Are automatic systems the future of motorcycle safety? A novel methodology to prioritize potential safety solutions based on their projected effectiveness

Abstract

Author Information: Gustavo Gil, Giovanni Savino, Simone Piantini, Niccolò Baldanzini, Riender Happee, & Marco Pierini.

Objective:
Motorcycle riders are involved in significantly more crashes per kilometer driven than passenger car drivers. Nonetheless, the development and implementation of motorcycle safety systems lags far behind that of passenger cars. This research addresses the identification of the most effective motorcycle safety solutions in the context of different countries.

Methods:
A knowledge-based system of motorcycle safety (KBMS) was developed to assess the potential for various safety solutions to mitigate or avoid motorcycle crashes. First, a set of 26 common crash scenarios was identified from the analysis of multiple crash databases. Second, the relative effectiveness of 10 safety solutions was assessed for the 26 crash scenarios by a panel of experts. Third, relevant information about crashes was used to weigh the importance of each crash scenario in the region studied. The KBMS method was applied with an Italian database, with a total of more than 1 million motorcycle crashes in the period 2000–2012.

Results:
When applied to the Italian context, the KBMS suggested that automatic systems designed to compensate for riders' or drivers' errors of commission or omission are the potentially most effective safety solution. The KBMS method showed an effective way to compare the potential of various safety solutions, through a scored list with the expected effectiveness of each safety solution for the region to which the crash data belong. A comparison of our results with a previous study that attempted a systematic prioritization of safety systems for motorcycles (PISa project) showed an encouraging agreement.

Conclusions:
Current results revealed that automatic systems have the greatest potential to improve motorcycle safety. Accumulating and encoding expertise in crash analysis from a range of disciplines into a scalable and reusable analytical tool, as proposed with the use of KBMS, has the potential to guide research and development of effective safety systems. As the expert assessment of the crash scenarios is decoupled from the regional crash database, the expert assessment may be reutilized, thereby allowing rapid reanalysis when new crash data become available. In addition, the KBMS methodology has potential application to injury forecasting, driver/rider training strategies, and redesign of existing road infrastructure.