



Call 911 Programs for Reporting Suspected Impaired Driving

A Preliminary Investigation in Four Canadian Communities

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Introduction

Impaired driving is a major cause of unintentional injury in Western industrialized nations, including Canada. Estimates suggest that in 2010 between nearly 1,000 and 1,500 people died in alcohol-related crashes in Canada (MADD Canada; Pitel & Solomon, 2013). Additionally, of the almost 300,000 people seriously injured in motor vehicle crashes in 2010, 63,821 (more than one in five) resulted from impairment-related crashes (Pitel & Solomon, 2013). The rate of alcohol-related serious injuries is estimated by MADD Canada to be 175 per day.

Over the past several decades, national and provincial legislation has been enacted to reduce the toll of impaired driving in Canada including lowering the per se limit to a blood alcohol concentration (BAC) of .08, short-term administrative license suspension at a BAC level of .05, graduated driver licensing, zero tolerance, use of alcohol ignition interlocks, and so forth. The value of laws and policies to deter unwanted behavior, however, depends substantially on their enforcement—that is, the ability of law enforcement to detect and apprehend those who violate the law so that appropriate penalties may be applied. When the public perceives that the probability of detection of impaired driving is low, the likelihood that drivers will operate a motor vehicle after drinking alcohol is higher than when the chances of detection and the probability of sanctions are high (Ross, 1982).

Patrolling the roadways to ensure that a relatively high proportion of impaired drivers are identified and apprehended—and, hence, that drivers perceive that if they break the law they will be caught—is labor intensive and presents a challenge to police departments' efforts to conduct strong traffic enforcement. One way to augment police efforts is to have the public act as the “eyes” of police by reporting suspicious driving behavior to authorities, who can then be dispatched to investigate further and make an arrest, if it is warranted. In some U.S. jurisdictions such as Montgomery County, Maryland, citizen volunteers have been trained in the impaired driving detection cues and equipped with communications devices so that they can report suspected impaired drivers more directly and quickly to the police (Kelley-Baker, Brainard, Lacey, Vishnuvajjala, & Cobb, 2008). More often, citizen's reporting programs involve public education and publicity campaigns to encourage all motorists who observe suspicious driving behavior that may indicate impairment to call a dedicated phone line or a general emergency number such as 911. As part of the state of New Mexico's comprehensive impaired driving system, a toll-free hotline was established for reporting suspected impaired drivers. In 2006, public use of the hotline resulted in nearly 2,600 calls; three years later, almost 21,000

calls were received that resulted in 1,814 contacts with the public by law enforcement and 418 impaired driving arrests (Ramirez, Lacey, & Tippetts, 2014).

Over the past decade, numerous communities across Canada have established local Call 911 programs. Some of these were started before MADD Canada launched its Campaign 911 initiative in May 2007 to encourage and support citizens' reporting efforts nationwide to deter impaired driving; others were initiated in response to MADD Canada's efforts.

MADD Canada's Campaign 911

Campaign 911 is a nationwide public awareness campaign developed by MADD Canada in collaboration with its partner organizations in law enforcement (e.g., the Canadian Police Association, Canadian Association of Police Boards) to empower citizens to assist the police in keeping Canadian roadways safe by calling in suspected impaired drivers. To be empowered, citizens need to have the ability to identify the signs of impaired driving and the competency and willingness to make the call. Thus, Campaign 911 materials were designed to enhance awareness of the problem of impaired driving, provide education materials to support citizen reporting, and foster a sense of civic responsibility or guardianship. The campaign aimed to enhance 911 efforts in local communities where they already existed and encourage communities without current programs to implement them.

With the program's launch, MADD Canada and its local chapters began distributing educational materials across the country in several forms—posters, bookmarks, public service announcements (PSAs), bus advertisements and banners, and perhaps most importantly, signs posted along roadways. The purpose of these materials was to provide Canadians with knowledge about how to identify signs of impaired driving and how to report necessary information to police dispatchers. The materials also reinforce safety messages that the public's role is to report relevant information to the police and not to try to apprehend suspected impaired drivers. One of the key components of the public awareness campaign is the installation of permanent road signs providing a simple call to action. Although other informational materials support program messages (e.g., pamphlets, coffee mugs, etc.), the permanent signage is seen as crucial to raising and maintaining awareness. Having a highly visible 911 program is expected to enhance specific deterrence by getting more impaired drivers off of the roadways and general deterrence by increasing public perceptions that there is a higher likelihood of being caught if one drives impaired.

Within the past several years, some local 911 programs have undertaken efforts to assess their effectiveness. Two programs that have been subject to initial evaluation are in the province of Alberta, Canada—one in the city of Edmonton and the other in Calgary. These programs and their recent evaluations are discussed in the next sections.

Curb the Danger (Edmonton)

In October 2006, the Edmonton Police Service (EPS) established a new program, Curb the Danger (CTD), designed to improve communication with the public, enhance community awareness of impaired driving, and increase enforcement of impaired driving laws by encouraging road users to report suspicious driving by calling 911. Overall, the program's focus was to increase community participation in the real-time detection and apprehension of impaired driving offenders. To promote this police-community collaboration, the EPS partnered with the City of Edmonton Office of Traffic Safety to provide highly visible signage for the program (Edmonton Police Service, 2008). The signs, which are strategically placed in key locations throughout the city, encourage motorists to call 911 if they see a possibly impaired driver on the road.

