Preventing Road Traffic Injuries in Jamaica: Gap Analysis and Recommendations

Prepared for The National Road Safety Council of Jamaica by The Johns Hopkins Center for Injury Research and Policy
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EXECUTIVE SUMMARY

The Johns Hopkins Center for Injury Research and Policy (JHCIRP) was asked by the National Road Safety Council of Jamaica (NRSC) to conduct a gap analysis and produce recommendations for programming, policy, and/or research to reduce traffic-related crashes, deaths, and injuries in Jamaica.

The gap analysis utilized three methods: a literature review to document the epidemiology of road traffic injuries in Jamaica; a review of Jamaica’s existing data sources relevant to road traffic crashes and the initiatives being undertaken by NRSC; and a site visit to conduct stakeholder interviews. Gaps and priorities were determined by synthesizing and discussing the results of these activities with the NRSC leadership. Best practice recommendations to address these priorities were culled from the research literature and international organizations. Throughout the process, the research team maintained regular communication with NRSC leadership through email and calls via Skype.

Six overarching priorities consistent with the Safe Systems approach were identified by the research team and NRSC (Table 1):

1. Structural Priorities
2. Cultural and Educational Priorities
3. Safety Vehicle Accessibility Priorities
4. Data Priorities
5. Emergency Response Priorities
6. Electronic Surveillance Priorities

A total of 24 best practice recommendations identified to address these priorities were culled from the research literature and international organizations. Each of these recommendations is described in detail with supporting references to the literature. Many of the best practices come from World Health Organization guidance and are grounded in the Safe Systems approach. Some practices are already in progress in Jamaica, while others have support in the Road Traffic Act that was pending at the time of this work. The commitment of the NRSC and the multiple other stakeholders to ensuring passage and implementation of the Act bodes well for the future of road traffic safety in Jamaica.
<table>
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<th>Priority</th>
<th>Best Practice Recommendation</th>
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| Enforcement | 1. Implement drink and drug-driving law with testing enforcement that meets international standards of limits  
2. Strengthen traditional enforcement with the use of automated enforcement systems  
3. Enforce motorcycle riders for proper helmet wearing  
4. Require standards for vehicles to ensure seat-belt anchorage points  
5. Consider increasing fine levels  
6. Urge International Road Assessment Programme (IRAP) safety assessments and local road assessments to produce star ratings for roads ownership, safety roads, and responsibilities |
| Low literacy | 7. Develop pictorial/oral drivers' licensing test to measure road safety knowledge of those who cannot read  
8. Increase and enhance educational programs to address the issues of unsafe driving |
| Prioritizing safety | 9. Establish an interagency joint task force between groups responsible for educational campaigns in road safety to ensure consistency in messaging and reduce redundancy in work. |
| Coordinated messages | 10. Ensure availability of electronic stability control in vehicles as well as other built-in safety technology [e.g., Intelligent Speed Assistance (ISA) and Autonomous Emergency Braking (AEB)] |
| Vehicle fitness | 11. Support transportation, law enforcement, and healthcare sectors working together to integrate data into shared systems using the preparation, implementation, assessment approach  
12. Institute mechanisms to promote data-driven practice  
13. Enhance data systems to capture exposure measures, intermediate and final outcomes, and socio-economic costs, and outputs |
| Coordination of indicators and reporting | 14. Standardize curriculum and training for all EMTs to the basic life support (BLS) level  
15. Establish handoff procedure between different entities  
16. Equip all EMS services with appropriate and necessary tools |
| Protocols | 17. Develop centralized triage system that determines nature of the problem and dispatches appropriate and nearby assistance  
18. Ensure dispatcher is able to deliver pre-arrival instruction to caller  
19. Institute emergency lane law that requires drives to move over for an ambulance, fire truck, or police car |
| Availability & response | 20. Equip all EMS services with appropriate and necessary tools, including dedicated communication networks among dispatch, ambulances, and hospitals |
| Communication networks | 21. Train citizens, police and fire officers in medical first aid (this can be carried out by EMTs or emergency physicians) |
| First responder trainings | 22. Implement electronic surveillance tools, especially transportable speed cameras to reduce vehicle speeds and crash incidence on roadways |
| Electronic surveillance technology | 23. Utilize a private company that offers turn key services to reduce data and personnel demands on the police force while aiding in the collection of fines |
| Implementation support | 24. Establish or hire a fleet tracking and management services to improve accountability and safety while aiding in the dispatch of police officers |
INTRODUCTION

The Johns Hopkins Center for Injury Research and Policy was asked by the National Road Safety Council of Jamaica (NRSC) to conduct a gap analysis and produce recommendations for programming, policy, and/or research to reduce traffic-related crashes, deaths, and injuries in Jamaica. The team from Johns Hopkins University included Dr. Andrea Gielen, Professor and Director of JHCIRP; Dr. Keshia Pollack Porter, Professor and Director of the JHCIRP's Research Core; and students Mr. Trevor Luke Wrobleski and Dr. Sung Huang Laurent Tsai. The scope of the work for the 12-month project (January - December 2018) included the following tasks:

1) Review existing data sources and reports provided by NRSC, as well as conduct a literature review of the extant peer-reviewed literature on road traffic injuries in Jamaica.

2) Identify and summarize the types of crashes, mechanisms of injury, and populations affected.

3) Based on (1) and (2) and with input from the NRSC and others as identified by NRSC, determine priority traffic issues to be addressed.

4) Review relevant policies and programs provided by NRSC to determine alignment with priorities identified in (3).

5) Conduct a literature review on traffic safety evidence relevant to the priority traffic issues, policies, and programs identified in (3) and (4).

6) Based on (1)-(5), provide a summary report with recommendations for existing and future surveillance, policy, programs, and research/evaluation (months 9-12).

A gap analysis is a method of comparing current performance of an organization against the desired outcomes of the organization (Jennings, M.D., 2000). In this gap analysis, the research team compared Jamaica's current road safety data, along with the activities and priorities of the NRSC and other stakeholders to existing best practices literature, including the Safe Systems approach. This report summarizes the process and findings from the gap analysis. Based on the resulting gaps, and in consultation with the NRSC, the research team generated a set of evidence-based best practice recommendations, consistent with the Safe Systems approach to aid the NRSC in its future efforts. The report is organized into three sections: Approach, Results, and Conclusions. Two Appendices provide more detailed information from the literature (Appendix 1), and the data reviews (Appendix 2).
APPROACH

The gap analysis utilized three methods: a literature review to document the epidemiology of road traffic injuries in Jamaica; a review of Jamaica’s existing data sources relevant to road traffic crashes and the initiatives being undertaken by NRSC; and a site visit to conduct stakeholder interviews. Gaps and priorities were determined by synthesizing and discussing the results of these activities with the NRSC leadership. Best practice recommendations to address these priorities were culled from the research literature and international organizations. Throughout the process, the research team maintained regular communication with NRSC leadership through email and calls via Skype.

Review of the Literature

The gap analysis began with a search of the existing peer reviewed literature to identify relevant studies related to road safety in Jamaica. Researchers used Google Scholar, Ebsco Host, Web of Science, PubMed, and Semantic Scholar to search databases for articles concerning “Jamaica, road traffic, accidents, crashes, safety, injury, hospital records, injury systems, unintentional injuries, road, traffic accidents, drugs, drunk driving.” along with other terms as new areas of potential interest were identified (e.g., literacy and driver license testing). When the literature presented relevant information on injuries, road or traffic conditions, demographics, monitoring systems, drug or alcohol use, crash types, and safety measures, the literature was further reviewed to determine relevance in the review. Only studies published in English were included; however, no year limits were used for this literature review. If literature cited other relevant sources in its analysis, those sources – if peer reviewed – were also examined.

Once the articles were obtained, they were read, and categorized by the research team. Articles were grouped together and summarized by surveillance mechanisms, prevalence of road injuries, demographic information (including age and sex), type of injury, time of day/week patterns, drug and alcohol use, and safety methods (including seat belts, helmets, and child restraints). Results of the literature review were used to develop a context for understanding road traffic injuries in Jamaica and the existing systems to monitor them. These findings also provided valuable background for the site visit and in-person meetings with stakeholders. See Appendix 1 for detailed results of the literature review.

Review Existing Data Sources

The NRSC provided the Johns Hopkins Center for Injury Prevention and Research team with road traffic incident data from many sources, including from the Ministry of Transport and Mining, MONA Geoinformatics Institute, and the University of the West Indies. Data were selected for their relevance to road traffic injuries and fatalities, and were used to examine trends in road traffic incidents. The data were also reviewed to understand the epidemiology of road traffic injuries in Jamaica. The research team initially examined the long-term trends of road traffic injuries and fatalities to understand the trends in prevalence of road traffic injuries over time. After discussions with the NRSC leadership, the team decided to focus on the most recent data available for determining future needs and priorities.
Finally, the research team also examined the NRSC’s online presence for current and relevant projects and policy directives led by the Council. The results of the review of existing data sources can be found in Appendix 2.

**Conduct Site Visit and Stakeholder Meetings**

From May 1-5, 2018, Drs. Gielen and Pollack Porter traveled to Kingston, Jamaica to participate in stakeholder meetings to identify key areas of concern and to better understand the road safety problems as well as existing data and interventions. Meetings occurred with the NRSC leadership, Mona Geoinformatics Institute, Violence Prevention Alliance, University of the West Indies, National Works Agency, Ministry of Transport and Mining and the Road Safety Unit of the Ministry, the Insurance Association of Jamaica, and the Island Traffic authority. Notes from these meetings were compiled and reviewed with NRSC for their input, and to confirm our understanding of the ongoing programs and policies, as well as the priorities and issues raised by the stakeholders.

