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Predicting the effectiveness of road safety campaigns through alternative research designs

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ABSTRACT

Introduction: A large number of road safety communication campaigns have been designed and implemented in the recent years; however their explicit impact on driving behavior and road accident rates has been estimated in a rather low proportion. *Method:* Based on the findings of the evaluation of three road safety communication campaigns addressing the issues of drinking and driving, seat belt usage, and driving fatigue, this paper applies different types of research designs (i.e., experimental, quasi-experimental, and non-experimental designs), when estimating the effectiveness of road safety campaigns, implements a cross-design assessment, and conducts a cross-campaign evaluation. An integrated evaluation plan was developed, taking into account the structure of evaluation questions, the definition of measurable variables, the separation of the target audience into intervention (exposed to the campaign) and control (not exposed to the campaign) groups, the selection of alternative research designs, and the appropriate data collection methods and techniques. *Results:* Evaluating the implementation of different research designs in estimating the effectiveness of road safety campaigns, results showed that the separate pre-post samples design demonstrated better predictability than other designs, especially in data obtained from the intervention group after the realization of the campaign. *Conclusions:* The more constructs that were added to the independent variables, the higher the values of the predictability were. The construct that most affects behavior is intention, whereas the rest of the constructs have a lower impact on behavior. This is particularly significant in the Health Belief Model (HBM). On the other hand, behavioral beliefs, normative beliefs, and descriptive norms, are significant parameters for predicting intention according to the Theory of Planned Behavior (TPB). *Practical applications:* The theoretical and applied implications of alternative research designs and their applicability in the evaluation of road safety campaigns are provided by this study.

1. Introduction

The ultimate aim of a road safety campaign is to contribute to the reduction of the number of road crashes and the number of people killed or injured on the roads, by influencing road users' behavior. Statistics show that road traffic injuries, being the eighth leading cause of death globally and the leading cause of death for young people aged from 15 to 29 years old, result in 1.24 million fatalities each year, and cause injuries or disabilities to 20 to 50 million people (WHO, 2013).

The road environment involves interactions between road users and infrastructure, traffic rules, vehicles, but also interactions among different types of road users, such as drivers, heavy vehicle drivers, motorcycle and bicycle riders, and pedestrians. Human factors are a major contributor to road crashes (Gras, Cunill, Sullman, Planes, & Aymerich, 2004); when road users do not succeed to adapt safely to the road environment, the likelihood of a crash occurrence significantly increases.

In order to influence road user behavior to follow the driving regulations and safeguard safety on the road network, interventions are required. These interventions should address aspects that motivate users to adopt a safe behavior, and quit from any unsafe acts, either unintended (i.e., slips, lapses, mistakes) or intended (i.e., violations, intentional mistakes; Reason, 1990).

Road safety communication campaigns attempt to change those parameters that affect road user behavior, change inappropriate behavior (unsafe acts) that increases risk, and promote road safety, so as to contribute to the reduction of the frequency of road accidents and the minimization of the severity of their impacts (Delhomme, De Dobbeleer, Forward, & Simões, 2009). A campaign can be conducted on a stand-alone basis and use paid advertisements, including for example mass and local media (i.e., television, radio, newspapers), outdoor media (i.e., billboards), personal media (face-to-face communication), and/or unpaid media coverage, including in this case free publicity (i.e., press releases, press articles; Delhomme et al., 2009). On the

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other hand, for the increase of the effectiveness and the coverage of the wider possible target audience, road safety communication campaigns are often combined with other supportive actions or are implemented as part of combined activities. Such integrated programs include for example the support of the campaign messages through *enforcement*, which raises the awareness of the audience about the topic that the campaign promotes, the provision of information about new or modified laws through the campaign dissemination material (*legislation*), the communication of specific issues through *education*, and the approach of people focusing on specific behaviors and the external factors that may influence them (*reinforcement*; Delhomme et al., 2009).

A large number of road safety communication campaigns has been designed and implemented in the recent years; still, the impact of the campaigns on driving behavior and road accidents' rates has been assessed in a rather low proportion. This proportion is further lower in attempts of evaluation that follow a scientifically sound methodology (Boulanger et al., 2007; Delhomme et al., 1999; SafetyNet, 2009), even though the need for evaluation is significant and the benefits important (Adamos & Nathanail, 2011; Delhomme et al., 2009). The strengths of evaluating a road safety campaign, which depicts the necessity for designing one, are (Elliott, 1989; Boulanger et al., 2009):

- To assess whether the implementation of the campaign had a positive effect in influencing road user behavior towards a safer direction (less accidents, injuries, fatalities);
- To enable the involved parties to learn about the campaign, mainly in terms of whether the campaign worked or not;
- To increase the effectiveness of the campaigns when they are in progress, by requesting, for example, additional resources for the improvement of their activities;
- To increase general knowledge about which campaigns are effective and which are not under attributes such as scope (i.e., national vs. local), target group (direct vs. indirect), activities (media vs. combined), etc.;
- To set a scientifically sound background for the design, implementation and evaluation of future campaigns, as adoption of successful channels of reaching the audience, use of theoretical models for changing road user behavior, etc.; and
- To improve road safety, by implementing techniques that have been validated by evaluated campaigns and have been indicated as the most appropriate for the derivation of reliable and statistically significant conclusions.

