Response to NTC Collaborative Response to the Consultation Regulatory Impact Statement (CRIS): Barriers to the safe use of personal mobility devices

TO: National Transport Commission (NTC)
FROM: Jamieson Trauma Institute (JTI) Queensland, Royal Australasian College of Surgeons (RACS) National Trauma Committee, Australasian Injury Prevention Network (AIPN), Queensland Injury Surveillance Unit

KEY CONTACTS:

- Associate Professor Kirsten Vallmuur, MAIC Principal Research Fellow, Australian Centre for Health Services Innovation, Queensland University of Technology and Jamieson Trauma Institute; Member of RACS National Trauma Committee; Member RACS Queensland Trauma Committee
- Dr Matthew Hope, Deputy Director of Trauma, Orthopaedic Unit, Division of Surgery, Princess Alexandra Hospital and Metro South Health Service; Member of National Trauma Committee Royal Australasian College of Surgeons; Chair RACS Queensland Trauma Committee
- Dr Ben Beck, Deputy Head Prehospital, Emergency and Trauma Research, Public Health and Preventive Medicine, Monash University; President, Australasian Injury Prevention Network (AIPN)
- Dr Ruth Barker, Director, Queensland Injury Surveillance Unit

DATE: 18/12/2019

RESPONSE:
We submitted a very detailed collaborative response to the *NTC Issues Paper: Barriers to the safe use of innovative vehicles and mobility devices* to outline our shared position on personal mobility devices. Hence, for our response to this CRIS, we have chosen to simply provide an update for the NTC by including several recent publications and presentations that have occurred since the previous submission.

Please find attached:

- A copy of the original response to the NTC Issues paper.
- A copy of the recent publication describing the impact of the e-scooter trial on emergency department resources in a major trauma service in Brisbane: *Mitchell G, Tsao H, Randell T, Marks J, Mackay P. Impact of electric scooters to a tertiary emergency department: 8-week review after implementation of a scooter share scheme. Emerg. Med. Australas. 2019; 31: 930–4.*
- A copy of the recent editorial written by Dr Ruth Barker, Director of the Queensland Injury Surveillance Unit: *Barker R. Editorial: Electric Scooters. Emerg. Med. Australas. 2019*; 31, 914–915.
- A copy of the slides presented at the Australasian Injury Prevention Network Conference in Brisbane 25th November 2019 by Associate Professor Kirsten Vallmuur, with updated figures on injury presentations from Lime Scooters in Brisbane titled: *Responsive surveillance for prevention policy:A case study of the lime scooter trial in Brisbane*.

We are happy to correspond with the NTC if there are any further questions.

Response to NTC Issues Paper: Barriers to the safe use of innovative vehicles and mobility devices

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RESPONSES TO SELECTED QUESTIONS FOR COMMENT:

5. What are the practical and measurable outcomes required from a nationally consistent policy and regulatory framework for innovative vehicles?

Before the introduction of any new innovative vehicle to the marketplace, a broad consultation process should be undertaken with the key stakeholders who have a role in either enforcing, monitoring or responding to issues that arise due to the use of these vehicles. This includes, but is not limited to:

- Regulators: Transport, local council, workplace health and safety, fair trading/product safety units;
- Enforcement: Police, security agencies;
- Responders: Ambulance, trauma clinicians, allied health professionals;
- Funders: Compensation providers (vehicle, health and workplace);
- Community: Pedestrian advocacy groups, health promotion groups, injury prevention agencies etc.

This consultation process would help inform the safe implementation of such vehicles into the community, and the design of an evaluation framework, including the identification of a broad range of available and desirable indicators for measuring the impact of the innovative vehicle.

From the health indicator perspective, the current data sources are limited in their ability to capture specific details regarding innovative vehicle use, with vehicle classifications (where they are used) largely confined to broad categories, such as bicycles, motorcycles, cars, trucks, buses etc. in keeping with the International Classification of Diseases (ICD) approach. There is significant variation in the data availability and vehicle classifications used in ambulance service and emergency department data sources across Australia, and while hospital data is nationally consistent in collection, the only ICD-10-AM codes to capture motorised scooters, for instance, are:

- W02.9 - Fall involving other and unspecified pedestrian conveyance *(includes motorised scooter and falls out of shopping trolleys amongst other devices and is only applicable if there is no other vehicle or conveyance involved in the incident)*
- V00.14 - Pedestrian injured in collision with pedestrian conveyance, traffic accident, scooter, powered *(this includes when one or both parties are using a motorised scooter but the fifth character of the code only identifies if the counterpart was a motorised rider, not if the person injured was also a motorised scooter rider).*

Furthermore, while there is a process whereby requests can be made to update the ICD-10-AM classification system used to capture the cause of injury hospitalisations, highly specific requests for types of innovative vehicles to be included are unlikely to be approved and even if they are, the process for rolling out a new edition of the ICD-10-AM takes several years. Furthermore, hospitalisation data is generally not available for analysis until approximately one year after discharge from hospital and requires data approvals for release.

Therefore, there is a clear need to be able to identify robust mechanisms to be able to monitor injuries associated with innovative vehicles. For example, there are new opportunities to capture specific details in a more responsive, real-time manner as the roll-out of integrated electronic medical record (iEMR) systems occurs throughout Australia. As data becomes increasingly digitised and centrally accessible through integrated intelligence systems, there may be capacity for centralised querying of these data to identify mentions of the use of emerging innovative vehicles. There may also be capacity for designing triggers in front-end data entry platforms to capture more specific information for ad hoc surveillance projects to enable real-time monitoring of injury presentations to emergency departments. It would be beneficial for such opportunities to be explored with key agencies, such as the Australian Digital Health Agency, to assess the feasibility of utilisation of such a system for future surveillance initiatives.

6. What evidence-based distinctions between acceptable and unacceptable levels of risk associated with the use of innovative vehicles could be considered to inform the way innovative vehicles are regulated?

In order to determine whether the risk is 'acceptable', the risks associated with innovative vehicles need to be considered in the broader context of risks associated with other pedestrian conveyances which *are* accepted and used routinely by the community, such as bicycles and non-motorised wheeled devices (e.g. skateboards, scooters). While injuries can and do occur while using these devices, they can serve as a baseline for a level of risk that the community does and has accepted for decades. Thus, to evaluate whether the level of risk associated with innovative vehicles is acceptable, data are required which enumerates:

- the number and severity of injuries in relation to innovative vehicle types *and* other commonly used pedestrian conveyances;
- the size and demographics of the user population for innovative vehicle types *and* other commonly used pedestrian conveyances;
- the costs of treatment and outcomes of patients injured using innovative vehicle types *and* other commonly used pedestrian conveyances;
- the responsible parties bearing the costs for care of injured parties injured using innovative vehicle types *and* other commonly used pedestrian conveyances (i.e. the community burden);
- the biomechanical hazards and thresholds of injury tolerance associated with the use of innovative vehicle types *and* other commonly used pedestrian conveyances at different speeds and using different safety devices (such as helmets);
- the dynamic interactions between and hazards to 'on foot' pedestrians and innovative vehicle types *and* other commonly used pedestrian conveyances (e.g. how pedestrians react to conflict situations with different types of devices and speed of response to avert collisions);
- the differential impact road and footpath infrastructure have in relation to innovative vehicle types *and* other commonly used pedestrian conveyances (e.g. impact of different footpath surfaces or maintenance issues for small wheeled devices to larger rubber wheeled devices etc.).

8. How do current classifications of drivers of wheelchairs as both 'pedestrians' and 'vehicles' in the Australian Road Rules create confusion?

