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INTRODUCTION

The demand for trauma care in Jamaica has reached epidemic proportions\(^1\)\(^-\)\(^3\). In this setting 13% of all road traffic accident victims are injured on motorcycles\(^4\) and the number has been increasing over the past decade\(^4\).

The victims are exposed to a greater degree of body trauma than automobile occupants involved in collisions of similar velocities because of the lack of available safety equipment such as airbags and seatbelts\(^4\)\(^-\)\(^9\). The resultant injuries place a heavy burden on the government funded public health care system in Jamaica\(^1\)\(^-\)\(^3\), with 72% of collision victims requiring major operative intervention\(^4\) and 4.4% in-hospital mortality\(^3\)\(^,\)\(^10\).

Apart from the demand on health care resources, motorcycle collisions have a serious negative impact on Jamaica’s productive sector. With 53% of collision victims being young persons between the ages of 20 and 35 years\(^4\), the society loses many man-hours of work when these potentially productive individuals are injured. The resultant disability takes an additional toll, with 20% of head injured victims having persistent disability and functional dependence in daily living activities after discharge\(^4\). A further 22% of victims were not able to return to work in a timely fashion\(^4\).

The impact of these preventable injuries on the social, economic and health care sectors of Jamaica is enormous\(^1\)\(^-\)\(^4\)\(^,\)\(^10\). Thought must be given to preventive strategies to minimize the impact of these injuries on precious health and human resources.

Generally, two approaches to injury prevention are recognized: Primary prevention aims to reduce the incidence of motorcycle collisions through legislation, law enforcement and behavioural change. Secondary prevention goes beyond “accident prevention” and aims to limit the severity of injury once a collision has occurred. This paper reviews the secondary preventive methods current employed in Jamaica and the authors offer suggestions on strategies to further reduce these injuries.

STRATEGIES FOR SECONDARY PREVENTION

Organ injury occurs as a result of energy transfer that exceeds the threshold for tissue damage. Limitation of tissue damage can be achieved by reducing energy transfer to collision victims either through passive or active mechanisms.

INJURY LIMITATION BY PASSIVE MECHANISMS

Passive Mechanisms offer protection even when victims are non-compliant because they require no active input from the rider. Traditional automobiles offer passengers several passive mechanisms for secondary prevention, including
airbags, crash cages, collision crumple zones and bumpers. Unfortunately, none of these safety devices are available to motorcycle users.

**INJURY LIMITATION BY ACTIVE MECHANISMS**

Active mechanisms for secondary prevention are those requiring continued activity on the part of the user. These include the use of seatbelts in traditional automobiles or helmets and protective clothing for motorcycle users. These mechanisms are less effective than passive mechanisms that do not require voluntary rider activity.

**EVALUATING EXISTING SECONDARY PREVENTION STRATEGIES**

To ensure that the existing strategies for secondary prevention of motorcycle collision injuries are effective, policy makers should carry out regular policy evaluation exercises. There are two prerequisites to maximize the benefit of this exercise: (1) The problem must be defined by determining local injury demographics and the resultant therapeutic requirements; (2) Any existing policies must be critically evaluated to determine whether they adequately meet the existing demands.

The local injury demographics from motorcycle collision victims in Jamaica have already been described (4,11,12). The commonest injuries encountered are soft tissue trauma (100%), extremity long bone fractures (78%), head injuries (53%), thoracic injuries (26.3%), abdominal visceral injuries (14.1%) and peripheral vascular injuries (3.3%).

The Government of Jamaica published a revised Road Traffic Act in 1999 that addressed the requirements governing the safe use of motorcycles on Jamaican roadways (13). Several clauses that addressed preventive strategies were incorporated into that act (13). The Government of Jamaica charged the Island Traffic Authority with enforcement of these policies (13). To evaluate the efficacy with which these policies address the existing needs, potential injuries must be evaluated individually.