When the caller can provide sufficient information to the police dispatcher (e.g., vehicle description and license plate, location, and driving pattern), one result is that the vehicle is successfully intercepted by the police and an assessment is made of whether the driver is impaired. Alternatively, when interception is not possible, a letter is sent to the registered owner of the vehicle detailing the incident along with contact information for the CTD program. In cases where the caller cannot safely keep the suspected impaired driver in view or provide the information necessary to dispatch a police vehicle, the call is terminated and the incident is broadcast to all police as a "Be On the Lookout For" (Edmonton Police Service, 2009). In addition to sending letters, the CTD team tracks license plate numbers to detect repeat calls on a vehicle, which are then forwarded to Traffic Section, Patrol, or the Driver Fitness and Monitoring Board (if the case appears to involve suspected medical issues). If successful, this citizen-police partnership is expected not only to increase the odds of detecting and apprehending impaired drivers, but also ultimately to increase the level of deterrence in the community and over time decrease the number of impaired driving crashes, fatalities, and injuries.

The CTD program was recently the subject of a process and outcome evaluation (Grekul & Thue, 2013). The purpose of the evaluation was to describe the CTD program and to examine its effects on the following intermediate outcomes: (a) communication with citizens regarding impaired driving, (b) awareness of impaired driving among the public, and (c) enforcement of impaired driving. Data used in the evaluation came from three sources: (a) the EPS computer-aided dispatch system including the details of CTD calls; (b) CTD program data on CTD calls and their outcomes (e.g., numbers of interceptions by police and various actions resulting from calls such as letters sent to the registered owners of vehicles, 24-hour license suspensions, and impaired driving and other charges laid); and (c) results from the *2010 Edmonton Survey*, conducted by the University of Alberta's Population Research Laboratory. The *2010 Edmonton Survey* was a random-digit-dial phone survey of 402 city residents on topics including the CTD

program. For the EPS computer-aided dispatch system, data were available from 2004 to 2009, encompassing nearly three years prior to program implementation and three full years after the program was initiated.

Data analyses showed that after the CTD program was implemented in October 2006, the numbers of calls regarding suspected impaired drivers increased significantly. Calls for service to EPS to report incidents of suspected impaired driving significantly increased 44% from 6,618 in 2006 to 9,559 in 2007, the first full year of program operation. Additionally, the subset of calls for service that resulted in sufficient information reported by the caller so that police could be dispatched to investigate a suspicious vehicle for impaired driving (dispatched calls) also increased significantly from the year before the program to the first year of implementation (by 65% from 2,647 in 2006 to 4,361 in 2007). For the 3-year post-implementation period, the researchers found that each year about 30% of calls from citizens were successfully intercepted by police and 18%-30% of registered owners received a letter. In terms of charges against drivers, each year since program implementation about 31% of intercepted calls resulted in an impaired driving charge (representing a total of 2,595 drivers between 2007 and 2009); 24-hour suspensions were in the 2%-4% range. Finally, the number of tickets issued in relation to a CTD call increased steadily and included a wide range of traffic offenses—careless or dangerous driving, speeding, hit and run—and other criminal offenses—assault, theft, drug- and alcohol-related offenses, firearms-related offenses, and breach of probation. Considering interceptions and letters together, the CTD program has resulted in more than 50% of calls leading to some form of official police attention. This translates into nearly 15,000 citizens over 3 years being subjected to some form of specific deterrence.

The survey data indicated that 66% of Edmonton residents were aware of the CTD program. Of those respondents who were aware of the program, 40% reported having seen program signs on the roadways, 44% had heard about the program on the radio, 39% learned about it from television, 25% read about it in the newspaper, and smaller proportions learned about it from friends and the Internet. Of the 39% of those who reported having witnessed what they thought might have been an impaired driver, only about one-quarter (26%) had called in to report the incident. The same percentage believed it was extremely likely or likely that other adult city residents would call 911 if they encountered a suspected impaired driver. With respect to deterrence, respondents were asked about their perceptions of the likelihood of detection of an impaired driver. Only 17% reported believing that it was extremely likely or likely that a person who had had too much to drink would be stopped by police.

Considering the enforcement and survey data together, the study authors noted that although the CTD program has become a major source of impaired driving charges (accounting for 40% or more of these charges each year), the program's impact on deterrence was lagging behind. Despite the increase in calls, a large majority of suspected impaired drivers were not

being reported by the public and a large gap existed between knowledge of the program and action. Thus, although the program had succeeded in its goals of increasing communication and public awareness of impaired driving and its enforcement, there was room for improvement in the public's responsiveness.

