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Factors associated with motorcyclists' speed behaviour on Malaysian roads

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ABSTRACT

This research uses data from observations of 8277 motorcyclists at various types of roads of the road hierarchy in Malaysia in 2015, to investigate the effects of road characteristics, motorcyclists' riding behaviour, motorcyclists' and motorcycles' characteristics on the occurrence of riding with excessive speed. For data collection and analysis, new software, i.e. MECHROM, was developed. The speed analysis shows that motorcyclists go faster than other vehicles on dual carriageway primary roads with three-lanes and dual carriageway collector roads with four-lanes. In general, 42.2% of the observed motorcycles exceed the speed limit and 28.6% of them go beyond the 85th percentile of the traffic speed. In determining the factors associated with motorcyclists riding with excessive speed, a mixed effect logistic regression model was produced, with three levels statistically significant random effect parameters. The fixed parameters factors are: primary road, roads with no shoulder, motorcycles with engine capacity of more than 150cc, not overloaded motorcycle, bright motorcycle, male rider, wears helmet and shoes, riding in the middle of the lane or shoulder, lane splitting (i.e. passing through in between two vehicles) and weaving between vehicles. The random parameters show that the majority of variation in the outcomes (56.5%) occurs at level 1 (the rider), while 12.2% of variation occurs at level 2 (motorcycle), and 31.2% at level 3 (location). The variations indicate that the motorcyclist's characteristics and riding behaviour are of importance, while the variable "type of motorcycle" clearly indicates that riding with excessive speed occurs regardless of the type of motorcycle.

1. Introduction

According to the WHO, close to a quarter (24.1%) of the world's road traffic deaths occur among motorcyclists (WHO, 2013, 2014). Of these motorcycle fatalities, the South-East Asia region (i.e. mostly low- to middle-income countries such as Malaysia, Thailand and Myanmar) has the highest rate of around 50%, compared to "only" up to 11% motorcycle fatalities in high-income countries in the European region (Abdul Manan, 2014a). In terms of the highest number of road traffic deaths per 100,000 population, Malaysia is ranked 19th out of 182 countries in the world (Abdul Manan, 2014a). Malaysia also has the 2nd highest death rate in Asia (WHO, 2013). Moreover, it is currently ranked number 5 in the world among countries

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with a high percentage of motorcycle crash fatalities, i.e. more than 50% of the total road fatalities are associated with motorcycles (Abdul Manan, 2014a; Abdul Manan & Várhelyi, 2012). Hence, Malaysia typifies the countries with safety problems of motorcyclists (i.e. motorcycles account for more than 25% of registered vehicles, and reported crash fatalities) and its data is close to the average of these countries, i.e. 47% of registered vehicles are motorcycles and 59% of the victims of reported crash fatalities are motorcyclists (Abdul Manan, Jonsson, & Várhelyi, 2013).

In Malaysia, road fatalities are increasing yearly (WHO, 2013, 2014). The major contributor to this is the steady rise in motorcycle crash fatalities rate since the year 2003 (PDRM., 2012). In 2014, the number of motorcycle crash fatalities reached the highest in a 10-year period, with 4179 fatalities (JKJR & MIROS, 2014; PDRM, 2012). The economic impact of this is that Malaysia lost on average RM6.45 billion since 2010 (RM5.94 billion loss) to 2014 (RM6.77 billion loss per year) (see Fig. 1). This figure is taken into the account of inflation records since 2010 to 2014 (see BNM (2015)) and based on the value of RM1.2 million per motorcycle fatality from Nor, Yusoff, and Radin Umar (2001). Thus, if nothing is done to mitigate or curb Malaysia's motorcycle crash fatalities, the figures may continue to increase over the coming years, and Malaysia will continue to suffer severe economic losses.

One of the significant factors associated with road traffic crashes is speeding, which is a widely established road safety indicator (Elvik, Høye, Vaa, & Sørensen, 2009; Hauer, 2010; Várhelyi, 1996), nevertheless there are also other road environment and behavioural factors of importance (Abdul Manan, 2014a).

