Comparison of crashes during public holidays and regular weekends

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ABSTRACT

Traffic collisions and fatalities during the holiday festive periods are apparently on the rise in Alberta, Canada, despite the enhanced enforcement and publicity campaigns conducted during these periods. Using data from 2004 to 2008, this research identifies the factors that delineate between crashes that occur during public holidays and those occurring during normal weekends. We find that fatal and injury crashes are over-represented during holidays. Amongst the three risky behaviors targeted in the holiday blitzes (driver intoxication, unsafe speeding and restraint use), non-use of restraint is more prevalent whereas driver intoxication and unsafe speeding are less prevalent during holidays. The mixed results obtained suggest that it may be time to consider a more balanced approach to the enhanced enforcement and publicity campaigns.

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1. Introduction

1.1. Background

Motor vehicle collisions are a major concern in many developing and developed countries. For instance, recent Canadian data showed that a total of 2767 fatalities and 194,177 injuries occurred on the roads as a result of motor vehicle collisions in 2007 (Transport Canada, 2007). In the Canadian Province of Alberta alone, nearly 400 people are killed and more than 27,000 people are injured in over 112,000 motor vehicle collisions each year (Alberta Transportation, 2006). The annual social cost of motor vehicle collisions to Albertans is estimated at $4.68 billion or 2.4% of Alberta's gross domestic product. Therefore, much more work needs to be done to make our roads safer for all users at all times.

With regard to time, traffic collisions and the ensuing fatalities during the statutory holiday festive periods are apparently on the rise in both developing and developed countries (Anowar et al., 2009, 2012). For example, a total of 6937 collisions occurred in 1999 during the holidays and long weekends which killed 39 people in Alberta but the total number of crashes escalated to 11,337 in 2008, with 43 people killed (Alberta Transportation, 1999, 2008). Although collisions during statutory holidays represent

only a small percentage (less than 10%) of the total motor vehicle collisions occurring in Alberta, the number of fatal collisions occurring during statutory holidays is found to be higher than those during non-holidays. Overall, the average number of fatal collisions for these holidays (1.11 per day) is approximately 18% higher than the non-holiday rate (0.94 per day). The average number of people killed per day on Albertan roadways during these holidays is also higher than the rest of the year (Anowar et al., 2012).

Consequently, there are more aggressive police enforcement activities and publicity campaigns targeted at drink-driving, speeding and other risky driving behaviors during these festive holidays in Alberta and worldwide (Alberta Transportation, 2006; Transport Canada, 2001; Pilkington, 2000; Watson et al., 2002; Alsop and Langley, 2000). Moreover, traffic fatalities and enforcement activities during these long weekends often attract disproportionately more media and public attention. A sample of news headlines in Alberta shows that this issue is a concern for rural and urban communities, large municipalities and small towns, and printed and electronic media:

"*Christmas Eve crash near Mundare kills three, orphans baby*" (Edmonton Journal, 27/12/2010).
"*Long weekend means police patrol roads*" (Channel 880 News, 21/4/2011).
"*Royal Canadian Mounted Police (RCMP) will hunt speeders on Easter long weekend*" (Calgary Herald, 21/4/2011).
"*The Labour Day long weekend proved once again to be deadly on Alberta's roadways*" (Crowsnest Pass Promoter, 4/9/2008).

Holidays are meant to be times of enjoyment and festivity. Unfortunately, these times also have the image as a time for partying, drunkenness, speeding and other reckless driving behaviors. Holidays are also associated with a large increase in recreational private travel resulting in longer trip distances, and more travel in rural and unfamiliar environment. Supposedly, owing to these factors, in many countries of the world, holiday periods are commonly viewed as times of heightened danger on the roads resulting in fatal and injurious traffic collisions. Hence, additional resources are frequently employed during public holidays to boost enforcement and publicity campaigns. However, these factors are also over-represented during regular weekends and relatively little research has been done on identifying the road safety issues related to specifically public holidays.

1.2. Objectives and scope of study

In this paper, a logistic regression model will be estimated to identify the factors contributing to crashes during public holidays and long weekends. In particular, we aim to determine whether crashes during public holidays are more severe than any regular weekends and whether the factors contributing to crashes during public holidays are different from those contributing to weekend crashes. More importantly, our results will also provide valuable insight on whether the increased enforcement activities and publicity campaigns during the holidays are used efficiently to address the correct road safety problems.