1. **SKIN AND SOFT TISSUE INJURIES:**

The high prevalence of soft tissue extremity injuries in motorcycle collisions is expected because of the degree of body exposure of motorcyclists. Fortunately, most are minor injuries involving only skin and/or subcutaneous tissues (14). These injuries are caused by unprotected contact with hard surfaces on collision vehicles or by the rider tumbling, rolling or sliding along the road surface.

Specialized motorcycle clothing provides some protection against this type of injury mechanism (15-22). Most of these garments are made of leather that reduces the tendency of the body to tumble by creating a smoother motion when it slides over road surfaces. Schuller et al reported that injured riders who wore protective leather clothing had a significantly shorter duration of hospitalization / recovery and were 40% less likely to suffer permanent physical deficits compared to unprotected riders (18). They concluded that protective clothing prevented or reduced 43% of soft tissue injuries and 63% of deep and/or extensive injuries (18). Otte et al reported similar findings, where impact protective gear and high boots significantly reduced the incidence of limb injuries and complex leg fractures (20).

Opponents to the use of protective motorcycle clothing tout the counterargument that there is little protection in the event of a high-speed collision. However, the Motorcycle Collision In Depth Study (MAIDS) revealed that 75% of motorcycle collisions occurred at speeds <50 km/h (35 mph), especially in urban areas (22,23). Additionally, 40% of riders tumbled, rolled or slid along the road surface without impacting with another vehicle or fixed object (22,23). These are exactly the type of collision mechanisms where protective motorcycle clothing offer the greatest injury limitation.

The Road Traffic Act in Jamaica does not address the use of protective garments (13). Observational studies have also revealed that most motorcyclists in Jamaica do not wear protective clothing (12). This is possibly because most are leather garments that are impractical for tropical climates. It is probably time for legislators to consider the use of protective garments and manufacturers of protective motorcycle clothing should consider developing protective material that is suitable for consumers in tropical countries.

2. **EXTREMITY INJURIES (FRACTURES AND VASCULAR INJURIES):**

It has been well established that the lower limbs are the body parts most likely to be injured in motorcycle collisions (4,12,14,15,18,20,24). Approximately 30–45% of these injuries are compound fractures that require operative débridement and/or external fixation (14). This is expected when exposed limbs become trapped between the motorcycle and the ground or impacting vehicle.

Crash bars have been touted as a means of preventing these injuries although there is little scientific evidence to support
their use as effective injury countermeasures. Crash bars may reduce the prevalence of foot and ankle injuries, but tend to increase the incidence of injuries to the femur, knee, proximal leg and upper body. It has also been suggested that crash bars change the collision dynamics and increase the likelihood for the rider to impact the pavement “head-first”, thereby increasing the potential for fatal head and neck injuries. These are areas that deserve further study.

The use of crash bars as mandatory safety equipment was not addressed in the Jamaica Road Traffic Act. It is an important factor to at least consider since it has been reported that 47% of the motorcycle collision victims on Jamaican roads present with complex lower limb injuries.

3. HEAD INJURIES:

The use of an approved safety helmet that meets US Federal Motor Vehicle Safety Standards (FMVSS) 218 is the single most important factor to significantly reduce the severity of head and neck injuries resulting from motorcycle collisions. Helmeted riders have been shown to have 70% reduction in injury severity and 40% reduction in mortality compared to un-helmeted riders in collisions. Other proven benefits include significant reductions in the likelihood of sustaining head injuries, requirements for Intensive Care and costs associated with the treatment of these patients.

Adversaries of the helmet laws have suggested that the data showing significant protective effects from helmet use may not be applicable to motorcycle riders in under-developed nations. They cite road conditions that differ from developed countries that have high velocity traffic and multiple lane speedways. This is particularly true in Jamaica, where the narrow, winding, single lane roadways do not readily allow high velocity travel. However, there is data proving that helmet use still provides protection to motorcycle collision victims in this setting. Prospective cohort studies of motorcycle collision victims in Jamaica have revealed that the use of an approved helmet at the time of a collision significantly reduced the likelihood of sustaining head injuries (34% vs 66%), severe traumatic brain injuries (29% vs 47%), intra-cranial lesions (27% vs 45%) and serious neuro-motor disability (1% vs 4%) after hospital discharge.

