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Navigating the Electric Vehicle Environment: E-Bikes and E-Scooters

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1. Abstract

The increasing adoption of Personal Mobility Devices (PMDs) across Australia is leading to a diverse and everchanging landscape. PMDs are small, electrically powered devices, designed for a singular user to travel short distances. They typically include devices such as electric scooters (e-scooters), electric bikes (e-bikes) and electric skateboards (e-skateboards).

More broadly, their increased adoption represents a sustainable, affordable and efficient alternative to traditional transportation methods; promoting healthier lifestyles whilst creating efficient solutions to common infrastructure issues including traffic congestion and the 'last mile' problem. However, the rapid adoption of PDMs has also introduced various new and distinct challenges for insurers, regulators, policymakers and urban planners.

Different licensing, road and vehicle design laws have created significant different experiences between Australian states and territories. PMDs can exhibit vastly different risk characteristics to other forms of conventional transport due to their unconventional design, rider behaviour and vehicle usage. Road infrastructure and urban environments, state-based legislation, interactions with pedestrians and other road users and the implementation of telematics all have the propensity to further influence risk profiles, thereby creating further complexities for insurers.

With a focus on e-bikes and e-scooters; this paper considers the academic literature to look at their different risks characteristics and contributing factors - which includes the regulation on licensing, PMD designs, road use (helmets and speed limits) and road infrastructure. A review of Australian injury data provides a better understanding of their risks for physical injury and fire damage. Lastly, the paper illustrates the insurance gap that presently exists for Australian PMD users given the current insurance regulations and design of the Compulsory Third Party and Workers Compensation schemes.

2. Overview of Mobility

What are e-bikes and e-scooters?

In Australia, e-mobility devices (also referred to as e-rideables) are a type of vehicle known as a personal mobility device (PMDs). These are typically devices that are designed for single person use and propelled by an electric motor (i.e. e-bikes and e-scooters).

The regulation of these devices varies by state and territory. E-bikes and e-scooters are often regulated under separate frameworks, with differences in permitted device specifications (e.g., weight and size limits), electrical and product safety requirements, and restrictions on where, when, and how they may be used.¹

In Australia, e-bikes are generally treated as bicycles fitted with an electric motor, with pedalling intended to remain the primary means of propulsion.² Import and compliance settings typically apply maximum power output and speed thresholds that an e-bike must meet to be considered compliant.³ Devices that meet these thresholds are treated in the same manner as standard bicycles for road-use purposes.⁴ By contrast, non-compliant devices may be classified differently under relevant laws and may be subject to additional requirements (such as registration and insurance) or restrictions on public road usage.

An e-scooter is an electrically powered personal mobility device (PMD) comprising of two wheels connected by a deck or frame and steered using handlebars.⁵ E-scooters exist in a range of designs. Conventional models require the rider to stand, while newer variants incorporate a seat and may resemble mopeds in appearance, but are differentiated by their different power and weight restrictions.⁶

E-scooters are generally considered more accessible than e-bikes because they typically require less physical effort to operate. Many models use a throttle-based drive system, which can reduce the skill and exertion required compared with pedal-assisted e-bikes. In addition, e-scooters are generally compact and potentially collapsable, making them easier to store after trips. These characteristics can make e-scooters particularly convenient for urban environments.⁷

Growth Trends

The e-mobility industry has experienced significant growth over the past decade coinciding with the introduction of shared e-mobility schemes which allow for easy access to conveniently located e-bikes and e-scooters.⁸

Bicycle sharing schemes have been around in one form or another since the 1960s.⁹ The first dockless sharing schemes were introduced in the 1990s, though technological improvements have varied the scheme design over time.¹⁰ Modern app-based systems began to appear during the mid 2010's,¹¹ as e-bike shared schemes gained popularity in China in 2017.¹² While the first e-scooter shared scheme was introduced in the United States in 2017.^{13,14}

