

**"Watch for Me NC" Pedestrian and Bicycle Safety Program:
Developmental Framework and Process Evaluation**

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1 **ABSTRACT**

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3 Limited research exists on the process, partners, and resources needed to develop and effectively
4 implement programs addressing pedestrian and bicycle safety. Before communities can evaluate
5 the effectiveness of their programs, they first need more guidance on what efforts could
6 theoretically lead to fewer crashes, the extent of program delivery needed before changes in
7 behavior or other safety outcomes can be measured, and how to assess and improve program
8 delivery. The Watch for Me (WFM) intervention was a multi-faceted community-based
9 pedestrian and bicycle safety program implemented in North Carolina. The purpose of this paper
10 is to 1) describe the WFM intervention development; 2) assess program delivery through
11 implementation records; and 3) identify successes and challenges in implementing behavioral
12 interventions to promote pedestrian and bicycle safety. As a report of process evaluation, it
13 proceeds and complements reporting of program effects on intended outcomes (in progress).
14 This paper provides details on the nature, duration, and frequency of the delivery of key
15 program components—including outreach, officer training, law enforcement operations, and
16 media engagement—as well as program costs and partnerships. Funding, intra-agency
17 partnerships, and data to support decision-making were instrumental in WFM implementation.
18 Key program delivery challenges included limited resources (including law enforcement time) to
19 effectively saturate a large, dispersed population and loss of program novelty over time. These
20 results and lessons can help guide researchers and decision-makers in developing and evaluating
21 similar programs. In addition, results also suggest a set of process measures that can be used by
22 others to increase the consistency and comparability of program delivery.
23

24 **BACKGROUND AND OBJECTIVES**

25

26 In the United States (US) and North Carolina (NC), pedestrians and bicyclists represent 16% of
27 all motor vehicle traffic (MVC) fatalities. According to the National Highway Traffic Safety
28 Administration (NHTSA), 4,743 pedestrians and 726 bicyclists were killed in MVCs in the US in
29 2012, and an estimated 76,000 pedestrians and 49,000 bicyclists were injured (1, 2). In NC,
30 2,400 pedestrian-involved MVCs and 977 bicyclist-involved MVCs occur each year (3, 4).

31

32 The magnitude of pedestrian and bicycle crashes, coupled with an awareness of the health
33 benefits of active transportation, have given rise to a number of safety-related interventions.
34 Many communities, during the process of developing pedestrian and/or bicycle master plans,
35 develop recommendations for education and enforcement activities to complement engineering
36 improvements. In a content analysis of 46 local and regional pedestrian master plans in NC,
37 Jones et al determined that “the most common programs proposed to improve pedestrian
38 safety were either school-based (76%) or law enforcement-based (63%) programs” (5).
39 However, the study notes, few plans provided details on how such programs would be
40 implemented or the resources needed to implement them.

41

42 Although the interest in comprehensive efforts to promote pedestrian and bicycle safety is high,
43 there is a profound lack of published research and evidence-based guidance on the process,
44 partners, resources, and amount of time needed to develop and deliver such programs.
45 Moreover, the theoretical underpinnings or health behavior models that support pedestrian or
46 bicycle safety interventions are rarely, if ever, articulated in published research. If states and
47 communities are to develop programs or attempt to measure program effectiveness in preventing
48 pedestrian and bicycle injuries, they first need more guidance on what efforts could theoretically
49 change behaviors and lead to fewer crashes, the extent of program delivery needed before
50 changes in behavior or other safety outcomes can be measured, and how to evaluate program
51 delivery. A sound program delivery evaluation may also help explain outcome-related
52 evaluations.

53

54 In NC, a multi-faceted, theory-driven pedestrian injury prevention intervention, Watch for Me
55 NC (WFM), was launched in 2012 to reduce pedestrian crashes and injuries through a
56 community-based program involving education, outreach, and law enforcement measures. In
57 2013 it was enhanced with bicycle messages and expanded to additional communities. In both
58 years, the program delivery was evaluated using multiple methods including process and
59 administrative measures, measures of individual and organizational changes, and behavioral
60 outcomes.

61

62 The purpose of this paper is to 1) describe the WFM intervention development process; 2) assess
63 program delivery through measures obtained from intervention implementation records; and 3)
64 identify successes and challenges in implementing behavioral interventions to promote
65 pedestrian and bicycle safety. This process evaluation complements a detailed evaluation of
66 program effects—a controlled before-after study measuring changes in rates of drivers yielding
67 to pedestrians in crosswalks and other behavioral observations—that is in progress. These
68 process results provide important evidence of theoretical considerations, key outreach and
69 training activities and associated costs, challenges and successes in program delivery, and

70 lessons that can help guide researchers, program leaders, and decision-makers when considering
71 the need for investment in such programs and corresponding evaluations. It also suggests a set of
72 measures that can be used by others to increase the consistency and comparability of program
73 delivery.

