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Characteristics of older cyclists (65+) and factors associated with self-reported cycling accidents in the Netherlands



TRANSPORTATION RESEARCH

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ABSTRACT

Cycling supports the mobility, health and independency of the ageing population. However, older cyclists have an increased injury risk. On average, the risk of older people to sustain an injury in a cycling accident is three times higher per cycling kilometre than for middle-aged people and the injury risk increases with age. In comparison with middle-aged cyclists (<65 years), the risk of hospitalization is more than four times as high for older cyclists (≥65 years). The aim of this study was to reveal characteristics of older cyclists in general and to explore which of these characteristics are associated with selfreported cycling accidents from age 59. More than eight hundred older cyclists (>65 years) filled out a questionnaire, which included questions on demographics, bicycle specifications and personal characteristics. By means of a logistic regression, the relationship between personal factors and self-reported bicycle falls were studied. The univariate models showed that age, physical and mental impairments, bicycle model, living environment, feelings of uncertainty of the cyclist and changed cycling behaviour (such as more patience, lower speed) were related to falling off a bicycle. From the multivariate model we can conclude that several factors are associated with falling off a bicycle in the older population: (1) every year the cyclists becomes one year older (from the age of 65), the chance they have fallen increases with 7.3%, (2) If cyclists have mental impairments, the chance they have fallen increases with a factor 2.5, (3) if cyclists were less than completely confident the chance they have fallen increases with factor 1.8, (4) if cyclists live in a rural environment compared to an urban environment the chance they have fallen increases with a factor 2.1. In conclusion, demographic, cycling and personal factors can be related to increased self-reported fall risk. It is advised to take these factors into account when implementing new cycling related safety measures.

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1. Introduction

In the Netherlands cycling is a common mode of transport, and the Netherlands is a world leader in bicycle safety (Schepers et al., 2015). Conditions in the Netherlands are favourable for cycling as the consequence for several factors like climate, infrastructure, cycling facilities and the flat landscape (Heinen, Van Wee, & Maat, 2010; Ministry of Infrastructure and the Environment, 2009). The high amount of bicycle use increases safety, as it corresponds with a greater awareness of cyclists among drivers (Schepers, 2012). However, due to the ageing population, there are more older cyclists and they cycle longer into a higher age (Wegman, Zhang, & Dijkstra, 2012). It is important to make sure that the older population can continue cycling safely, as it contributes to physical health and overall fitness (Fishman, Schepers, & Kamphuis, 2015; Oja et al., 2011). Older adults experience increased feeling of independence and mobility, increased health and social contacts because of cycling (Fagerström & Borglin, 2010; Törnvall, Marcusson, & Wressle, 2016), However, while cycling supports the independence and health of the ageing population (Oja et al., 2011), older cyclists have an increased risk for being involved in a cycling accident (Martínez-Ruiz et al., 2014). In the Netherlands, 67% of all bicyclists fatalities were among cyclists aged 60 years and or older. This is more than twice as much as fatally injured car drivers within the same age group (CBS, 2014). On average, the risk of older people to sustain an injury due to a cycling accident is 2–5 times higher per cycling kilometre than for middle-aged cyclists (Berveling & Derriks, 2012; Zeegers, 2010). The probability of a fatal accident outcome for cyclists aged 75 and older is 17 times higher than for cyclists younger than 75 years (SWOV, 2009). Furthermore, the risk of hospitalization is more than four times as high for older cyclists after visiting an emergency department (SWOV, 2009), compared with middle-aged cyclists. The number of seriously injured victims per kilometre travelled by bicycle increased slightly over the last decade for all age groups (Weijermars, Bos, & Stipdonk, 2016). However, the rise in number of victims in single sided accidents (i.e. where no other road user was involved) resulted mainly from the older, more vulnerable cyclists (Berveling & Derriks, 2012; Norden & Bijleveld, 2011; Schepers & Vermeulen, 2012). For these reasons, cycling safety has become a focus point in Dutch policy.

Human performance can be described by the International Classification of Functioning, Disability and Health (ICF WHO, 2017). The ICF, is a classification of health and health-related domains. As the functioning and disability of an individual occurs in a context, ICF also includes environmental factors and personal factors. However, most research on cyclist safety focussed on bicycle accidents types and characteristics, mainly related to external factors, such as infrastructure. As said, the older cyclist is mostly the victim of a single-sided accident (Schepers & Wolt, 2012). Accidents studies on single-sided accidents; loss of balance, colliding with an obstacle or entering the verge (Schepers & Wolt, 2012). However, according to Davidse et al. (2014), a considerable number of single-sided accidents are preceded by interaction with another road user (see also Westerhuis & De Waard, 2016).

Literature on single-bicycle accidents is limited, which can be explained by the fact that minor single-bicycle accidents are rarely reported in official road crash statistics (Schepers & Wolt, 2012; Wegman et al., 2012). Cyclists accidents are more likely to be reported when the injury severity increases (Langley, Dow, Stephenson, & Kypri, 2003), and the rate of reporting is much higher for bicycle accidents with motor vehicles involved than for bicycle accidents with no motor vehicles involved (Kroon, 1990; Langley et al., 2003; Reurings & Bos, 2011; Schepers et al., 2015). The underreporting of crashes in police statistics and the selective reporting are complicating factors hindering insight in factors associated with falling of a bicycle. Despite many studies about (single-)bicycle accident types, insight in the personal factors that could play a role and information about non-reported mostly non-severe bicycle falls, is missing in the scientific literature.

The increased risk of falling for older cyclists off a bicycle may be the results from both cognitive and physical decline (OECD, 2001). Mental impairments, like a decrease in attention, working memory, and a lower reaction time, could also make cycling in traffic more mentally demanding. Physical factors, like reduced (bone)strength and increased stiffness, may result in more severe injuries after falling off a bicycle. By gaining knowledge about the factors associated to falling, cycling accidents might be prevented (Rijkswaterstaat, 2016). Insight in factors related to the higher fall risk of older cyclists may result in the design of measures to reduce the number of injured older cyclists. These factors could include personal, bicycle or infrastructural factors.

This study focusses on exploring demographic, bicycle and personal factors related to self-reported bicycle falls, instead of focusing on accident characteristics. The focus of this study is on (1) revealing characteristics of the older cyclist who has been involved in a self-reported falling accident, and (2) exploring factors associated with self-reported cycling accidents.

2. Method

2.1. Participants

In total, more than 2000 older cyclists from the Netherlands, aged 65 years and older were asked to complete a questionnaire. The only inclusion criteria were that the participants had to be aged 65 years or over and could ride a bicycle.

The participants were mainly (76.5%) recruited during Cycling School Lessons of the Dutch Cycling Union (Fietsersbond). These Cycling School Lessons days were informative and informal days to gather information about cycling to experience difference bicycle types, to cycle together and receive advice. The instructors of these cycling lessons distributed the questionnaire and a stamped return envelope on 52 occasions. A link to the online version questionnaire was also distributed by

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