SPORT UTILITY VEHICLES AND VULNERABLE ROAD USERS

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All authors declare that the answer to the questions on your competing interest form (http://bmj.com/cgi/content/full/317/7154/291/DC1) are all No and therefore have nothing to declare

In an ageing society older pedestrians represent a particularly vulnerable group of road users, despite more prudent road usage. Those over 60 are more than four times as likely to die if injured by a car than younger people [1]: in a pattern repeated around the developed world, older people in Ireland represent 30% of pedestrian fatalities while accounting for only 11% of population [2]. The WHO has recognised protection of older pedestrians as the key safety measure for this age group [3]. Older pedestrians represent the most vulnerable of an already at-risk group of road users and maximising pedestrian protection is therefore an important goal. Pedestrian protection is an even more pressing problem in the developing world. While pedestrian injuries and fatalities arising from collisions with vehicles represent about 20% of automotive casualties in the European Union [4], the proportion of who are pedestrians can rise to nearly 50% in countries with poorer roads and where a high percentage of travel is by foot [5].

Pedestrian protection is achieved in several different ways. These include separation of vehicular traffic from pedestrians, reduction of vehicle speeds [6 7 8], development of “smart vehicles” to avoid collisions and improved vehicle design to reduce injuries to pedestrians [9]. The proliferation of Sport Utility Vehicles (SUV’s) in all developed countries as well as emerging accident analysis data provides an opportunity to evaluate the effect of vehicle design on pedestrian safety. In Europe, sales of SUVs have increased by 15% in the last year, while sales of standard cars have dropped by 4% [10]. In Ireland, SUVs now represent almost 8% of new registrations.

In the US, Gabler and Lefler have shown that despite poorer fuel efficiencies and increased fuel costs, 40% of new vehicles purchased are classified as light trucks or vans (many of which are SUV’s) [11]. These researchers have used the US Fatal Accident Reporting system database (FARS) to analyse the relative dangers posed to pedestrians by the introduction of these high fronted vehicles. Results show that, for the same collision speed, the likelihood of a pedestrian fatality is nearly doubled in the event of a collision with a large SUV compared to a passenger car. To this study has been added several more studies consistently showing higher rates (up to four times greater) of severe injury and death for pedestrians in collisions with SUV’s [12-14].

A common misconception is that the increased vehicle mass is responsible for the increased hazard to pedestrians from SUV's. In fact, although vehicle mass is important for car to car collisions, it is a very minor factor for vehicle-pedestrian collisions given the disparity between the weight of the pedestrian and the vehicle [15]. The increased mortality and morbidity from SUV's arises primarily from the geometry of the front end structure. In a typical collision between a car and an adult pedestrian, the bumper strikes the lower leg region and the leading edge of the bonnet then strikes the femur/pelvis region causing the pedestrian to rotate towards the bonnet. This results in the bonnet or windscreen impacting the shoulders and/or head. After this further injuries often occur through impact with the ground. A key mitigating factor in injury severity is the relatively peripheral nature of the primary impact of the bumper to the lower legs. [16-18]. This affords a degree of protection to the critical upper body regions in the primary impact and the resulting body rotation onto the bonnet tends to further diminish the impact, often called 'wrap and carry'. The principal pedestrian injuries from cars are predominantly tibia/fibula fracture and/or knee cruciate and collateral ligament injuries from the primary bumper contact [19], and head injuries from the secondary impact with the bonnet or windscreen [20].

However, when an SUV strikes a pedestrian, injury patterns are different. The key design difference between SUV's and cars is the bonnet height, and this results in a more severe primary impact which involves the critical central body regions of the upper leg and pelvis [21]. Also, there is now less rotation as the impact is closer to the body centre of mass, resulting in a more efficient impact energy transfer. For example, raising the bonnet leading edge height from 600mm to 850mm, increases the impulse by a factor of about two [22]. This results in a doubling of injuries to vulnerable regions such as the head, thorax and abdomen [14]. Femur/thigh loading occurs from contact with the bonnet leading edge during the rotation phase, especially if the bonnet is raised [22].

Another group of vulnerable road users are small children, and a well described risk with SUV's are accidents in driveways, in which SUV's and light trucks are over-represented [23 24]. This is probably an index of the increased height of the SUV and poor visibility design.

It is now clearly established that SUV's represent a significantly greater hazard to vulnerable road users than ordinary cars. As the proportion of SUV's is growing rapidly, the risk is likely to be exacerbated by the greater physical vulnerability of an ageing population. Addressing this threat requires an integrated approach from public health, transportation and road safety agencies (including vehicle designers) with the aim of reducing the burden associated with these vehicles. It will also be important to change crash investigation processes to include a more clearly defined categorization of SUV's in vehicle-pedestrian impact statistics. Given the increasing economic importance of the SUV market to manufacturers, traffic safety activists in the health professions will need to keep pressure on governments who prioritize economic and industrials concerns ahead of effective safety strategies [25].

In the interim, informing consumers of the increased risk to pedestrians from SUV's may represent a useful first step in raising public awareness of the hazard. The Irish Medical Organisation has recently adopted a policy calling on motor manufacturers and distributors to display warning notices on SUV's which advise potential vehicle purchasers of the increased risk of severe injury and death to pedestrians associated with these vehicles. Resistance from the industry to such initiatives is likely to be strong, just as it has been from the tobacco industry for warnings on cigarette packaging [26]. However, healthcare advocates should take heart from previous successful traffic safety initiatives [27]: addressing the hazards posed by SUV's to pedestrians is an emerging and real traffic safety challenge in the developed world.

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