Report Impaired Drivers (Calgary)

Three years after Edmonton established its program, a similar initiative to engage citizens in calling 911 to report suspected impaired drivers was started in Calgary, Alberta, Canada. Calgary's program, known as Report Impaired Drivers (RID), launched in October 2009. The RID Program is a collaborative effort involving numerous traffic safety partners including the Calgary Police Service (CPS), Public Safety Communications, MADD Calgary Chapter, MADD Canada, City of Calgary Roads, and the Alberta Health Services. Representatives from these organizations formed the RID Steering Committee to oversee the development and implementation of the program.

Based on the MADD Canada Campaign 911, the core of Calgary's program is a public media campaign (RID Campaign) designed to raise awareness of the problem of impaired driving, educate the public on the signs of possible impaired driving, and encourage road users to report cases of possible impaired driving in real time. Key messages for the media campaign were adapted from the MADD Campaign 911 and included "Report Impaired Drivers, Pull Over, Call 911" and "It's your community. It's your call." The educational materials distributed to the public consisted of three primary messages—"10 Possible Signs of an Impaired Driver," "Safety Reminders," and "What to Do If You Observe a Suspected Impaired Driver." The campaign and supporting materials focused on raising public awareness, increasing citizens' self-efficacy to identify an impaired driver, and fostering the behavior of reporting suspected impaired drivers.

The evaluation of the first year of the RID Program (Einitsky & Staniland, 2011) was conducted between August 2009 (a couple of months before program implementation) and August 2010 and consisted of three parts: (a) a description of the RID Campaign, (b) an analysis of program implementation, and (c) an analysis of early effects. Data sources for the process components of the evaluation included program monitoring data (e.g., activities and operations) and 911 call response tracking data (provided by the CPS computer-aided dispatch system). The assessment of changes in early outcomes associated with RID Campaign was based on a pre-post launch public survey developed by the Alberta Health Services and finalized by the RID Steering Committee, with input from the survey contractor, NRG Research Group. The purpose of the survey was to provide estimates of exposure to program messages and changes in both cognitive variables of interest—awareness and attitudes—and behavior. Specifically, the survey asked respondents about their self-efficacy in identifying impaired driving, whether they would call in to report a suspected impaired driver if they saw one on the road, and, if they would not, their reasons for not taking action.

Regarding program implementation, the RID Campaign was delivered as intended based on the program description. A media conference at the RID Campaign launch included representatives from all traffic safety partners. Outdoor media included large roadside signs (posted for 6 months), transit king boards (bus ads that ran for 8 weeks), print collateral materials (e.g., bookmarks, posters), and other media channels such as participating organizations' websites, PSAs, and so forth. Organizational support from partnering entities was high, with critical support from Public Safety Communications (education and training of call centers' staff to handle calls) and the CPS (coordinating all aspects of the RID Campaign, ensuring that officers received education and training to deal with the increased volume of calls for service). The campaign received a more extensive mix of media elements than originally planned to due in-kind contributions from several partner organizations. Although the program received good overall support from the media and endorsement of the campaign's messages, there was also some negative media concerning the capability of timely responses to a 911 call.

In terms of early program outcomes, the survey data ($n = 500$ at pre- and posttest) provided estimates on attitudes and intentions, while call data were used to track changes in behavior. In May 2010 (about seven and a half months after implementation), 29% of the sample recalled hearing about the RID Campaign; the most common ways of learning about the program were through the media and billboards. Intentions to call 911 if a suspected impaired driver were encountered remained stable at 83% at both pre-and posttest. Interestingly, endorsements of some of the reasons for not calling 911 increased slightly across survey administrations: 11% to 20% for "it is not my problem," 57% to 65% for "it is the job of the police," 5% to 16% for "no cell phone." Calgarians' confidence in their ability to identify signs of suspected impaired driving showed very little change. Finally, despite little change in attitudes and intentions, the change in call volume suggested that the target behavior did change. During the first year of the RID Campaign, calls to report suspected impaired drivers increased 80% compared to the same period one year earlier. In turn, data on the number of impaired driving charges made increased by 28% (268 before the RID Campaign to 343 in the first year of the program).

Across both sites' evaluations, data suggest that Call 911 programs using public awareness programs to encourage the public to assist the police in identifying impaired drivers have been successful in increasing call volume (even if self-reported attitudes and intentions showed no change) and the numbers of impaired drivers intercepted by police. Neither evaluation, however, was designed to assess the longer-term outcomes anticipated from these programs in terms of reduced rates of impaired driving crashes, injuries, and fatalities.

The Current Study

To address the issue of whether Call 911 programs in Canada have been associated with reductions in the consequences of impaired driving (e.g., alcohol-impaired crashes), MADD

Canada contracted with Pacific Institute for Research and Evaluation (PIRE) to conduct a multi-site study using a pre-post design. Initially, the plans were to gather data from a total of six local sites selected by MADD Canada, with three matched pairs of sites where one site in each pair had a program that had been in existence for several years and another site in each pair, with a much more recent program, was to serve as the comparison. Data were to be collected for the period 2003 through 2010 to include several years of data before and after the 2007 introduction of MADD's Campaign 911. Given the start dates of local programs, this period would likewise allow for 3 or more years of pre-implementation data and, for most sites, at least 2 years of post-implementation data. PIRE researchers contacted each of the sites and requested data on program implementation (e.g., road signs posted, educational materials distributed); intermediate outcomes (e.g., 911 calls, impaired driving arrests, and sobriety checkpoints); and longer-term outcomes such as traffic crashes, fatalities, and injuries.

