



# Factors contributing to young moped rider accidents in Denmark



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## ARTICLE INFO

### Article history:

Received 17 April 2015

Received in revised form 3 November 2015

Accepted 5 November 2015

Available online 27 November 2015

### Keywords:

Road traffic accidents

Mopeds

Young road users

Accident analysis

## ABSTRACT

Young road users still constitute a high-risk group with regard to road traffic accidents. The crash rate of a moped is four times greater than that of a motorcycle, and the likelihood of being injured in a road traffic accident is 10–20 times higher among moped riders compared to car drivers. Nevertheless, research on the behaviour and accident involvement of young moped riders remains sparse.

Based on analysis of 128 accident protocols, the purpose of this study was to increase knowledge about moped accidents. The study was performed in Denmark involving riders aged 16 or 17. A distinction was made between accident factors related to (1) the road and its surroundings, (2) the vehicle, and (3) the reported behaviour and condition of the road user. Thirteen accident factors were identified with the majority concerning the reported behaviour and condition of the road user. The average number of accident factors assigned per accident was 2.7. Riding speed was assigned in 45% of the accidents which made it the most frequently assigned factor on the part of the moped rider followed by attention errors (42%), a tuned up moped (29%) and position on the road (14%). For the other parties involved, attention error (52%) was the most frequently assigned accident factor. The majority (78%) of the accidents involved road rule breaching on the part of the moped rider.

The results indicate that preventive measures should aim to eliminate violations and increase anticipatory skills among moped riders and awareness of mopeds among other road users. Due to their young age the effect of such measures could be enhanced by infrastructural measures facilitating safe interaction between mopeds and other road users.

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## 1. Introduction

Young road users still constitute a high-risk group with regard to road traffic accidents (e.g. [World Health Organization, 2013](#)). While much research attention has been paid to young car drivers, young moped riders have also been identified as a high-risk group (e.g. [Kim et al., 1995](#); [SWOV, 2009](#)). The lack of research in this field was identified by [Kopjar \(1999\)](#). However, despite occasional studies emphasizing the severity of the problem and need for further research (e.g. [Bjørnskau et al., 2012](#); [Brandau et al., 2011](#); [Steg and Brussel, 2009](#)), knowledge about the behaviour and accident risk of young moped riders remains sparse.

Knowledge on the risk behaviour of young moped riders is impeded by high levels of under-reporting. Recently, an under-reporting level of 74% was identified in Denmark ([Møller et al., 2010](#)). In addition, national accident statistics ([Blackman and Haworth, 2013](#)) and studies on road safety ([Kim et al., 1995](#); [Haworth et al., 2007](#); [Miggins et al., 2011](#)) often do not distinguish

between different types of powered two-wheelers. Despite such impediments it has been shown that the crash rate of a moped is four times greater than that of a motorcycle ([Blackman and Haworth, 2013](#)). Further, the likelihood of being injured is 10–20 times higher among moped riders compared to drivers ([Aare and Holst, 2003](#)), and 13 times higher compared to cyclists ([Brems and Munch, 2008](#)).

Studies have identified some level of stability in risk-taking from late adolescence into early adulthood among drivers (e.g. [Møller and Haustein, 2013](#); [Vassallo et al., 2014](#)) as well as differences in risk-taking behaviour and attitudes among pre-licensed adolescents ([Mann and Lansdown, 2009](#); [Waylen and McKenna, 2002, 2008](#)). In many countries a moped is the first motor vehicle for many youngsters, and it is possible that riding styles and behaviour established at this stage may last long into the driving career.

Factors such as riding speed, alcohol use, and male gender have previously been identified as key risk factors among moped and motorcycle riders (e.g. [Kim et al., 1995](#); [Miggins et al., 2011](#); [Moskal et al., 2012](#)). Therefore, focus on gender and possible differences regarding specific accident factors, is highly relevant. However, the mere presence of a risk factor does not necessarily lead to an accident, as an accident is the result of the interplay between several

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factors in a given situation. Categorizing factors into three categories, namely factors related to the road and its surroundings (1), to the vehicle (2), and to the behaviour and condition of the road user (3), has previously proven to be useful when trying to understand the mechanisms leading to road traffic accidents (e.g. Bjørnskau et al., 2012; Elliot et al., 2007; Rothengatter, 1997). This distinction will therefore also be applied in this study.

Based on national accident statistics it is possible to provide an overview of factors present at the time of the accident. However, only predefined factors included in the official registration of road traffic accidents can be included in such analyses. Thus, influence from factors such as inattention or distraction will most likely not be included, as those factors are usually not registered in the national accident statistics. In addition, the identification of new factors or provision of more detailed information about the existing factors is difficult based on accident statistics. The latter is also true for information based on standardized questionnaires, as it is difficult to ask for information about not yet identified factors. To further improve the understanding of moped accidents, studies using alternative methods to explore the interplay between factors present at the time of the occurrence of an actual accident are needed.