74

75 **PRIOR RESEARCH**

76

77 Several studies summarize the effectiveness of community-based pedestrian and/or bicycle
78 safety programs that used educational, outreach, or enforcement components. Most studies focus
79 on evaluating program outcomes: knowledge change, behavior change (e.g., looking behaviors,
80 crosswalk use, yielding rates), or crash rate change. Few published reports describe how the
81 programs were developed, how key decisions were made, what resources were utilized, or what
82 theoretical or research evidence-base informed program development.

83

84 The StreetSmart program in Washington, DC is regarded as one of the longest-running
85 pedestrian education and enforcement programs in the US, in operation since 2000 (6). Its
86 intervention approach using enforcement and public outreach has been widely modeled, and it
87 was frequently referenced in the development of the WFM program. It is one of the few
88 programs identified that has published a detailed report of its program delivery. The annual
89 report focuses heavily on the media investment strategy and communications outputs but
90 provides no conceptual rationale underlying its approach. On the basis of materials available on
91 the program website, the program has clearly evolved over the years but published reports do not
92 include a discussion of lessons learned regarding program delivery.

93

94 Huang and Petritsch (7) evaluated three separate community-based pedestrian safety
95 interventions occurring in Missoula, MT, Savannah, GA, and Washington, DC (which was an
96 early version of StreetSmart). The 2006 study (not formally published) includes a brief
97 documentation of intervention activities, which varied widely across the interventions. The
98 authors concluded that additional funding and reliable community champions were needed to
99 ensure the strength of the intervention implementation before more rigorous outcome-oriented
100 evaluations could be conducted.

101

102 Van Houten and Malenfant (8) evaluated a Miami Beach, FL intervention involving targeted
103 police enforcement and local publicity. In 2013, Van Houten et al. published a thorough
104 evaluation of an enforcement-based intervention that was similar in design to the 2004 effort (9).
105 While both studies provide background research supporting the conceptual development of the
106 program—which was based on deterrence theory—and details on how the law enforcement
107 operations were conducted and evaluated, there is limited information provided regarding many
108 aspects of program delivery, which limits the replicability of the model.

109

110 Zegeer, et al. (11) produced one of the few crash-based evaluations of a comprehensive
111 pedestrian safety intervention to date. The journal article and full agency report describe
112 partnership and program development and many aspects of program delivery and lessons
113 learned. However, as the program was conducted over a number of years with different
114 components led by various partners, measuring and tracking program delivery was an admitted
115 challenge in the study.

116
117 Table 1 provides an overview of key characteristics of the afore-mentioned pedestrian and
118 bicycle programs and summarizes the program delivery metrics that were reported in the studies
119 cited, when available. The table highlights how program components, the intensity of their
120 implementation, and the delivery information reported varies widely across programs.

121
122 Several other pedestrian and bicycle safety interventions have been delivered in cities, regions,
123 and states, including efforts in Florida, Maine, New Mexico, Chicago, Boston, and Washington
124 State. However, these have either not been formally evaluated (using process or outcome
125 measures), have not been in existence long enough for evaluations to be completed, or results
126 have not been published or made publicly available.

Table 1. Summary of Key Program Characteristics and Delivery Metrics.

Citation	(6)	(7)	(7)	(8)	(9)	(10)
Program Location	Washington, DC and surrounding area	Missoula, MT	Savannah, GA	Miami Beach, FL	Gainesville, FL	Miami-Dade County, FL
Conceptual program basis	Not reported	Not reported	Not reported	Based on prior studies showing effectiveness of enforcement	Deterrence theory and prior studies	Based on prior studies of “safety zones” and countermeasures
Partners involved	Not reported	Not reported	Numerous reported	Not reported/ not applicable	Traffic magistrates; city planning and PD	Numerous reported
Timeframe for program delivery (covered by report cited)	Began in 2000 and has Spring/Fall campaigns; data below represents activities in FY 2014	2004-2005	2005-2006	2-week intervention and 1-year maintenance period (year not stated)	2010-2011	1999-2003
Total budget	\$602,00	Not reported	Not reported	Not reported	Not reported	Not reported
Media budget	\$245,600	Not reported	Not reported	Not reported	Not reported	Not reported
# of media events	2 kick offs and 16 media events	Not reported	Not reported	1 press release issued	Press releases issued by PD	Not reported
Earned media coverage	2 print stories; 21 TV stories; 48 web articles	“Substantial coverage” noted but no details provided	Not reported	2 TV stories and 1 print story	11 print stories, 4 TV stories, unknown amount of radio	Not reported
Website traffic	5,400 website visits	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
# of radio or TV ads	808 15-sec ads run in 2 2-week periods on 7 stations	2000 radio spots on 11 stations; 343 TV spots on 2 stations	2-minute spot run 8 times on 1 local TV channel	Not applicable	Radio ads run over 5-week time period	Ads were used but quantity not reported
#/type of outdoor ads	Hundreds of exterior bus ads and gas station ads	126 signs placed	Not reported	Not applicable	Sandwich boards and street signs; amount not specified	400 posters; bus ads; amount not specified
Law enforcement operations taken	2 month-long “waves” per year; total # of operations not reported	4 operations (no timeframe provided)	None; local advocates held community enforcement events	# not reported; most enforcement occurred in a 2-week period	4 waves of 2-week long enforcement periods at 6 sites	See citation (8), which was the enforcement arm of this program
Warnings/citations reported	1,423 warnings; 4,701 citations	Not reported	Not applicable	1,562 stops, resulting in 307 citations	1,177 warnings; 401 citations	See citation (8), which was the enforcement arm of this program
Organizational Training	Not reported or not applicable	Not reported or not applicable	Not reported	Not reported here; see citation (10)	Officers were trained; details not reported	Two waves of officer training courses held
# of grassroots events	Not reported or not applicable	Not reported or not applicable	Multiple school-based events held	Not reported here; see citation (10)	Outreach to schools/drivers	20 assemblies/ health fairs attended