After several years, data had been obtained from four sites. In most cases, sites could only provide some portion of the total data that had been requested. Additionally, the specific data provided across sites varied considerably and often did not overlap. Given the number of sites and the amount of comparable data across sites, the scope of the evaluation was limited. In the end, the research questions that could be addressed by the current evaluation were the following:

1. Is there evidence of a reduction in the rate of alcohol-related crashes from pre- to post-implementation in communities with relatively strong call 911 programs versus comparison communities?
2. Has there been a decrease from pre- to post-implementation in the ratio of single-vehicle nighttime crashes to multiple-vehicle daytime crashes in the sites with relatively strong implementation versus comparison sites?
3. Has there been a significant increase from pre- to post-implementation in impaired driving enforcement (impaired driving arrests, sobriety checkpoints) in sites with relatively strong versus comparison programs?

Methods

The current research design used an 8-year period from 2003 through 2010. Data from four Canadian cities (Calgary, Edmonton, Fredericton, and York Region) were analyzed to determine whether the implementation of the Call 911 program had a notable impact on (1) fatal alcohol-related crashes, (2) non-fatal (i.e., injury) alcohol-related crashes, (3) alcohol crash rate, (4) single-vehicle and multiple-vehicle crash ratios, (5) impaired driving arrests, and (6) frequency of sobriety checkpoints conducted by each city. Of particular interest is whether the implementation strength of the Call 911 program had a significant impact on any of the outcomes listed above.

Sites

The four sites participating in the evaluation were Calgary, Alberta (program start October 2009); Edmonton, Alberta (program start October 2006); Fredericton, New Brunswick (program start spring 2008); and York Region, Ontario (program start June 2006).

Sources of Data

Licensed drivers. The current study used the number of licensed drivers in each city to develop rates. Data for three of the sites were provided by MADD Canada; in the case of Fredericton, MADD Canada was able to supply the number of licensed drivers for the province of New Brunswick. Total licensed drivers in Fredericton were estimated by dividing the total population aged 16 and older of Fredericton by the total population of New Brunswick aged 16 and older, and then multiplied that proportion by the total number of licensed drivers in New Brunswick. This provided an estimation of the total number of licensed drivers in Fredericton. The data on licensed drivers were used to calculate crash rates, the alcohol-related incidents measure (see section below on crash data).

Length of Call 911 program. Implementation dates for each of the four cities were derived from published program materials or queries placed with program officials. For each of the four cities, the years in which the Call 911 program was implemented in its entirety were coded as “1” and the years before the implementation of the program were coded as “0.” The year in which the program was implemented was coded as a proportion to reflect the time of year in which the change was enacted. For example, if the program was enacted in September, where it would be present for only a third of that year, it was coded as “0.33”; if the program was enacted in April, where it would be present three quarters of the year, it was coded as “0.75” and so forth.

Call 911 road signs. The strength of the program was assessed by examining the annual number of Call 911 signs each city chose to post. These data were gathered from calls made to program officials. In a short telephone contact, officials were asked to provide the number of signs in their communities for each year of program implementation; if they could not provide an exact number, ranges were provided for estimates (e.g., 1-9 and 10-19 at the low end to 75-99 and 100 or more at the high end). Cities that placed more than 50 signs throughout the duration of the study period were categorized as “strong implementation sites,” while those that posted fewer than 50 signs were deemed “comparison sites.” Based on these criteria, two cities were deemed to have strong implementation (Edmonton and York), while two served as comparisons (Calgary and Fredericton).

Alcohol-related and non-alcohol-related crashes. Annual data from each of the four cities’ police services were sought for both alcohol and non-alcohol crashes—as determined in police accident reports—and were used to calculate ratios and rates for analyses. First, the fatal

crash ratios and non-fatal crash ratios were calculated to assess alcohol involvement in crashes with at least one fatality or in which someone was injured. For each type of crash, the number of crashes that were positive for alcohol was divided by those crashes that were deemed not to involve alcohol. Second, the alcohol-related incidents measure was calculated—the rate of alcohol-related fatal plus injury crashes per 10,000 drivers.

In theory, many variables could potentially impact the rates of alcohol-related crashes in any city (e.g., road conditions, weather, impaired driving laws, policies such as enforcement, etc.) and, as such, ideally each of these variables would be controlled for in data analyses. Unfortunately, even if it were possible to know all the potential factors that may contribute to alcohol-related crashes, obtaining accurate operational measures for each would be impossible. However, as many of these unknown factors would likely impact alcohol-related and non-alcohol-related crashes equally, the use of non-alcohol-related crashes in the denominator helps control for many of these potential effects.