Although the Jamaica Road Traffic Act mandates motorcycle riders to wear approved helmets, less than half of motorcycle collision victims on Jamaican roads are compliant with the helmet laws and only one third of motorcycle collision victims were helmeted at the time of a collision. These figures are well below those reported from high-income countries, but they are comparable to reports from other low-income nations. However, there have been positive trends toward increased helmet use since the amended Road Traffic Act was published in 1999. Seven years after the introduction of the helmet law, 62% of riders wore helmets compared to 34% of riders immediately after its introduction in 2000.

4. ABDOMINAL AND THORACIC VISCERA:

Blunt thoraco-abdominal visceral injuries are serious consequences of motorcycle collisions, affecting 40% of collision victims on Jamaican roadways and accounting for 25% of motorcycle road traffic fatalities. Unfortunately, there are currently no safety mechanisms identified that reliably offer protection against injuries to the torso.

RECOMMENDATIONS TO IMPROVE SECONDARY PREVENTION

It is clear that there is need for Jamaican legislators to consider additional strategies for secondary prevention, but there is also room to improve existing policies. The only strategy for secondary prevention of motorcyclist injury currently in existence in Jamaica is the requirement for helmet use. The drawback with this type of active mechanism is the requirement for continued activity by the motorcyclist.

EDUCATIONAL CAMPAIGNS:

With less than 50% of motorcycle collision victims on Jamaican roads compliant with helmet laws, the largest barrier is non-compliance by the motorcyclist. Non-compliant motorcyclists report several reasons for not wearing helmets, including prohibitive cost, impaired vision, attenuation of critical traffic sounds, increased fatigue, helmet discomfort, inconvenience and incompatibility with rastafarian locks. None of these alleged disadvantages are supported by evidence, and this is an important point to deliver by public educational campaigns.

Campaign messages can be transmitted via mass media targeting high-risk populations. Although young males are commonly thought to be most involved in risk taking behaviour, observational studies have revealed that
women and pillion riders between the ages of 20 and 39 years account for the majority of non-compliant motorcycle users on Jamaican roads (12). Educational campaigns should target all motorcycle riders, but should pay special attention to these groups.

Educational campaigns may also be geared to address a troubling cultural practice that exists on Jamaican roadways. This has been previously described as the “bike back culture” where pillion passengers (usually females) are scantily clad to maximize their body exposure, without protective garments or helmets (12). The legislators should pay close attention to the “bike back culture” as the unprotected pillion passengers place themselves at risk by engaging in this practice. Additionally, this can be a very distracting practice to automobile drivers also utilizing the roadways, thereby increasing the likelihood of collisions. Apart from the helmet law (13), pillion passengers who fall victim to the “bike back culture” are currently not in contravention of any other traffic regulation. We believe that legislators should address this and put special provisions in place within the Road Traffic Act to regulate this practice.

**TRAFFIC LAW ENFORCEMENT:**

Traffic law enforcement has been documented to be lacking in Jamaica (11,12) and many other developing countries (30,32). This may be permissive to the high level of non-compliance on Jamaican roads. This is an area that legislators may easily rectify by policy adjustment to allow visible and consistent enforcement of traffic regulations.

**PENALTIES FOR OFFENCES:**

Legislators should also critically analyze the penalties imposed on non-compliant motorcyclists. Currently, the laws of Jamaica stipulate that person found to be in contravention of the Road Traffic Act is guilty of a punishable offence (13). Two types of penalties are imposed on offenders: imprisonment / Monetary Penalties and Demerit Points.

