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Temporal distribution of motorcyclist injuries and risk of fatalities in relation to age, helmet use, and riding while intoxicated in Khon Kaen, Thailand

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Abstract

This study investigated the temporal distribution of risky behaviors among injured motorcyclists, that is, riding unhelmeted or while intoxicated, and showed how they are associated with risk of fatal injuries. Data of motorcyclists injured in Khon Kaen municipality in northeastern Thailand and transferred to Khon Kaen Regional Hospital were obtained from the trauma registry system of the hospital. Case fatalities were compared by time of day, age group, helmet use, and alcohol intoxication. Unhelmeted riding peaked late in the evening and riding while intoxicated peaked around midnight. Both were associated with increased fatality risk after stratification by time of day; the odds ratios were 3.49 (95% confidence interval (CI) = 1.48–9.36) and 3.01 (CI = 1.71–5.19), respectively. Nighttime injuries were not significantly associated with increased fatality risk after stratification by helmet use or alcohol intoxication. Unhelmeted driving was prevalent and associated with higher fatality risk among younger drivers, whereas intoxicated driving was less prevalent among teens but associated with increased risk among those aged 20–39 years. This study shows that riding unhelmeted or while intoxicated can explain the increased fatality risk at night, suggesting that safety education or enforcements should be targeted at specific age groups and appropriate times.

Keywords: Nighttime; Motorcyclist; Helmet; Alcohol

1. Introduction

In developing countries, motorcycles are widely used as an economical mode of transportation; however, they also account for the majority of traffic-related morbidity and mortality in these areas. In Thailand, the number of registered motorcycles has been increasing rapidly, from 8.2 million in 1994 to 16.6 million in 2002 (in Khon Kaen: 190,746 in 1994 and 538,264 in 2002) (Alpha Research, 2004), and in 2000, motorcycles were involved in 73% of road traffic crashes and 79% of fatal crashes (Ministry of Public Health, 2002).

Although the protective effects of helmets in reducing head injuries and mortality rates have been shown (Gabella et al., 1995; Liu et al., 2004; Norvell and Cummings, 2002; Rowland et al., 1996), evaluation studies of mandatory helmet use legislation have also indicated smaller mortality reductions than expected (Graham and Lee, 1986; Ichikawa et al., 2003) or no significant reductions (Sosin and Sacks, 1992). This has led to implication of the risk compensation hypothesis (Adams, 1995; Graham and Lee, 1986); however, an alternative explanation is possible.

Evaluation studies that focus on post-law behavior changes during the daytime, such as increased helmet use, differ from those during the nighttime when the majority of motorcycle crashes occur (Doyle et al., 1995; Panichaphongse et al., 1995; Sirathranont and Kasantikul, 2003). There is a higher risk of severe injuries with nighttime motorcycle crashes than those that occur in the daytime (Cirera et al., 2001; Lin et al., 2003a; Quddus et al., 2002; Valent et al.,

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2002). This might be because high-risk behaviors are more prevalent at night; riding unhelmeted (Skalkidou et al., 1999) and while intoxicated (Hingson and Winter, 2003; Kasantikul et al., 2005) are more common at night, and both are especially prevalent in developing countries where law enforcement activities are weaker at night (Chongsuvivatwong et al., 1999; Conrad et al., 1996; Ichikawa et al., 2003). These behaviors also tend to be linked; among injured intoxicated motorcyclists, unhelmeted riding, speeding, and crashes at night were common (Kasantikul et al., 2005; Luna et al., 1984; Nelson et al., 1992; Peek-Asa and Kraus, 1996; Shankar and Mannering, 1996). Intoxicated driving (Kasantikul et al., 2005; Lin et al., 2003a; Luna et al., 1984; Shankar and Mannering, 1996) and speeding (Lin et al., 2003a; Peek-Asa and Kraus, 1996) are also known to increase the severity of injuries associated with motorcycle accidents. Further, younger people in their teens or early twenties, who represent the majority of injured motorcyclists (Bray et al., 1985; Doyle et al., 1995; Gabella et al., 1995; Norvell and Cummings, 2002; Swaddiwudhipong et al., 1994), tend to partake in high-risk behaviors when driving at night (Williams, 2003). It has been shown that younger car drivers are also at higher risk of fatal or non-fatal crashes at nighttime (Williams, 2003; Rice et al., 2003), resulting in countermeasures such as provisional licensing schemes (Lin and Fearn, 2003). However, information is lacking with regard to how these factors are associated with increased risk of fatal injuries among motorcyclists at night.