**Determine Gaps and Priorities**

After critically examining the peer reviewed literature, existing data sources, and the results of the site visit, the research team developed a preliminary list of priorities that reflected the gaps in road traffic safety in Jamaica. The list was based on the populations at the greatest risk of injury and death, the ongoing NRSC initiatives, and the team’s understanding of the local context for road traffic injuries, road conditions, monitoring, and enforcement practices in Jamaica. This list of priorities was then sent to the NRSC for input and validation. Together, the JHCIRP team and the NRSC conducted a Skype meeting to clarify the information and produce a final list of priorities for addressing the gaps in road safety in Jamaica.

The NRSC also advised that the overarching approach to road traffic safety in Jamaica should be a Safe Systems approach (World Resource Institute, “Sustainable & Safe.”) The key informant interviews revealed a common understanding and desire to work towards the Safe Systems approach in road safety in the country of Jamaica. While this approach was not found in the Jamaica-specific peer reviewed literature, further examination following the key informant interviews highlight the growing influence of this approach in countries worldwide. The Safe Systems approach to address road injuries centers on the idea that human errors are inevitable but fatal crashes and serious injuries are not. In this method of addressing road injuries, the Safe Systems approach seeks to build roadways and associated technology that is accepting of human error while preventing fatalities and serious injuries. This movement is a shift of responsibility for crashes away from the individual and towards a shared responsibility among governments, engineers, the individual, and policy makers. Sometimes simplified to the 4S’s (Safe People, Safe Vehicles, Safe Roads, and Safe Speeds), the Safe Systems approach to addressing road safety is key to the priorities and recommendations set out in this report, and is summarized in the Conclusion.
RESULTS

Six overarching priorities consistent with the Safe Systems approach were identified by the research team and NRSC (Table 1):

1) Structural
2) Cultural and Educational
3) Safety Vehicle Accessibility
4) Data
5) Emergency Response
6) Electronic Surveillance

Best practice recommendations to address these priorities were culled from the research literature and international organizations. A total of 24 best practice recommendations were identified to address all of the priorities (see Table 1). The remainder of this section discusses these priorities and best practices in more detail.
Structural Priorities  
*Enforcement Recommendations*

This priority is based on the findings that the:

- Current systems that ticket and manage speed violations can be improved to streamline both ticket delivery and records;
- Vehicle regulation should occur more regularly with standard consequences for those whose vehicles fail fitness tests; and
- Traffic courts and dedicated traffic police may benefit from restructuring to ensure timely processing of violations and improved road safety.

Five best practice recommendations were identified to address this priority. These recommendations and a brief summary of the supporting literature follows.

1. **Implement drink- and drug-driving law with testing enforcement that meets international standards of limits.**

A drink-driving law, based on Blood Alcohol Concentration (BAC) is optimal, even in countries where alcohol consumption is legally prohibited ("WHO | Global Status Report on Road Safety 2018" n.d.). Laws that establish lower BAC limits (≤0.02 g/dL) for young and novice drivers can lead to a 24% reduction in the number of crashes ("WHO | Global Status Report on Road Safety 2018" n.d.). A drink-driving law has also been shown to be effective at reducing alcohol-related injuries and deaths based on BAC of less than or equal to 0.05 g/dl, the level that is recommended in countries such as in Brazil, Morocco, and the United States. (Andreuccetti et al. 2011; Fell and Voas 2006, 2014; Ying, Wu, and Chang 2013). The recommended best practice in the WHO’s Global Status Report on Road Safety is a BAC of less than or equal to 0.05 g/dL for all drivers in general, whereas 0.08 g/dL is the legal limit in Jamaica ("WHO | Global Status Report on Road Safety 2018" n.d.).

Strong relationships with different stakeholders, including federal and state authorities, local legislators and civil society should be established in order to advocate for legislative change ("WHO | Global Status Report on Road Safety 2018" n.d.).
Random breath testing (RBT) and police sobriety checkpoints are enforcement mechanisms that have been shown to lead to significant reductions in alcohol-related crashes (Tippetts et al. 2005). RBT requires stopping and testing drivers. Sobriety checks involve setting up particular checkpoints or roadblocks and only testing those suspected of alcohol impairment. While RBT is most effective, both approaches are shown to reduce alcohol-related crashes (“WHO | Global Status Report on Road Safety 2015” n.d.).

There are a wide variety of psychoactive substances that can adversely influence driver behavior (e.g., cannabis, cocaine) (“WHO | Global Status Report on Road Safety 2015” n.d.). A meta-analysis of 66 studies showed an increase in the risk of a crash for 11 different drugs tested (Elvik 2013). Best practice of drug-driving requires:

- building up limit levels for specific medications where there is strong evidence-based science connecting utilization levels with crash chance;
- standardized way to deal with testing for particular medications; and
- consensus to be based on optimal enforcement procedures relating to specific drug-driving laws (Elvik 2013).

Meta-analyses of the impact of cannabis use on collision risk have appeared in the literature (Elvik 2013; M.-C. Li et al. 2012; Asbridge, Hayden, and Cartwright 2012), and conclude that collision risk is significantly increased by cannabis use, with the reported odds ratios ranging from 1.10 to 2.79. Combined consumption of cannabis and alcohol appears to significantly increase risk of collision more than consumption of either drug alone (Dubois et al. 2015). Grotenhermen et al. (2007) reported that blood “serum THC concentrations in the range of between 7 and 10 ng/ml (3.5–5 ng/ml in whole blood)” are as impairing as a BAC of 0.05% (Grotenhermen et al. 2007).

Numerous countries have implemented programs that train police officers to be Drug Recognition Experts (DREs) who can make psychophysical assessments to determine impairment by drug use (Rogeberg and Elvik 2016). Watson and Mann et al. summarized type of laws as practiced around the world, Table 2 (Watson and Mann 2016):
2. Strengthen traditional enforcement with the use of automated enforcement systems.

Traffic speed is associated with impact speed in crashes and therefore has significant implications for public health. Speed enforcement was the most common intervention evaluated, and demonstrates the best outcomes when strong enforcement initiatives are part of a multifaceted approach (Staton et al. 2016). Ticketing and managing speed violations can be improved to streamline both ticket delivery and records. One study in Uganda increased police presence on four major roads in the capital city of Kampala; results found a 17% reduction in the number of road traffic deaths on these roads (Bishai et al. 2008).

The WHO Global Status Report determined if counties met the best practice criteria on urban speed management (“WHO | Global Status Report on Road Safety 2015” n.d.). Three best practice criteria were used to assess the legislation on speed laws presence of a national speed limit law; urban speed limits not exceeding 50 km/h (research shown that lower limits are recommended for urban areas and 30 km/h for residential areas and areas with high pedestrian activity); and local authorities having the power to modify speed limits. Only 46 out of 169 countries met all three best practice criteria and most are high income, which suggests that the speed management remains a problem in many countries, especially those that are low and middle income.
Recent reviews showed that setting posted speed limits five mph less than the engineering suggested practice could lead to operating speeds that are more in line with the originally posted speed limits and overall safety benefits (Gayah et al. 2018).

Speed cameras rank among the foremost cost-effective social policies, saving both money and lives (Hu and McCartt 2016; S. Li et al. 2018; Wilson et al. 2006). Automated speed enforcement (ASE) could be a promising strategy to handle several of the constraints of current approaches to speed enforcement. Evidence from many countries suggests that ASE is an efficient and cost-effective strategy for reducing traffic-related injuries (Morain, Gielen, and Bhatta 2016).

Best practice suggests that once motorized traffic mixes with pedestrians and cyclists, motion speeds ought to be beneath 30 km/h (“WHO | Managing Speed” n.d.). Speeds above this could be permissible only if the roadsides are safe, median separation exists, intersections are designed suitably, and different road users are separated (Table 3).

**TABLE 3. VISION ZERO: SAFE SPEEDS FOR VARIOUS ROAD TYPES AND THEIR POTENTIAL CONFLICTS**

<table>
<thead>
<tr>
<th>Type of Road</th>
<th>Safe Speed</th>
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<tr>
<td>Roads with possible conflicts between cars and unprotected users</td>
<td>30 km/h</td>
</tr>
<tr>
<td>Intersections with possible side-on conflicts between cars</td>
<td>50 km/h</td>
</tr>
<tr>
<td>Roads with possible frontal conflicts between cars</td>
<td>70 km/h</td>
</tr>
<tr>
<td>Roads with no likelihood of frontal or side-on conflicts between road users</td>
<td>≥ 100 km/h</td>
</tr>
</tbody>
</table>

**SOURCE:** Tinval and Haworth, 1999.

3. **Enforce motorcycle riders for proper helmet wearing.**

Motorcyclists are at an increased risk because they regularly share the road with fast-moving cars, buses and trucks, and because they are less visible. Also, their absence of physical protection makes motorcyclists vulnerable to injury. Wearing a motorcycle helmet can reduce the risk of death by almost 40% and the risk of severe injury by approximately 70% (“WHO | Global Status Report on Road Safety 2015” n.d.). Effective enforcement of motorcycle helmet laws can increase helmet-wearing rates and reduce head injuries (Liu et al. 2008). Only 74 of the 169 countries state that motorcycle riders fasten chin straps properly in order to meet the law (“WHO | Global Status Report on Road Safety 2015” n.d.). Only 70 countries have national helmet laws that apply to all drivers and passengers, all road types and all engine types and require riders to fasten helmet properly.