In Australia, the first shared schemes launched in 2018, starting with e-scooters in Queensland.¹⁵ They have since expanded into various vehicle types and models across other states. This has resulted in substantial growth with industry figures estimating that the industry now encompasses close to 20,000 vehicles facilitating more than 45,000 daily trips.¹⁶

While shared schemes have often provided many Australians with their first exposure to e-mobility, growing enthusiasm has driven increased private ownership for commuting and leisure use. Ongoing uptake appears to be influenced by several factors, including reduced emissions and improved air quality,^{17,18} lower operating costs, transportation effectiveness, and potential health and fitness benefits for riders.¹⁹

Unfortunately, the rapid increased usage of e-mobility devices has led to an increase in the number of road accidents. Accidents involving e-bikes and e-scooters now commonly appear in news headlines^{20,21} which has meant that their significant benefits can become overshadowed by the public safety concerns surrounding how these devices are being used.^{22,23} Nevertheless, they continue to remain popular with the latest National Walking and Cycling Participation Report estimating that nationwide the ownership of an e-bike has double since 2023 increasing to 6% of all households.²⁴

Role in urban transport systems

E-mobility devices continue to play an important role in supporting Australian public transport systems. Infrastructure, urban design, transportation options and land characteristics are amongst many key factors that impact on the use of these devices.

Research indicates that issues with steep terrain which generally sees lower rates of cycling can be mitigated by the electric motor in e-bikes through reducing the physical strain on a cyclist²⁵. This promotes improved fitness²⁶ as cyclists choose this mode over other alternative transport such as cars and contributes to greater flexibility in transportation decisions and shifting mobility patterns.

However, the total impact that e-mobility devices have on the public transport system will be dependent on which modes of transportation they replace which can be highly dependent on region and the e-mobility devices available.^{27,28} In Europe, studies have found e-scooters replacing cars less than 10% of the time whereas the figures in American studies have ranged from 33% to 50%²⁹ and highlights the differing impact that e-mobility devices can have on transportation across different regions.

E-mobility devices are highly effective at solving the 'last mile problem' which refers to the "poor connection between trip origins or destination and public transport stations".³⁰ However, this is dependent on infrastructure availability for riders.

The increase in demand and imports for e-mobility devices has created significant challenges for urban design planners as existing infrastructure (e.g., bike lanes) has not been designed to accommodate these devices³¹. E-mobility users use footpaths due to increased risks when riding on roads,³² however, most riders would prefer to bike lanes^{33,34}. This sharing has meant that many pedestrians to feel unsafe³⁵ whilst also increasing the risk of accident and injury to all road users.³⁶

While cycling infrastructure is generally significantly more cost effective than traditional infrastructure³⁷, expansion still requires significant long-term planning to implement successfully.³⁸ The type and quality of infrastructure available is likely to impact the use of e-mobility devices. For instance, e-scooters are designed with small wheels resulting in instability and hence a rider aversion to uneven surfaces.³⁹

Data on e-mobility devices usage remains limited in both Australia and internationally. While studies have drawn on information provided by shared rental schemes, utilising their advanced data collection and monitoring tools⁴⁰, there is still relatively little data available regarding private e-mobility ownership whose usage may diverge. Currently there is an

estimated 260,00 E-bikes imported annually in Australia.⁴¹ The most recent National Walking and Cycling Participation Report estimated that e-bike ownership was 6% nationwide.⁴² This is consistent with other reported figures such as a 2022 Sydney survey which estimated that private e-bike usage was at 6.29% of the adult population⁴³ and a 2024 New Zealand study which estimated personal e-scooter ownership between 5 and 7 percent.⁴⁴

Benefits of e-mobility

Although e-mobility devices are a relatively new form of transportation in Australia, they are already impacting the Australian lifestyle. E-bikes may support healthier lifestyles by increasing physical activity; estimates suggest that e-bike riding delivers around half the physical activity benefit of conventional cycling, while also encouraging broader cycling uptake.⁴⁵ E-mobility devices can also offer a low-cost alternative to other modes of transportation which can range from \$20,000 - \$30,000 per year for Australians.⁴⁶