PROGRAM DEVELOPMENT

Timeline and Community Partners

The WFM program originated with a NHTSA demonstration grant received by the University of North Carolina's Highway Safety Research Center (HSRC) and grew over a several-year time period. In 2011, it gained support from the North Carolina Department of Transportation (NCDOT), and the following year it launched publicly in four municipalities in the Triangle region of NC: Raleigh, Durham, Chapel Hill, and Carrboro. There were several program components: 1) dissemination of educational safety messages through targeted outreach and education 2) law enforcement training and organizational capacity building, 3) high-visibility enforcement of pedestrian and motorist laws, and 4) media engagement. In 2013, NCDOT added funding to include six additional Wake County towns and expand the messaging to incorporate bicycle safety. New partners included the municipalities: Apex, Cary, Fuquay-Varina, Knightdale, Morrisville, and Wake Forest. Within these communities, eight universities also joined in the effort. Figure 1 provides a timeline of key program development and implementation milestones.

Jan 2010	HSRC performed pedestrian (and later bicycle) crash analysis to identify high-crash areas in the Triangle; conducted field assessments to observe behavioral and infrastructural issues
Oct 2011	Formed steering committee with NCDOT and Triangle municipal partners; HSRC staff reviewed the literature and crash data, interviewed stakeholders to identify intervention opportunities, and made recommendations to NCDOT on program strategy
Jan 2011	Steering committee selected program name and project staff began developing and designing communications materials and coordinating with local partners to plan program delivery
Aug 2012	Law enforcement staff receive training; public outreach elements of the program launched in 4 communities and 4 universities (pedestrian-focus only); comprehensive pilot program evaluation conducted for NHTSA (called Year 1)
Oct 2012	High-visibility enforcement activities begin
Aug 2013	Law enforcement staff receive training; public outreach elements of the program launched in 10 communities and 8 universities (pedestrian- and bicycle-focused); comprehensive pilot program evaluation conducted for NCDOT (called Year 2)
Oct 2013	High-visibility enforcement activities begin
Jan 2014	Program expands statewide

Figure 1. Timeline of Program Development and Delivery Milestones.

Application of Health Behavior Models

With limited research available on effective programs that could be modeled, WFM program leaders sought to ground the program in the best theoretical evidence-base possible. The overall WFM program strategy, as well as specific messages and media-related materials, were influenced by several health behavior change models or theories. These include the behavioral

model of pedestrian crashes (11), Health Belief Model (12), Socio-Ecologic Framework (13, 14, 15), Stages of Change Theory or Transtheoretical Model (16), and Deterrence Theory (17).

The behavioral model of pedestrian crashes, developed by Snyder and Knoblauch, (11) suggests that the critical behaviors in the sequence leading to or avoiding a crash are 1) search, 2) detection, 3) evaluation, 4) decision, 5) action, 6) vehicle response. Interventions operating under this model can reduce or prevent crashes by 1) reducing human error in performing the behaviors above, or 2) by changing the built environment so that a potential crash is less likely or is easier to avoid. In NC, an effort was already ongoing to implement its Statewide Complete Streets policy to modify the built environment. The WFM program sought to complement the Complete Streets program by focusing on ways to reduce human errors contributing to crashes. An analysis of five years of pedestrian and bicycle crash data provided information on common crash risks in the Triangle region. The WFM program developed a series of specific messages targeted at behaviors identified as factors associated with the most common crashes. For example, a large portion of crashes occurred at intersections and involved drivers making turning maneuvers. Messages to pedestrians and to drivers emphasized the risk of crashes at intersections and advised them to scan in all directions for other road users before making their way through an intersection. Efforts to increase road user scanning and detection of other modes are consistent with the behavioral model of pedestrian crashes (11). This approach was also supported by the Health Belief Model (12), which suggests that personal behavior change is influenced by numerous factors, including the perceived susceptibility and severity of a health risk, the perceived benefits and barriers to taking action, and internal or external “cues to action” that prompt one to take action.