SVN to MVD crashes. In addition to gathering data concerning the presence of alcohol in both injury and fatal crashes, we gathered data on single-vehicle nighttime crashes (SVN) and multiple-vehicle daytime crashes (MVD). Single-vehicle nighttime crashes were defined as those crashes involving one vehicle and occurring between 10:00 p.m. and 6:00 a.m., whereas MVD crashes were those involving more than one vehicle and occurring between 6:01 a.m. and 9:59 p.m. These particular time periods and types of crashes are of interest as previous research has established that SVN crashes are the most likely to involve alcohol, while MVD crashes are least likely to be alcohol-related (Heeren, Smith, Morelock, & Hingson, 1985; Voas, Romano, & Peck, 2009) and thus serve as good surrogates when crash data are not available. Heeren et al. (1985) concluded that all nighttime fatal crashes would provide an appropriate surrogate measure. Voas, Romano, and Peck (2009) updated the Heeren et al. (1985) study confirming the validity of the SVN surrogate for alcohol-related crashes. These data on SVN and MVD crashes were collected from analysts within each of the respective police services; for Edmonton, we also received data from the Office of Traffic Safety.

Impaired driving arrests. When attempting to gauge the effectiveness of a program targeting impaired driving, assessing how the implementation of that program impacted impaired driving arrests is vital. These data were also provided by the police services.

Sobriety checkpoints. Similar to impaired driving arrest data, other enforcement-related data that may be related to the implementation of the Call 911 program might include the use of sobriety checkpoints. Sobriety checkpoints were measured by the number of days in a year a given city chose to conduct checkpoints rather than the total number of individual checkpoints set up by police in a year. That is, if police conducted three checkpoints in one day, it was counted as one rather than three. The police services were the source for checkpoint data.

Data Analyses

Data in the current study were examined using a series of Multiple Linear Regression (MLR) analyses. Analyses were conducted using (1) fatal crash ratio (alcohol-related to non-alcohol-related crashes), (2) injury crash ratio (alcohol-related to non-alcohol-related crashes), (3) alcohol-related incidents rate (alcohol-related fatal and injury crashes per 10,000 licensed drivers), (4) SVN to MVD ratios, (5) impaired driving arrests, and (6) sobriety checkpoints as outcome variables, and (1) implementation dates for the Call 911 program and (2) number of Call 911 road signs posted as predictor variables. All analyses were conducted using SPSS v. 21 (IBM Corporation, 2012).

Results

Before conducting MLR analyses, the data were examined for missing items and outliers. In analyses where not all cities were able to provide necessary data (e.g., Fredericton did not provide information on impaired driving arrests, York did not provide information on sobriety checkpoints), listwise deletion was utilized. That is, only cities that provided complete data for each research question were included in the corresponding analysis. For analyses related to Research Questions 1 and 2, 32 (4 cities x 8 years) data points were analyzed; when examining impaired driving arrests and sobriety checkpoints (Research Question 3), 24 (3 cities x 8 years) were analyzed. No outliers were found to fall outside of the expected range of values. As such, these values are believed to represent true responses and were retained for analysis. Table 1 displays the Pearson correlations between each of the predictor and outcome variables.

Table 1. Correlations Matrix.

	1	2	3	4	5	6	7	8
1 Alcohol-related incidents	1.000							
2 Fatal crash ratios	.019	1.000						
3 Non-fatal crash ratios	-.340	.232	1.000					
4 SVN/MVD crash ratios	-.457*	-.147	-.046	1.000				
5 Impaired driving arrests	.338	.053	-.219	-.411	1.000			
6 Sobriety checkpoints	.973**	.114	-.405	-.378	.909**	1.000		
7 Length of Call 911 program	-.194	-.162	.336	.146	-.247	-.400	1.000	
8 Call 911 road signs	-.375*	-.023	.427*	.183	-.255	-.425	.848**	1.000

* $p < .05$

** $p < .001$

Research Question 1: Is there evidence of a reduction in the rate of alcohol-related crashes from pre- to post-implementation in communities with relatively strong Call 911 programs versus comparison communities?

Research Question 1 was analyzed in a series of MLR analyses. The first two analyses examined the ability of the two predictor variables—length of program implementation and number of 911 road signs—to predict (1) the ratio of alcohol-related fatal crashes to non-alcohol-related fatal crashes and (2) the ratio of alcohol-related injury crashes to non-alcohol-related injury crashes. Because Call 911 road signs would not be expected to be present prior to the implementation of the program itself, a high correlation between the two variables was evident ($r = .848$). However, road signs were not used in all the years the program was implemented for all cities in the current study and, subsequently, the two variables warranted separate evaluation. For fatal crash ratios, the overall model was not found to be significant ($R^2 = 0.073$, $F(2, 28) = 1.099$, $p = .347$), indicating that the implementation date of the Call 911 program and the strength of the program as measured by the presence of road signs did not explain a significant amount of variance in the fatal crash ratio. However, the injury crash ratio—though also not significant—appeared to trend towards significance ($R^2 = 0.185$, $F(2, 29) = 3.290$, $p = .052$). This may indicate that insufficient strength in the analysis may be partially responsible for the lack of significant findings. See Table 2 for detailed MLR results for all analyses.