E-mobility devices are also becoming a significant contributor to the Australian economy. It has enabled the growth of the delivery industry, as well as provided employment many opportunities. A 2022 We Ride Australia Report identified that e-scooters contribute over \$728m to the Australian economy annually.⁴⁷ This is evident in the tourism industry where large proportion of e-scooter riders are tourists.⁴⁸ These riders produce substantial economic benefits from additional spending⁴⁹ with studies suggesting that e-scooter usage reduces retail vacancies and improves foot traffic.^{50,51,52,53}

E-bikes have become a highly utilised mode of transport for food delivery service riders⁵⁴ with studies estimating that 46.1% of riders are using an e-mobility device in some areas.⁵⁵ Comparable trends to the usage of e-bikes in food delivery have been observed in Australia with a Melbourne study identifying that 47% of e-bike users were delivery drivers.⁵⁶

This use of e-mobility devices in the delivery industry can contribute to lower carbon emissions⁵⁷ with reports in Australia finding that the use of 918,000 shared e-bikes resulted in 1,850 tonnes of carbon emissions saved each year.⁵⁸

Emerging Trends

The rise of e-mobility devices has resulted in many unintended consequences and emerging trends that emerge that as of this time have not been properly explored in literature. In Australia there has been an increasing number of injuries relating to e-mobility device usage resulting in hospitalisations becoming a daily occurrence.⁵⁹

A key emerging trend is that users often lack knowledge of all applicable laws. Many riders are uncertain about where devices can be used and what constitutes a legal device.⁶⁰ One survey conducted in NSW found that 78% of participants were unaware that e-scooters were illegal to ride in public.⁶¹ This lack of knowledge is contributing to the increase in non-compliant e-mobility devices^{62,63} with many buyers unaware of their illegality.⁶⁴ A New Zealand survey reported that 60% of e-scooters were in fact non-compliant and could travel faster than the maximum allowable speed,⁶⁵ with Australian studies finding similar results.⁶⁶

Furthermore, the use of e-mobility devices poses a significant safety risk given no formal training is required before using the devices despite them often requiring a non-traditional skillset to operate. Given the lack of age limits on users, many young users also lack adequate understanding of road rules. This importance of this training is underscored by the fact that higher proportion of e-scooter accidents occur on first use.⁶⁷

3. Regulatory Framework

E-mobility regulation in Australia is shaped by multiple overarching laws, policy frameworks, and administrative authorities, requiring co-ordination across all parts of government. This section outlines the primary responsibilities of the different parts of government in relation to e-mobility devices.

Federal Government

The Federal Government establishes the overarching laws and regulations that govern the e-mobility landscape. However, the Federal Government delegates responsibility to individual states and territories to develop and enforce specific state laws governing e-mobility devices.

Two key federal policy instruments affecting e-mobility devices are the Australian Design Rules (ADRs) and the Road Vehicle Standards Act 2018. The ADRs establish national technical standards for vehicles, including requirements that may affect whether a device can be supplied and used as a bicycle, motor vehicle, or other rideable device.⁶⁸ When a device falls within the definition of a road vehicle, additional requirements may apply under the Road Vehicle Standards Act, which governs the importation of road vehicles and associated compliance processes.⁶⁹ Conversely, when devices that fall outside this framework they may not be subject to the same approval pathways which can affect how easily they can be imported into the Australian market.⁷⁰

The Federal Government also supports cross-jurisdictional coordination to promote data sharing. This includes national data collection and reporting mechanisms. For example, the Australian Road Deaths Database, managed by the Bureau of Infrastructure and Transport Research Economics (BITRE), compiles police-reported road transport fatalities submitted monthly by state and territory road safety authorities.⁷¹

