Accident Analysis and Prevention 83 (2015) 74–89

Contents lists available at ScienceDirect

Accident Analysis and Prevention

journal homepage: www.elsevier.com/locate/aap

Young drivers' night-time mobility preferences and attitude toward alcohol consumption: A Hybrid Choice Model

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ARTICLE INFO

Article history:
Received 4 January 2014
Received in revised form 3 July 2015
Accepted 3 July 2015
Available online 26 July 2015

Keywords:
Young drivers
Night-time Mobility
Alcohol Attitude
Hybrid Choice Models

ABSTRACT

This paper proposes an analysis of mobility preferences of young people at nighttime. In OECD countries in the last decades, data show that road crashes are the single biggest cause of death of 15–24 years-old drivers. On average, over 8500 young drivers were killed each year and it is demonstrated that the accidents tend to occur on weekend nights and when young people drive under the influence of alcohol.

Focusing on the demand for mobility, we approach the problem from several points of view, concentrating on the relationship between attitudes towards alcohol and some of the most common countermeasures implemented to address young-driver risk. In particular, we examine the potential demand of young drivers for new modes of public transport, understand their preferences for plans designed to reduce and/or prevent the number of risky situations. Our analysis covers different aspects of private modes of transport, including amounts of fines and police checkpoints. We also investigate the characteristics of existing and available public transport systems (e.g. fares and levels of services).

Through a Stated Preferences experiment (SP), we collected young people's preferences about nighttime mobility within our application area (Lugano, Switzerland).

Using the Hybrid Choice Models technique, we developed an approach and we estimated a model designed to incorporate simultaneously three dimensions of the problem: attributes of the alternatives, characteristics of young drivers, and alcohol-related psychological variables.

Our estimates suggest that, first, there are young drivers who are willing to choose public alternatives; secondly, the countermeasures considered can increase their number; and, thirdly, people with a higher attitude to alcohol are more willing to switch to new public transport alternatives and more sensitive to "Drinking and Driving Do not Mix" policies. Action plans developed on the basis of these findings and on the relevance of the psychological component will have a better chance to succeed.

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1. Introduction

According to the International Road Traffic and Accident Database (IRTAD, 2011), which includes aggregated data from 30 countries, despite a large reduction since 1989, the 18–25 year age group remains vastly over-represented in road trauma statistics. Switzerland does not represent an exception in these statistics and, relative to the number of inhabitants, young people aged 18–24 represent the largest group of casualties.

"Young Drivers: The Road to Safety", co-authored by the Organization for Economic Co-operation and Development (OECD) and the European Conference of Minister of Transport (ECMT, 2006)[1] in 2006, highlights that: "Traffic crashes are the single greatest killer of 15–24 year-olds in OECD countries. It is estimated that over 8500 young drivers of passenger vehicles were killed in OECD countries each year. . . . Crash death rates for drivers under 25 are roughly double those of older drivers. Clearly, young drivers play a disproportionate role in the overall public health problem of

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[1] This ECMT report is the result of working group of expert researchers coming from Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Korea, the Netherlands, Norway, Sweden, the United Kingdom and the United States.

http://dx.doi.org/10.1016/j.aap.2015.07.002
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road traffic safety risk." Globally, it is possible to conclude that young drivers are over-represented in fatality statistics, inasmuch as they pose a greater risk than other drivers to themselves, their passengers, and other road users. In all countries this is a serious public health issue that policy-makers and road safety professionals have to address.

In the next section, we present the existing literature showing that fatal accidents involving young drivers tend to take place on weekends and at night, and when young people drive under the influence of alcohol.

Because of the multi-faceted nature of the causes and the differences in legal systems, level of motorization and traffic safety between countries, this issue will require a package of countermeasures (Elvik and Vaa, 2004). A significant body of research has looked at the efforts in place around the world likely to have a major impact on reducing young, novice driver risk. The countermeasures suggested by the related literature include three provisions, namely (i) to improve driver training and testing, seen as the most effective measure for its direct effect (Baker et al., 2007; Hallmark et al., 2008; Zhu et al., 2009); (ii) to establish appropriate legislation and enforcement of road safety laws (Harrison et al., 1999; Lin and Fearn, 2003; Wagenaar et al., 2001); and (iii) to increase the availability and promote the use of safer modes of travel, which has an indirect effect in reducing crashes (Mercer, 1985; Homel, 1990; Regler et al., 2004). Although it has been proved that the licensing and training processes can effectively act as a form of prevention, data from OECD countries show that the greatest risk remains immediately after the driving license has been obtained, especially during the first year. On the one hand, it does matter that enforcement is effectively put in place, combined with repercussions that act as disincentives for infringements and hazardous behavior in general. On the other hand, researchers and experts agree that those enforcements should focus on areas where young people figure in excessively high numbers. These include binge drinking, infractions such as speeding, driving under the influence, and failure to use seat belts, and at times and locations where young people are particularly active. Public administrations need to address the limited availability and the costs of public transport alternatives, in particular at late hours and at weekends. Indeed, where supply of such alternatives is inadequate, individual means of transport, especially the car, will prevail.

