A close up of a sign

Description automatically generatedA drawing of a person

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**Women who walk.**

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In recent years the inclusion of women in medical and scientific studies has been promoted. This essay was inspired by the story of Mary Ward the first casualty of a road traffic accident in Birr Co. Offaly in 1869. On close examination of women and men’s travel patterns, both sexes use transport differently (1, 2). Men tend to operate on a simple travel pattern of twice daily journey, outbound and inbound journey between home and work (1). Whereas women usually have more complex travel patterns (1). Females have a propensity to ‘trip chain’ where they make several small, interconnected journeys between places of business (1, 2). These journeys are less predictable and can vary greatly on the days, destination, time spend at one location and mode pf transport (1, 2). Trip chain by women can be explained as women are responsible for approximately 75% of unpaid care worker globally and women are more likely to be employed in part-time work (1). Their daily routines may involve bringing children to school, going to work, then departing work to pick up children, going to the supermarket, checking in on elderly relatives, bringing family members to health appointments, extra-curricular activities etc. (1). Some women may have access to a car to undertake this complex system of journeys however statistically if a household possess only one car the patriarch has pre-eminence access over the matriarch (1, 3). Therefore, women are more likely to rely on walkways, public transport or being a passenger in a car to navigate their daily routines (1, 3). Approximately 66% of public transport users are female (1, 2). So, using this setting, let us investigate traffic medicine focusing on the pedestrians and car passengers.

Road traffic accidents (RTAs) are the main cause of unintentional injuries and the primary contributor of injury-related disability adjusted life years (3-6). RTAs are the ninth leading cause of death worldwide and the main cause premature deaths worldwide (3-6). Approximately 15% of European road traffic collisions involved pedestrians (3). The common road traffic injuries (RTIs) sustained by sufferers are burns, crush injuries, disfiguring facial injuries, fractures, internal organ injuries, lacerations, soft tissue injuries, non-specific back pain, spinal cord injuries, and post-traumatic stress disorder (4-6). Subsequently RTIs cause a major societal and economic burden. In 2010 the United Nations launched the Decade of Action for Road Safety 2011-2020 with aims to reduce the burden of RTIs and protect 5 million lives globally from premature disability and death (5). Since this initiative launched awareness of road safety and its direct links to economic and social development have grown significantly and promotion of road safety interventions have gain prominence (5). In 2021 the Road Safety Authority recorded the lowest number of road user casualties since documentation began in 1959 (7). Similarly, Ireland had its lowest ever number of pedestrian deaths at 18 fatalities (7).

Pedestrians involved in road traffic accidents present with trauma injuries different to wounded motor vehicle occupants (3, 8, 9). As RTAs involve immense force, deceleration, and inertia, when impact is suffered by an unprotected human body the injuries that occur are severe(3, 8, 9). Pedestrian motor vehicle collisions (PMVCs) consist of three main physical impacts, the bumper, the bonnet and windscreen as well as the ground (3, 8, 9). Centred around this mechanism, exact injury patterns in PMVCs are defined (3, 8, 9). In the 1960s, Farley coined the term ‘fatal triad’ to describe a clinical scenario where a patient sustained injuries to their head, pelvis, and lower extremities during a PMVCs (3). In the 1970s this theory was refined to a combination of injuries to the head, hip/pelvis, and knee region (3, 8, 9). Where the fatal triad is not always observed, it can be stated that lower extremity musculoskeletal injuries are the most common injuries suffered by causalities of PMVCs (3).

In contrast to motor vehicle occupants more children, elderly and women were involved in PMVCs (1, 3). These pedestrians sustain head, pelvis, and lower extremity injuries more commonly and at greater severity than the car driver or passengers (3, 8, 9). Regarding the injury pattern, the combination of head, chest and lower limbs are the most common sequence (3, 8, 9). Moreover, injured pedestrians have a higher mortality than motor vehicle occupants, despite them experiencing shorter rescue time and an approximately equal injury severity score (ISS) (3, 8-10).

