Montana Department of Transportation March 2015
RESEARCH PROGRAMS

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Assessing the Effectiveness of Montana's Vehicle Occupant Protection Program

http://www.mdt.mt.gov/research/projects/safety/occupant.shtml

Introduction

States invest extensively in occupant protection programs, yet the impact these programs have on improving seat belt compliance rates remains unclear. Although seat belt use was on the rise in Montana prior to 2002, it has stagnated at between 76 percent and 81 percent compliance since that time (Montana Department of Transportation, 2011). Similar trends have been observed at the national level. Small declines in compliance (79.2 to 78.9 percent in 2010), paired with increases in fatal crash incidence from 2010 to 2011, brought seat restraint compliance concerns to the forefront of Montana Department of Transportation (MDT) priorities. A 2011 assessment by the National Highway Traffic Safety Administration (NHTSA) recommended that MDT enact a suite of measures aimed at improving compliance. Among these was an evaluation of existing occupant protection programs.

The purpose of this research project was to quantitatively evaluate the relationships between MDT's occupant protection program activities and seat restraint use throughout Montana. Quantitative evaluations of program effectiveness are critical to optimizing program impacts, yet performing evaluations of these programs is challenging.

What We Did

A cross-disciplinary research team worked in collaboration with MDT to produce a quantitative evaluation of four programs; Office of Public Instruction (OPI) driver education programs, Selective Traffic Enforcement Programs (STEP), Buckle Up Montana (BUMT) coalitions, and media campaigns aimed at improving seat belt use rates in Montana. Program impacts were measured using National Occupant Protection Use Survey (NOPUS) data. The objective of the analysis was to quantitatively compare seat belt use at places and times where MDT programs were present to places and times where they were not present.

To achieve this objective, the research team prepared data and constructed a statistical model that compared sites impacted by specific MDT programs to unimpacted sites. Prior to collecting data, the researchers conducted an extensive literature review on assessing occupant protection programs. This literature review revealed two issues that current program assessment protocols do not treat in depth, but which are nonetheless relevant when assessing traffic safety programs in general. First, we found little precedence on protocols for compiling program and surveillance data across the spatial and temporal domains of interest. Second, the statistical methodology employed in published analyses typically does not account for a single community hosting multiple programs geared toward achieving the same objective.

When assessing the efficacy of a single program, it is important to use methods that differentiate between all the programs present in a single community. While statistical techniques for estimating program-specific effects, and identifying treatment complexes with particular synergy, are regularly used in other fields (Gelman & Hill, 2007), we found limited application of these techniques

within the transportation safety domain (Pulugurtha & Repaka, 2008). To address these gaps, Geographic Information Systems (GIS) was utilized to link the NOPUS data to the presence of local occupant protection programs. For this project, one GIS layer consisted of the seat belt survey points, and additional layers covered each occupant protection program under assessment. For example, one layer indicated regions covered by BUMT coalitions and another layer referred to county-level STEP expenditures. After building separate layers for each program being assessed, statistical software was used to "drill down" through the GIS data to extract the values associated with each survey site. Drilling down provided a unique set of local program measures (which could be presence/absence of occupant protection program or intensity of effort, depending on available data), linked to each seat belt surveillance site.

What We Found

The evaluation suggested that MDT's programs largely operate independently of one another. Buckle Up Montana program presence was associated with increased seat restraint use rates, especially in areas that were not in large media catchment areas. Selective traffic enforcement programs showed a strong relationship with increased seat restraint use, but this relationship disappeared in models that included all occupant protection programs. Driver education program completion rates were not associated with increased seat belt use. There was no saturating effect of program impacts, except for media campaigns, where additional dollars led to improved occupant protection rates only to a point.

Detecting program-specific effects was challenging using the NOPUS data, and the team suggested additional data collection for isolating particular program effects in the future. Figure 1 shows the change in odds of seat belt usage when moving from the baseline group (no occupant protection programs present) to a modified group that includes each predictor. Factors with horizontal lines overlapping the vertical "equally likely" line represent no detectable impact on occupant protection; those to the right of the "equally likely" line are associated with significant increases in seat restraint use, and those to the left of "equally likely" are associated with diminished seat restraint use. A summary of the project conclusions are below.