While this question references 'wheelchairs', the question is equally applicable to innovative vehicles such as motorised scooters. It is our understanding that currently motorised scooter riders are considered pedestrians and would only be of interest to road safety authorities as 'vehicles' if involved in a collision with another 'vehicle'. However, this presents challenges for regulation, monitoring, and compensation avenues for both the motorised scooter rider and other parties involved in any collision (whether they be pedestrians or vehicles). Clarification of this distinction is required to avoid such confusion.

9. Is there a need for construction and performance requirements for motorised mobility devices to ensure safe use on public transport infrastructure?

There is a complicated web of regulators involved in ensuring the safety of innovative vehicles, including but not limited to transport authorities (vehicles, road rules and road infrastructure), local councils (transport share scheme permits, local infrastructure), workplace health and safety (worker journey safety), fair trading/product safety units (consumer hire schemes, goods 'safe and fit for purpose' requirements). There is limited opportunity for enforcement in the current consumer product safety legislation, with regulators required to demonstrate systemic failures before intervention (in the form of safety recalls) can be enacted. There is discussion at a national level for the introduction of a General Safety Provision that would place the onus on Australian manufacturers and suppliers of products to demonstrate their products are safe before being sold/hired to the community. A broad safety provision such as this would be desirable, especially in the area of innovative vehicles, where it is difficult to develop generic construction/performance requirements that would cover the range of emerging vehicles in the marketplace.

10. What evidence is available on the road safety risks associated with motorised mobility devices that could be used to inform the way motorised mobility devices are regulated?

In order to gather injury surveillance data in Brisbane during the trial of Lime scooters, the Jamieson Trauma Institute (Brisbane), on behalf of RACS Qld Trauma committee, liaised with local Emergency Departments (EDs) and the Queensland Ambulance Service to collect and compile deidentified aggregate data for presentations related to the use of Lime scooters (electronic rental scooters). Flyers with photos of different types of personal motorised mobility devices were distributed to all EDs around central Brisbane and to the Queensland Ambulance Service, seeking their assistance in clearly documenting the type of scooter in the ambulance case description/ED triage text. Clinical staff were asked to specifically document the type of scooter using preferred terms which were provided, as well as asked to document the injury circumstances as completely as possible including how and where the incident occurred, whether a helmet was worn, speed (if known) and whether the injury was as a result of or associated with alcohol consumption. These data were then compiled for ambulance attendances as well as for presentations at four public EDs (three adult and one paediatric) and one private adult ED in Brisbane during a period slightly over a two-months. Note that these data are self-reported, rely on documentation in the clinical notes to specifically mention a 'Lime scooter' involvement and may be incomplete, and therefore should only be used as indicative estimates until more comprehensive data collection measures are implemented.

Examining the ambulance attendance data, there were a total of 30 presentations which were specifically documented as Lime scooter-related attendances with an age range from 16-75, with 20-34 year olds accounting for 53% of ambulance attendances overall and an equal number of males and females treated. Saturdays and Sundays were the most frequent days with 60% of

ambulance attended cases occurring on the weekend. Where there was documentation of the injury treated, 76% were for contusions/abrasions and 19% for a head injury (not specified if major or minor). Over 83% of cases were transported to hospital as a result of their injuries.

ED presentation data for five central EDs in Brisbane identified a total of 134 patients presenting for treatment of an injury after a Lime scooter-related incident (which also includes cases not transported by ambulance). This is almost 70 ED injury presentations per month over the approximately two-month period related to the use of Lime scooters. Ages ranged from under 5 years to 81 years, with 20-34-year-old patients accounting for 63% of cases overall, with males accounting for 54% of cases and females accounting for 46% of cases. Over 31% of patients arrived at the ED by ambulance. Hospital admission was required as a result of these injuries in 11% of cases, and surgery was required in 10% of cases (only two hospitals provided data on whether an operation was required). Four hospitals (n=109) provided data on injuries treated with minor head injury recorded for 11% of cases, 3 major head injuries treated, upper limb fractures treated in 21% of cases, lower limb fractures treated in 6.4% of cases, sprained/strained limbs treated in 17.4% of cases, almost 60% of cases requiring treatment for contusions/abrasions, and one thorax injury treated (some cases had multiple injuries recorded hence percentages exceed 100%).

Helmet use was poorly documented across all ED sites with only 22% of cases mentioning whether a helmet was worn or not, and of those that mentioned helmet status, 28% stated a helmet was not worn. Alcohol use was documented for 16% of cases presenting to the ED. Documentation of speed was variable and only recorded in 35% of cases, but of the cases where a speed was mentioned, 28% suggested the speed was 30kph or greater (though the accuracy of speed estimation is uncertain).

While there has been documentation of numerous injuries arising from the use of these new personal mobility devices, we do not know whether they are associated with an increase in injuries per person or per journey, compared with other transport options. More comprehensive data are needed on the number and type of injuries sustained in order to understand the safety profile of these new personal mobility devices.

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ORIGINAL RESEARCH

Impact of electric scooters to a tertiary emergency department: 8-week review after implementation of a scooter share scheme

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Abstract

Objective: A retrospective audit of presentations to a tertiary trauma centre reviewing the demographics of electric scooter injuries in the first 2 months of the scooter-share scheme, which was commenced in Brisbane in November 2018.

Methods: Electric scooter-associated presentations to the Royal Brisbane and Women's Hospital Emergency and Trauma Centre from November 2018 to January 2019 were identified. Data collected included patient demographics, type and location of injuries, helmet use, alcohol consumption, length of stay and disposition. Estimates of costs associated with electric scooter presentation were also obtained.

Results: Fifty-four electric scooter encounters were included during the 2-month period. Helmets were worn in 46% and was associated with reduced risk of head injury (odds ratio (OR) 0.18, $P = 0.029$). Alcohol was involved in 27% although this did not impact on admission rates (OR 1.25, $P = 0.83$) or operative management (OR 2.14, $P = 0.42$). Contusions/abrasions and fractures/dislocations were the most common types of injury, whereas upper limb and minor head injuries were the most common sites of injury. Most patients were discharged home (87%), with 74% completing their emergency visit in under 4 h. Six patients required operative management and 15 patients needed outpatient follow-up. There were no deaths. Average patient cost per presentation was $542 and ranged from $285 to $1345.

Conclusions: The findings characterised injury patterns and costs associated with electric scooters in our ED. Given the increasing popularity of electric scooters as an alternate form of transportation, our study may help to inform public policy for future injury prevention.

Key words: *electric scooter injury, emergency medicine, head injury, scooter-share scheme.*

Key findings

- As the number of electric scooters continues to rise, so does the number of injuries to both riders and bystanders.
- Upper limb and head injuries were the most common injuries.
- Emergency Physicians must highlight the impact to the healthcare systems of share-scheme electric scooters, especially the impact of alcohol and riding without helmets.

Introduction

In November 2018, Lime (Neutron Holdings Inc., San Francisco, CA, USA) introduced an electric scooter sharing scheme in Brisbane, the first of its kind in Australia.[1] This has resulted in an increase in electric scooter use with over 50 000 trips taken within the first 2 weeks.[2] Electric scooters provide an independent alternative to cars and bicycles. These devices are powered by rechargeable battery with a range of approximately 20–60 km per charge, and a maximum speed of approximately 25 km/h. It offers a feasible solution to the 'last mile' problem, which is the distance that feels strenuous to walk but too short to drive. However, with the increasing use of electric scooters, there is also increased media attention on accidents and injuries associated with electric scooters.[3,4] The exact incidence and type of injuries associated with electric scooter since the roll out of scooter sharing scheme in Brisbane is unclear.