The present study focuses on light-moped accidents involving riders aged 16 or 17 years old. In Denmark the term light-moped refers to a powered two-wheeler with a cylinder volume of less than 50 cc. The maximum allowed speed for this type of vehicle is 30 km/h inside as well as outside built-up areas and regardless of the speed limit of other road users. The rider must use the cycle path at all times, if available. Many different types of cycle paths exist, including, for example, cycle paths physically separated from the main road by a kerb, or painted road markings. Passengers are not allowed, and helmet use is mandatory. The minimum age for riding this type of moped is 16. For persons aged 16 or 17 a moped certificate is needed. The certificate can be obtained by following a brief course which includes a combination of theory and practice.

Based on analysis of accident protocols, the purpose of the present study was to increase knowledge about moped accidents involving young riders. An exploratory approach was used in order to allow relevant but not predefined accident factors to be identified. Based on the identification of accident factors related to the road and its surroundings, the vehicle, and the reported behaviour and condition of the road users, the results can be used for the development of targeted preventive measures.

## 2. Method

### 2.1. Data

A sample of 140 accidents was drawn from the Danish national database of road traffic accidents. The sample was randomly selected based on the following criteria: The accident happened in 2007, involved a moped rider aged 16 or 17, and an equal number of accidents (14) from each police district. Twelve accidents were excluded from the analysis due to lack of available information. The total number of accidents included in the study was 128, of which 53% involved a 16-year-old, 47% a 17-year-old, 81% a male, and 19% a female rider. The sample constituted 20% of the total number of accidents involving a 16- or 17-year-old rider in 2007 with a very similar age and gender distribution. Permission to collect police reports was received from the Ministry of Justice. The police reports included information obtained at the accident scene, photos, testimonies provided by the road users, witnesses, and family at the time of the accident, as well as later in court, at the hospital or on other occasions. Based on a template, a police report is always created when the police are sent for in relation to a road traffic

accident. However, small variations in level of detail provided in each case exist. No pattern in these small variations could be identified.

### 2.2. Analysis

#### 2.2.1. Accident characteristics

Based on accident protocols the following information on each accident was registered onto a common database: time, place, weather conditions, manoeuvre, parties involved, and condition of the vehicle(s). In addition, information regarding age, gender, impairment (alcohol, drugs, and illness), speed, helmet use, moped certificate, and degree of injury was registered for the moped rider as well as for the other parties involved. An overview of the accidents in terms of time of day, type of accident, counterparts and similar characteristics was provided.

#### 2.2.2. Accident factors and road rule breaching category

Based on the available information each accident was reconstructed and accident factors and road rule breaching categories (see below) were assigned. Aspects of key importance for the occurrence of the accidents were identified as accident factors. All factors could be assigned to the rider as well as to the other parties involved, and multiple factors could be assigned to each accident. A distinction was made between factors related to the road and its surroundings, the vehicle, and the reported behaviour and condition of the moped rider. Accident factors concerning the road and its surroundings included weather conditions, visibility conditions (e.g. restricted access to relevant information due to the location of a road sign), objects on the road, and road design (e.g. missing/poorly maintained road markings). Accident factors concerning the vehicle included insufficient maintenance (e.g. defective brakes) and tuning up the moped (modification of the moped to increase its performance thereby enabling riding speeds above the legal limit). However, tuning was only assigned as an accident factor in cases where the tuning was a prerequisite for the high speed at which the accident happened). Accident factors concerning the reported behaviour and condition of all road users involved included aspects such as attention, riding speed, position on the road, impairment, and mistakes handling the vehicle. This part of the analysis was assisted by two experienced research assistants. Pilot coding was performed to ensure coding agreement.

For accident factors identified in at least 20 accidents, it was investigated whether the factors were more common among male or female riders. Group differences were examined by  $\chi^2$  tests and are reported when significant.

Based on the reported violations each accident was assigned to a road rule breaching category (A, B, C). A was assigned if no road rule breaching was reported; B was assigned if the reported riding speed exceeded the limit, but not by more than 33%, the rider admitted not to have paid attention to approaching traffic, and/or disobeyed the right of way; C was assigned if the reported riding speed was 33% or more above the speed limit or the rider was impaired by alcohol/drugs. In addition, C was assigned if basic rules for riding a moped were violated by the rider (e.g. riding the moped despite not having a moped certificate, not wearing a helmet and/or riding with passengers). Gender differences in road rule breaching categories were tested ( $\chi^2$  test).

## 3. Results

### 3.1. Accident characteristics

An overview of the types of accidents in the sample is provided in Table 1 and compared to all registered moped accidents in the period 2004–2008 of the same age group and older adults.

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