The effectiveness of national helmet legislation in reducing injuries depends on the quality of helmets worn. While there is a high-quality international helmet standard (UNECE regulation 22), Jamaica has low compliance regarding helmet wearing, with approximately 50% riders not wearing a helmet (Crandon et al., 2009b). National guidelines must guarantee that the standard meets quality criteria, and that accident testing offices are accessible to test head protectors delivered to this standard (“WHO | Global Status Report on Road Safety 2015” n.d.). Numerous nations, despite having a helmet law, still have no standard or have legislation that is vague about the standard to which it refers.
A study in nine low- and middle-income countries found that about half the helmets being used were non-standard helmets, limiting the potential gains of helmet use program (Road Traffic Injuries Research Network Multicenter Study Collaborators et al. 2013).

4. Require standards for vehicles to ensure seat-belt anchorage points.

Wearing a seat-belt reduces the chance of a fatality among drivers and front-seat occupants by 45–50%, and also the risk of severe and minor injuries by 20% and 45% respectively (Cohen and Einav, 2003.). Among rear seat occupants, seat-belts reduce severe and fatal injuries by 25% and minor injuries by up to 75% (The Handbook of Road Safety Measures 2009). Wearing a seat-belt also decreases the chance of being thrown from the vehicle within the event of a crash. Without appropriate and functioning anchorage points in a vehicle, seat belts will not be able to provide adequate protection. Priority vehicle safety standards, including ISOFIX child restraint anchorage and seat-belt anchorage were suggested by Global NCAP and the World Forum (“WHO | Seat-Belts and Child Restraints: A Road Safety Manual for Decision-Makers and Practitioners” n.d.). They are being fully applied by only 40 out of a total of 193 UN Member States and overwhelmingly by high-income (“WHO | Seat-Belts and Child Restraints: A Road Safety Manual for Decision-Makers and Practitioners” n.d.). The requirements are absent in many of the large middle income countries, which are responsible for 50% passenger car production (“Global NCAP Resources” n.d.).

5. Consider increasing fine levels.

Nichols et al. suggested that increasing fine levels is a strategy that has potential to further raise seat belt use, in addition to primary law upgrades and high-visibility enforcement (Table 4) (Nichols et al. 2014). The data indicate that primary laws (i.e., a police officer can stop and ticket a seat belt nonuser for that violation alone), compared with secondary laws (i.e., require that some additional violation be observed), were associated with 10- to 12-percentage-point-higher observed seat belt use and about 9-percentage-point-higher FARS use (Nichols et al. 2014). According to 600 state-years of data included in the analysis, fines of $5 to $25 or from $25 to $60 were both associated with a 3- to 4-percentage-point gain in seat belt use under both primary and secondary laws (Nichols et al. 2014). Specifically, a fine increase from $5 to $60 was associated with a 6- to 8-point gain in seat belt use, and an increase from the median fine of $25 to a high of $100 was associated with a 6- to 7-point gain in seat belt use (Nichols et al. 2014). Fines higher than $100 were associated with few gains in seat belt use. Primary laws, fines, and enforcement are important factors in determining seat belt use, and none of these factors likely has maximum potential without the benefit of at least some paid media to support it (Nichols et al. 2014). Revenue from traffic fines can also be used to finance road safety activity. For example, the Swedish Road Administration retains 35% of parking fines to cover administrative costs. Also, in Great Britain and Victoria, fine revenues from speed cameras are earmarked to provide road safety funding (“WHO | ‘How to’ Road Safety Manuals” n.d.).
TABLE 4. PERCENTAGE-POINT INCREASES IN RAW SEAT BELT USE ASSOCIATED WITH LAWS AND FINE AMOUNTS

<table>
<thead>
<tr>
<th></th>
<th>Percentage-point increase in seat belt use</th>
<th>1997-2002 period</th>
<th>2003-2008 period</th>
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<tbody>
<tr>
<td></td>
<td>FARS</td>
<td>Observed</td>
<td>FARS</td>
</tr>
<tr>
<td>Law upgrade</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secondary to primary</td>
<td>+9.2</td>
<td>+11.9</td>
<td>+9.0</td>
</tr>
<tr>
<td>Fine increase</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$5 to $100</td>
<td>+9.4</td>
<td>+8.7</td>
<td>+10.6</td>
</tr>
<tr>
<td>$5 to $25</td>
<td>+3.3</td>
<td>+3.1</td>
<td>+3.8</td>
</tr>
<tr>
<td>$25 to $60</td>
<td>+3.3</td>
<td>+3.1</td>
<td>+3.7</td>
</tr>
<tr>
<td>$60 to $100</td>
<td>+2.7</td>
<td>+2.5</td>
<td>+3.1</td>
</tr>
</tbody>
</table>

SOURCE: Nichols et al. 2014

Structural Priorities

Engineering Recommendations

This priority is based on the findings that the:

- Road ownership and maintenance responsibility should be clarified.
- Policy issues such as reporting structures and permitting systems need to be reworked for clarity and improved safety.

Our best practice recommendation was identified to address this priority, and a brief summary of the supporting literature follows.

6. Urge International Road Safety Assessment Programme (iRAP) safety assessments and local road assessments to produce star ratings for roads ownership, safety roads, and responsibilities.

International Road Assessment Programme (iRAP) safety assessments use road examination to produce star ratings for roads: five stars indicate the safest roads and one star the least safe roads. Star ratings are provided for vehicle occupants, motorcyclists, pedestrians and cyclists, whereas countries’ roads are assessed for the percentage that meets certain star ratings for every kind of road user. iRAP was established to help tackle the devastating social and economic burden of road crashes. Without intervention, the number of deaths worldwide is projected to increase to some 1.8 million by 2020 (“IRAP - International Road Assessment Programme” n.d.). More than 40 million deaths and serious injuries could be avoided over 20 years if high return engineering treatments were applied to the highest volume 10% of roads in every country worldwide (“IRAP - International Road Assessment Programme, 2016”). An assessment of iRAP Safer Road Investment Plans from 60,000km of road across 7 high- and low-income countries (Australia, US, UK, Mexico, China, Malaysia, and the Netherlands) showed that fatalities caused by most crash types can be reduced by 45% or more cost-effective improvements to road infrastructure (Figure 1) (“IRAP - International Road Assessment Programme, Star Rating Target Policy Paper 2016” n.d.).
The top life-saving road treatments identified by iRAP include duplication (involves separating opposing traffic flows to reduce head-on crashes), safety barriers, additional lanes, better pavement, and pedestrian footpaths. (“IRAP - International Road Assessment Programme, Star Rating Policy Target Paper, 2016”) Targeted investment of $218 billion in LMICs would deliver an estimated $3,500 billion in crash-cost savings at an overall benefit-cost ratio of 16 to 1. (“IRAP - International Road Assessment Programme, Star Rating Policy Target Paper 2016”).

**FIGURE 1. FATALITY PREVENTION POTENTIAL OF ROAD UPGRADES**

![Fatality Prevention Potential of Road Upgrades](image)

iRAP has developed the star rating protocols and software system ViDA that facilitates the analysis and presentation of star rating results. Access to ViDA is free of charge, The Star Rating and Investment Planning tools are also supported with the free Road Safety Toolkit that provides best-practice advice and detailed research and fact sheets for all of the treatments and road attributes used in the star rating model, following table and figure shows countries with various treatments and its economic improvement, as well as an example of fact sheet on the target paper (“IRAP - International Road Assessment Programme, Star Rating Policy Target Paper, 2016”).

The iRAP approach could be used to mobilize support for the implementation of necessary engineering countermeasures (“WHO | Global Status Report on Road Safety 2015” n.d.). iRAP recommends that all new or upgraded roads are built to a minimum 3-star standard for all road users. Building brand new 1- and 2-star roads should be avoided as it is likely to impose a significant burden of death and injury on the community being served by the new road.
Data collected from iRAP consistently show that crash costs per kilometre travelled are approximately halved for each incremental improvement in star rating. (“IRAP - International Road Assessment Programme, Star Rating Policy Target Paper, 2016, 2013” n.d.) Examples of implementing components of iRAP can be found in IRAP-International Road Assessment Programme, Star Rating Policy Target Paper, 2016 and include assessments of 350,00km of roads in China, 60,000km in Mexico, and World Bank programs in India and Africa.

Cultural and Educational Priorities

Low Literacy Recommendations

The priority is based on the findings that:

- Roadways and licensing should be made safe and accessible to those unable to read who are able to properly operate a vehicle.

Our best practice recommendation was identified to address this priority, and a brief summary of the supporting literature follows.

7. Develop pictorial/oral drivers’ licensing test to measure road safety knowledge of those who cannot read.

Literacy rates in Jamaica average 87%, with women having higher literacy rates than men in the country (Hunter, 2016). This leaves many in Jamaica unable to read a licensing test, even though they possess the knowledge and skills to drive a vehicle. Since understanding safe road practices, having the ability to drive, and being able to read road signs are not the same as being able to read a written driving test (Keenan et al., 1982), an oral or pictorial licensing test for those who are unable to read should be adopted. In the United States, this method of testing has been developed, and is used in states like Florida (Keenan et al., 1982) and California (Harrington, 1973). In the pictorial test, the test proctor reads the passage for each section, and the respondent selects the appropriate response in the picture scenarios. According to the National Academy of Sciences from a study in California, those who are illiterate, who are able to pass a driving test, are capable of driving a car with similar crash outcomes as those who are literate (Harrington, 1973). If an illiterate person is able to convey the same knowledge that a literate person is able to convey about the laws of the road, there does not appear to be a difference in the rate of car crashes.
Cultural and Educational Priorities

Prioritizing Safety Recommendations

This priority is based on the findings that the:

- Safety culture can be improved on Jamaican road ways.