In addition, the Federal Government allocates resources that can support infrastructure investment relevant to e-mobility safety and accessibility. These initiatives are delivered through a range of programs administered by the Department of Infrastructure, Transport, Regional Development, Communications, Sport and the Arts, which can provide funding to local councils for e-mobility infrastructure projects.^{72,73,74}

State and Territory Government

State and Territory Government are responsible for setting the laws regarding:

- the use of e-mobility devices;
- establishing penalties for riders who fail to comply with the relevant legislation;⁷⁵
- mandated insurance arrangements, that impact on the eligibility and claim benefits for an injured rider; and
- maintaining specific datasets such as hospital admissions or road fatalities.^{76,77}

As a result, there are considerable jurisdictional differences in each of the areas. Two important impacts are:

- There are significant discrepancies between punishments for similar offences. An infringement in one state might result in a minor financial penalty while in another it could result in the suspension of a driver's license.⁷⁸

- While they aim to collect similar data, there are different recording practices that may limit data consistency. For example, an e-bike accident may be reported as a bicycle accident in the absence of an appropriate category. This can make it difficult to accurately quantify the number of injuries sustained through e-scooter and e-bike incidents. This may hide trends and limit lawmakers' ability to make to pass legislation to adapt to the trends impacting the community. Consequently, the incidence of e-bike and e-scooter accidents is likely significantly underreported.^{79,80,81}

As the use of e-mobility devices has grown, so has the awareness of their dangers and corresponding rise in media attention.^{82,83} This has led to Parliamentary inquiries in New South Wales⁸⁴, Western Australia⁸⁵ and Queensland⁸⁶ in the last two years. These inquiries have focussed on improving road user safety and understanding the adequacy of current regulation.

These inquiries may accelerate state and territory legislative changes in many policy areas of e-mobility devices. For example, the NSW inquiry in 2025 considered the idea of e-mobility injuries being included as part of the NSW CTP scheme. While it rejected this idea, the NSW government did accept the inquiry's recommendation to investigate alternative insurance arrangements.

Local Government

Local councils are responsible for the planning, delivering and maintaining of infrastructure⁸⁷, including footpaths, signage, and related assets that influence the safe operation of e-mobility devices. In practice, major infrastructure decisions are often undertaken in partnership with state and/or federal governments due to the scale of funding required. While councils play a central role in local transport, integrating e-mobility devices presents challenges as projects typically require long lead times for planning, consultation, and delivery.⁸⁸

Local councils rely heavily on state government funding to deliver infrastructure projects,^{89,90} and this funding is often tied to specific programs or project scopes. As a result, councils may have limited flexibility to reallocate resources toward emerging local priorities⁹¹ such as e-mobility infrastructure. Recent budget pressures have further constrained investment^{92,93,94} resulting in current investment often significantly lower than suggested mobility infrastructure and active transport targets.^{95,96}

Since the introduction of shared schemes in Australia, local councils have commonly been responsible for negotiating and liaising with scheme operators. As these arrangements are often negotiated on a council-by-council basis, they can impose a substantial administrative burden and contribute to inconsistent contractual conditions across Australia's local government areas. Agreements may specify designated operating and parking zones, data-sharing obligations, maintenance requirements, and caps on fleet size and/or the number of approved operators. While such provisions can support safer operations and improved public-space management, regulatory settings differ across states, and some jurisdictions do not require operators to enter into agreements with local councils.⁹⁷ However, it is generally more practical for operators to negotiate with local councils who have the power to fine and impound vehicles that are improperly parked and left cluttered on the street.⁹⁸

4. E-Mobility Device Characteristics and Risk Profile

Shared Schemes vs Private Ownership

Shared e-mobility schemes operate in a materially different context from privately owned e-bikes and e-scooters, including differences in vehicle specification, maintenance regimes, user experience, and governance arrangements.