The Socio-Ecologic Framework (13, 14, 15) recognizes that individual behaviors are influenced by individual characteristics as well as interpersonal, environmental, and broader sociocultural factors. The practical implication is that multi-level interventions targeting individuals, organizations, and physical and social environments are likely to be the most effective in changing health behavior. Based on this, staff designed the program to be multi-level, including education (direct and passive outreach aimed at individuals, organizations such as law enforcement agencies, and social networks and media), enforcement of laws, partnership development among municipal and police staff, and policy change (such as provision of funding/staff for routine education and enforcement).

The Stages of Change Theory or Transtheoretical Model (TTT) (16) proposes that individuals reside on a continuum of motivation and readiness for behavior change: 1) Pre-contemplation 2) Contemplation, 3) Preparation, 4) Action, and 5) Maintenance. The goal of interventions based on the TTT model is to move people (and their respective organizations) to the next stage of change. The WFM program was grounded in the Stages of Change/TTT model in that it offered officer training to advance officers’ stages of change. Fundamental to the delivery of the WFM intervention is the buy-in of the police officers responsible for implementing the enforcement operations to the full extent possible. Unlike other safety programs, funding was not available for officer over-time pay; rather, program leaders sought to engage enforcement agencies so that pedestrian and bicycle safety would become routine and institutionalized. A common premise, supported by the TTT model, is that officers who are familiar with the law and who have the resources/capacity to enforce the law, coupled with an attitude and sense of efficacy that supports conducting such activities, will be more able to successfully implement the enforcement

elements of the program and contribute to the intensity of the intervention delivery. With the officer training in particular, the intervention aims to move officers from the pre-contemplation or contemplation stage to preparing and taking action to support pedestrian safety through advanced law enforcement techniques.

Many traffic safety programs are predicated on Deterrence Theory (17). This theory states that people are more likely to avoid illegal behaviors when they believe that the likelihood of getting caught is high and that punishment for the behavior is certain and will be swift and severe. This theory suggests that changing the perception by drivers of being apprehended and punished is an important part of changing their behavior so that they yield to pedestrians. Deterrence theory was considered in the development of certain intervention messages, particularly those aimed at drivers, which emphasized the legal consequence of failure to yield to pedestrians. Interviews with multiple press outlets emphasized the extensive enforcement outreach and the potential for tickets and warnings to those failing to obey the laws. Officers were also instructed to stress their city-wide presence and the likelihood of stopping (and punishing) errant drivers and others. They were provided template press releases and other materials to help highlight enforcement efforts and summarize citation data.

PROGRAM IMPLEMENTATION AND PROCESS EVALUATION METHODS

As indicated in Figure 1, the WFM program launched in 2012 in four communities, with most activities taking place between August and December (hereafter referred to as Year 1). In 2013, a second wave of the pilot program was launched in an expanded set of communities in the same region (referred to as Year 2).

To describe the intervention delivery, researchers obtained records of paid media, earned media, website usage, law enforcement operations, and community engagement activities. NCDOT's media purchasing contractor, MSA Marketing, Inc., provided information regarding media contracting and printing services used. Researchers tracked earned media (i.e., TV, radio, and print news coverage that was not purchased) by routinely searching Lexis-Nexis archives and GoogleNews Alerts. WFM website usage data was extracted from Google Analytics.

Researchers gathered law enforcement operations data from partnering enforcement agency staff. In Year 1, eight agencies were contacted bi-weekly with requests for data. In Year 2, 18 agencies were contacted bi-monthly. In Year 1, partner agencies provided summaries of outreach activities in monthly meetings, but no formal data collection tool was used. In Year 2, researchers gathered monthly data on community engagement from community partners using a web-based survey.

To examine the effectiveness of the training in building officer capacity to support the WFM effort, researchers collected data through a self-administered questionnaire. The questionnaire was designed to measure officer knowledge of relevant laws, plans regarding participation in WFM enforcement events, attitudes about pedestrians, and self-reported capacity to perform operations aimed at improving pedestrian safety (e.g., resources of the individual and support from his/her organization), as well as response efficacy (i.e., the sense that the work they perform will have lasting value/effect). Officers from agencies participating in the WFM

program enrolled in the two-day training course and received the questionnaire before and after courses were delivered.

PROCESS EVALUATION RESULTS

Individual and Social-Network Education and Outreach

The program included targeting individuals to raise awareness of traffic safety risks, appropriate behaviors, relevant laws, and responsibilities. Outreach primarily occurred indirectly through the use of purchased media and materials. Researchers anticipated that individual-level engagement could inspire social-level engagement through grassroots and/or social networking. A total of \$114,900 was spent on media, including radio, indoor and outdoor advertising (e.g., transit ads), and digital materials in 2013. All materials can be found at www.watchformeNC.org. Messages were developed by NCDOT staff in coordination with HSRC and the steering committee. Table 2 summarizes the media/materials and their placement and duration in 2013. Typically, print materials were strategically placed at “points of opportunity” where actively traveling road users would have the chance to apply the message at the time of reading it. This is opposed to web-based or magazine advertising that may reach a reader who is not traveling at the time and would therefore have to remember the message later in order to apply it when walking, bicycling, or driving. Roughly the same amounts of materials were created and distributed in Year 1, though no bicycle safety materials were available the first year.