To further examine Research Question 1, MLR analysis was used to assess the ability of the two program variables to predict alcohol-related incidents (fatal and non-fatal alcohol-related crashes per 10,000 drivers). The length of implementation of the Call 911 program in all cities accounted for almost 44% of variance in alcohol-related incidents ($R^2 = 0.439$), while the number of road signs posted in each city for each year of the study accounted for about 75% of variance in the same ($R^2 = 0.747$). The total variance explained by the model as a whole was about 20% ($R^2 = 0.195$), $F(2, 29) = 3.509$, $p = .043$. Although length of time since program implementation was unexpectedly and positively related to the variance within the crash rate, the number of road signs was negatively related to the crash rate variance as expected. Thus, programs that posted more signs were able to explain greater amounts of variance in alcohol-related fatal and injury crashes per 10,000 drivers than were sites with fewer signs. This could indicate that the number of road signs reminding drivers to report suspicious driving was the single greatest predictor of program success in the current study.

Research Question 2: Has there been a decrease from pre- to post-implementation in the ratio of single-vehicle nighttime crashes to multiple-vehicle daytime crashes in the sites with relatively strong implementation versus comparison sites?

Research Question 2 was analyzed using MLR analysis examining the ability of the two program variables to predict the ratio of single-vehicle nighttime crashes to multiple-vehicle

daytime crashes. For the ratio of SVN to MVD, the overall model was not found to be significant ($R^2 = 0.034$, $F(2, 21) = 0.369$, $p = .696$), indicating that the implementation date of the Call 911 project and the number of road signs failed to explain a significant amount of variance in the variance of the SVN to MVD crash ratio.

Research Question 3: Has there been a significant increase from pre- to post-implementation in impaired driving enforcement (impaired driving arrests, sobriety checkpoints) in sites with relatively strong versus comparison programs?

Research Question 3 was also examined using MLR to determine whether the length of program implementation and program strength as measured by the number of road signs predicted (1) the rate of impaired driving arrests and (2) the number of sobriety checkpoints conducted in a year in each city. The model predicting the rate of impaired driving arrests was not found to be statistically significant in the current study ($R^2 = 0.062$, $F(2, 28) = 0.926$, $p = .408$). Similarly, the model predicting sobriety checkpoints was also not found to be significant in the current study ($R^2 = 0.186$, $F(2, 20) = 2.291$, $p = .127$).

Table 2. Outcome Models for Alcohol-related Fatal and Non-fatal Crashes, SVN to MVD Crashes, Impaired Driving Arrests and Sobriety Checkpoints.

	β	R	R^2	Adj. R^2	F	Df	p
Alcohol-related incidents rate ^a		.441	.195	.139	3.509	2,29	.043
Call 911 Implemented	.439						
Call 911 Signs	-.747						
Fatal alcohol-related to non-alcohol-related ratio		.270	.073	.007	1.099	2, 28	.347
Call 911 Implemented	-.506						
Call 911 Signs	.406						
Injury alcohol-related to non-alcohol related ratio		.430	.185	.129	3.290	2,29	.052
Call 911 Implemented	-.093						
Call 911 Signs	.506						
SVN to MVD ratio ^b		.184	.034	-.058	0.369	2, 21	.696
Call 911 Implemented	-.033						
Call 911 Signs	.211						
Impaired Driving Arrests		.249	.062	-.005	0.926	2, 28	.408
Call 911 Implemented	-.200						
Call 911 Signs	-.056						
Sobriety Checkpoint		.432	.186	.105	2.291	2, 20	.127
Call 911 Implemented	-.140						
Call 911 Signs	-.307						

^a Alcohol-related fatal and injury crashes per 10,000 drivers

^b SVN (single-vehicle nighttime) and MVD (multiple-vehicle daytime)

Discussion

Summary of Findings

The current study examined four Canadian cities (Calgary, Edmonton, Fredericton and York) over a period of eight years (from 2003 through 2010) to determine whether implementation of the Call 911 program had a notable impact on alcohol-related crashes and impaired driving enforcement. Specifically, the study sought to examine how the length of program implementation and the strength of the program (as measured by number of road signs used by each city) impacted specific measures of these outcomes.

Of note, although the model was unable to explain a significant amount of variance in fatal crash ratios, it was found to be trending toward significance in explaining variance in injury crash ratios. Specifically, Call 911 implementation period and program strength accounted for approximately 18.5% of variance in alcohol-related injury crashes. Further, when we examined alcohol-related fatal and non-fatal crashes per 10,000 drivers as an outcome, nearly 20% of variance was accounted for by program implementation and strength. No significant relationships were supported in the current study when examining SVN/MVD ratios, impaired driving arrests, or sobriety checkpoints.

Study Limitations

The current study has several limitations that should be considered when interpreting the findings. As this is a study of the effectiveness of road signs prompting drivers to report suspected impaired drivers, a measure of exposure would have been desirable. However, survey data regarding the percentage of drivers who had seen signs were not available from each community. Consequently, each of the four cities was asked to provide an estimate of how many drivers may have been exposed to the signs. The extreme variability in these estimations (ranging from as low as 3% to 100%) made these estimates impractical for analytic purposes, and they were subsequently removed from analyses.

