

# **Can a Boxer Engine Reduce Leg Injuries Among Motorcyclists? Analysis of Injury Distributions in Crashes Involving Different Motorcycles Fitted with Antilock Brakes (ABS).**

## **Abstract**

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### **OBJECTIVES:**

Several studies have shown that motorcycle antilock braking systems (ABS) reduce crashes and injuries. However, it has been suggested that the improved stability provided by ABS would make upright crashes more frequent, thus changing the injury distributions among motorcyclists and increasing the risk of leg injuries. The overall motorcycle design can vary across different categories and manufacturers. For instance, some motorcycles are equipped with boxer-twin engines; that is, with protruding cylinder heads. A previous study based on a limited material has suggested that these could provide some leg protection; therefore, the aim of this research was to analyze injury distributions in crashes involving ABS-equipped motorcycles with boxer-twin engines compared to similar ABS-equipped motorcycles with other engine configurations.

### **METHODS:**

Swedish hospital and police records from 2003-2014 were used. Crashes involving ABS-equipped motorcycles with boxer-twin engines (n = 55) were compared with similar ABS-equipped motorcycles with other engines configurations (n = 127). The distributions of Abbreviated Injury Scale (AIS) 1+ and AIS 2+ were compared. Each subject's injury scores were also converted to the risk for permanent medical impairment (RPMI), which shows the risk of different levels of permanent medical impairment given the severity and location and of injuries. To compare injury severity, the mean RPMI 1+ and RPMI 10+ were analyzed for each body region and in overall for each group of motorcyclists.

### **RESULTS:**

It was found that AIS 1+, AIS 2+, and PMI 1+ leg injuries were reduced by approximately 50% among riders with boxer engines. These results were statistically significant. The number of injuries to the upper body did not increase; the mean RPMI to the head and upper body were similar across the 2 groups, suggesting that the severity of injuries did not increase either. Indications were found suggesting that the overall mean RPMI 1+ was lower among riders with boxer engines, although this result was not statistically significant. The mean values of the overall RPMI 10+ were similar.

### **CONCLUSIONS:**

Boxer-twin engines were not originally developed to improve motorcycle crashworthiness. However, the present article indicates that these engines can reduce leg injuries among riders of motorcycles fitted with ABS. Though it is recommended that future research should look deeper into this particular aspect, the present findings suggest that the concept of integrated leg protection is indeed feasible and that further engineering efforts in this area are likely to yield significant savings in health losses among motorcyclists.