1.3. Literature review

Road crashes during the major holiday periods attract intense media interest. Nonetheless, research studies focusing on analysing the contributory factors of the road crashes are relatively few, and mostly examine specific holidays, crash types or behaviors. For example, the Australian Transport Safety Bureau (ATSB, 2003, 2006) conducted two studies focusing on holiday accidents. The goal of both studies was to examine the characteristics of fatal crashes occurring during the national holiday periods. The annual trends in road fatality numbers for two of the major statutory holiday periods, Christmas and Easter, were examined and compared with the remainder of the year. Interestingly, both studies found that the observed differences of fatality rates between holiday and non-holiday periods were generally small in size and not statistically significant.

A similar research initiative was undertaken by the American state of Missouri to identify the magnitude, severity and characteristics of holiday traffic crashes (MSHPSAC, 2003). The study analyzed crashes occurring during the following statutory holidays: Memorial Day, Fourth of July, Labor Day, Thanksgiving Day, Christmas and New Year Day. However, no comparison was made between holiday and non-holiday crashes or between holiday and regular weekend crashes.

Bloch et al. (2004) used crash data of 14 major holidays and special occasions in California to compare the rise in alcohol related fatal and injury crashes during holidays with that of the non-holiday periods. They employed the Poisson regression modeling technique (log-linear and logistic), controlling for the seasonal differences in terms of days of week and months of the year. The results of the study suggested that drinking and driving was more of a concern during the winter holiday seasons than the summer ones.

Farmer and Williams (2005) used data for the years 1986–2002 to determine which days of the year tend to experience a relatively higher number of deaths. They observed that six of the ten days with the greatest number of deaths occurred near these major American holidays: Independence Day, Christmas, New Year, and Labor Day.

The authors attributed such high numbers of crash deaths to the probable combination of increased recreational travel, alcohol consumption, and excessive speeding during holidays. Amongst other possible reasons for the increased fatalities during holidays suggested were: travel on rural unfamiliar roads, driver distractions and fatigue, which all resulted in the increased likelihood of drivers committing errors.

In another study, Alsop and Langley (2000) specifically focused on the Christmas road tolls. They used the negative binomial and binomial regression techniques to examine the temporal trends in the number of fatalities during the Christmas holiday festivities in New Zealand. Their results indicated that the road toll neither decreased nor improved significantly over the years. The authors argued that the lack of statistically significant increase in Christmas fatalities could be viewed as a positive outcome, given the large increases in population and number of cars driven. Presumably, the average individual risk might have reduced over time. On the other hand, a lack of statistically significant decrease in Christmas fatalities could not be viewed as a positive outcome, given the increased emphasis placed on this period by traffic safety agencies.

Besides statutory holidays, the effect of weekdays and weekends were also explored in several studies since traffic patterns during weekdays and weekends were quite different and crashes during weekends tended to be more severe (Yau, 2004; Gray et al., 2008; Barua and Tay, 2010; Quddus et al., 2010; Christoforou et al., 2010; Rifaat et al., 2011). According to these authors, much of the traffic during weekends consisted of discretionary travel, involved more drivers who had been drinking, speeding and driving while fatigued. However, very little research was found that examined the relative crash risks between holidays and weekends or the differences in the factors contributing to crashes during these two types of non-work days.

2. Methodology

2.1. Logistic regression model

Recall that the aim of the research is to determine the factors that are different between crashes that occur during statutory holidays (including long weekends) and those crashes occurring during normal weekends. Since the dependent variable is discrete and dichotomous in nature, the binary logistic regression is an appropriate technique to identify the different factors contributing to these two types of crashes. In this study, the binary response variable, y_{in}, is defined as:

$$y_{in} = \begin{cases} 1, & \text{if crash } n \text{ occured during statutory holidays} \\ 0, & \text{if crash } n \text{ occured during regular weekends} \end{cases} \quad (1)$$

Let, $P_n(i)$ and $1 - P_n(i)$ denote the probability of crash n occurring during statutory holiday periods and regular weekends, respectively. McFadden (1981) shows that under the standard logistic distribution, the closed form solution of the probabilities will be:

$$P_n(i) = \frac{\exp(\boldsymbol{\beta_i x_{in}})}{1 + \exp(\beta_0 + \boldsymbol{\beta_i x_i})} \quad (2)$$

where $\boldsymbol{x_{in}}$ is a vector of measurable characteristics that determine outcome i; $\boldsymbol{\beta_i}$ is a vector of estimable parameters.

The best estimate of $\boldsymbol{\beta}$ could be obtained by maximizing the log likelihood function:

$$LL(\boldsymbol{\beta}) = \sum_{i=1}^{n} \{ y_{in} \ln(P_n(i)) + (1 - y_{in}) \ln(1 - P_n(i)) \} \quad (3)$$

In this study, *Stata* version 11 is used for model development and estimation.