The term “safety culture” has many meanings and applications as applied to workplaces, aviation, and health care organizations among others. A critically important way to achieve a culture of safety in Jamaica is by adopting a Safe Systems approach that is designed to address road safety infrastructure, policy, and programmatic needs. Safety culture can also be improved by shifting popular beliefs and practices, which is the focus of the best practice recommendation that was identified to address this priority, and a brief summary of the supporting literature follows.

**8. Increase and enhance educational programs to address the issues of unsafe driving.**

Culture refers to the shared customary beliefs, attitudes, values, and practices that characterize a group of individuals and/or a community (“Definition of CULTURE” Merriam Webster). In addition to a Safe Systems approach that supports a culture of safety, educational programming and public information campaigns have important roles to play. Figure 2 details six key points relevant to such efforts.

**FIGURE 2. SIX KEY POINTS ABOUT ROAD SAFETY PUBLIC EDUCATION**

1. Informing and educating road users can improve knowledge about the rules of the road and about such matters as purchasing safer vehicles and equipment.

2. Basic skills on how to control vehicles can be taught.

3. Education can help to bring about a culture of concern and develop sympathetic attitudes towards effective interventions.

4. Most programmes providing highway safety education do not work in isolation – they need to be linked or used in combination with other measures.

5. There is a need for a balanced approach to the role of education and publicity, taking into account evidence from research on behaviour change, the interventions that may be promising, those to avoid, and those to encourage, as well as the need to implement proven measures.

6. General non-specific road safety campaigns should be avoided. Campaigns should rather be used to put important questions on the agenda, and should preferably support other measures such as new legislation or police enforcement.

**SOURCE:** WHO Road Safety Training Manual (n.d.)
Drivers education illustrates many of these key points. While these programs teach new drivers how to operate a vehicle and inform them of the rules of the road, results of systematic literature reviews provide no evidence that driver education reduces road crash involvement, and suggest that they can lead to a modest but potentially important increase in the proportion of teenagers involved in traffic crashes (Ker et al. 2005; Rothman et al. 2014). In the U.S., these findings were attributed to the early licensure that accompanied completion of drivers education classes, results that brought about the development and implementation of graduated driver licensing policies (GDL), which promote safe skill development by restricting driving privileges for a period of time (e.g., required number of hours of supervised driving, restrictions on driving at night, limits on carrying passengers, etc.). According to a national evaluation of GDL programs in the U.S., the:

“The most comprehensive GDL programs are associated with reductions of about 20% in 16-year-old drivers’ fatal crash involvement rates. Based on existing programs that were sufficiently common for analysis, the greatest benefit appears to be in programs that include age requirements plus: 3 or more months of waiting before the intermediate stage, nighttime driving restriction, and either supervised driving of at least 30 hours or a passenger restriction (“NHTSA” n.d.).

Thus, new drivers must still be taught how to drive safely, but this education must be accompanied by effective policies that reduce their crash risks.

Educational programming should be as carefully crafted as a newly constructed roadway, based in evidence on to how best to inform, persuade, and support the specific unsafe driving practices. The starting point is to work in partnership with the intended audience to understand their existing values, knowledge, beliefs and practices, which can be determined through formative research such as public opinion surveys and focus group discussions (Gielen AC et al. 2008; Kahan et al. 2014). With that information, planners should articulate SMART objectives of the campaign, program, and message (“CDC - Develop SMART Objectives - Evaluate a CoP - Resource Kit - CoP - OSTLTS” n.d.):

- Specific: Concrete, detailed, and well defined so that you know where you are going and what to expect when you arrive
- Measurable: Numbers and quantities provide means of measurement and comparison
- Achievable: feasible and easy to put into action
- Realistic: Considers constraints such as resources, personnel, cost, and time frame
- Time-Bound: A time frame helps to set boundaries around the objective.
The peer reviewed literature provides evidence on the effectiveness of educational programs and much of it is conveniently summarized in Cochrane Collaboration reviews, which can be accessed online (Duperrex, Roberts, and Bunn 2002; Ehiri et al. 2006; Owen et al. 2011). The WHO (“WHO | Road Traffic Injuries” n.d.) and the National Highway Traffic Safety Administration (“NHTSA” n.d.) also have on-line resources for educational materials and programs that can be tailored to fit Jamaica’s local context. General principles for effective educational programming are summarized in Figure 3. While all five points in Figure 4 are important to include, having the resources and skills to take action is arguably the most critical and the most often left out when educational programs are planned. Multiple intervention evaluations have demonstrated that education alone is less effective than education that is accompanied by access to resources; for instance, car seat and bike helmet programs are more effective when participants are given the products at reduced cost or for free (Ehiri et al. 2006; Owen et al. 2011).

**FIGURE 3. GENERAL PRINCIPLES FOR EDUCATION TO BE EFFECTIVE**

For education to be effective, individuals must:
1. Be exposed to the information
2. Understand and believe the information
3. Have the resources and skills to follow the information/take up the recommended actions
4. Derive benefits (or perceived benefits) from following the information/taking up the recommended actions
5. Be reinforced for following the information/taking up the recommended actions


**Cultural and Educational Priorities**

**Coordinated Messages Recommendations**

This priority is based on the findings that the:

- Agencies responsible for educational campaigns should work more closely together to produce, implement, and evaluate messages.

One best practice recommendation was identified to address this priority, and a brief summary of the supporting literature follows.

9. **Establish an interagency joint task force between groups responsible for educational campaigns in road safety to ensure consistency in messaging and reduce redundancy in work.**

Multiple organizations have responsibility to collect, process, interpret, disseminate, and act upon data concerning Jamaican road injuries. To most effectively harness the capacities of these numerous separate groups that share a common goal of promoting road safety, it would be beneficial for them to work together to enhance coordination of road safety educational campaigns and messages. Enhanced coordination can promote efficiently using educational resources, reducing redundancy, and enhancing consistency in messaging. A task force -- a temporary group organized to address a specific issue -- would be a useful organizational structure to determine how best to enhance coordination and collaboration.
The NRSC should consider convening a task force of key stakeholder organizations and government agency representatives to undertake an assessment of current educational programming and messages, and to conduct a SWOT analysis of increased coordination as a goal (i.e., what are the Strengths, Weaknesses, Opportunities, and Threats of increased coordination of educational programming?). Assuming the task force agrees on a goal of enhanced coordination, the 2017 World Health Organization’s Strategic Communications Framework for Effective Communications could be used to build a communication strategy that is more “actionable, accessible, relevant, timely, understandable, and credible” (WHO Strategic Communications Framework for Effective Communications, 2017).

**Safety Vehicle Accessibility Priorities**

*Vehicle Fitness Recommendations*

This priority is based on the findings that the:

- Unfit vehicles should not be imported to Jamaica or allowed on the roads.

One best practice recommendation was identified to address this priority, and a brief summary of the supporting literature follows.

**10. Ensure availability of electronic stability control (ESC) in vehicles as well as other built-in safety technology [e.g., Intelligent Speed Assistance (ISA) and Autonomous Emergency Braking (AEB)].**

Safe vehicles are an essential part of the Safe Systems approach, as they play a critical role both in averting crashes and reducing the likelihood of serious injury in the event of a crash (“WHO | Global Status Report on Road Safety 2015” n.d.). The most important UN regulation for crash avoidance is electronic stability control (ESC) (“WHO | Global Status Report on Road Safety 2015” n.d.). ESC aims to prevent skidding and loss of control in cases of oversteering or understeering, and is effective at preventing different types of crashes, reducing both serious and fatal injuries (Erke 2008; Lie et al. 2006). The success of ESC has led to it rapidly becoming mandatory in many high-income countries, although only 46 countries currently apply a mandatory ESC regulation. (“WHO | Global Status Report on Road Safety 2015” n.d.).

Both Intelligent Speed Assistance (ISA) and Autonomous Emergency Braking (AEB) are vehicle safety technologies suggested by WHO (“WHO | Managing Speed” n.d.). ISA helps improve drivers’ compliance with speed limits by alerting them when they are traveling above the posted speed limit. The standard ISA system uses an in-vehicle digital roadmap onto which speed limits have been coded, combined with a satellite positioning system. There are different versions of ISA (advisory only, supportive and limiting) and the level at which the system intervenes to control the speed of the vehicle varies.
AEB helps drivers avoid or mitigate collisions with other vehicles or vulnerable road users. The three versions of AEB (city, inter-urban, and pedestrian) help provide constant monitoring of the road ahead and can assist the driver by automatically applying the brakes if they do not respond immediately to a potential crash situation.

Vehicle safety enhancements can be achieved through regulatory action by government or by a voluntary commitment from manufacturers to make these technologies a standard feature of all vehicles. In the U.S. twenty vehicle manufacturers representing 99% of the country’s auto market have committed to make AEB a standard feature in all new cars by no later than 2022. Consumer demand can also facilitate the speed with which these enhancements become available; thus, the educational campaigns that are the focus of recommendations #8 and #9 should consider focusing on the theme of making safer vehicles more accessible.