In the USA, electric scooter sharing schemes have operated since 2012. Two studies have examined injuries associated with electric scooters in the USA. Trivedi *et al.*[5] performed a retrospective audit of 249 encounters to a single ED following scooter-related injuries. They found that fractures, head injuries and contusions/sprains accounted for the majority of presentation, with 94% of patient discharged home from the ED. A more recent study by

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Aizpuru *et al.*[6] investigated injuries in 32 400 electric scooter injuries from a national database. The authors confirmed that head injuries were the most common body area injured and fractures or dislocations were the most common diagnosis. Notably, that study showed major orthopaedic injuries and concussions were the strongest predictors of hospital admission.

The present study aimed to examine the demographics and injury characteristics of emergency presentations associated with electric scooter use during the first 2 months since the introduction of a scooter sharing scheme in Brisbane. In addition, the influence of helmet on head injury and alcohol on admission and operative management were also specifically investigated.

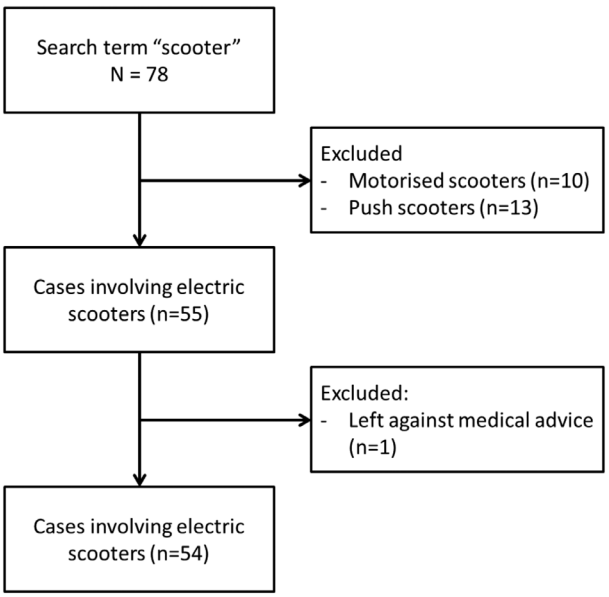

Figure 1. *Participant audit flow diagram.*

Methods

We conducted a retrospective audit of all patient encounters to the Emergency and Trauma Centre of the Royal Brisbane and Women's Hospital from 23 November 2018 until 23 January 2019. As our hospital was situated in proximity to the city business district where electric scooters were readily available, we were in a unique position to obtain data on injuries associated with electric scooters. The institutional review board reviewed the study and provided an exemption from full ethical review (LNR/2019/QRBW/51754).

Data collection

A search was conducted of the Emergency Department Information System (EDIS) of all ED encounters with non-case-sensitive terms 'scooter' in the triage field. Medical records were reviewed by one of three ED investigators (TR, JM and GM). Encounters that were not due to electric scooters (e.g. push scooters, mobility scooters) were excluded. Data were included if the injured person(s) was either the rider of the electric scooter or hit by an electric scooter. If the medical records were unclear regarding the type of scooter, then the treating doctor was approached for further clarification. The number of electric scooter injuries presenting to our ED during the first month in 2018 (23 November to 23 December) was compared with the same period in 2017.

The data were de-identified. Patient demographics (age, gender), mode of presentation (walk in *vs* ambulance), Australasian Triage Scale (ATS), type of injury, helmet use, alcohol use, medical imaging, emergency length of stay, disposition, and whether surgical intervention or outpatient follow-up was required were obtained. In addition, cost analysis for each triage category was also examined. This included government cost for emergency presentation based on ATS category plus cost during hospital admission and/or outpatient follow-up. However, in our audit, it was not possible to include the cost of any required operation or the associated inpatient costs for the length of the hospital admission.

Statistical analysis

The mean and standard deviations of patients' age and emergency length of stay were calculated. Descriptive statistics of included cases were included in the results. To examine the impact of helmets, odds ratios (ORs) were calculated against the incidence of head injuries. Only cases where there was documentation of the presence or absence of a helmet were included for OR calculation. To assess the impact of alcohol, ORs were calculated against the incidence of hospital admission and operative management. Statistical significance was set at $P < 0.05$.

Results

The original search yielded 78 encounters, with 23 cases excluded (Fig. 1). This resulted in 55 emergency presentations that involved electric scooters were identified. One case was excluded from analysis and involved a patient who left against medical advice prior to treatment. This resulted in a final sample of 54 cases. One patient was hit by an electric scooter whereas in 53 cases, the rider was the patient. The incidence of electric scooter presentation during the 2 months investigated was ~23 in every 10 000 emergency presentations. The data showed in the first month of the electric scooter share scheme, 29 electric scooters related presentations were encountered. This is in comparison to one encounter during the same period in 2017.

Table 1 shows demographics of the 54 cases included in the final analysis. The data showed that the majority of patients were categorised as ATS 3 (n = 18, 33%) or

TABLE 1. *Patient and injury characteristics associated with electric scooter*

	n (%)
Gender	
Male	28
Female	26
Age (years)	
16–25	17 (31)
25–35	22 (41)
35–45	9 (17)
>45	6 (11)
ATS category	
1	0
2	11 (20)
3	18 (33)
4	20 (37)
5	5 (9)
Alcohol	
Yes	15 (28)
No	39 (72)
Mode of transport	
Walk in	30 (56)
Ambulance	24 (44)
Helmet	
Yes	25 (46)
No	11 (20)
Undocumented	18 (33)
Imaging	
No imaging	8
X-ray	42
CT	13
MRI	1
Emergency LoS (h)	
0–1	4 (7)
1–2	8 (15)
2–4	28 (52)
>4	14 (26)
Disposition	
Home	47 (87)
Admission	7 (13)

ATS, Australasian Triage Scale; CT, computed tomography; LoS, length of stay; MRI, magnetic resonance imaging.

TABLE 2. *Type and location of injury associated with electric scooters*

Injury	*n*
Contusions and abrasions	32
Upper limb	18
Lower limb	10
Trunk	4
Fractures/dislocations	16
Upper limb	11
Lower limb	5
Minor head injury	10
Sprains/strains	9
Upper limb	8
Lower limb	1
Thorax injury (including rib fractures)	1

4 (n = 20, 37%), with 44% (n = 24) transported to the ED via ambulance. Of the encounters, 20% (n = 11) were documented as not worn a helmet at the time of the incident with 46% (n = 25) reported with helmet worn. The presence of a helmet was not documented in 33% (n = 18). In addition, 27% (n = 15) of patients admitted to alcohol consumption prior to electric scooter use. During their stay in the ED, 78% (n = 42) of patients had X-ray imaging, with 24% (n = 13) of patients having computed tomography scans as part of their workup. The majority of patients (74%, n = 40) completed their ED visit under 4 h, with 87% of patients discharged after their ED visit. Of the patient discharged, 15 patients presented to outpatient clinic for follow-up. There were no deaths.

Table 2 shows the type and location of injuries associated with electric scooter use. The most common type of injury was contusions or abrasions (n = 32), followed by fractures or dislocations of the upper and/or lower limbs (n = 16) and minor head injury (n = 10). Six patients required inpatient operative management, with four patients undergoing open reduction internal fixation of fractures, one patient requiring joint stabilisation and one undergoing maxillofacial management.