**IMPRISONMENT / MONETARY PENALTIES**

Any offender convicted of operating a motorcycle without approved protective headgear (Section 43-D) is liable to a fine not exceeding $2,000.00 ($27.34 US) in the case of a first offence, and a fine not exceeding $5,000.00 ($68.35 US) in the case of a second offence (13). These monetary penalties are deterrents to non-compliance, but the fines are not appropriate in modern times. Implementation of more realistic penalties may motivate more motorcycle users to be compliant with the helmet laws.

**DEMERIT POINT SYSTEM**

The Island Traffic Authority manages a “demerit point system” and maintains records of endorsements on drivers’ licenses (13). In this system, the appropriate demerit points “are assigned to offenders’ driver licenses by the courts in addition to any penalty for that offence” and the offenders can have “their license disqualified in accordance with the demerit points accumulated” (13). The offenders can be disqualified for a period of 6 months if they have accumulated 10-14 points, one year with 15-20 points and 2 years with >20 demerit points (13). While this demerit system provides an additional deterrent to, it does not compensate for inappropriate monetary penalties.

**IMPAIRED DRIVING:**

Driving while under the influence of drugs or alcohol is another reason for non-compliance (21,23). Alcohol impaired driving is a problem that has been singled out because it has been identified as an important cause of road traffic mortality worldwide (30). Alcohol has several deleterious effects, including impaired behavioural and cognitive capacities (30-32), reduced reaction time (30,33,34), impaired judgement (30,31,33,35) and reduced visual acuity (31,36).

The National Road Safety Council reported that 3.3% of all road traffic collisions on Jamaican roads are attributable to the influence of alcohol (31). To deter inebriated drivers, the Road Traffic Act (Section 34-1) has listed driving under the influence of alcohol (DUI) as an offence where a driver attempts to operate a motor vehicle with “alcohol levels above the legal limit of 35micrograms/100ml on breath testing or 80mg/100ml of blood” (17). Currently, Jamaica Constabulary officers are granted the authority to conduct breath tests on suspected DUI offenders. Non-compliant drivers can be arrested without a warrant and, if convicted, will face monetary penalties and/or imprisonment (Section 34b-5) (13).

Although legislation is in place, enforcement of traffic laws remains a problem (11,12). Legislators should aim to achieve visible, high profile enforcement that may include activities such as random breath testing at sobriety check points by special DUI task forces with proper equipment and training (30,37). The enforcement activity should also target specific groups / individuals (32).
When convicted of a DUI offence under Jamaican law, the guilty rider is liable to imprisonment for a term not exceeding 4 months (6 months for a second conviction) or a penalty not exceeding $20,000.00 ($249.02 US) and disqualification from holding a license for 12 months from conviction. Again, the penalties for a DUI offence in Jamaica are not appropriate deterrents in modern times. Legislators should revise these penalties, while considering the evidence that recidivist DUI offenders are less receptive to traditional sanctions and require intense, tailored rehabilitation since many are alcohol abusers\(^{38-40}\).

It is commendable that the Jamaican government has implemented several related pieces of legislation that restrict access to alcohol: The Child Care and Protection Act\(^{41}\) restricts alcohol access to anyone below the legal purchasing age of 18 years (Section 62-b); the Spirit License Act\(^{42}\) regulates points of sale by requiring proprietors to be licensed to sell alcohol (Section 3); the Excise Duty Act\(^{43}\) regulates points of sale (Section 31-39); and the Customs Act\(^{44}\) imposes special taxation for alcohol purchases. Other useful strategies, already utilized in high-income countries, that the Government of Jamaica may also consider include defining a lower legal limit for novice drivers, younger drivers and drivers of commercial vehicles\(^{39-46}\).

**CONCLUSIONS**

It is time for policy makers in Jamaica to examine the available alternative measures for secondary prevention of motorcycle collision injuries. Legislators should also re-examine existing laws to ensure that the penalties for non-compliance are applicable in this modern era. This is an important task in the current economic climate where there is need to preserve the precious health and human resources.

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