On the other hand, there are weaknesses when evaluating a campaign, referring for example to the difficulty of isolating potential changes in driving behavior or accident due to the campaign effectiveness (Woolley, 2001). Isolating the explicit impact of a campaign on driving behavior or accidents, especially when the campaign is accompanied by supportive actions (i.e., education) is not an easy process.

Still, there are methods, such as comparison groups (i.e., before-after design) or time series analyses that may be useful and effective for the isolation of the effects of a campaign (Delhomme et al., 2009). In addition, the separation of people into intervention groups (exposed to the campaign) and control groups (not exposed to the campaign), can be useful and efficient when evaluating, since it allows researchers to draw valid conclusions on whether the effects of the campaign were due to the campaign itself, or other consequential parameters (e.g., changes in legislation) affected results (Delhomme et al., 1999).

In literature, there is strong evidence that the adoption of a theoretical background (behavioral model) works effectively when designing and evaluating a road safety campaign, and that specific theoretical approaches apply better in this type of campaigns. For example, in "A review of mass media campaigns in road safety" (Delaney, Lough, Whelan, & Cameron, 2004), it was indicated that the Rogers Protection Motivation Theory (Rogers, 1975, 1983; Rogers & Mewborn, 1976), the Extended Parallel Process Model (Witte, 1992, 1998), and the Theory of Planned Behavior (Ajzen, 1991) showed the highest degree of applicability when developing a road safety campaign. In another report entitled "A theoretical approach to assess road safety campaigns – Evidence from seven European countries" (Forward & Kazemi, 2009), the results of the evaluation of seven campaigns in Sweden, Belgium, the Netherlands, Austria, Slovenia, Greece and Poland highlighted the necessity of using a well-structured theoretical background for the selection and assessment of the appropriate variables that predict behavior. The theoretical models used in the specific campaigns were an extended or modified version of the Theory of Planned Behavior (Ajzen, 1991) and the Transtheoretical Model (Prochaska & DiClemente, 1983). Lastly, Wundersitz, Hutchinson, and Woolley (2010) in their report "Best practice in road safety mass media campaigns: A literature review," examined 14 road safety campaigns, published from 2001 to 2009, and, among other issues, highlighted the importance of incorporating a scientific theoretical approach in the road safety campaign strategy.

Several approaches or methods of evaluating road safety campaigns are indicated in literature, with the majority of them being developed according to the timing of the implementation (i.e., before, during and after the campaign realization; Robson, 2001; MacDonald et al., 2001). In Boulanger et al. (2009), four main types of evaluation are indicated referring to *formative evaluation*, *summative evaluation*, *economic evaluation,* and *meta-analysis*. Formative evaluation is conducted in order to collect data and gather information while the campaign is being developed or in the case that an existing campaign is modified, and there is an intention for improvement (Elliott, 1989). On the other hand, a summative evaluation measures the effectiveness of an intervention on the target population, and indicates whether an initiative of the campaign strategy had the expected effect and reached the intended goals (Frechtling 2002; Robson, Shannon, Goldenhar, & Hale, 2001). The scope of an economic evaluation is to assess both the outcomes of an intervention and the cost of producing the specific outcomes. After the determination of the costs through a cost analysis, the most common methods for the comparison of the costs to the outcomes of the program are cost-effectiveness and cost–benefit analyses (Boulanger et al., 2009). Lastly, meta-analysis is a method that combines and evaluates the results of several independent studies that address a number of related research hypotheses (Boulanger et al., 2009). Examples of meta-analyses may be found in Elvik and Vaa (2004), who evaluated road safety campaigns based on changes in the number of accidents, and in the study of Phillips, Ulleberg, and Vaa (2011), which revealed that the implementation of road safety campaigns caused a reduction of accidents by 9%.

For a successful evaluation, an evaluation plan should be developed in order to ensure the high quality of the assessment, justify the time and costs, and maximize the validity of the findings and outcomes. Five phases may be considered in an evaluation plan, including (Boulanger et al., 2009):

- The engagement of stakeholders (i.e., people or organizations that have interest in investing in the campaign, or in the findings of the evaluation);
- The description of the campaign, in terms of needs, target groups, outcomes, activities, inputs, and outputs;
- The development of evaluation questions and definition of measurable outcomes;
- The selection of a research design and data collection method; and
- The data collection, analysis, reporting, and dissemination.

Based on the findings of the above described literature, including either extensive reports or individual studies referring to specific road safety campaigns, the aim of this paper is twofold:

a) To apply different types of research designs (i.e., experimental, quasi-experimental, and non-experimental designs), when estimating the effectiveness of road safety campaigns, and run a cross-design assessment, and
b) To conduct a cross-campaign evaluation.