A key distinction between shared scheme fleets and private vehicles is that shared schemes may use higher specification devices which can enable the inclusion of additional safety features.⁹⁹ While this improves rider safety through reducing accident frequency, the vehicle's greater mass can increase injury severity, particularly in collisions with pedestrians.¹⁰⁰ However, shared scheme operators have reported that the majority of trips occur without incident,^{101,102} and that when incidents do occur they primarily affect the rider of the device (i.e. falls) rather than other road users.¹⁰³

Travel behaviour also differs between shared and privately owned devices. The literature suggests shared e-scooters are more frequently used as part of multimodal journeys (e.g., as a first/last-mile connection to public transport),¹⁰⁴ which may contribute to shorter average trip lengths relative to private use.¹⁰⁵ Pricing structures in shared schemes where costs increase with trip duration may further incentivise shorter trips. By contrast, some studies suggest privately owned devices are more likely to be substituted for car trips, whereas shared e-scooters may more often be substituted for walking,¹⁰⁶ although specific patterns often vary across different locations.

User profiles and trip purposes differ as well.¹⁰⁷ Shared-scheme riders are often younger¹⁰⁸ and tend to use devices less frequently than private owners.^{109,110,111} Shared e-scooters are also commonly used for leisure and discretionary travel, while privately owned devices are more frequently used for commuting.^{112,113}

Evidence on safety behaviour and injury risk is mixed. One Queensland study reported higher rates of risky and non-compliant behaviour (i.e. lower helmet use) among shared scheme compared with private owners.¹¹⁴ Subsequent research suggests helmet-access features some shared schemes (i.e. helmet locking) have had limited impact on rider helmet usage.¹¹⁵ In contrast, other studies have associated privately owned e-scooters with a higher risk of injury.¹¹⁶ However, limited reporting of exposure and baseline usage limits comparisons between regions.

Data Limitations

Exposure data required to calculate injury or crash incidence rates for e-scooter and e-bike riders are not widely available¹¹⁷, largely due to challenges in reporting and data collection¹¹⁸. Consequently, much of the international evidence relies on retrospective analyses of injury records. While these studies can describe injury patterns among those who receive treatment, the absence of reliable exposure data limits the ability to estimate risk and to determine whether observed trends reflect true experience or changes in the underlying population

Unlike motor vehicles, e-bikes and e-scooters lack odometers, navigation and registration systems, thus standardised exposure tracking (e.g., for distance travelled) is not available. As a result, exposure estimation often depends on survey-based approaches or indirect

proxies. Simple measures such as the number of devices or riders in an area provide only limited insight. More informative exposure metrics include trip frequency, distance travelled, time spent riding, and the types of infrastructure used (e.g., road, cycleway, shared path), which together provide more meaningful interpretation of crash and injury data.

Since 2021 e-mobility devices have not been classified as motor vehicles and therefore are not subject to as many stringent import standards. Although some estimates suggest that approximately 260,000 e-bikes are imported annually,¹¹⁹ these figures are not always disaggregated by state or by device category (e.g., compliant vs non-compliant devices), constraining efforts to relate injury counts to underlying device ownership and usage.

However, some studies have addressed the exposure gap by using operational data from shared mobility operators.¹²⁰ For example, one study used shared scheme data across several European cities¹²¹ to estimate crash rates using trips, trip distance, and trip duration as exposure measures. Results indicated substantial variation in estimated crash rates across cities; however, e-bike riders consistently exhibited higher crash rates than e-scooter riders. This finding contrasts with common hypotheses that e-scooters may have higher crash risk due to stability constraints. However, given the limited number of exposure-based studies and differences in regulatory, infrastructure, and riding contexts, it remains unclear whether these results apply to other geographies, including Australia.