Importation policies and car assessment programs may offer opportunities to enhance vehicle safety. Pre-shipment inspection of vehicles coming into Jamaica is contained in the current Jamaica Motor Vehicle Import Policy, which was adopted on April 3, 2014 (“Motor Vehicle | Jamaica Customs Agency Website” n.d.). Examining the requirements, if any, for safety features of the vehicles that are allowed to enter could be useful. New Car Assessment Programmes (NCAPs) are highly successful in promoting supply and demand for safer vehicles. NCAPs carry out crash tests on dummies in new cars to rate the vehicle’s performance – five stars represent the top score. Studies have shown that the risk of being killed in a one-star vehicle are twice those of a five-star. In newer NCAP programmes, such as in Latin America, results of the first NCAP programme in 2010 indicated that safety in top selling cars lagged 20 years behind North America and Europe; however, by 2014, five models were awarded five-stars and were well above regulatory requirements (“Global NCAP Resources” n.d.)
Data Priorities

Coordination of Indicators and Reporting Recommendations

This priority is based on the findings that the:

- There is a need for greater synergy between data collection and analysis groups, as well as utilization of the data.
- Standardizing similar indicators will yield better comparisons, which should also be included in monitoring systems that capture post-injury data.

One best practice recommendation was identified to address this priority, and a brief summary of the supporting literature follows.

11. Support transportation, law enforcement, and healthcare sectors working together to integrate data into a shared system.

The WHO guidance on data systems has identified data needs from each of the three sectors -- transportation, law enforcement, and healthcare (see Figure 4). (WHO Data Systems, 2010).

The transportation sector involves multiple agencies responsible for the condition and design of roads, the roadworthiness and registration of vehicles, and the management of the licensing system for drivers. Each of these areas of responsibilities has its own data needs and systems. Several other recommendations in this report address many of these responsibilities, and one underlying common issue across all of them is the availability of valid, reliable, and timely data.

Police need quality data so they can monitor the occurrence of crashes, keep track of legal proceedings and fines, and lead evidenced based enforcement with directed checkpoints, police presence, and speed cameras. The data should be easy to input into a computerized system, should be connected to an analysis mechanism, and the police should receive training as to how to use the system (WHO Data Systems, 2010). To facilitate completing data recording tasks, incentives and reinforcements can be considered; the extent to which the individuals who complete data recording see the utility of the data (e.g., through reports, priority setting, etc.) can promote compliance.

The health sector contributes information such as the use of pre-hospital care, hospital emergency room admissions, physical and psychological rehabilitation, and cost of care analysis. It is often a challenge to follow up on outcomes, such as death that is caused by a crash but where death does not immediately follow the crash. Furthermore, the cost of care from a road traffic incident may be undercounted when the patient receives treatment at a later time for minor or moderate injuries sustained. Ambulance runs and medical records are important sources of data that can be utilized to address the items listed in Figure 5. In conjunction with these data sources, the public health department may have useful data from household surveys and other sources that can be used to address these items as well.
A systematic assessment of the existing data sources was beyond the scope of the current gap analysis. The NRSC may want to consider convening key leaders who are responsible for each of these sector’s data sources and needs.

Such a convening could identify duplication of effort and data gaps, and facilitate future coordination across sectors; this approach could be used to address Recommendation #12 below as well.

**FIGURE 3. GENERAL PRINCIPLES FOR EDUCATION TO BE EFFECTIVE**

<table>
<thead>
<tr>
<th>Transportation Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Identify locations, time periods and road types or segments with high frequencies</td>
</tr>
<tr>
<td>of different types of road traffic crashes, according to severity, and the environmental</td>
</tr>
<tr>
<td>factors which may have contributed to them</td>
</tr>
<tr>
<td>2. Determine the human factors that may have contributed to road traffic crashes and</td>
</tr>
<tr>
<td>for which corrective measures should be applied</td>
</tr>
<tr>
<td>3. Identify vehicles at relatively higher risk of involvement in crashes and vehicle</td>
</tr>
<tr>
<td>related technical/mechanical factors of the vehicles that contribute to the crashes;</td>
</tr>
<tr>
<td>4. Select appropriate treatments for high-risk locations and monitor the effects</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Law Enforcement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Site and location of crash</td>
</tr>
<tr>
<td>2. Weather conditions at time of crash</td>
</tr>
<tr>
<td>3. Vehicles/road users involved</td>
</tr>
<tr>
<td>4. Insurance status</td>
</tr>
<tr>
<td>5. Vehicle inspection status</td>
</tr>
<tr>
<td>6. Number of people killed or injured at the scene</td>
</tr>
<tr>
<td>7. Demographic information</td>
</tr>
<tr>
<td>8. Whether first aid was administered</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Health Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Estimate the magnitude of fatal and non-fatal road traffic injuries</td>
</tr>
<tr>
<td>2. Identify the risk factors involved</td>
</tr>
<tr>
<td>3. Evaluate the effectiveness of injury management and treatment</td>
</tr>
<tr>
<td>4. Ascertain current trends and the impact of prevention programmes</td>
</tr>
</tbody>
</table>

**11. Support transportation, law enforcement, and healthcare sectors working together to integrate data into a shared system.**

Reliable and detailed data systems that are able to capture and report on traffic and road safety are vitally important for identifying problems, risk factors, and priority areas, formulating strategies to address problems, and setting goals/monitoring targets (WHO, 2010). According to the WHO’s Data Systems guide (2010), road data systems are important to:

- Document the nature and magnitude of road traffic injuries
- Demonstrate effectiveness of interventions and
- Provide information on the cost/cost reduction of crashes and programs.
As such, data systems play a large role in the steps of reducing road traffic injuries. The data collected from effective systems allows for improved injury prevention. This is part of the Safe Systems approach, and knowing the key information in crashes can help policymakers and stakeholders develop better programs to prevent crashes, accommodate for human error, and aid in targeting of driving interventions.

**Emergency Response Systems**

*Protocol Recommendations*

This priority is based on the findings that the:

- Data are essential for public health surveillance, which is the “continuous, systematic collection, analysis and interpretation of health-related data needed for the planning, implementation, and evaluation of public health practice” (WHO, n.d.)

Four best practice recommendations were identified to address this priority, and a brief summary of the supporting literature follows.

**13. Enhance data systems to capture exposure measures, intermediate and final outcomes, and socio-economic costs, and outputs.**

There are many interested parties in road traffic safety who each collect data regarding crashes. Police departments collect data from individual crashes. Insurance companies collect information to set rates based on crash risk as well as determine who was at fault when a crash occurs. Transportation departments oversee license drivers and test vehicles for road worthiness. Hospital records document health outcomes following a crash. Typically, each agency has its own separate data system and data integration across agencies is rare. According to the WHO, it is important that road data are entered into a “computerized database, processed, analyzed and disseminated.” The WHO Data Systems guidelines (2010) recommends that all road data systems are able to:

- Capture nearly all crashes that result in death and a significant proportion of those that result in serious injuries;
- Provide adequate detail on the vehicle, the road user and the road/environment to assist with identification of causes, and selection of countermeasures;
- Include accurate crash location information;
- Provide reliable output in a timely manner to facilitate evidence-based decisions.”
This comprehensive system requires inputs from various stakeholders including law enforcement, the transportation sector, and health care professionals. To integrate the data sources across these separate groups, the U.S. Department of Transportation Federal Highway Administration recommends the steps summarized in Figure 5.

**FIGURE 5. SUMMARY OF STEPS INVOLVED IN SAFETY DATA INTEGRATION**

- Lay the foundation and conduct gap analysis
- Establish data governance process
- Develop data collection and integration plan

- Perform data integration
- Develop and Deploy the Extra, Transform, & Load Process
- Conduct Analysis

- Perform effectiveness evaluation
- Identify training needs for Data Collection, integration, and analysis

The U.S. Department of Transportation also created a toolbox for developing road data systems, that can be accessed at https://safety.fhwa.dot.gov/rsdp/toolbox-home.aspx and tailored depending on the decided needs of the invested parties.

**14. Standardize curriculum and training for all EMTs to the basic life support (BLS) level.**

All EMS providers should be trained in a standardized and approved manner to the level of basic life support (Kobusingye et al., 2005). Research on emergency medical systems around the world, including India, has shown that BLS improves outcomes for injured patients and training beyond the level of BLS (i.e., advanced life support – ALS) has not been shown to improve outcomes (Kobusingye et al., 2005) (Brown et al., 2016). BLS training then requires fewer resources along with less time than ALS training, while providing equal or better outcomes, and is therefore preferable. Establishing standards for how EMT training will help to ensure that quality care is uniformly delivered throughout an entire jurisdiction.
15. **Establish handoff procedure between different entities.**

Handoff procedures during prehospital care involve the transition of a patient from EMS care to hospital care. EMS should have a procedure for choosing hospitals based on the distance from the incident, the desires of the patient, and the capacity of the hospital to provide the appropriate care (Gunderson, 2015). Ideally, the patient should be taken to the closest hospital capable of providing the necessary services.

To ensure the patient is taken to the hospital that is able to provide the appropriate level of care, protocols should be established that clearly notifies the EMTs of the capabilities of the hospitals in the area. EMS should also contact the receiving hospital en route, to ensure that the hospital has an open bed for the patient and to prepare the hospital to receive the new admission (Gunderson, 2015). Having these protocols will minimize the time it takes to hand off a patient, which could harm a patient and prevent the ambulance from responding to other patients in need of care. Finally, when the patient does arrive to the hospital and is accepted by the attending physician, there needs to be a standard method, agreed to by both the EMS personnel and the receiving hospital, to hand over records and information about the patient (Price 2006).

16. ** Equip all EMS services with appropriate and necessary tools.**

All ambulance systems should be equipped with communication and GPS units. GPS units are essential to ensure EMS workers can find their way to the sites of crashes and then have access to the best possible routes to the appropriate treatment facilities. Communications devices, other than cell phones are important to link central command centers with ambulances and hospitals receiving the injured parties (Clair et al., 2003).
Emergency Response Priorities

Availability & Response Recommendations

This priority is based on the findings that the:

- Data are essential for public health surveillance, which is the “continuous, systematic collection, analysis and interpretation of health-related data needed for the planning, implementation, and evaluation of public health practice” (WHO, n.d.)