MDT programs contribute to a small increase in seat belt use rates, but their impacts are small relative to other factors.
The factors with the largest effect on seat belt use rates in Montana are road type, population density, and income (Figure 1). Since none of these factors are under MDT's control, it would be easy to overlook the role that MDT's programs play. However, the effects associated with several MDT programs were significant, albeit relatively small. Buckle Up Montana coalition presence and media presence were both associated with increased seat restraint usage (though this increase was diminished when both programs impacted the same site). The slightly negative, but statistically insignificant relationship between driver education completion and seat belt use is likely to change as Montana's OPI reworks its driver education curriculum.

STEP may be highly effective, but its impacts are masked by the presence of other programs. Selective Traffic Enforcement Programs were the most effective of the programs examined when analyzed in the absence of other MDT programs, but that impact eroded when other programs were included in the model (see Figure 1, STEP). This is likely a feature of the data used, and may not reflect a true reduction of a STEP effect. The STEP activities showed similar impacts on seat belt use regardless of the population density or spatial jurisdiction in which they were allocated. This means that additional STEP hours allocated to a very rural county had similar impacts on seat belt use as STEP hours applied in an urban setting. In other words, STEP efforts in urban and rural jurisdictions

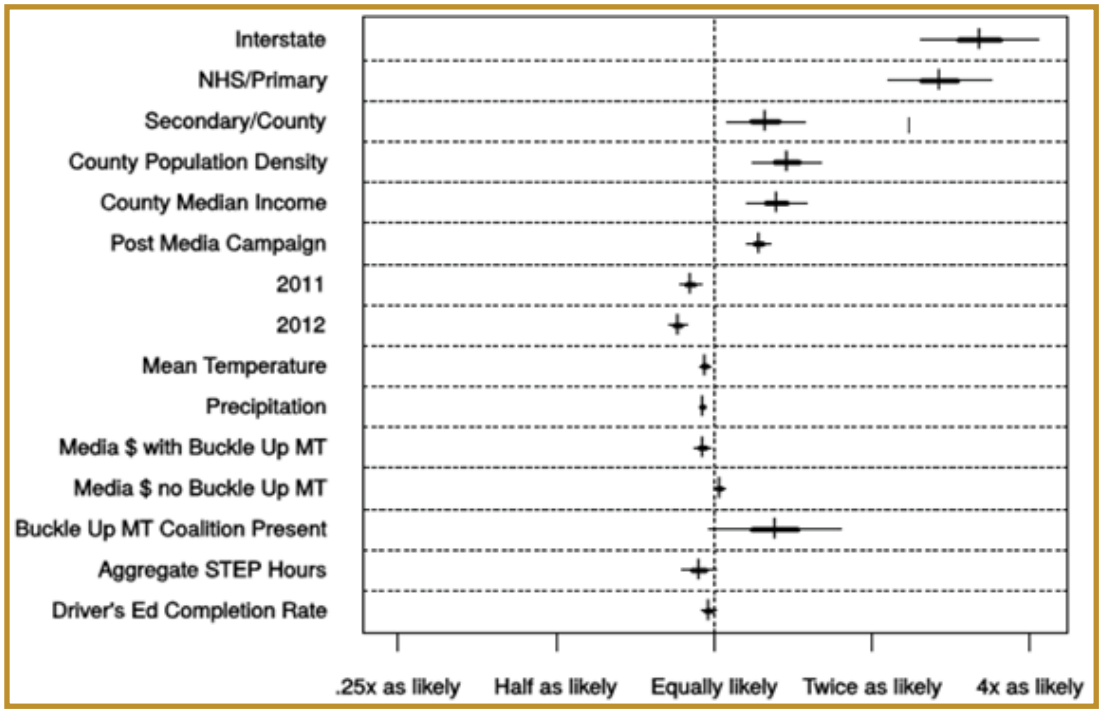

Figure 1: Factors of Seatbelt Use

access roughly the same number of vehicle passengers. Therefore, rural jurisdictions appear to be allocating STEP activities very effectively toward target periods of intense vehicle travel.