User Characteristics and Usage Patterns

Rider demographics and contextual factors appear to shape patterns of e-mobility use and injury risk. Both younger and older riders are commonly represented among e-bike and e-scooter users^{122,123} which may contribute to their overrepresentation in crash and injury statistics.^{124,125,126} Among younger riders, developing cognitive skills and limited road experience may be associated with reduced situational awareness, poor decision-making, and higher rates of non-compliant or risky riding behaviour.^{127,128} In contrast, older riders may experience slower reaction times and reduced balance, which can increase the risk of injury.^{129,130} Despite these risks, e-mobility devices can provide mobility benefits for older adults by alleviating issues that might restrict their mobility.¹³¹

Geographic context is also likely to influence use patterns. Riders living in inner-city areas typically have greater access to dedicated infrastructure and shared mobility schemes, lowering barriers to adoption and increasing exposure. This proximity to public transport may further encourage e-mobility use as a first/last-mile option, which may partially explain the higher observed use among younger riders.¹³²

Gender differences have been widely reported in e-mobility use and riding behaviour. Men are often the predominant users of e-bikes and e-scooters, and some studies attribute this to a greater willingness to use riskier modes of transportation with higher speeds and fewer safety features.^{133,134} Men and women also exhibit different riding behaviour¹³⁵ as women are typically less likely to demonstrate risk-taking behaviour and may adopt more conservative riding strategies,¹³⁶ such as selecting routes further from motor vehicle traffic.^{137,138} Notably, women comprise a larger proportion of e-bike users relative to conventional bicycle users,¹³⁹ potentially reflecting the lower physical effort¹⁴⁰ required for e-bike use despite the heavier device frames.¹⁴¹ One study suggested that gender may also influence route choice (e.g., willingness to detour), affecting the types of infrastructure used, with differences more apparent for privately owned devices than for shared schemes.¹⁴²

E-mobility use and subsequent injury risk can also vary by time of day and riding surface conditions. Studies indicate e-scooter use commonly peaks between mid-afternoon and early evening on workdays, while Friday and Saturday usage may extend later into the

evening and early morning.¹⁴³ Lighting can influence both the likelihood and severity of injuries,^{144,145} with poorly illuminated environments associated with higher crash risk.¹⁴⁶ Seasonality is also relevant as crashes are often reported more frequently during warmer months, consistent with higher riding volumes.^{147,148} In cooler or wetter months overall riding tends to drop^{149,150,151} with slippery surface conditions¹⁵² potentially impacting riding behaviour, particularly for e-scooters given their instability.¹⁵³

However, the evidence on road surface effects is mixed. Some studies still report many crashes occurring on dry surfaces, which may reflect riders choosing not to ride during rainy periods¹⁵⁴ or riding more cautiously when conditions are poor.¹⁵⁵ As a result, the relationship between season, surface condition, and injury severity remains contested in the literature, with at least one study finding no clear association between road-surface condition and crash severity.¹⁵⁶

Crash and Injury Characteristics

E-scooter crashes are reported commonly in densely populated urban areas, with higher incidence during afternoon and early evening periods.¹⁵⁷ Some research suggests that other road users may underestimate e-scooter operating speeds,^{158,159} which can contribute to collisions in shared spaces. Reported crash locations vary by jurisdiction, but incidents are often recorded on footpaths and shared paths,^{160,161,162} alongside a substantial proportion of single-vehicle events such as falls.^{163,164,165} Collisions involving motor vehicles appear less common than rider-only events, but when they occur they are frequently reported at intersections.^{166,167} Across the literature, head injuries are commonly reported¹⁶⁸ among e-scooter crash victims, particularly in fatal cases,¹⁶⁹ with facial trauma and orthopaedic injuries also frequently observed.^{170,171,172,173}