Unsurprisingly, it was found that the presence of a helmet reduced the incidence of head injuries (OR 0.18, 95% confidence interval (CI) 0.04–0.83, Z = 2.19, P = 0.029). However, the presence of alcohol did not increase the incidence of admissions (OR 1.25, 95% CI 0.17–9.01, Z = 0.22, P = 0.83) or operative management (OR 2.14, 95% CI 0.34–13.42, Z = 0.81, P = 0.42).

Figure 2 shows the financial cost as per the ATS category. As expected, cost increased with ATS category. Patients triaged with category of 5 (n = 5) incurred a cost to the department of ~$285 per patient. The average cost of category 4 patient (n = 20) is $372 (minimum $331; maximum $645). A category 3 patient (n = 18) had an average cost of $625 (range from $542 to $915). Patients who were triaged as an ATS 2 ranged from $801 to $1345, with an average cost of $1048 per patient. This greater cost is associated with increased frequency of admissions to either short stay unit or the hospital, and follow-up outpatient appointments. There were no ED presentations with an ATS category 1 during the data collection period.

Discussion

Electric scooters were introduced to Brisbane through a trial where Lime was given a temporary pass for up to 500 scooters by the local council, which has now been extended.[7] Since the implementation of this scheme, there has been an increase in the number of presentations to our ED with 54 encounters within the first 2 months. The present study highlighted that contusions/abrasions, limb fractures and minor head injuries were common injuries associated with electric scooters. Notably, the results showed that wearing a helmet was related to reduced risk of head injuries. The findings provide insight into the impact of electric scooter injuries on emergency presentations.

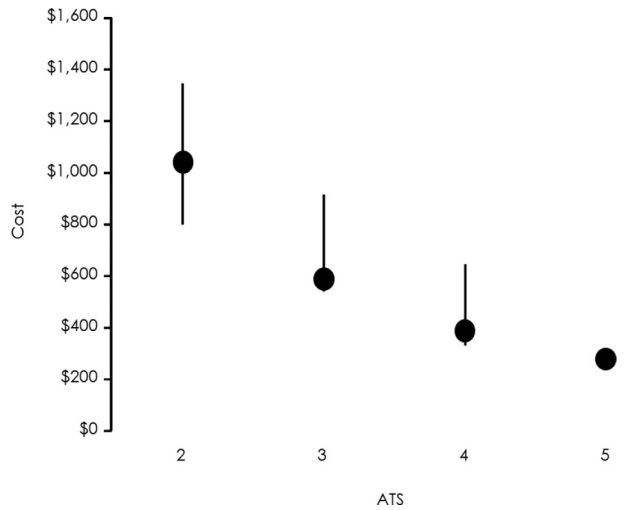

Figure 2. *Mean and range of financial cost of electric scooter injuries according to Australasian Triage Scale (ATS). Note no patient was categorised as ATS 1.*

Electric scooters offer several benefits. The ease of hiring electric scooters via simple app download and sign up, their availability in the city business district, ease of operation and low cost are attractive features to the general public. A recent survey in the USA showed that ~70% of people surveyed viewed electric scooters as a viable transport mode instead of using a private car for short distances or in addition to public transportation.[8] In addition, electric scooters have potential benefits on environmental impact due to low carbon emission rates compared to motor vehicles.[9]

As the use of electric scooters grows, the incidence of injuries sustained has also increased. In our study, we found that the incidence of emergency presentations associated with electric scooters was ~23 in every 10 000. This is greater compared with a previous study[6] that looked at a national database that included tertiary and peripheral EDs, whereas the close proximity of the Royal Brisbane and Women's Hospital to the city business district where electric scooters were mostly situated, meant that we were more likely to encounter these presentations. Similar to previous work, contusions/abrasions and fractures/dislocations were the most common type of injury. This is likely due to the fact that most electric scooter injuries involved falls off the scooters. However, the mechanism of injury was not specifically examined in the present study. In addition, injuries to the upper limb and head were the most common site and this is consistent with previous work.[5,6]

In our study, 11 of the 54 encountered reported not having a helmet. Importantly, it was noted that patients who wore a helmet were less likely to present with head injury compared to those without. Although all patients with head injuries had minor head injury, we recently encountered a patient (not included in the audit) who sustained a subdural bleed that required intubation and intensive care unit admission. This highlights the potential for significant injuries with electric scooters. There were two reasons why helmets were likely not worn. First, during the first 2 months of electric scooter sharing scheme in Brisbane, helmets were not compulsory although it was encouraged. Second, helmets were not always available with electric scooters. Helmets are now compulsory and failure to comply is an offence punishable by a fine, with the responsibility of wearing a helmet on the user rather than the scooter hire company. Future studies will elucidate whether mandatory helmet laws have an impact on its compliance during electric scooter operation.

In contrast to helmet use, alcohol was not found to be a significant factor that determined the severity of injury, as judged by hospital admissions or the need for surgical operative management. However, in our data, we did not quantify the level of alcohol intoxication. Thus the lack of association could be due to small sample size or heterogeneity of the sample. Future studies should consider quantitative alcohol levels (e.g. blood alcohol level) or functional effects of alcohol intoxication (e.g. ataxic gait, altered cognition).

Electric scooter injuries also incur a cost to the public health system. Recently the Brisbane City Council has proposed a $5000 flat fee for a 3-month permit, in addition to a $570 annual fee for each scooter with a 500-scooter limit per permit.[10] This would result in revenue of approximately $305 000 annually or $50 833 over a 2-month period. In the present study, the total cost of presentations associated with electric scooters totalled $32 108. If these numbers continue, it would mean that 63% of revenue from the electric hire scooter scheme would need to be proportioned to cover the costs to the ED alone. This cost analysis is limited to a patient's presentation to the ED, imaging, arranging an outpatient appointment and admission to ED short stay unit or arranging admission to the hospital. The cost analysis does not cover cost for inpatient costs such as the operation, repeat imaging, nor the outpatient follow up with orthopaedics, maxillofacial or physiotherapy. The cost to the Royal Brisbane and Women's Hospital ED is a fraction of the total cost to the hospital. If tertiary ED is utilising almost two-thirds of the revenue of this initiative, it is difficult to see how this venture is beneficial to the local city council. [Correction added on 24 October 2019 after first online publication: some values and information in this paragraph have been updated.]

There were several limitations to the present study. First, the study included a small sample size, was restricted to a single ED and was not adequately powered to look at other risk factors (e.g. age, gender, time of presentation) on patterns on injury.

Future studies with greater sample size and involving multiple EDs will aid to verify our findings and further unravel risk factors be associated with patterns of injury, hospital admission or need for operative management. Second, as our Emergency and Trauma Centre only receives adult patients (that is, over the age of 16 years), it is unclear how many younger patients make up the cohort of electric scooter injuries. Third, as electric scooters were relatively new during the period of our retrospective audit, the study was limited to available clinical documentation. Future work would benefit from improvements in ED clinician documentation of relevant incident characteristics, including mechanism of injury and helmet use, through education of emergency staff and posters at triage.

Conclusion

Electric scooter sharing schemes such as the one started in Brisbane by Lime are transformative to the way people travel. In the USA alone, there are over 100 cities where electric scooter shared services are reportedly available.[11] With the prospect of electric scooter schemes in other cities of Australia, our findings provide preliminary insight into the injury patterns associated with their use. Given recent media attention of the death of a patient associated with electric scooter accident,[12] further work into the impact of electric scooters will aid in stronger injury prevention efforts which may aid to minimise injuries.

Author contributions

HT: data collection, data analysis, manuscript preparation. GM: data collection, data analysis, study coordination, manuscript preparation. TR and JM: study design, data collection, data analysis, study coordination, manuscript preparation. PM: study design, data collection, data analysis.