Media investment has initial benefits, but benefits decline when expenditures exceed $12,000. A significant quadratic effect characterized the relationship between additional media investment and seat belt use when media was examined alone. This suggests that although initial media investments result in substantial gains in seat belt use, after a certain point, additional dollars no longer elicit the same benefit.

BUMT is highly effective, but BUMT and media are most beneficial when they operate separately. Buckle Up Montana Coalitions had the strongest effect of any MDT program analyzed, when all programs were considered in the same model (see Figure 1, Buckle Up MT coalition present). The slightly antagonistic relationship between media expenditures and BUMT presence suggests that BUMT coalitions and media campaigns overlap in their target audience and target method of increasing compliance (see Figure 1, Media $ with Buckle Up MT vs. Media $ with no Buckle Up MT). Efficiency might improve if the BUMT/media relationships were better coordinated to eliminate redundant effort.

What the Researchers Recommend

This project produced direct estimates of program impacts on seat restraint use in Montana. The findings provide an additional line of evidence supporting the general efficacy of MDT's occupant protection programs. This project resulted in no implementation plan or timeline; instead, the findings presented here are intended to help MDT make informed decisions about program continuation.

Recommendation 1
Continue existing STEP and BUMT coalition efforts, since these programs were individually associated with increased seat restraint use in their target vicinities. The data suggest that STEP impact may decline in the presence of other programs. To clarify STEP's specific impact, consider running a designed experiment to isolate the effect of STEP from other MDT programs.

Recommendation 2
In this dataset, media investment was associated with increased seat belt use at proximal NOPUS survey sites, but this was only true for sites that did not also have a local BUMT program. Furthermore, an individual assessment of media effects suggested that while the first $12,000 of media investment are very effective at increasing compliance, further investments have diminishing returns. Both of these trends need further investigation. Media investment was relatively consistent throughout the state, which clouded estimates about the per-capita and per-dollar benefit of media campaigns. Consider diversifying the size of media investments so that a range of different media investment values can be explored. Additionally, it would be beneficial to run an experiment in which media and BUMT effects could be separated.

Recommendation 3
Consider supplementing NHTSA's NOPUS data survey with program-specific data collection that better isolates the impacts of particular programs through pre-intervention versus post-intervention data collection and analysis. For example, MDT might collect pre- and post- driver education data on compliance in high school parking lots, or collect before and after sampling of STEP sites to see if interventions appear to change rates on a fine scale. Also, program impacts can be estimated more precisely in the presence of strong baseline data recorded prior to program implementation.

Recommendation 4
Consider moving all of its data records to an electronic format, as this will lower costs and improve efficiency in future program evaluations.

Recommendation 5
This analysis suggests that program effects are additive, with the possible exception of media and BUMT. Therefore, it would likely be advantageous to invest in multiple programs in a county (with the possible exception of BUMT and media).

Recommendation 6
For a more comprehensive approach beyond the data driven approach described here, it is critical to obtain drivers' attitudes and behaviors regarding seat restraint use. It is recommended that a follow-up human factors assessment of Montana's drivers be conducted to understand the current traffic safety culture, with the aim to identify strategies for increasing seat restraint use across the state. This would include recruiting a diverse sample of drivers across the state to collect relevant quantitative and qualitative data through user surveys and focus groups.

References

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Pulugurtha, S. S. and Repaka, S. R., "Assessment of models to measure pedestrian activity at signalized intersections." Transportation Research Record: Journal of the Transportation Research Board, Vol. 2073 (2008) p. 39-48.

For More Details . . .

The research is documented in Report FHWA/MT-15-001/8221-001, http://www.mdt.mt.gov/other/research/external/docs/research_proj/mt_seatbelt/Final_Report_15.pdf

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MDT Implementation Status: March 2015

Results of this project will be used in discussions regarding Montana's occupant protection programs. Information presented will be communicated to MDT peers and stakeholders to be coordinated with existing programs and the Comprehensive Highways Safety Plan as appropriate.

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