Three best practice recommendations were identified to address this priority, and a brief summary of the supporting literature follows.

17. Develop centralized triage system that determines nature of the problem and dispatches appropriate and nearby assistance.

Effective triage systems also play a key role in the EMS system. A centralized dispatch that appropriately categorizes the incident and sends the required personnel in a timely and effective manner increases the likelihood of positive outcomes and improves efficiency (Mould-Millman et al. 2015). Programs seeking to strengthen their emergency care system have established a common number for dispatch for all police, EMS, and fire departments (Brown et al., 2016). These dispatch systems should also be able to recognize the severity of a case based on the call and send an appropriate response of police, fire, and EMS professionals (de Ramirez et al., 2014). This level of coordination between first responders requires a standardized triage procedure that provides direction or a framework to the dispatcher so that he/she can make the right decision on the necessary response to meet the demands of the incident.

18. Ensure dispatcher is able to deliver pre-arrival instruction to caller.

The dispatcher should also be able to provide some form of medical instruction to the caller so that stabilization can begin prior to the arrival of medical professionals and to help prepare the professionals on the scene – these services are called pre-arrival instructions (Wise and Grossman, 2018). Pre-arrival instructions from a central dispatcher has been used in many contexts, from high income countries where such procedures are standard to low income settings such as Ruhiira, Uganda (de Ramirez et al., 2014). Training the central dispatchers and ensuring there is a standard procedure by which they can provide medical direction in the event of an emergency means that those needing care may be able to receive basic interventions by nearby individuals even before the arrival of professionals (Gunderson, 2015). Pre-arrival instructions can also help guide EMTs and other safety officers to the scene, giving them a better sense of what to expect and prepare for when responding to the scene of an incident.
19. Institute an emergency lane law that requires drives to move over for an ambulance, fire truck, or police car.

To ensure that the injured parties can be reached in a timely manner, Jamaica should consider adopting an Emergency Lane Law, similar to those in Germany and Switzerland, that require all vehicles to move over when there is an approaching emergency vehicle (European Commission 2007). This type of law has been deemed a "Best Practice" by the WHO to improve road safety. On a highway, cars on the left side move further left and those on the right move further right, thereby clearing a lane for EMS, Fire, and Police vehicles so that they can more quickly reach and transport those who need assistance. The costs of the law are very low, primarily associated with the cost of advertising the law to the public (European Commission, 2007).

Emergency Response Priorities

*Communication Network Recommendations*

This priority is based on the finding that:

- Strong communication networks are essential for high-quality emergency care systems.

One best practice recommendation was identified to address this priority, and a brief summary of the supporting literature follows.

20. Equip all EMS services with appropriate and necessary tools, including dedicated communication networks among dispatch, ambulances, and hospitals.

Beyond GPS and communication devices, EMS professionals need to have the appropriate equipment to stabilize and transport injured individuals to the hospital. While an ambulance is not required for all EMS units, it is essential that transportation is available to move injured people from the scene of the incident to the hospital. Lists of essential equipment have been developed and include: comprehensive first aid kit, gurney, neck stabilizer, etc. (Claire et al. 2003). Research shows that the core necessities for all EMS units includes personal protective equipment (PPE), a stretcher, pressure dressings, splints, and a radio (Kobusingye et al., 2005). It is important that EMS personnel are trained on how to use the equipment that are provided (Kobusingye et al., 2005).
Emergency Response Priorities
First Responder Training Recommendations

This priority is based on the finding that:

- Providing first responder training can help fill the gap in care until an injured person is able to get to the hospital.

One best practice recommendation was identified to address this priority, and a brief summary of the supporting literature follows.

21. Train citizens, police and fire officers in medical first aid (this can be carried out by EMTs or emergency physicians).

Involving the police and fire departments in the EMS system is generally a beneficial and cost effective method for increasing access to care (Gunderson, 2015). Fire-based EMTs are very cost-effective since the costs of adding the medical equipment and EMS training along with the EMS supervision is relatively minor compared with the stand-alone start up costs (Gunderson, 2015). Since the fire department may already be called in the event of a road injury for rescue purposes or clean up, the continued integration and dual function (Fire-EMS) departments may be advantageous and cost effective for both the EMS and fire departments. Police and law enforcement may also be involved with the EMS system, but constraints on police and the general increase in demand for police to investigate and address crimes may reduce their capacity for involvement in addressing vehicle crashes in a treatment capacity (Gunderson, 2015). Nevertheless, since the police are often called to the scene in the event of a crash or crime, and may even be first on the scene, it may be advantageous to make further use of the response by having officers trained in first aid.

Electronic Surveillance Priorities
Advanced Surveillance Technology Recommendations

This priority is based on the finding that:

- Technology can help enforce traffic safety laws.

One best practice recommendation was identified to address this priority, and a brief summary of the supporting literature follows.
22. Implement electronic surveillance tools, especially transportable speed cameras to reduce vehicle speeds and crash incidence on roadways.

Speed cameras are automated tools to enforce traffic safety laws (IIHS, n.d.). There are many types of speed cameras including fixed, transportable, mobile, and handheld devices. The fixed speed camera is installed in one location and provides continuous speed coverage. The transportable speed camera – commonly referred to as a “speed trap” – can be moved to different locations to monitor speeds and issue tickets. The mobile and handheld speed cameras vary in type from the former two types of speed cameras (American Transport Solutions, n.d.). The mobile and handheld systems are less autonomous, requiring a human to be present with the machine to capture a violation. The mobile speed camera can be built into police cruisers, while the handheld system is used by an officer to monitor speed. The handheld cameras are often referred to as “radar guns” and may be used to monitor speed or to monitor speed and issue tickets depending on the model of the device (American Transport Solutions, n.d.). Figure 6 illustrates these various types of speed cameras.

![Types of Speed Cameras](source: American Traffic Solutions, n.d.)

A 2010 Cochrane review examined studies that measured the effects of speed cameras on crashes and road speed. Of the 28 studies the report examined that measured crash outcomes, all studies found that after implementing the speed cameras, road crashes decreased (Table 5; Wilson et al., 2010). These data strongly support speed cameras as an effective method to reduce the rate and severity of road crashes.

### TABLE 5. SUMMARY OF THE IMPACTS OF SPEED CAMERAS IN REDUCING CRASHES

<table>
<thead>
<tr>
<th>Crash Type</th>
<th>Reduction in Crashes (Average)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Crashes Near Camera</td>
<td>8-49% (14-25%)</td>
</tr>
<tr>
<td>Injury Crashes</td>
<td>8-50%</td>
</tr>
<tr>
<td>Serious Injuries &amp; Fatalities Near Camera</td>
<td>11-44%</td>
</tr>
<tr>
<td>Total Crashes Wider Area</td>
<td>9-35% (11-27%)</td>
</tr>
<tr>
<td>Serious Injuries &amp; Fatalities Wider Area</td>
<td>17-58% (30-40%)</td>
</tr>
</tbody>
</table>

SOURCE: Wilson et al., 2010
Electronic Surveillance Priorities

Implementation Support Recommendations

This priority is based on the finding that:

- Adequate support is needed to help implement these electronic surveillance systems.

One best practice recommendation was identified to address this priority, and a brief summary of the supporting literature follows.

**23. Utilize a private company that offers services to reduce data and personnel demands on the police force while aiding in the collection of fines.**

Currently, there are numerous private companies that provide services for vehicle speed monitoring, including all the services necessary to administer the issuance of tickets. Some of these companies programs that include a road scan to determine the best placement for the equipment (e.g., speed cameras), install the machines, monitor the roads, record the video stream, notification when vehicles speed, capture the license plates, and administer the collection of the ticket. When these companies are used, either a flat rate or a percentage of paid citations is shared between the police and the company administering the citations. While having a private company involved in these services comes with a cost, it will reduce the workload for police who are often responsible for implementing these services, and who are also often already overextended.

Electronic Surveillance Priorities

Police Mobilization Recommendations

This priority is based on the finding that:

- Technology exists to help effectively dispatch officers to the scene of a crash.

One best practice recommendation was identified to address this priority, and a brief summary of the supporting literature follows.
24. Establish or hire a fleet tracking and management services to improve accountability and safety while aiding in the dispatch of police officers.

Police tracking allows for the central office to more effectively manage a police force and vehicle fleet ("GPS Tracking for Law Enforcement | US Fleet Tracking" n.d.). In conjunction with the EMS and fire brigade services, fleet tracking can improve response times and allows for the most appropriate resources to be dispatched to the scene rapidly. GPS tracking can provide police dispatchers with information on the location of police in the field to ensure that they are at their post, to aid in dispatch, to help officers navigate to the scene of a crash or crime, to improve officer driving safety, improve time of arrival estimations, reduce phone calls, and improve accountability in policing ("GPS Tracking for Law Enforcement | US Fleet Tracking" n.d.). There are several private companies that provide a range of tracking and management services and can be hired to assist with these services.

CONCLUSION

Jamaica’s new road safety act and stakeholder interest in a Safe Systems approach bode well for road safety in Jamaica over the next decade. Although the recommendations are intended to help shape future transportation safety work, the priorities and timeline for action are dependent on many factors, including stakeholder engagement and available resources.

Figure 7 illustrates how the 4 Ss of the Safe System approach (Safe people, Safe vehicles, Safe roads, and Safe speeds) are integrated for collective impact. The recommendations in this report are consistent with the Safe Systems approach and each of the 4 Ss, as summarized below.