Competing interests

None declared.

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EMA Emergency Medicine Australasia

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EDITORIAL

Electric scooters

This issue of the journal we publish a report analysing electric scooter injuries in Brisbane;[1] another paper on injuries in Dunedin is in the production pipeline and will be published soon. Emergency physicians know better than most, that life carries risk. So why have emergency physicians in Brisbane and Dunedin taken the time to write about this issue?

Brisbane was the first Australian city to introduce an e-scooter share hire scheme; first with Lime Scooter in November 2018 and more recently with Neuron; with other cities following suit. In Brisbane, this rollout has had no formal evaluation of public amenity and safety. There was no consultative process canvassing opinion about the implementation of a share-hire 'personal mobility device' (PMD) scheme. Did commercial interests override formal health and safety analysis?

E-scooters are not new, and before Lime's launch in Brisbane, some citizens were riding privately owned vehicles in public spaces. The recent regulatory relaxations have resulted in a steep increase in the number of both experienced and novice e-scooter users in Brisbane's transport infrastructure.

E-scooters are considered consumer products and captured under Australian consumer law. However, unlike vehicles which must adhere to the Australian Design Rules, there are currently no applicable mandatory product supply standards, and use of them is not captured in existing national road rules. Therefore, with the implementation of hire schemes, post-fix exemptions for PMDs are still evolving and vary state to state, meaning that even for Australians, permissible e-scooter use varies between cities. Nearly a year after Lime launched in Brisbane, the National Transport Commission (NTC) has released their 'Barriers to the Safe Use of Personal Mobility Devices' citing the following:[2]

> Many PMDs are already available in Australia; however, the Australian Road Rules predate the emergence of most of these devices. This means most PMDs are not recognised within the existing road rules.

Shared e-scooters are marketed as the 'last mile' commuting solution; a greener alternative to taking the car when walking is too much of an effort. Yet it seems unlikely that true commuters, needing to get from A to B on schedule, will ever be able to rely on haphazardly strewn devices that might be nabbed by competing 'commuters' at any moment. It is more likely that the scooters will be ridden by casual users and tourists.

Every new device has a user learning curve and every device has its own quirks. With new novice users riding each day on unfamiliar hire devices, mishaps will occur.

Lime and Neuron scooters currently operate devices with small wheels and an electric motor that is able to propel the rider at an advertised maximum speed of 25 km/h, with sufficient power to tackle Brisbane's hills with ease. However, small wheeled scooters have an inherent design flaw. They are susceptible to uneven terrain. Even a small obstacle can cause the front wheel to turn unpredictably. This effectively stops the scooter dead, and momentum causes the back of the scooter to flip the rider over the handlebars. This mechanism was implicated in the death of a NZ man.[3] The scooters are also top heavy. These design flaws are acknowledged in Lime's decision to roll out their 'Rolls Royce' scooter with bigger wheels, dual suspension and a lower centre of gravity touted as a 'safer, smarter and just a better ride'.[4]

Users electronically sign a user agreement prior to commencing the ride. However, this agreement appears to be rarely fulfilled[5] and difficult to enforce.

Requirements in Brisbane include:[6] single rider use, age greater than 16 years unless supervised by an adult, no consumption of liquor and helmet use (helmets are supposedly provided for riders to wear). However, personal observations from daytime walks around Brisbane's CBD have revealed helmetless-scooters, scooter-less helmets, riders wearing helmets as fashion accessories (over a wrist), an unhelmeted child riding a scooter being chased by another child on foot wearing a helmet, helmets worn but undone and riders doubling (to date no more than two on a scooter). Helmets are difficult to maintain with the scooter and this is referred to in the industry as 'helmet churn'. The scheme conveniently ignores the issue that a helmet, if provided, may or may not fit. Users can provide their own helmet, but again, one cannot rely on locating a scooter. Police have been struggling to enforce the relaxed regulations.

Reports from the USA, where share schemes have operated for some time, highlight additional issues of public nuisance, vandalism and theft.[7] In addition, there have been issues with firmware security and integrity with hacking (to override payment, geofencing, speed and mechanical control)[8,9] and glitching[10–12] that causes unexpected braking. Whether helmets and scooters are inspected, serviced or retried when damaged and remain fit for purpose is unclear.

Unfortunately, routinely collected emergency data do not support unpicking the complexity of this issue. As highlighted in the recent and forthcoming *Emergency Medicine Australasia* publications cited earlier, even basic information like helmet use and drug/alcohol intoxication is not captured in a

standardised fashion. However, issues such as product identification (personal or hire, make and model), product failure (mechanical, electronic or software), product misuse (hacking to override geofencing or speed controls), product design flaws and user behaviour are still poorly captured. And with limited data, it is challenging to properly inform the NTC regulatory impact process.

Emergency physicians, ambulance crews and the police are picking up the pieces from the mess of someone else's making.

Competing interests

None declared.

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Responsive surveillance for prevention policy: A case study of the lime scooter trial in Brisbane

Associate Professor Kirsten Vallmuur
MAIC Principal Research Fellow
QUT and Jamieson Trauma Institute
AIPN conference, 25-27th Nov 2019

MAIC Motor Accident Insurance Commission | Metro North Hospital and Health Service | Queensland Government

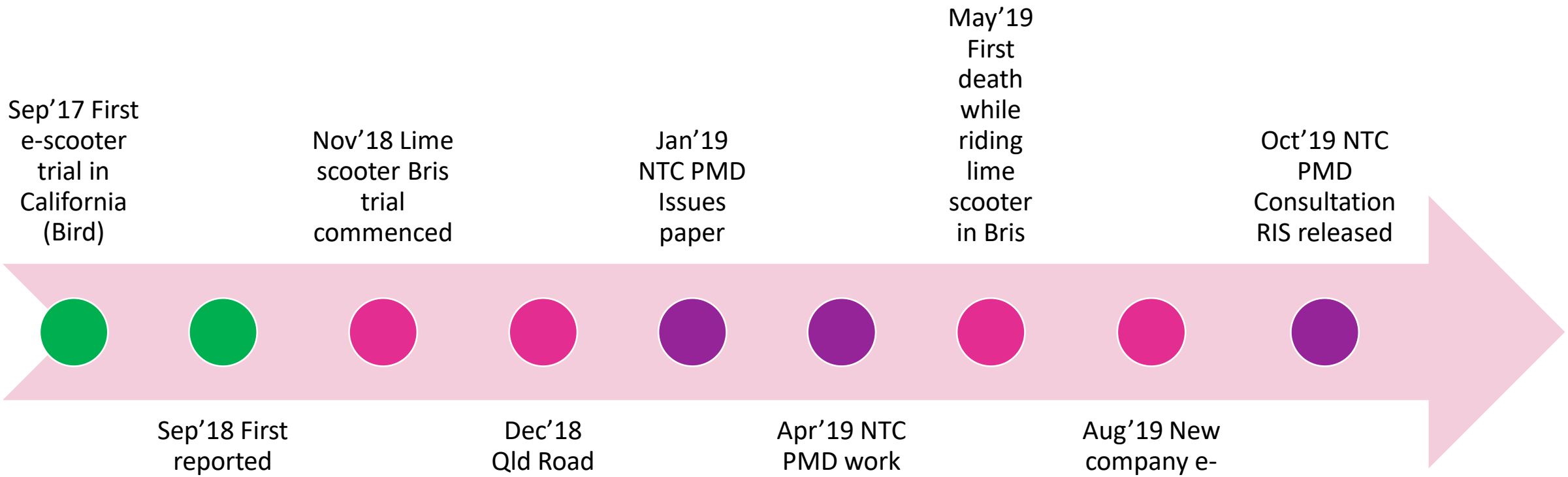
International Context

- Shareable e-scooter trials have been occurring around the world since Sep 2017 (California - Bird e-scooters)
- Estimated 16 USA deaths, 4 deaths Europe/UK, 1 death NZ, 1 death in Aust (first death recorded in Sep 2018)
- Study by CDC in Austin estimates 20 injuries per 100,000 trips (https://www.austintexas.gov/sites/default/files/files/Health/Epidemiology/APH_Dockless_Electric_Scooter_Study_5-2-19.pdf)
- Brisbane first Australian city to allow trial of Lime scooters
- Perceived benefit (according to Brisbane City Council) is use for last km travel to encourage public transport use and use by tourists – lack of data available to demonstrate whether this belief supported