Second, several cities were unable to provide some pieces of information for certain years. In some cases, outcome variables (e.g., impaired driving arrests and sobriety checkpoint frequencies) were unavailable for the entire study period and subsequently had to be eliminated from corresponding analyses. As the current study had a potential of 32 maximal data points (four cities x eight years), missing data had significant repercussions for statistical power, reducing the likelihood of observing significant results and increasing the likelihood of a Type II error.

Further, understanding the *strength* of the Call 911 program was vital to being able to answer all of the research questions. In the current study, strength was measured as the number of road signs posted by a city in any given year. In most cases, cities were able to

provide exact numbers of signs posted; however, one city was unable to provide these data and instead provided estimates of the number of signs. These estimates were notably larger than any of the other sites, which provided actual counts of signs, and may have contributed to skewing the outcome of the analyses.

An additional limitation concerns the data on the number of calls made to report suspected impaired drivers. One way to assess the effectiveness of a citizen's reporting program would be to examine the number of calls made to emergency response officials. Unfortunately, one city was unable to provide this information for any year of the study, while two more only reported calls made during the years the study was in effect, making a pre-post analysis impossible. Future examinations into the efficacy of Call 911 programs should ensure the collection of this data throughout the duration of the study to allow for appropriate analyses.

Finally, numerous variables could potentially impact fatal and non-fatal crashes—including national or provincial alcohol-related laws, driving safety laws, enforcement, vehicle kilometers traveled, etc. Ideally, these variables would have been identified and conceptualized, and appropriate data would have been collected, to allow for them to be controlled in all subsequent analyses. However, it was not possible within the confines of the study to collect data on these variables and, thus, they were not controlled for in the analyses. Future studies should seek to identify and control for these variables to gauge their impact on crash ratios.

Applications of 911 Call Data

In addition to tracking citizen participation in collaborative efforts to remove impaired drivers from the roads, the Call 911 data may serve other uses. For example, in the CTD evaluation, Grekul and Thue (2013) noted that the initiation of the Call 911 program in Edmonton resulted in an increase in calls for service to police (as was true in other sites); this increase presented a challenge for managing police resources. However, temporal analyses of call data could be used to determine the days and times associated with the greatest call volume and used to strategically deploy police resources. An assessment could then be made to determine whether the dedication of additional or targeted officer deployments is practical and producing desired results (e.g., more vehicle interceptions, more impaired driving charges laid). The authors also noted that spatial analyses of the call data could be useful in identifying where in the community impaired driving is occurring. Such analyses may identify problematic locations (e.g., licensed premises selling alcohol) and could inform decisions about where to locate Call 911 signs as well as police resources.

Other sites in Canada have similarly proposed and/or implemented creative applications of the Call 911 data. For example, in Saint John, New Brunswick, the Call 911 data were used to

develop an innovative enforcement strategy that shows great promise (Stewart, 2012). The MADD Campaign 911 was launched in Saint John in May 2007. The Saint John Police Service discovered that a high percentage of impaired driving calls for service involved vehicles that appeared in their system two or more times, many of which were never caught by the police.

During a 4-year period, out of 3,125 impaired driving calls for service, 2,480 (nearly 80%) had complete license plate information. Out of those 2,480 vehicles that were reported as having an impaired driver via the 911 Campaign, 512 (20.6%) appeared in the police system more than once. The Saint John Police Service termed these Repeat Target Vehicles (RTVs). They noted that almost a quarter (24.3%) of repeat impaired driving calls for service occurred within 30 days of the first call. When they closely examined 7 RTVs, they found that 4 of those 7 were later involved in a reported crash.

Of 64 alcohol-impaired-driving crashes in Saint John occurring since 2000, 26 crashes (41%) involved a vehicle with a prior call for service for impaired driving. Six of the 26 vehicles appeared in the 911 system anywhere from 4 to 8 times. As a result of this analysis, the registered owners of RTVs in Saint John are now being sent official letters that their vehicle has been flagged for possible impaired driving and that patrol members are aware of this and vehicle checks will be made. Also, spot checks are now conducted near locations where RTVs have been reported. Had this strategy been in place earlier, 4 of the 6 RTVs cited between 4 to 8 times would have been flagged before their involvement in subsequent crashes. This research and use of the 911 system has created opportunities for developing new, innovative impaired driving enforcement strategies that were not possible in the past.

In conclusion, although the statistical analyses in this report (with all the data limitations) produced few significant associations between the Call 911 measures and outcomes used, the program still appears to have benefits. As described earlier, individual studies (Einitsky & Staniland, 2011; Grekul & Thue, 2013) showed increases in citizen calls for service for potential impaired drivers and the numbers of vehicles intercepted by police. Certainly the signage and publicity in the Call 911 communities have increased awareness of the impaired driving problem. Police cannot patrol every roadway at all times to detect impaired driving, so citizen reporting can help in that regard. Finally, at least in New Brunswick, an innovative enforcement strategy is being used based on Call 911 data that has potential to reduce impaired driving in that community.