There is a higher rate of elderly pedestrians involved in RTAs than as drivers or passengers (3, 8, 11). A common hypothesis to why elderly people tend to be affected by RTAs as pedestrians and sustain injury from a collision is because of their reduced physiological capabilities (3, 8, 11). Moreover, when older people are involved in a collision the risk of them sustaining severe injuries is considerably higher than younger persons who experience a similar mechanism of injury (3, 8, 11). Interestingly, females were overrepresented in the pedestrian group when contrasted against motor vehicle occupants (3). There is very little data concerning gender distribution in collision trauma patients (3). One hypothesis might be the higher life expectancy of women in conjunction with the fact older people are more likely to be involved and severely injured in RTAs (3). Moreover, sex differences concerning access to household cars still occur in the western world (1, 3). Although there are few countries with evidence to challenge this statement, in Germany men 65 years and older prevail over women of the same age in terms of owning a driving license (3). Concurrently, no relevant sex differences are known in younger drivers (3). Unfortunately, the higher rate of children in PMVCs is not unexpected (3, 8). This is most likely because of their erratic behaviour as road users (3). Alongside this, studies have established that children have longer reaction times and less developed locomotory capabilities which further make them susceptible to be victims of PMVCs (3).

Between victims of PMVCs and motor vehicle occupants there are significant differences in injury patterns and degree of severity (3, 8, 11). In PMVCs the force of impact usually hits an unprotected human body (3, 8, 11). The lack of physical protection against this force makes pedestrians, bicyclists, or motorbike drivers especially vulnerable road users (3, 8, 11). Interestingly, motor vehicle drivers and passengers demonstrated a higher rate of injuries to the abdomen while pedestrians sustained body injured to mainly the head and limbs (3, 8, 10-12). This high rate of severe head injuries is one explanation for low initial GCS scores on hospital admission, commonly recorded as less than 9 (3). Moreover, for the high rate of pre-hospital intubations of pedestrian casualties (3). This typical PMVC injury combination is supported by the standard theory of PMVC kinematics (3). However, recent studies have revealed notable unique variations in common PMVC injury arrangement that are affected by several factors e.g., body region of first impact, main impact direction and type of vehicle (3, 8, 11). The typical ‘fatal triad’ of injuries is difficult to identify in severely injured PMVC casualties (3). Still, there may be differences in terms of inclusion criteria like injury severity (3). When the ‘fatal triad’ was developed physicians did not use the Abbreviated Injury Scale (AIS) score to determine coherence of injury combinations and severity (3). For a complete picture of variation in injury type and severity, one must account for the pedestrian involved as well as external circumstances like the type of vehicle, road, and traffic flow at that time (3, 8, 11). In terms of treatment, it can be said that identifying the fatal triad is less relevant (3).

Intriguingly, although pedestrian causalities experience shorter on-scene treatment and emergency transport operating times, they still have considerably higher mortality than motor vehicle occupants, 21.7% vs 12.3% respectively (3, 8, 11). This contradicts the widely recognized paradigm, that time is a vital factor, in trauma care of severely injured patients (3, 8, 11). Roughly 15-20% of severely injured motor vehicle occupants are trapped in their car when paramedics arrive (3, 8, 11). Thus, on-scene treatment time is prolonged for most injured motor vehicle occupants rather than in injured pedestrians (3, 8, 11). Nonetheless, the expected mortality, using the RISC- Score to calculate; and the observed mortality, were higher in the pedestrian group (3). In regards the RISC-Score factors, the underlying collision mechanism and the injury sustained are the main to influences of mortality (3). The severity of head injury and age also strongly effect prognosis and mortality (3). This is reasonable as these four factors are where pedestrians and motor vehicle occupants’ injuries differ most (3).