Brisbane Context

- Trial commenced 16/11/18 with temporary exemption from Qld Road Rules
- Qld Road Rules changed in < 1 month to accommodate personal mobility devices (PMD's) including:
  - CAN ride on footpath (including separated paths where must ride on bicycle side of path) or local streets <50kph with no dividing line
  - CAN'T ride on CBD roads OR main roads OR in on-road bicycle lanes OR in pedestrian only footpath/footbridge zones
  - MUST be at least 16 years of age, or 12 with adult supervision
  - MUST wear an approved bicycle helmet
  - MUST NOT travel over max speed of 25kph
  - MUST NOT not carry passengers
  - MUST NOT use a mobile device
  - MUST NOT drink and ride

Implementation Timeline



Implementation Timeline

Sep'17 First e-scooter trial in California (Bird)

Nov'18 Lime scooter Bris trial commenced

Jan'19 NTC PMD Issues paper

May'19 First death while riding lime scooter in Bris

Oct'19 NTC PMD Consultation RIS released

QUESTIONS INCLUDED:

- Key factors when determining safe rules of operation (including speed) for PMD's on roads and road-related areas?
- Evidence-based distinctions between acceptable and unacceptable levels of risk associated with the use of PMD's to inform regulation?

Apr'19 PMD gro estabi

QUESTIONS INCLUDE:

- Has the impact analysis sufficiently considered all relevant variables and available evidence? What other factors could be included in the analysis?
- Most appropriate road infrastructure and safe max speed?
- Most appropriate age to allow PMD use?

Injury Surveillance Challenges

- Challenges in quantifying injuries associated with e-scooters
- Rapid implementation with minimal consultation with clinical community limiting opportunity to implement prospective data collection -> reliance on retrospective data
- Limitations in ICD/SNOMED systems to select cases -> reliance on text fields
- Lack of standardisation of description of scooter in injury text data (e-scooters vs Lime vs electric scooters vs 'skooters') -> specific vs sensitive case capture
- Lack of completeness of capture of key factors (helmets, alcohol, speed, brake faults, pedestrian collision etc)-> how to interpret null values?
- Unwieldy processes for accessing timely injury data (example to follow)
- Reluctance to release of injury and/or exposure data by companies
- BUT Qld clinicians keenly interested in contributing to national discussion
- Key topic of Nov RACS Trauma meeting 2018 – how to proactively gather data

Two Approaches to Data Gathering

1. Design and implement a traditional research study to collect injury data

OR

2. Request for data by a clinical entity for a legitimate preventative purpose

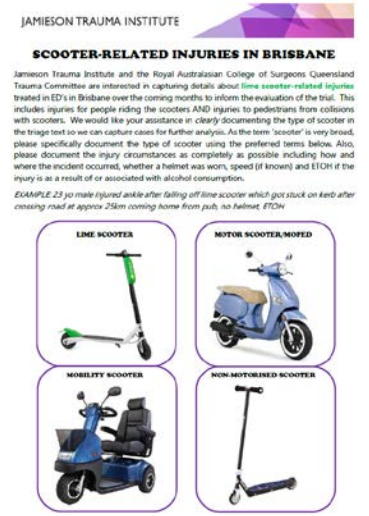
1. Traditional Research Approach

- Data sources: Ambulance, three major adult ED's in catchment area, workers compensation
- Procedure: Retrospective chart audit and observational study of broad range of electric Personal Mobility Devices
- Ethics and governance:
  - Hospital and university ethics committee applications
  - Public health act application
  - Data sharing agreements with every site
  - Site specific approvals for every site
  - Ambulance commissioner approval

- Commenced process March 2019
- Still awaiting final approvals – likely 2020 before commencement
- NO timely data to inform regulators, NTC, clinicians, media, community (or conference attendees!)

2. Clinical coalition data request

- Data sources: Ambulance, three major adult ED's and one paediatric ED in catchment area
- Procedure: Flyers distributed to each agency in early December for display at triage to prompt nurses, aggregate data requested at two time points (March and October – to inform NTC inquiries)
- Ethics and governance: Nil. Request submitted via RACS Qld Trauma Committee and Jamieson Trauma Institute to inform committee response
- Data provided promptly within 2 weeks of both requests
- Enabled compilation for coordinated collaborative response
- Limitations: Incompleteness of causal circumstances
- Benefit: Broad data to feed into the public discussions


JAMIESON TRAUMA INSTITUTE

SCOOTER-RELATED INJURIES IN BRISBANE

Jamieson Trauma Institute and the Royal Australasian College of Surgeons Queensland Trauma Committee are interested in capturing details about lime scooter-related injuries treated in ED's in Brisbane over the coming months to inform the evaluation of the trial. This includes injuries for people riding the scooters AND injuries to pedestrians from collisions with scooters. We would like your assistance in *clearly* documenting the type of scooter in the triage text so we can capture cases for further analysis. As the term 'scooter' is very broad, please specifically document the type of scooter using the preferred terms below. Also, please document the injury circumstances as completely as possible including how and where the incident occurred, whether a helmet was worn, speed (if known) and ETOH if the injury is as a result of or associated with alcohol consumption.

EXAMPLE: 23 yo male injured ankle after falling off lime scooter which got stuck on kerb after crossing road at approx 25km coming home from pub, no helmet, ETOH