Guidance for Developing Strong Call 911 Programs

Despite the lack of significant findings, important information was gleaned throughout this effort to evaluate the Call 911 strategy. This information provides guidance on how to establish and maintain Call 911 initiatives (i.e., programmatic efforts) and effectively assess the

contributions of these programs to the incidence of impaired driving in the community (i.e., data/evaluation efforts).

As with many community–police initiatives, full support for a citizen’s reporting program from command-level officers is crucial to success. The chief of police and other managers (e.g., commander of traffic safety) determine how police resources will be allocated and, thus, set the agenda for police activities, including their impaired driving enforcement effort. Their commitment to and investment in the program is essential to both establishing and maintaining an effective program. If a Call 911 program is well implemented, it likely will result in a substantial increase in the volume of calls for service to police that must be investigated. Thus, good implementation may place further demands on law enforcement resources. A police chief who is committed to the program and to using the call data to inform decisions about how to efficiently deploy police resources in response to this increased demand will be more likely to overcome these challenges and help develop a strong and successful program.

Road signs are a key tool for raising awareness and motivating citizens to call 911 to report suspicious driving behavior while they are traveling on the roadways. Signs need to be large enough to catch drivers’ attention and quickly relay the necessary information. They also need to be plentiful, yet within local community requirements. To produce maximum exposure among the driving public and be most effective in helping the public identify suspected impaired drivers, the posting of road signs should be strategic, including their placement on heavily traveled roads and locations in the community that are impaired driving “hot spots.” Data from local traffic safety offices on the average daily volume of cars traveling roads as well as police data on the locations associated with calls for service for alcohol-related incidents (e.g., fights, public intoxication, crashes, etc.) should be used to inform the placement of road signs.

Another important program feature that many Call 911 sites have instituted is the process of following up with reported vehicles that were not intercepted by police. Even with a strong program, only a proportion of reported vehicles will be identified on the roadway and stopped by police. However, if letters are sent to the registered owners of vehicles that are not intercepted (who may or may not have been the driver whose behavior was reported), the proportion of police contacts with the public concerning suspected impaired driving can be substantially increased. This dual focus may help to increase deterrence by removing impaired drivers from the roadways (those who are intercepted), and discouraging repeat impaired driving and raising awareness of the program’s efforts among the public (via the letters to vehicle owners).

Successful Call 911 efforts ideally will combine strong programmatic efforts with strong data collection initiatives so that programs can be evaluated, effectiveness can be tracked over time, and findings can be used to make program improvements. Evaluation findings may also

be used to inform the public of the successful aspects of the program and sustain community support. Such evaluation efforts require that critical data be available for several years pre-implementation and post-implementation so that stable estimates can be developed in data analyses examining changes in outcomes that are expected to vary with the program's existence and strength. Good data should be collected and analyzed on the volume of 911 calls made to police by motorists, the number of road signs posted, the number of impaired driving arrests, the origin of the arrests (i.e., from a 911 call, routine patrol, a sobriety checkpoint, or a crash investigation), the location of the arrests, and the number of repeat arrests.

In the first year or two of a program's development, changes in intermediate rather than long-term outcomes may be expected and are important in assessing program fidelity (i.e., whether implementation is proceeding smoothly, with the planned activities, and on time). Intermediate outcomes such as the reach of program messages (e.g., media coverage) and 911 calls received to report suspected impaired drivers are often collected by the police services that are key partners in their communities' Call 911 programs. Other data on intermediate outcomes that are important for determining whether the program is having desired effects include the public's awareness of the problem of impaired driving, perceived ability and motivation to call 911 if a suspected impaired driver is encountered, and perceptions about the likelihood of being apprehended for impaired driving. These self-report data are not typically obtained by police, but require surveys of the public. Partners in the Call 911 program such as provincial health services, city offices of traffic safety, and other organizations such as universities may provide the expertise needed to conduct these surveys. Finally, another intermediate-level indicator of program effectiveness is the number of impaired driving arrests that come from 911 calls. Although 911 call volume provides an indication of the public's willingness to report suspected impaired driving, it is the proportion of total arrests based on calls that helps gauge the value added to police efforts to apprehend impaired drivers that is associated with the Call 911 program. If the public is well educated in recognizing the signs of impaired driving and can provide the necessary information to police for intercepting suspicious vehicles, the proportion of calls from the public that result in police action (i.e., interception, 24-hour suspension, or letter) should be relatively high. Publicizing the success of the public's efforts can be used to leverage further support from the public and will help increase perceptions that impaired drivers will be detected and apprehended.

Ultimately, changes in the public's ability and willingness to report suspected impaired driving is expected to increase deterrence and reduce the occurrence of alcohol-related crashes, fatalities, and injuries in the community. Effects in these outcomes typically take longer to develop than changes in perceptions and behavior, although they provide the strongest evidence of program success. To capture these effects, police services will need to collect and maintain good crash data on both alcohol-related and non-alcohol-related crashes.

In summary, a successful Call 911 program needs a strong commitment from key officials in the community and a highly publicized and visible public education and awareness campaign. It also needs good data collection and evaluation activities to constantly improve methods and strategies, and to provide periodic feedback on results to the citizens in the community. Call 911 programs have good potential to reduce impaired driving in any community willing to implement them “boots and all.”

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