Table 2. 2013-2014 WFM Media and Materials.

Item Description, Placement, and Time Frame	Example
<p>Transit Ads: External Ads of various sizes were placed on 3 regional bus systems on 32 buses; ads ran from August to November 2013. Two specific messages aimed at increasing driver yielding to pedestrians and making room for bicyclists when passing. Bus vendors estimate 90% of riders are “exposed” to transit ads each month; ridership varies by transit agency.</p>	
<p>Transit Ads: Internal 526 (11 x 17 inch) internal ads were placed on seven regional bus systems on more than 300 buses; ads ran from August until mid-November. These included a pedestrian-oriented ad (with 6 specific messages) and a bicycle-oriented ad (with 8 specific messages).</p>	
<p>Bumper Stickers Two standard-size bumper stickers had pedestrian and bicycle safety messages aimed at drivers. 27,500 bumper stickers were distributed to ten city planning departments and eight universities for distribution in Fall 2013.</p>	
<p>Brochure/Rack Card A two-sided 4.25 by 11 inch document with laws and safety tips aimed at drivers, pedestrians, and bicyclists was developed; 25,900 were printed in English and 2,950 were printed in Spanish. These were provided to all 18 partners and law enforcement agencies for distribution through libraries, community centers, local businesses, and direct contact.</p>	
<p>Banners Ninety seven 3 ft by 6 ft or 3 ft by 8 ft outdoor banners had messages aimed at drivers. These were placed in 13 of the 18 communities in high-visibility locations or used at community events.</p>	
<p>Posters NCDOT printed a total of 10,776 posters (11 by 17 inch or 18 by 24 inch) posters with a series of six messages aimed at pedestrians and eight messages aimed at bicyclists. These were placed in businesses, community centers, libraries, campuses, and other public locations throughout participating communities.</p>	
<p>Bike Lights 2,200 bike light sets (front and tail lights with the WFM logo), were distributed primarily by police officers to bicyclists observed riding without lights during the Fall campaign months; these were also distributed through community events.</p>	
<p>Reflective Bracelets 3,400 bracelets/arm or leg straps with LED lights and the WFM logo were distributed at community events during the Fall campaign months by the 18 partners.</p>	
<p>Website The site www.WatchForMeNC.org serves as a central information point, describing the effort and providing safety facts and resources and information for the media.</p>	
<p>Radio Ads 15-second ads included safety messages aimed at drivers; versions were created in English and Spanish. The ads aired 459 times during peak commute hours for eight weeks between August and October 2013.</p>	<p>N/A</p>

Of the 18 partners, nine municipalities and six universities actively worked to distribute messages and engage the community. Based on the information reported by community partners, at least 71 local events were attended or hosted by WFM partners from June 2013 to January 2014. Events ranged in size and audience and included:

- University open houses or student orientations
- New employee orientations
- National Night Out
- Park/trail opening ceremonies
- Community open houses
- School events (e.g., walk or bike to school events)
- Festivals, fairs, and farmers markets

Additionally, materials were commonly distributed at city/town hall, bike shops, community centers, and campus locations. Materials were distributed during police enforcement events and through churches, crime prevention programs, and other partner organizations.

Organizational Training and Outreach

In addition to outreach aimed at individual road users, WFM partners performed education, training, and outreach targeting key organizations. To join the program in Year 2, each community was required to pass a resolution with city council acknowledging the importance of pedestrian and bicycle safety and pledging to support activities to improve safety in the community. This required outreach to elected officials and helped raise awareness of pedestrian and bicycle safety concerns. Each municipal coordinator was then responsible for disseminating the materials provided by NCDOT and engaging decision-makers, stakeholders, and organizations within the respective community. Every community participated differently, but almost all reported giving presentations about the WFM program and safety messages to the City Council, Pedestrian and Bicycle Advisory Board(s), and the Transportation Advisory Councils (TAC) of the area Metropolitan Planning Organizations (MPOs). Program coordinators delivered driver trainings and safety presentations to taxi drivers and bus drivers in Raleigh and Durham, the two largest participating municipalities. Several communities reached out through school-based channels, including holding crossing guard training events, integrating pedestrian and bicycle safety messages into the local drivers' education programs, and establishing a child pedestrian and bicycle safety curriculum and skills training program.

Building and Measuring Law Enforcement Capacity

Fifty-five law enforcement officers representing the 18 agencies participating in the program took part in a two-day training course offered by NCDOT in 2013 to build their capacity to perform pedestrian safety operations as part of the WFM program. The course involved classroom education regarding relevant NC laws and best practices in conducting enforcement, and field exercises to conduct operations aimed at improving driver yielding at crosswalks.

A pretest-post-test comparative survey design was used to assess the effects of participation in the training course on self-reported capacity to support the program and perform pedestrian safety operations. Fifty-four officers completed both before and after surveys. Officers included

those from bike squads, community police teams, traffic safety units, and other field operations or safety teams. Officers also represented various types of police departments: municipalities (43), universities/colleges (8), county (2), and state government (1). Of the 54 respondents, only 10 reported to have taken a previous course on pedestrian and bicycle laws.