According to the Malaysian police records, 18% of at-fault-motorcycle accident fatalities are associated with speeding (PDRM, 2012). However, research has shown that police records when investigating the cause of the accidents, e.g. speeding, are usually unreliable (Austin, 1995; Bull & Roberts, 1973; Shinar, Treat, & McDonald, 1983; Wilson, Begg, & Samaranayaka, 2012). Speeding, which may result in crashes is a frequent violation among motorcyclists, (Elliott, Baughan, & Sexton, 2007; Horswill & Helman, 2003; Hurt, Ouellet, & Thom, 1981; Steg & Brussel, 2009). Excessive speeding can lead to higher frequency of road traffic crashes (Huth, Füssl, & Risser, 2014; Özkan, Lajunen, Dogruyol, Yildirim, & Coymak, 2011) and to higher severity to the motorcyclists involved in a road traffic crash (Hurt et al., 1981; Broughton et al., (2009).

Generally, mean speed of motorcyclists is lower than that of larger vehicles (Abdul Manan & Várhelyi, 2015). However, riders of high capacity motorcycles have more hazardous attitudes and behaviour in traffic (Bjørnskau, Nævestad, & Akhtar, 2010). Horswill and Helman (2003) comparing a group of motorcyclists with a matched group of automobile drivers found that motorcyclists chose faster speeds than car drivers, overtook more often, and pulled into smaller gaps in traffic (Horswill & Helman, 2003). Also, speeding was found frequent among motorcyclists, especially those on 'racing bikes' (motorcycles of more than 250 cc.) (Bjørnskau et al., 2010; Broughton et al., 2009).

Studies have shown that young, male motorcyclists have a stronger propensity for risky behaviour, e.g. speeding, which has been shown to be associated with increased risks of accidents and at-fault crashes, and a higher tendency towards negligence of traffic regulations and motorcycle safety checks (Chang & Yeh, 2007; Haque, Chin, & Huang, 2009; Mannering & Grodsky, 1995b; Rutter & Quine, 1996). Inexperienced motorcyclists have also shown a tendency to violate traffic rules (Perez-Fuster, Rodrigo, Ballestar, & Sanmartin, 2013).

In terms of speeding opportunity, motorcyclists are more likely to speed when overtaking, which may be a reflection of the ease, and therefore frequency, with which the motorcycle can carry out this manoeuvre (Broughton et al., 2009). In terms of location, motorcycle riders are more likely to speed on rural roads and less likely to speed on urban roads, and, riders are much more likely to speed in daytime than at night (Broughton et al., 2009). However, in urban condition, moped riders are more likely to speed (Steg & Brussel, 2009). Furthermore, the effect of speeding is intensified at un-signalized junctions (Pai & Saleh, 2007).

"Excessive speeding" is defined as a vehicle exceeding the relevant speed limit (WHO, 2004), but it varies from country to country. Some define it as going 10% to 20% above the posted speed limit (Elvik et al., 2009; FHWA, 2012; ITE, 1999; MUTCD, 2009; SWOV, 2009; Taylor, Lynam, & Baruya, 2000; Várhelyi, 1996). On the other hand, excessive speeding can also be defined as going beyond the 85th percentile traffic operating speed, which is commonly set as the speed limit (Elvik et al., 2009; FHWA, 2012; ITE, 1999; MUTCD, 2009). Excessive speeding categorised as inappropriate and risky driving behaviour (Grey, Triggs, & Haworth, 1989; Williams, Kyrychenko, & Retting, 2006; Zuckerman, 1996).

There are various other risk factors associated with motorcyclists' riding behaviour. Weaving and lane splitting were also proved to be risky (ACEM, 2003; Clarke, Ward, Bartle, & Truman, 2004; Hurt et al., 1981. Weaving, bumping, overloading loss

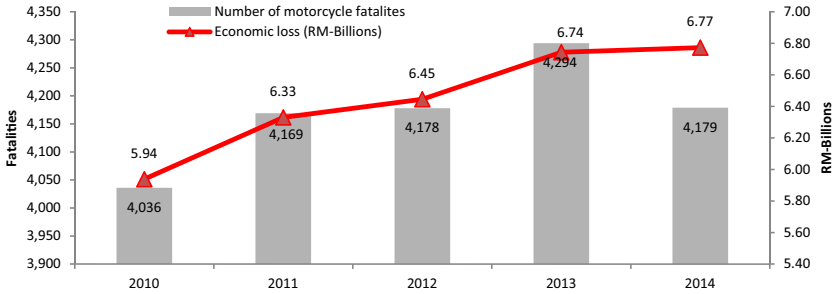

Fig. 1. Number of motorcycle fatalities and associated economic loss in Malaysia (BNM, 2015; JKJR & MIROS, 2014; PDRM, 2012; WHO, 2014).