Comparisons between e-scooters and e-bikes are less consistent. Some studies describe e-scooters as potentially higher risk compared to e-bikes as e-scooter riders are often perceived to engage in riskier rider behaviour.¹⁷⁴ Citing factors such as smaller wheel¹⁷⁵ diameters (which increase sensitivity to surface defects and debris) and lower rider familiarity, particularly with acceleration and braking characteristics compared to conventional bicycles.¹⁷⁶ However, evidence directly comparing relative crash involvement and injury severity remains limited and context dependent. For example, one European study reported higher crash rates among e-bike riders than e-scooter riders when exposure was accounted for using measures such as trip counts, distance travelled, and ride duration.¹⁷⁷ Another study reported no clear difference in the likelihood of severe injury between e-scooter and e-bike riders.¹⁷⁸ Overall, the current evidence base suggests that comparative risk estimates vary across settings and depend heavily on how exposure and injury severity are measured.

Comparison with Other Transport Modes

There is a substantial body of literature examining injury frequency and severity across established transport modes. E-mobility injuries exhibit distinct characteristics compared with injuries sustained by users of other personal mobility devices.¹⁷⁹ Accordingly, this analysis compares e-mobility injury patterns against those sustained by bicycles and motorcycles.

Many reporting systems record e-scooter incidents under the broader category of bicycle incidents, despite material differences in operating characteristics. Some studies suggest that e-scooters may be associated with higher crash rates than conventional bicycles,¹⁸⁰ although estimates can vary by jurisdiction. E-scooter riders tend to be younger than cyclists and commonly exhibit lower helmet use and higher reported alcohol involvement, which may contribute to higher injury rates.¹⁸¹ Injury profiles likewise differ between e-scooters and bicycles. E-scooter incidents are often associated with a higher risk of head injury, with severity more closely resembling motorcycle accidents than conventional cycling.¹⁸²

E-scooters also exhibit distinct usage patterns, with evidence suggesting they are more frequently used on residential roads, whereas bicycles are more commonly used on major roads.¹⁸³ E-Scooters also tend to suffer higher rates of lower extremity injuries with traffic density significantly influencing crash severity.¹⁸⁴ In addition, severe injuries, including facial fractures and brain injuries, have been reported more frequently in fall related e-scooter incidents compared to bicycle falls.¹⁸⁵ Notwithstanding this, some studies report similar overall mortality rates between e-scooter and bicycle incidents, despite e-scooters exhibiting a higher rate of severe traumatic brain injury.¹⁸⁶

E-bike riders involved in accidents tend to be older than riders of conventional bicycles.¹⁸⁷ However, some studies suggest that the higher injury risk sometimes observed among

e-bike riders may be attributable to other factors such as rider age, exposure (time or distance ridden), underlying health, and gender rather than the device itself.¹⁸⁸ Accordingly, e-bikes are not necessarily a higher risk once these factors are accounted for.¹⁸⁹

When injuries did occur those sustained by e-bike riders tended to involve a motor vehicle at higher rates than bicycles.¹⁹⁰ Injury profiles also tended to differ between the vehicle types. Higher rates of head injury and greater injury severity have been reported among e-bike riders compared with conventional cyclists.^{191,192} Pelvic injuries are also reported more frequently in e-bike incidents,¹⁹³ and injuries to the lower extremities differ in location compared to conventional bicycle incidents.¹⁹⁴ E-bike riders tend to exhibit a higher incidence of traumatic brain injuries compared to standard bike riders despite e-bike riders being nearly twice as likely to be wearing a helmet.¹⁹⁵

Evidence suggests that e-bike injury patterns may align more closely with conventional cycling than with motorcycling.^{196,197} Compared with e-bike incidents, motorcycle incidents more frequently involve high speed collisions,¹⁹⁸ whereas e-bike incidents are more commonly single vehicle incidents such as falls.¹⁹⁹ However, some studies report a higher frequency of head and facial injuries among e-bike riders than among motorcyclists,²⁰⁰ which may be influenced by differences in protective equipment (i.e. full-face helmets use among motorcyclists).²⁰¹