Notably, pedestrians show both a considerably higher rate of severe head injury and substantially less pre-hospital interventions, particularly a lower pre-hospital intubation rate when contrasted with equally injured motor vehicle drivers or passengers (3). Despite, the conformity between predicted and observed deaths in both groups, one must conclude that the underestimation of pedestrian traffic collision fatalities during on-scene emergency treatment may impact the group’s poor clinical prognosis (3). Similar observations can be made regarding pre-hospital sedation and operations in the hospital (3). Pedestrian groups analysed had such severe injuries which made surgery necessary in greater than 80% of cases (3, 8, 11). Pedestrians undergo surgery in 81.2% of RTA and motor vehicle occupants in 85.3% (3, 8, 11). A potential reason for this may be an underestimation or the circumstance that a portion of pedestrians die before the surgery begins (3, 8, 11). Regarding sedation, 75% of pedestrian receive sedation whereas, 84% of motor vehicle occupants are sedated (3). Of note, more severe injuries undermine a less aggressive therapy regime (3). Conversely a ‘scoop and run’ regime of emergency services for severely injured patients and short transport times could explain less pre-hospital treatment (3). These facts discussed are significant but may not be a comprehensive look at PMVC casualties (3). Most of the information collected is by registered hospital trauma centres (3). RTAs which happen fay from trauma centres and therefore victims may be taken to smaller hospitals may experience different clinical outcomes (3).

Following on from the pedestrian scenario, women are more likely to be a passenger rather than driver in a car (1-3). Recent improvements in motor vehicle design with a priority to safety have resulted in a decreased in serious injury and mortality for vehicle occupants in RTAs (12). Car manufacturers utilize crash test data to classify vehicle safety performance with the conventional opinion of the driver as the most vulnerable occupant rather than the front seat passenger (FSP) (12, 13). However, crash test simulations consider the level of protection around drivers and FSPs rather than the injuries endured in RTAs (12). The most common injury sustain by motor vehicle occupants in a RTA is a blunt diaphragm rupture, however like PMVC victims, FSPs present a unique pattern of injuries (3, 12, 13). UK databases reveal that higher rates of serious injury and mortality occur in FSPs than in drivers involved in RTAs (12). FSP mortality is 0.47% higher than driver mortality (13). As these UK databases collect information on real events, they are more revealing than the hypothetical events portrayed by car manufacturers (12). Traditionally, it was though that the driver was the most susceptible to injury, because of their closeness to the steering wheel (12, 13). However, statistics would suggest that in modern cars the steering wheel acts as a protective agent (12, 13). Regarding airbag deployment of the driver and passenger sides, the presence or absence of side collision protection systems may provide insight into the difference between driver and FSP injuries (12). The care given to driver protection by way of driver’s side air bags and related safety measures have improved the level of driver security (12). The absence of a steering wheel may cause greater forward momentum in FSPs resulting in a greater force transfer, focused into the chest and abdomen (12). The relatively higher occurrence of spinal injuries may be caused by hyperflexion because of this greater forward momentum (12, 13). When looking at seatbelt wearing behaviour, it seems influences by age and gender, this is a possible factor influencing injury of FSPs (12). Optimal positioning a seatbelt on a body are designed around a male architype and are often ill-fitting for children, petite, or pregnant women (12). Another potential reason is that a driver, being in control of the motor vehicle, can intentionally or not take evasive action (12, 13). The exact mechanism of the RTA will affect the combination of injuries suffered (12, 13). Unlike in crash test analysis, FSPs are at increased risk of injury compared to drivers in actual RTAs as recorded in the STAG database (12). All vehicle occupants sustain abdominal injuries, however FSPs experience the highest severity of injury, then rear passengers and finally drivers (12, 13). When looking at RTA casualties who arrive alive to hospital, the highest mortality was found in FSPs (13). Their most common and serious injuries were chest injuries (12, 13). Rear seat passengers are at the larger risk for serious traumatic brain injuries followed by FSPs then drivers (13). Results from crash test studies and real-life car safety performance should be examined together to develop optimal safety mechanism for all car occupants (12). Car manufacturers should put equal attention into protecting all potential passengers of their cars (12).

To conclude, pedestrians are vulnerable road users (3, 8, 11). If involved in a RTA they usually sustain severe injuries and have high consequent mortality (3, 8, 11). Emergency services should be alerted to the unique scenario of an injured pedestrian and prepare for the typical PMVC victim to be wither very young or elderly with substantial head and lower limb trauma as well as an impaired level of consciousness and hypovolemic shock (3). Likewise, other motor vehicle occupants suffer a unique pattern of injuries compared to drivers (12, 13). Acknowledging this, emergency services can enhance the initial emergency management and consequently promote better clinical outcomes for a casualties involved (3, 12, 13).

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