Using data from the trauma registry of Khon Kaen Regional Hospital in Thailand, this study investigated temporal changes in riding unhelmeted and while intoxicated and their influence on risk of fatal injuries among injured motorcyclists, paying particular attention to different age groups.

2. Methods

2.1. Study setting

This study investigated motorcyclists injured in Khon Kaen municipality and transferred or referred to the Trauma Center of Khon Kaen Regional Hospital between 1998 and 2002. Data were derived from the trauma registry of the center. This center provides tertiary trauma care covering the Khon Kaen Province; details of the center and trauma registry are described elsewhere (Ichikawa et al., 2003). Khon Kaen Province, which has a population of more than 1.7 million, is located in northeastern Thailand where enforcement efforts based on the Helmet Act started on January 1, 1996. Consequently, helmet use in the daytime has reached almost 100%, though helmet use at night has showed only a slight increase.

Emergency room staff at Khon Kaen Regional Hospital collect information on age, the time of a crash, alcohol consumption, and helmet use by interviewing patients at the time of admission. If the patient is unable to answer, information is collected from family members or those who brought the individual to the hospital. Blood alcohol levels are not measured, but alcohol consumption is determined based on the interview and smell immediately after arrival at the emergency room. Although this measurement seems subjective, a study in Thailand described the tendency of Thai motorists to freely disclose their unfavorable driving behaviors, such as driving while intoxicated, after involvement in crashes (Kasantikul et al., 2005). Emergency room nurses are in charge of collecting clinical information data. Fatal cases include deaths that occur before arrival or while in the emergency room, and all deaths before discharge. Since those who die at the scene of the crash are brought to the Forensic Department of Khon Kaen University, we were not able to access data of such cases in the present study.

2.2. Analysis

We examined the temporal distribution of injuries among motorcyclists and case fatalities according to helmet use and alcohol consumption. To reduce the influence of random variations, figures show 5 h moving averages of injured cases; however, for the temporal distribution of case fatalities, 7 h averages were used because the number of fatal cases was so small that fluctuations were greater.

We then examined associations between the risk of death among injured motorcyclists and helmet use, alcohol consumption, and time of day. Odds ratios (ORs) were used to estimate the risk of death while riding unhelmeted, intoxicated or at night, compared to that while riding helmeted, sober or in the daytime. We were only able to examine the number of severely injured motorcyclists treated in the trauma center; those with less severe injuries who received care at lower levels or who were not injured were not included in the present study. Nighttime was defined as from 18:01 to 06:00. As an outcome measure, we calculated case fatalities, rather than mortality and morbidity rates, using population, the number of registered motorcycles or vehicle km traveled as the denominator, because although most severe cases are transferred to the Trauma Center, Khon Kaen Regional Hospital is not the only tertiary care hospital in the study area.

Since risk-taking behaviors, such as riding unhelmeted, while intoxicated or at nighttime, are likely to be linked and thus to confound each other, and since it is likely that they differ by age, we conducted stratified analysis by time of day, helmet use, intoxication, and age. We also calculated overall odds ratios (Mantel-Haenszel odds ratios; MH ORs) adjusted for the confounding factors. If the MH ORs were nearer to the null value (one) than the crude odds ratios, confounding was considered likely. Since age was considered an effect modifier, we did not calculate the MH ORs for stratification by age. We used a statistical software package (Epi-Info; Center for Disease Control and Prevention, Atlanta, Ga) to calculate the odds ratios and 95% confidence intervals. When a cell with a value less than 5 was obtained, exact confidence limits for crude odds ratios were calculated.