LIME SCOOTER

MOTOR SCOOTER/MOPED

MOBILITY SCOOTER

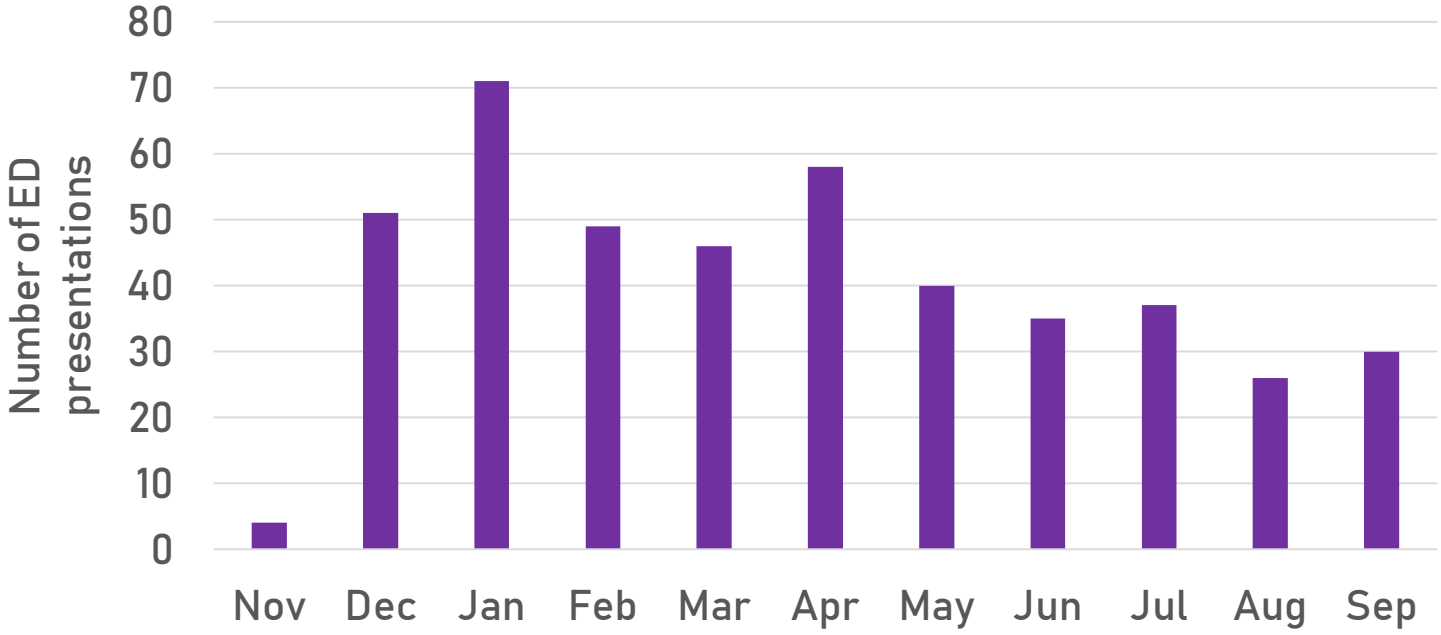
NON-MOTORISED SCOOTER

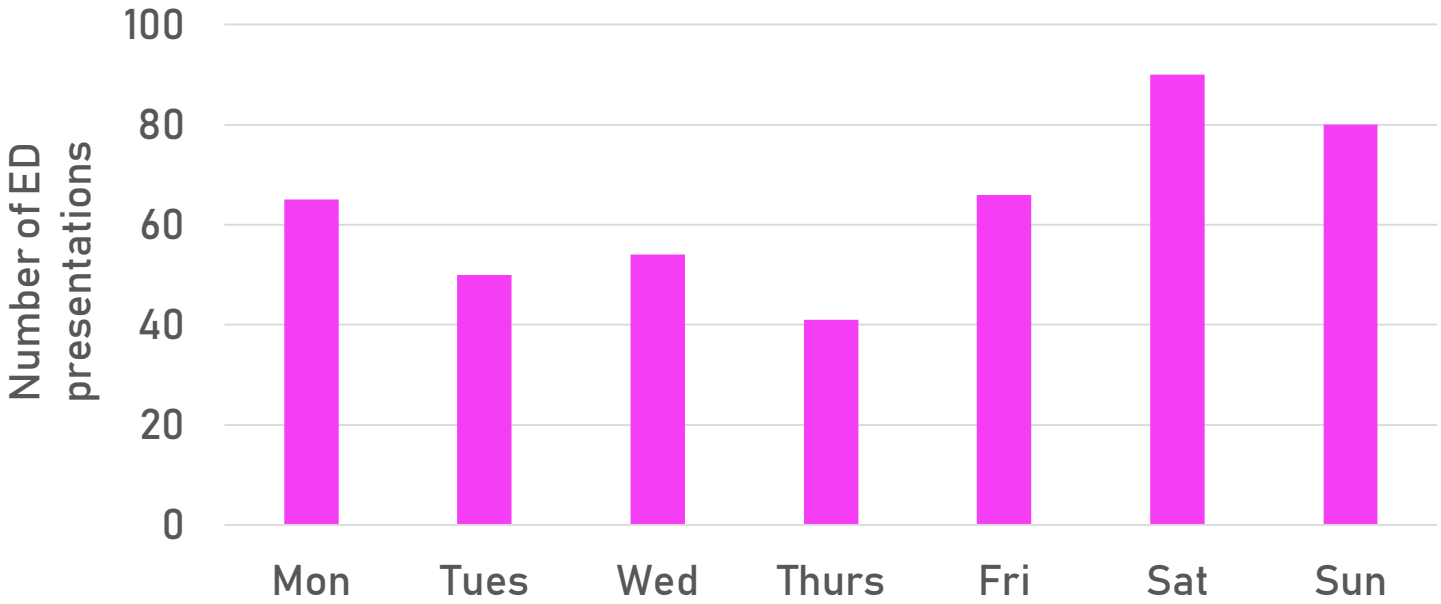
Summary of Injury Data to Date

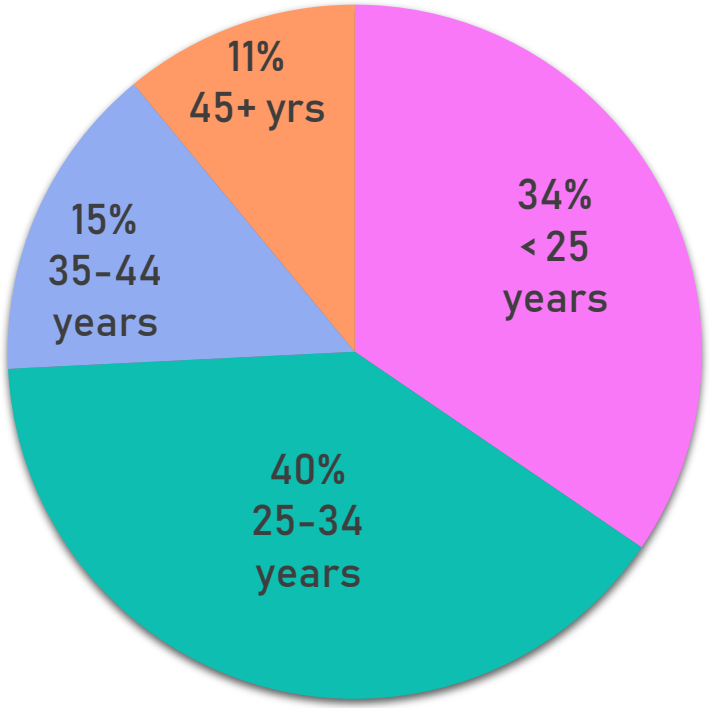
- Recent report of usage = 1.8M Lime trips in Brisbane between Nov 2018-End Oct 2019 https://www.afr.com/companies/transport/the-scooters-that-ate-brisbane-20190913-p52r21
- Estimated ED presentations Nov 2018-Sep 2019 = 447 Lime scooter-related injuries -> ~27 injuries per 100,000 trips
- Other estimates:
  - Study by CDC in Austin estimates 20 injuries per 100,000 trips https://www.austintexas.gov/sites/default/files/files/Health/Epidemiology/APH_Dockless_Electric_Scooter_Study_5-2-19.pdf
  - Lime estimated only 1 injury per 100,000 trips in New Zealand https://www.ntc.gov.au/sites/default/files/assets/files/Barriers-to-the-safe-use-of-personal-mobility-devices-Consultation%20RIS.pdf

- *Note: RTC Consultation Response still under preparation so please refrain from citing any figures from this presentation until our clinical committee has approved final release of response*

Summary of Injury Data to Date







447 Cases 16/11/18-30/09/19
11 Cases under 16 years old
60% Males
32% Arrived by Ambulance
11% Admitted to Hospital
56% Triage Category 4+

Influence of (any) Data….