Results indicate an increase in the number of correct responses regarding pedestrian and driver yielding requirements under different scenarios (e.g., at intersections and at midblock locations), and an improved recognition of NC laws regarding pedestrians and bicyclists. Average test scores for the main three knowledge-related items of the questionnaire rose from 77 to 90% correct (a 17% increase, p -value <0.001). The greatest gains were seen in questions regarding which party must yield right of way, while baseline understanding of NC laws began and remained relatively high.

Table 3 summarizes changes in self-reported attitude, resources/capacity, efficacy, and plans regarding pedestrian enforcement. For each item, a matched pair t-test (one-tailed, $\alpha = .05$) assessed the significance of the difference in individual scores from before and after the workshop. On the whole, there was a significant increase (27%) in officers reporting that they were familiar with laws protecting pedestrians. There was also a significant decline in officers reporting that pedestrian laws are difficult to enforce or do not need routine enforcement (14 and 18%, respectively). After the workshops, more officers stated that they had adequate resources, training, time, and the ability to perform pedestrian operations; officers also agreed more strongly that enforcement can improve driver compliance and can prevent crashes. Several officers also stated plans to conduct targeted enforcement in the next six months to a year. This indicates that the training may have been successful in encouraging officers and agencies to discuss or make plans to support pedestrian and bicycle safety.

Table 3. Officer Attitudes Scores Before And After Training.

Measurement Construct	Attitude/Belief Statement (1=Disagree; 6=Agree)	Item #	Before Avg.	After Avg.	% Difference	P-value
Attitude	I am familiar with the laws protecting pedestrian safety in NC	5	4.15	5.26	27%	0.0000
Attitude	Motorists who do not follow traffic laws pose a serious threat to pedestrian safety	6	5.58	5.70	2%	0.2424
Attitude	Keeping pedestrians safe is an important part of my job	7	5.70	5.74	1%	0.3436
Attitude	Pedestrian laws are difficult to enforce	8	3.49	3.00	-14%	0.0111
Attitude	Enforcing pedestrian safety is a worthwhile endeavor	13	5.59	5.70	2%	0.1387
Attitude	Pedestrian safety does NOT need routine enforcement	17	2.00	1.65	-18%	0.0083
Resources/capacity	My colleagues/I have adequate resources to use towards making our community safer for pedestrians	9	4.33	4.67	8%	0.0163
Resources/capacity	I have the support of my command staff to perform pedestrian safety operations	10	5.00	5.09	2%	0.2802
Resources/capacity	There is NOT enough pedestrian-focused training available that can help me do my job better	11	3.69	3.17	-14%	0.0020
Self/ Unit Efficacy	My department/unit could perform a pedestrian crossing operation	12	5.13	5.67	10%	0.0002

Measurement Construct	Attitude/Belief Statement (1=Disagree; 6=Agree)	Item #	Before Avg.	After Avg.	% Difference	P-value
Self/ Unit Efficacy	On an average shift, I do NOT have time to enforce laws to protect pedestrians	14	2.94	2.66	-10%	0.0542
Response Efficacy	If I enforce pedestrian safety laws, more drivers will yield to pedestrians in marked crosswalks	15	4.63	5.09	10%	0.0028
Response Efficacy	I can help prevent crashes by enforcing pedestrian/motorist laws	16	5.11	5.53	8%	0.0018
Plans	I have been thinking that my unit should work on planning a crosswalk enforcement operation within the next 6 months	18	4.25	4.85	14%	0.0007
Plans	During the next 6 months, I plan to routinely enforce drivers yielding at crosswalks	19	4.80	5.20	8%	0.0021
Plans	It is likely that my unit/department will enforce pedestrian laws regularly during the next 6 months	20	4.89	4.85	-1%	0.4240

Note: **Bold** values are significant at the $\alpha=.05$ level

Enforcement-based Outreach

Before the WFM program was implemented in 2012, only five pedestrian targeted operations (all in Carrboro, NC and resulting in less than 30 warnings/citations) were reported to have been conducted by the participating police departments. In Year 1, 37 targeted pedestrian safety operations were reported by the four municipal and four university agencies, resulting in over 460 warnings and 172 citations. In Year 2, eight municipal police agencies and three university police departments reported conducting more than 55 operations targeting enforcement of pedestrian- and/or bicycle-related laws, as well as routine enforcement patrols where officers incorporated pedestrian and bicycle safety surveillance. The reported operations involved at least 200 police officer hours, all performed without receiving any compensation from the WFM program sponsor. The operations resulted in more than 318 warnings and 162 citations. Pedestrians received 53% of the warnings issued, bicyclists received 17%, and motorists received 30%. All of the citations, however, were given to motorists. While the total number of warnings and citations in Year 2 was slightly fewer than observed in the initial year, it is clear that a significant shift in police agency resources dedicated to pedestrian and bicycle safety has been made since the program was established. However, overall enforcement intensity per capita was relatively low. Given that the Triangle has over a million residents, the total direct reach of the enforcement was less than half of 1% of the area population. Moreover, the majority of enforcement operations occurred in a single month (October, in step with press events and outreach efforts), and only one agency reported plans for routine and systematic year-round pedestrian safety enforcement operations.