**FIGURE 7. SAFE SYSTEM DIAGRAM (ADAPTED FROM SAFER ROADS, SAFER QUEENSLAND: QUEENSLAND’S ROAD SAFETY STRATEGY 2015–2021).**
Safe People are the focus of everything that is done in the name of road safety, but in particular, recommendations #7-#9 address the need for enhanced communication with all road users to promote safer practices (e.g., seat belt use). Formative, process, and outcome evaluations of such communication and education efforts should be supported. Strengthening drink and drug driving laws (#1) and proper helmet wearing (#3) will promote the goals of safe people. When prevention fails, effective emergency response is essential to saving lives and reducing injury. Improving emergency response in Jamaica was a high priority in this report, encompassing protocols (#14-#16), response availability (#17-19), communication (#20), and training (#21).

Safe Vehicles are the focus of recommendation #10, which places high priority on having vehicles with built in safety features; the extent to which this is feasible for Jamaica in the short term is unknown, but should be urgently investigated. Recommendation #4 addresses the need to have vehicle seat belt anchorage points as a standard requirement. Given the legal requirements that vehicles must have certain other working features (e.g., headlamps, seat belts), resources should be made available to those in need of financial help to fix/retrofit their existing vehicles.

Safe Roads are essential to a safe environment that reduces crash and injury risks. Recommendation #6 promotes the use of iRAP assessments to rate, fix, and upgrade roadways as an evidence-based approach to improving the road infrastructure.

Safe Speeds can be facilitated by several of the recommendations, including #2 (automated enforcement systems), #5 (increasing fine levels), and #22-24 (electronic surveillance and support).

Finally, a safe system requires data to guide decisions and set priorities. Jamaica has multiple relevant and important data systems in place. This report includes recommendations #11-13 focused on coordinating and integrating these data to maximize their utility.
References


https://doi.org/10.3390/ijerph10104628.
Appendix 1 - Peer-Reviewed Literature

The literature search yielded a mixed body of academic papers examining prevalence and other descriptive epidemiology, and data on road safety measures.

Prevalence. Between December 1999 and May 31st, 2000 data from JISS found that road injuries were responsible for 15% of all injuries reported in the Jamaican Injury Surveillance System (JISS) (Arscott-Mills et al. 2002). Motor vehicle injuries as a percent of all injuries have increased since 2000, with newer data showing that during 2001-2010 motor vehicle crashes accounted for 22% of all injuries reported to the University Hospital of the West Indies (Plummer et al., 2014).

Age. As seen in other countries, in Jamaica, young people account for the highest rates of road traffic injuries and fatalities. The estimates vary between different studies and stratifications of age groups, but those at highest risk are general between 20 and 40 years of age. Between December 1st, 1999 and May 31st, 2000 data from JISS found that young people (between the ages of 25 and 44) were most likely to be involved in motor vehicle crashes. Further data suggests that people aged 20-29 experienced 30% of vehicle related injuries while those aged 10-19 accounted for another 20% (Ward et al., 2010). From 2001 to 2005, insurance data suggests that 62.2% of vehicle crash victims were under 40 years of age and that children below the age of 10 accounted for 4.9% of all injuries, and people between the age of 20 and 29 accounted for 20.7% of injuries (McGrowder & Crawford, 2008). People aged 20-39 accounted for 40.7% of all road traffic victims (McGrowder & Crawford, 2008).

Sex. The vast majority of road traffic injury victims, road traffic crash victims, and fatalities associated with road traffic injuries are men. Males accounted for 70% of the crashes in the period from December 1, 1999-May 31st, 2000 (Arscott-Mills et al. 2002). 2004 data indicates that the ratio of males to females involved in road traffic injuries is 3.7:1 (Ward et al. 2010), with men being 1.8 times more likely to be injured in a motor vehicle crash than women (Ward et al., 2010). Insurance data from 2005-2006 suggests that 78.7% of the victims of traffic injuries were male (Francis et al. 1995), while other studies have found the levels to be as high as 93% male (Arscott-Mills et al. 2002).

Type of Vehicle. In Jamaica, concerning non-fatal crashes, approximately 55% of injuries occurred in motorcars (Ward et al., 2010). A different study suggests similarly that motorcar drivers were most likely to experience injury (accounting for 40% of injuries), followed by motorcar passengers (33%) (Arscott-Mills et al., 2002). In general motorcar are most likely to crash with another car (44%) and at lower rates crash into trucks/buses (11%), property alone, or persons (Ward et al., 2010).

Bicyclists were involved in 9% of injuries (Ward et al., 2010), and pedestrians account for 16% (Ward et al., 2010)-18% (Arscott-Mills et al., 2002) of injuries in the country. Among pedestrians, about 64% are struck by motorcars and 11% by buses or trucks (Ward et al., 2010).
Concerning fatalities, insurance data suggests that pedestrians were highly represented in traffic fatalities - accounting for 30.2% of deaths (McGrowder & Crawford, 2008). Private motorcar drivers accounted for 16.9% of fatalities and motorcar passengers accounted for another 16.6% (McGrowder & Crawford, 2008). Pedal cyclists make up 11.7% of the fatalities and motorcyclists, another 9.3% of deaths (McGrowder & Crawford, 2008). Commercial drivers and passengers experience the lowest rates of fatalities according to the insurance data (McGrowder & Crawford, 2008).

Time of day/week. The highest number of crashes in Jamaica occurs during the busiest times of the week and day. The majority (53.2%) of crashes occur during daytime hours (0600h-1800h). Weekends also accounted for higher rates of crashes (52.6%) compared to the rest of the week (McGrowder & Crawford, 2008). Can likely be attributed to higher levels of activity during the daytime hours and in travel on the weekends (McGrowder & Crawford, 2008).

Drug Use. Drugs, including alcohol, are major contributors to road injuries and fatalities in Jamaica. In two parishes (1) Kingston and (2) St. Andrews & St. Catherine, 77.5% of fatalities tested positive for alcohol, 22.5% tested positive for cannabis, and 3.2% tested positive for cocaine (Francis et al., 1995). More recent data from the A&E unit at the UHWI found that 66% of people injured in a car crash who required hospitalization tested positive for alcohol, cannabis, or cocaine, with 43% being positive for alcohol, 50% testing positive for cannabis, and 6% positive for cocaine (McDonald et al., 1999). Of those who tested positive for alcohol, 71% had blood concentrations higher than 80mg/dL (the legal limit in Jamaica) (McDonald et al., 1999). Younger drivers were more likely to test positive for drugs than older drivers (McDonald et al., 1999).

From an autopsy study in two parishes in Jamaica, the majority of those who had blood alcohol levels greater than 100mg/100mL (where 50mg/100mL is the WHO safe driving standard and 80mg/100mL is the legal limit in Jamaica), were pedestrians (Francis et al., 1995). This highlights the risk of elevated blood alcohol content, even for those not driving but still at risk on the roads.

Seat belt usage. While seat belts had been shown to reduce the risk of injury in the event of a car crash (CDC, 2014), prior to 1999 there was no legislation in Jamaica that required drivers and passengers in motor vehicles to wear a seat belt. In 1996, an observational study revealed only 21.1% of drivers and 13.6% of front seat passengers used seat belts (Crandon et al., 1996). Female drivers were more likely to wear seat belts than men, but only 25.4% of women drivers wore seat belts (Crandon et al. 1996). There was not a statistically significant difference between male and female front seat passenger seat belt usage, nor was there a difference between the city center and city periphery rates (Crandon et al., 1996).

By 2004, after introducing seat belt legislation (in 1999) that fined drivers and passengers who were driving without seat belts, a follow up observational study showed that the seat belt usage rate increased to 81.2% for drivers and 74.0% among front seat passengers (Crandon et al., 2006). This was not self-reported data, but rather, observational.
Further studies have shown that seat belt legislation in Jamaica have increased the rate of wearing seat belts among those who are in vehicle crashes (Williams et al., 2007). There was a 34% increase in rate of wearing a seat belt from 1999 (before the seat belt law was passed) to 2003 among drivers who were admitted to hospitals for a crash (from 47% of crash victims to 63% of crash victims) (Williams et al., 2007).

Helmets. Helmets have been shown to reduce the rate and severity of head injuries from motorcycle crashes, while also reducing health care costs and disability post-crash. A systematic review conducted by the Cochrane group found that helmets reduced the risk of motorcycle death by 42% and reduced the risk of serious head injury in the event of a motorcycle crash by 69% (Liu et al., 2008). There is concern in Jamaica that helmet are unnecessary since the road conditions are different in Jamaica when compared to other countries such as the United States, with more winding roads and poor road conditions (Crandon et al., 2009a). Some believe that these conditions make motorcycle crashes less severe since they are supposedly occurring at lower speeds. However, in Jamaica, helmets still significantly reduce the severity of head injuries and reduce the likelihood of sustaining an intra-cranial lesion from the crash (Crandon et al., 2009a).

There is legislation, passed in 1999, that mandates the use of approved helmets when on a motorcycle (Government of Jamaica, 1999). Compliance with such laws is low with one study finding that 50.4% of riders were in were not wearing a helmet at the time of their crash (Crandon et al., 2009b). Another study found even worse compliance with only 34.3% of motorcycle crash victims were wearing a helmet at the time of the crash (Crandon et al., 2009a). Whether or not a person was wearing a helmet at the time of a crash was determined by police or paramedics who arrived at the scene of the crash (Crandon et al., 2009a). This study excluded cases in which helmet use at the time of a crash could not be determined (Crandon et al., 2009a). Within Jamaica, 75% of motorcycle fatalities are due to head injuries (Crandon et al., 2009b).
Appendix 2. Country-Level Data

There are two primary surveillance systems that monitor road traffic injuries in Jamaica: 1) Jamaican Injury Surveillance System and 2) the Trauma Registry at the University Hospital of the West Indies. Both systems can be used to assess the epidemiological profile of injuries in Jamaica, measure the burden of injury, identify priority areas, and monitor and evaluate programs’ effects on injuries. In addition, country-level data are being produced, reported, and analyzed by a diverse group of stakeholders. To clarify the inputs and outputs of the multiple data sources within the country that were identified during the gap analysis process, please see Table 1 below.