In our research, we used a Stated Preferences (SP) experiment to collect young people's mobility preferences at nighttime in the agglomeration of Lugano (Switzerland). Stated preference (SP) data refers to choices made given hypothetical situations and stated choice experiments are considered an efficient methodology to study consumer preferences of multi-attributed products and services, especially when there are new alternatives or new attributes (Louviere et al., 2000). In our case, we are interested in the potential demand of young drivers for new modes of public transport and services that are designed to reduce the number of risky situations. We also analyse different aspects of the existing private modes. These aspects concern legislation (e.g. the amount of a hypothetical fine for a traffic infringement) and enforcement of road safety (e.g. the probability of a police checkpoint).

It is common knowledge that alcohol consumption is relevant in this context. Yet, since we are dealing with hypothetical situations in terms of new alternatives, new legislation and enforcement, actual alcohol consumption clearly cannot enter the equation at this stage. In order to take this key concept into account in our framework, we decided to consider the psychological factors behind the drinking-behavior. In practice, we include it in our model as a psychological latent variable helping us to investigate how different market segments based on that variable react to those countermeasures.

This work is grounded in discrete choice models, which belong to the family of Random Utility Models (RUM) and have been used extensively in the area of transport behavior research. By applying Lancaster's (1971) idea that products can be treated as bundles of characteristics, these techniques allow for a parsimonious treatment of demand and they can capture different tradeoffs between available alternatives and between the levels of the main attributes of alternatives involved in the decision. In particular, to analyze our data, we used a Hybrid Choice Model (HCM), which is a relatively new family of behavioral models. Those models integrate discrete choice and latent variables models allowing for the impact of attitudes and perceptions on the decision process. In the next section, we review current literature on the inclusion of psychological variables under discrete choice analysis. Our choice of HCMs is justified, in our context, as they help us adequately predict individual preferences for transport alternatives and their attributes, and to assess the impact of unobserved alcohol related factors involved in the behavioral process of young drivers' mobility choices. In fact, we develop a model framework and analysis that simultaneously takes into account all the concepts previously mentioned.

In order to estimate our model, we implemented the Maximum Simulated Likelihood estimator (MSL) which replaces the multidimensional non-closed integral with a smooth simulator.

In this context, our work can help to better develop and implement effective enforcement and disincentives as well as new public alternatives. Furthermore, to our knowledge, our research is the first to bring together in a behavioural model all three principal factors, which the literature has identified as causes of this problem: individual characteristics, specific circumstances and psychological factors.

The remainder of this paper is organized as follows. Section 2 reviews pertinent literature on both the causes of young driver accidents and the choice model methodology. Section 3 describes the location of the study, the City of Lugano. Section 4 outlines the SP experiment and the dataset used in the empirical work. Section 5 presents the specification of our model. Section 6 reports the findings of the empirical analysis while Section 7 briefly summarises the key findings and presents the main conclusions and possible policy implications.

2. Literature review

As declared in Section 1, our study contributes to existing attempts to understand young people's night-time preferences using discrete choice methods. This section therefore contains related background material. The first part of the chapter reviews the causes of young driver risk. The second part is a brief review of the discrete-choice theory and related recent models that can help to include psychological aspects in the analysis.

2.1. Causes of young driver risk

Youth is commonly recognized–by social scientists–as an age of big emotions, experimentations and, sometimes, pushing boundaries. It is also a time when most people first learn to drive. According to the existing literature, see for example Keall et al. (2004) where the authors analyse the data for New Zealand, this particular combination produces a much higher traffic safety risk for young drivers than for any other segment of the population. In summary, the causes of this problem fall into three groups: individual characteristics, specific circumstances, and psychological factors.

The most relevant individual characteristics are: age, gender, and experience. Data show that inexperience explains much of the high level of young traffic fatalities, while the second key

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