Media and Social Engagement

The radio ads, which aired 459 times in eight weeks, were estimated by MSA Marketing, Inc. to have made a total of 10,518,000 gross impressions on adults aged 18 and up. It was projected that 59% of adults in the media region were reached and that the average person should hear the message 14 times. Both radio and transit ads appear to have targeted a large audience during

peak times when pedestrian and bicycle crashes occur and were relatively inexpensive. These visual and auditory elements were perceived by the municipal coordinators to be clear and focused on appropriate behavioral messages. The print materials contributed to brand consistency, which may have helped with program recognition and awareness, although this was not specifically measured. A targeted approach focusing messaging in high-crash areas (such as bus routes) and at high-crash times (such as peak commutes) maximized the exposure given limited resources.

Earned media consisted of TV, radio, and print news coverage of the program that was not purchased. In each program year, NCDOT issued six press releases to help garner earned media. The program also sought to leverage newsworthy events, such as a community bike ride kick-off event and the law enforcement trainings. In Year 1, the program was referenced in nearly two dozen stories in local media, including a front page story in the Raleigh News and Observer, with an estimated total advertising value equivalency (AVE) of \$15,000. AVE reflects the approximate cost to purchase an advertisement of equal size or duration in the newspaper or broadcast timeslot. The figure was calculated based on posted newspaper rate cards and rates charged by television stations during the time the media was run. In Year 2, the releases generated roughly six stories, including a large article in one of the area's Spanish language papers. Each story reached approximately one-half million readers/television viewers. In total, the Year 2 total AVE of all news coverage was estimated to be about \$1,000. The decrease in earned media value from 2012 to 2013 may have resulted from the loss of novelty as the campaign was no longer a new—and therefore newsworthy—topic for reporters. Also, the campaign launch in 2012 was attended by David Strickland, the top Administrator of the National Highway Traffic Safety Administration at the time, and resulted in significant coverage from major news outlets. The 2013 program took a more grassroots approach, which may have resulted in greater awareness about the program through word of mouth and social media but less quantifiable traditional media attention.

Partnering organizations reported using a variety of social media strategies. Of the 18 participants in Year 2 that provided information, 67% posted messages on their website, 61% used Facebook, 50% issued a press release or newsletter (print or e-news), and 44% used Twitter to spread safety messages. In both years, news coverage and social media responses were largely positive. News stories focused on crash statistics and how the WFM program aimed to reduce injuries through education of all road users and enhanced enforcement of existing laws.

Researchers monitored WFM website usage using Google analytics. From July 2013 to February 2014, 4,000 unique visitors viewed the site 4,900 times. Eighty percent of web traffic came at the beginning of the program when the radio ads ran and press releases were issued. Fifty-six percent came from direct links, a sign that visitors were aware of the web address. There were several noticeable spikes in web use, most of which occurred around campaign announcements and news coverage. Website usage patterns suggest that press releases and efforts to gain broader media attention may significantly impact the number of people who seek out information regarding pedestrian and bicycle safety and the WFM program.

DISCUSSION

This program invested an immense amount of resources in an effort to disseminate pedestrian and bicycle safety messages and reinforce messages through social networks and enforcement agency actions. This section discusses some successes and challenges that were identified during program development and implementation.

Funding and In-Kind Support

Funding from NHTSA and NCDOT was crucial to intervention development. Roughly \$114,000 was spent on media-related costs and another \$140,000 to manage the program. Collectively, these funds supported material development, testing, and design; program outreach and media purchasing; as well as a range of HSRC activities such as partner coordination, training delivery, and program tracking and evaluation. Without these resources, the communities involved in the program would not likely have leveraged their own resources to participate; or, they may have developed smaller municipal programs that lacked the cohesion, coordination, and reach of the region-wide program.

While challenging to measure, municipal partners devoted significant in-kind support, attending meetings, conducting operations, and performing outreach. This enabled the targeted distribution of WFM messages and genuine community engagement. Unlike other programs, no NHTSA or NCDOT funds were used to provide overtime pay for enforcement. This scenario is reflective of real-world conditions other community programs face and may lead to a more sustainable program in the long-term by enabling police departments to pledge commitment due to community priorities rather than financial incentives. However, the issue of program cost and time available to commit to implementation was a consistent concern for program leaders. Other program coordinators may consider sources such as private foundations or local businesses, particularly when working in large, high-population areas where intense campaign delivery is needed to saturate the target population.

Inter/Intra Agency Partnerships and Program Champions

The intervention development and delivery was largely partner-driven. This had some disadvantages in that the intervention development involved group compromises, local politics, funding limitations, and non-scientific decision-making, leading it away from theory- or evidence-based practice. But the advantages likely outweighed the disadvantages in that a partner-driven approach led to strong community buy-in and increased capacity to implement the intervention on a large, regional scale.