**TABLE 1. DATA SOURCES REVIEWED BY JOHNS HOPKINS CENTER FOR INJURY RESEARCH AND POLICY**

<table>
<thead>
<tr>
<th>Source</th>
<th>Sub-Group</th>
<th>Reports</th>
<th>Data Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry of Health</td>
<td>Jamaica Injury Surveillance System</td>
<td>Jamaica Injury Surveillance System Database</td>
<td>Public hospitals</td>
</tr>
<tr>
<td>Jamaica Constable Forces</td>
<td>Road injuries</td>
<td>Daily police reports</td>
<td>Crashes reported to police</td>
</tr>
<tr>
<td>University of the West Indies</td>
<td>Tropical Medicine Research Institute</td>
<td>Jamaica Health and Lifestyle Survey 2007-8</td>
<td>Households</td>
</tr>
<tr>
<td>Ministry of Transport and Mining</td>
<td>Directorate of Planning, Research, and Evaluation Road Safety Unit</td>
<td>Annual Traffic Report</td>
<td>Jamaica Constabulary Force</td>
</tr>
<tr>
<td>Mona Geoinformatics Institute</td>
<td>Road Safety</td>
<td>Comprehensive Crash Mapping</td>
<td>Jamaica Constabulary Forces (data) and collated by Road Safety Unit (with data in Microsoft Access)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Annual Fatal Crash Reviews</td>
<td>Jamaica Constabulary Forces</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 Year Crash Analysis and Observations</td>
<td>Primary data provided by Traffic Division of the Jamaica Constabulary Forces and National Road Safety Council</td>
</tr>
<tr>
<td>University of the West Indies</td>
<td>Violence Prevention Alliance</td>
<td>Cost of Care Final Report</td>
<td>Jamaica Injury Surveillance System</td>
</tr>
<tr>
<td>Ministry of Transport and Mining</td>
<td>Island Traffic Authority</td>
<td></td>
<td>Vehicle fitness, road worthiness, and compliance with safety standards</td>
</tr>
<tr>
<td>Ministry of Transport and Mining</td>
<td>Road Safety Unit</td>
<td>Public information campaigns and legislation</td>
<td>Varied</td>
</tr>
<tr>
<td>Insurance Companies</td>
<td>Many companies</td>
<td>Risk data</td>
<td>Variable sources, especially customers and reported crash data.</td>
</tr>
<tr>
<td>National Works Agency</td>
<td></td>
<td>Road closure reports</td>
<td></td>
</tr>
<tr>
<td>Tax Administration Jamaica</td>
<td></td>
<td>Licensing</td>
<td></td>
</tr>
</tbody>
</table>
Preventing Road Traffic Injuries in Jamaica

Road Fatalities. Over the past quarter century in Jamaica, there has been a downward trend in the rate of road fatalities (Figure 1). Despite the progress being made in reducing the overall rate of injuries in the long term, in more recent time frames (2012-2016), Jamaica has seen an upward sloping trend in the rate of road fatalities (Figure 2).


![Graph showing road fatalities per 100,000 population from 1991 to 2017.](image1)


![Graph showing fatalities per 100,000 population from 2012 to 2016.](image2)

Road Fatalities. Over the past quarter century in Jamaica, there has been a downward trend in the rate of road fatalities (Figure 1). Despite the progress being made in reducing the overall rate of injuries in the long term, in more recent time frames (2012-2016), Jamaica has seen an upward sloping trend in the rate of road fatalities (Figure 2).
Road Fatalities By Type. From 2012 to 2017, pedestrians made up the largest number of annual road fatalities (lowest shaded portion of each bar, by year), followed by motorcyclists, PMC drivers, and PMC passengers (Figure 3). While the numbers of pedestrian fatalities stays generally stable over the time period, motorcyclist deaths more than double over the same period.


Road Fatalities by Outcome. Over the period of 2004-2014, there was a decrease in damage only crashes, while serious and fatal crashes remained unchanged and minor injury crashes showed a slight increase (Figure 4). Damage only crashes were consistently the most frequent.

**FIGURE 4: CRASHES PER YEAR BY OUTCOME. FIGURE CREATED FROM: MONA GEOMATIC INSTITUTE. (2015). MGI 10 YEAR CRASH ANALYSIS AND OBSERVATIONS.**
Road Fatalities by Age Group. From 2012-2017, the 20-29 year old age groups (26%) and those 60 years and older (16%) contributed the most to the number of road fatalities during the time period (Table 2).


<table>
<thead>
<tr>
<th>Table 2: Fatalities by Age 2012-2017</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age Group</strong></td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>Not Known</td>
</tr>
<tr>
<td>0-4</td>
</tr>
<tr>
<td>5-9</td>
</tr>
<tr>
<td>10-14</td>
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<td>15-19</td>
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<td>40-44</td>
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<td>45-49</td>
</tr>
<tr>
<td>50-54</td>
</tr>
<tr>
<td>55-59</td>
</tr>
<tr>
<td>60 and over</td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
</tbody>
</table>

Behavior Differences by Sex and Education. According to the Jamaica Health and Lifestyle 2008 survey (see Table 3), more males reported being drivers than females aged 15-74. Men also self-reported higher levels of seat belt use than females, 55% of males and 31% of females reporting that they "always" or "most times" wore a seatbelt when driving. Women were also far more likely to say that they "never" wore a seatbelt than men as drivers 44.8% of women and 11.3% of men. Men and women had similar rates of wearing seatbelts as front seat passengers and backseat passengers. However, only about 4% of backseat passengers "always" or "most times" reported wearing a seatbelt for both men and women, while about 80% of backseat passengers report that they "never" wear a seatbelt. Additionally from the Jamaica Health and Lifestyle survey, it is estimated that 38.4% of Jamaican's have ridden a bike or motorbike, but helmet usage is very low. Of riders, only 7.2% of men and 2.8% of women "always" or "most times" wear a helmet when they ride on a bike or motorbike (Jamaica Health and Lifestyle Survey). Women are less likely than men to wear helmets and more women than men "never" wear a helmet when riding, 90.5% vs 83.6% (Jamaica Health and Lifestyle Survey). Differences can also be seen in seat belt and helmet usage rates by educational attainment levels. Among drivers rates of seat belt use increase from 24.9% to 34.6% to 67.8% across the three levels of education from primary to post-secondary. The vast majority of respondents wear seat belts when they are front seat passengers, across the education levels (89.2%, 89.3%, 95.3%). Conversely, virtually no motorbike and pillion riders where helmets (< 7.8%).
### Table 3: Proportion (%) of Persons with Reported Lifestyle Behavior by Educational Attainment. JHLSII 2008. From Chapter 5 of the 2007/8 Health and Lifestyle Survey. Note: Sample sizes were not available; 2018 Health and Lifestyle Survey was not available.

<table>
<thead>
<tr>
<th>Social History</th>
<th>Education</th>
<th>Primary or Lower</th>
<th>Secondary</th>
<th>Post-secondary</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>M    F    T</td>
<td>M     F   T</td>
<td>M     F   T</td>
</tr>
<tr>
<td>Seat Belt Use</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drivers</td>
<td>Never</td>
<td>9.9</td>
<td>12</td>
<td>10.9</td>
</tr>
<tr>
<td></td>
<td>Always/Most times</td>
<td>42.8</td>
<td>5.6</td>
<td>24.9</td>
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<tr>
<td></td>
<td>Never Drives</td>
<td>47.3</td>
<td>82.5</td>
<td>64.2</td>
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<td>Front Seat Passengers</td>
<td>Never</td>
<td>9.3</td>
<td>12.4</td>
<td>10.8</td>
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<tr>
<td></td>
<td>Always/Most times</td>
<td>90.7</td>
<td>87.6</td>
<td>89.2</td>
</tr>
<tr>
<td>Helmet Use</td>
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<tr>
<td>Riders</td>
<td>Never</td>
<td>41</td>
<td>14</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>Always/Most times</td>
<td>7.3</td>
<td>0.1</td>
<td>3.9</td>
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<tr>
<td></td>
<td>Never Rides</td>
<td>51.8</td>
<td>85.9</td>
<td>68.2</td>
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<td>Pillion Rider</td>
<td>Never</td>
<td>45.7</td>
<td>23.6</td>
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<td>Always/Most times</td>
<td>6.8</td>
<td>0.8</td>
<td>3.9</td>
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<tr>
<td></td>
<td>Never Rides</td>
<td>47.5</td>
<td>75.6</td>
<td>61</td>
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<td>Injuries Sustained</td>
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<tr>
<td>Motor Vehicle Accident</td>
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<td>6.9</td>
<td>3.1</td>
<td>5.1</td>
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<tr>
<td>Criminal</td>
<td></td>
<td>2</td>
<td>0.7</td>
<td>1.4</td>
</tr>
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<td>Domestic</td>
<td></td>
<td>2.6</td>
<td>1.6</td>
<td>2</td>
</tr>
<tr>
<td>Exposure to Violence</td>
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<td>9.5</td>
<td>5.1</td>
<td>7.4</td>
</tr>
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</table>