (Node)										
		Gov (A)	**Gov (F)**	**Gov (E)**	**Gov (D)**	**Non-profit (G)**	**Gov (C)**	**Gov (K)**	**Gov (B)**	**Gov (I)**	**Gov (J)**	**Other (L)**
Contact *	Size	11	11	11	10	10	9	9	8	8	6	6
	Weighted degree	41	37	34	35	33	31	20	33	23	12	8
	Weighted closeness	4.1	3.91	3.67	3.71	3.47	3.66	2.52	3.93	3.13	2.23	1.8
	Weighted betweenness	0.24	0.05	0	0.11	0.01	0	0.02	0.05	0.01	0	0
	Eigenvector	0.11	0.11	0.11	0.1	0.1	0.09	0.09	0.09	0.09	0.06	0.06
Perceived Productivity **	Size	11	11	11	9	10	7	9	8	6	6	5
	Weighted indegree	43	46	35	38	26	28	20	28	16	13	20
	Weighted outdegree	40	46	41	35	28	22	24	28	16	13	20
	Weighted closeness	4.09	4.6	4.12	4.17	3.04	3.37	2.89	3.54	2.69	2.43	3.42
	Weighted betweenness	0.08	0.29	0.03	0.08	0	0	0	0	0	0	0
	Eigenvector	0.12	0.12	0.11	0.1	0.11	0.08	0.09	0.09	0.07	0.07	0.06
Resource Sharing ***	Size	11	10	8	9	8	7	8	7	4	3	4
	Degree	10	9	7	8	7	6	7	6	3	2	3
	Closeness	1	0.95	0.85	0.9	0.85	0.8	0.85	0.8	0.65	0.6	0.65
	Betweenness	0.22	0.1	0.01	0.05	0.01	0	0.08	0	0	0	0
	Eigenvector	0.13	0.12	0.11	0.12	0.11	0.1	0.1	0.1	0.05	0.03	0.05

Gov= government;

* weighted by contact frequency;

** weighted by perceived productivity rating;

*** not weighted, binary measure