A stable, long-term program lead (NCDOT) with technical support to aid regional coordination (HSRC) and strong community partners offered an ideal mix for program delivery. Within each municipality, a range of partners brought assets that contributed to the successful implementation of various activities. Key partners included City/Regional Planners, law enforcement, public information officers, Parks and Recreation Departments, and other injury prevention groups, such as Safe Kids. In addition to having diverse partners, formal commitments (including resolutions passed through 10 municipal city councils) helped ensure accountability and a steering committee provided structure and continuity to program activities.

Partners implemented various strategies but efforts were not evenly distributed across communities. Communities with more staff—in particular those with devoted pedestrian and bicycle coordinators—and those with a longer history of commitment to pedestrian initiatives were more likely to support key intervention components, including communication and enforcement, as measured by a range of implementation records. Participants also reported several barriers, including lack of personnel, lack of time or competing priorities, and lack of strong relations with a partner needed to support intervention delivery (such as law enforcement or school contacts).

Officer Training and Support

Providing training and support to officers was an important first step in building organizational interest and ability to focus on pedestrian and bicycle safety. While agencies conducted numerous operations, overall enforcement intensity per capita was relatively low given the large regional population. If overtime pay is not provided to support more wide-scale police operations, officers may need other resources to build their capacity to implement the program to the fullest extent possible. In addition to the training program evaluated above, the WFM program offered participating agencies materials to hand out during enforcement operations (such as materials described in Table 2), as well as template operations plans to coordinate and perform consistent and safe operations. Additionally, NCDOT equipped officers with signs and template press releases to help raise awareness of the purpose of their operations. More effort is needed in future years to maximize the visibility of enforcement efforts and plan routine, sustained efforts throughout the target community.

Scalability and Regional Focus

The nature of the Triangle, a community of more than a million people across three counties, was an obstacle for program delivery. A large and dispersed population required immense resources not fully available to program coordinators. Future programs with limited funds may consider a smaller geographic scope or more closed population group, such as a specific campus or smaller town. That said, there were considerable economies of scale utilized by working at the regional level, primarily in the development of a singular program message and theme, and larger-scale operations have the potential to reach a greater number of people. States looking to develop a uniform program may find WFM to be an important model; the program is now being rolled out Statewide in NC, with nine new community partners in addition to existing Triangle partners.

Study Strengths and Limitations

This paper details the development and implementation of a community-based, comprehensive pedestrian and bicycle intervention. In-depth process-based evaluations of theoretically-sound pedestrian and bicycle safety programs are extremely rare in published literature and are much-needed by decision-makers and program leaders seeking to establish sound programs and to improvements to program delivery.

In describing the various components of program delivery, this study also seeks to lay the foundation for future research to establish performance measures that can be used to evaluate the breadth and intensity of the implementation of an education and enforcement-based program. As the nature of pedestrian and bicycle safety interventions is quite diverse, there is often a lack of comparability even among interventions that have been adequately documented. This paper provides some insights regarding common program delivery metrics that can be consistently reported and shared, which may support local program decision-making, evaluation approaches, and program reporting methods in the future.

In addition, results of this process evaluation are expected to inform the results of the outcome evaluation, currently in progress. That is, the process evaluation results—detailing the scope, successes, limitations, and barriers to program implementation—may be helpful in understanding patterns of program effects. Whereas outcome evaluation is expected to demonstrate the extent to which WFM had intended effects on motorist and pedestrian behavior, the process evaluation results reported here should provide insights into reasons why the particular results were obtained.

The study also has several limitations. First, law enforcement officers completing the survey before and after receiving training are likely to have demonstrated maturation effects and test-induced performance increases, which may have impacted the post-training survey results. As no control group was used, the extent of this potential bias is unknown. Future efforts should consider this source of bias when interpreting findings related to self-reported knowledge and attitude changes and seek ways in which this bias can be mitigated through study design or analysis techniques.

Second, with regards to the presentation of media-related program delivery metrics, this study focused on a single media market in NC. It is not known how differences in media markets—including available media, population characteristics, and geographic spread—may affect access to media, costs of purchased media, media impressions, and the value placed on earned and donated media, making these measures difficult to compare across regions. Additional research is needed to better understand the comparability of media-related program delivery metrics in various regions.

A third limitation is the potential to under-report activities that were performed. This limitation is inherent to all large, community-based interventions. Each of the participating agencies had their own coalitions engaged in activities over ranging periods of time. Researchers made multiple efforts to track activities through direct interaction with agency staff and through a series of web-based surveys. While most staff were responsive to requests, certain activities were not always coordinated or were not planned in advance, so it is very possible that staff may have under-reported the true amount of intervention delivery taking place within their respective jurisdictions. In the 2014 launch of the program Statewide, steps have been taken to improve information reporting by making certain data-reporting elements mandatory, by providing uniform data reporting templates, and by building in regularly-scheduled reporting meetings into the program delivery process.

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