- Regardless of simplicity of the aggregate data, RACS figures used to:
  - Inform local council and assist in decisions regarding continuation of trial
  - Publicise inherent dangers of e-scooters to community through media https://www.couriermail.com.au/news/queensland/royal-australasian-college-of-surgeons-concerned-over-number-of-lime-scooter-injuries/news-story/e78c7c40d846a55096f7746a7c857338
  - Submit response to NTC issues paper to inform drafting of revised Australian Road Rules https://www.ntc.gov.au/submission_data/127
  - Inform safety review and impact analysis by NTC to prepare consultation regulation impact statement https://www.ntc.gov.au/sites/default/files/assets/files/Barriers-to-the-safe-use-of-personal-mobility-devices-Consultation%20RIS.pdf
- Impact due to existing strong networks between AIPN, RACS Trauma committees (State/National), trauma clinicians/researchers, transport and product safety regulators, local councils, local emergency departments and first responders, and compensation providers

….But Many Unanswered Questions

- Specific details about crash/injury frequency
- Direct and underlying triggers of crash
- Involvement of pedestrians, other road users, road infrastructure etc in crash circumstances
- Helmet use, alcohol involvement, speed, mobile phone use
- Product-related issues (braking failures, wheels locking, frame issues)
- Injury hotspots – specific locations of crashes
- Severity/types of injuries and patient outcomes
- Costs of medical treatment, impact on health services
- Compensation eligibility (work/CTP/public liability etc)
- Needs chart audit AND observational study AND interviews

And Many More Devices to Come……

Device	Length/ Width/Height (mm)	Weight (kg)
Onewheel 	230 x 292.1 x 726	11
Solowheel 	430 X 330 x 490	12
Evolve - Electric skateboard 	1020 x 306 x 83	7.9
Segway 	650 x 630 x 1,300	37
Boosted Rev – Electric scooter 	1118 x 610 x 1138 (44 x 24 x 44.8 inches)	20.9
Segway Drift W1 e-skates 	291 x 162 x 121 (single e-Skate)	3.5

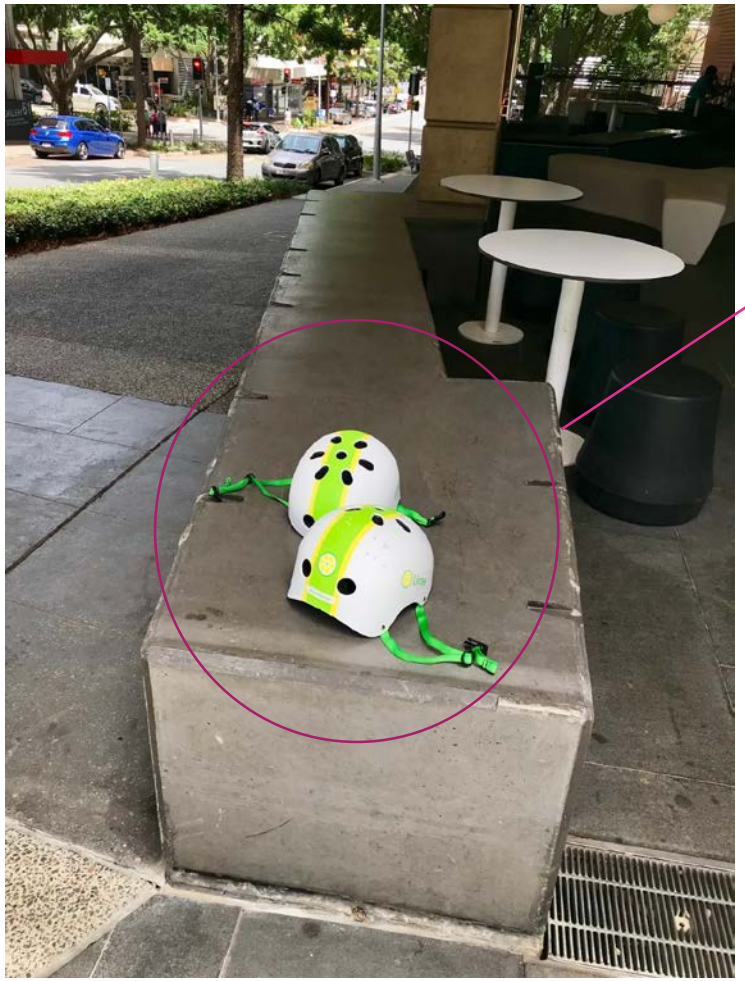
From:
https://www.ntc.gov.au/transport-reform/ntc-projects/Barriers-to-the-safe-use-of-innovative-vehicles-and-motorised-mobility-devices

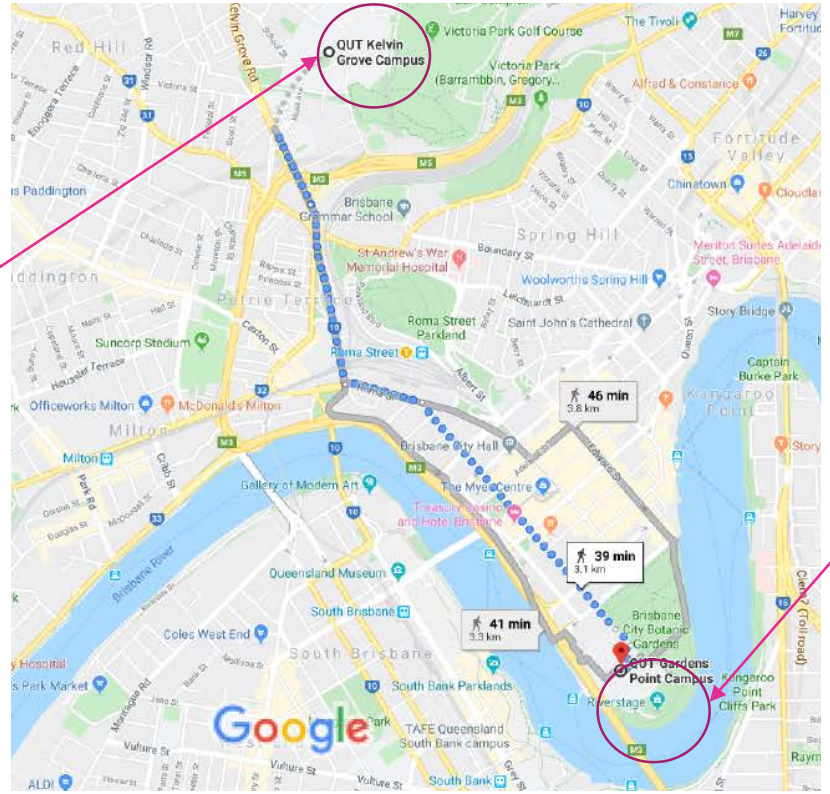
Responsive Surveillance to Innovative Vehicles

- Include data sharing requirement (usage and injuries) through company licence
- Require (and resource from company fees) visible enforcement of helmets/speed checks/alcohol
- Require (and resource from company fees) collection of injury data from ambulance, ED's, hospitals
- Access to CCTV footage by regulators of key PMD zones (and develop software for automated analysis of conflicts/incidents/ non-compliance)
- Develop data sharing agreement with police, health, product safety, transport, CCTV, council, companies
- Community consultation, education and publicity prior to implementation to provide opportunities for feedback and implementation of prospective data collection by community agencies
- Develop public web portal for crowd-sourced data regarding injuries/near misses/ issues
- Deidentified incident data to be made available to public via web portal to enable informed decisions
- Proactive engagement with industry/manufacturers to stay up-to-date with new products before public become guinea pigs

Example from My Institution

QUT Kelvin Grove Campus





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QUT Gardens Point Campus