Protective Equipment and Helmet Use

The elevated risk of facial and head injuries suffered by e-mobility riders may be exacerbated by low helmet usage, with one study reporting that 70% of those that were injured were not wearing protective equipment.²⁰² Helmet use is typically higher among privately owned e-scooter and e-bike users as they are more likely to own and carry a helmet,²⁰³ however, helmet use is still more common among cyclists than e-mobility riders.²⁰⁴

Helmet wearing also tends to be lower in shared schemes than in personal use.²⁰⁵ This may be reflecting barriers such as hygiene concerns²⁰⁶ and operational issues such as missing helmets.²⁰⁷

Comparative evidence suggests that injury patterns differ across different modes of transport. Head and facial injuries may be more common among bicycle and e-bike riders than among motorcyclists,²⁰⁸ who typically wear full-face helmets and visors that provide greater protection and may contribute to lower injury rates.

Current helmet designs may provide limited protection against facial injuries for e-scooter riders as helmets are predominantly designed to protect impacts to the top of the head.²⁰⁹ Facial injuries are therefore more common for e-scooter riders who often instinctively maintain their grip on the handlebars during a crash, limiting their ability to brace or protect themselves.²¹⁰ However, any additional protection requirements (i.e. mandating full-face helmets) should consider any potential behavioural responses, including a possible increase in risk-seeking behaviour, as some studies report that riders who wear helmets tend to ride faster.²¹¹

The rate of helmet use varies by e-mobility device type with e-scooter and e-skateboard riders more likely to ride without a helmet.²¹² While some shared schemes have cameras that can detect helmets usage, there are still high rates of non-compliance.²¹³

Infrastructure Effects on Rider Behaviour and Safety

The infrastructure available influences e-scooter riding behaviour. Where available, riders commonly prefer to ride in bicycle lanes rather than on footpaths or on roads.^{214,215} Dedicated cycling infrastructure can reduce exposure to motor vehicles and, when well maintained, may improve safety outcomes.²¹⁶ Infrastructure surface quality is also important as riders tend to avoid routes with uneven or degraded surfaces²¹⁷ as they can be a contributing factor to accidents.^{218,219}

Evidence also suggests that a substantial share of e-mobility injuries occur on footpaths, although injury severity may be lower than on roads due to the reduced likelihood of collisions with motor vehicles.²²⁰ Many pedestrian facilities were not designed to accommodate e-mobility devices, which can increase conflict between riders and pedestrians.²²¹ For example, some studies estimate that a large proportion of e-scooter riding occurs in close proximity to pedestrians²²² increasing the potential for near misses in shared spaces.

5.E-Mobility Physical Injury Risk

This section assesses e-bike and e-scooter impacts within Australia. Jurisdictional differences in regulation, infrastructure provision, and operating environments mean that incident and injury patterns may vary across states and may not be directly comparable with international evidence. Emergency Department (ED) presentation data supplied by Queensland (QISU) and Victoria (VISU) are used to characterise these impacts. The QISU and VISU data is further discussed in Appendix A.

It should be noted that comparison between states data cannot be readily drawn. Analysis of the QISU and VISU data indicated differences in operational definitions, and data methodologies. Furthermore, state-based contextual factors, such as regulatory settings, infrastructure provision, and community norms also impact their interpretations.

Queensland Experience

Queensland has a comparatively distinct e-mobility landscape within Australia, characterised by relatively widespread e-scooter use. Shared e-scooter operations commenced in Queensland in 2018, with private e-scooter use legalised around the same period.²²³ RideReport data for shared schemes indicate materially higher e-scooter utilisation than shared e-bike utilisation, with approximately 6,900 daily e-scooter trips compared with around 300 daily e-bike trips.²²⁴ By contrast, several other Australian jurisdictions have only recently legalised private e-scooter use²²⁵ or continue to restrict it, typically limiting operation to specific trial areas or shared-scheme programs.²²⁶

For this report QISU has provided data covering the period from January 1, 2021, to December 31, 2024.

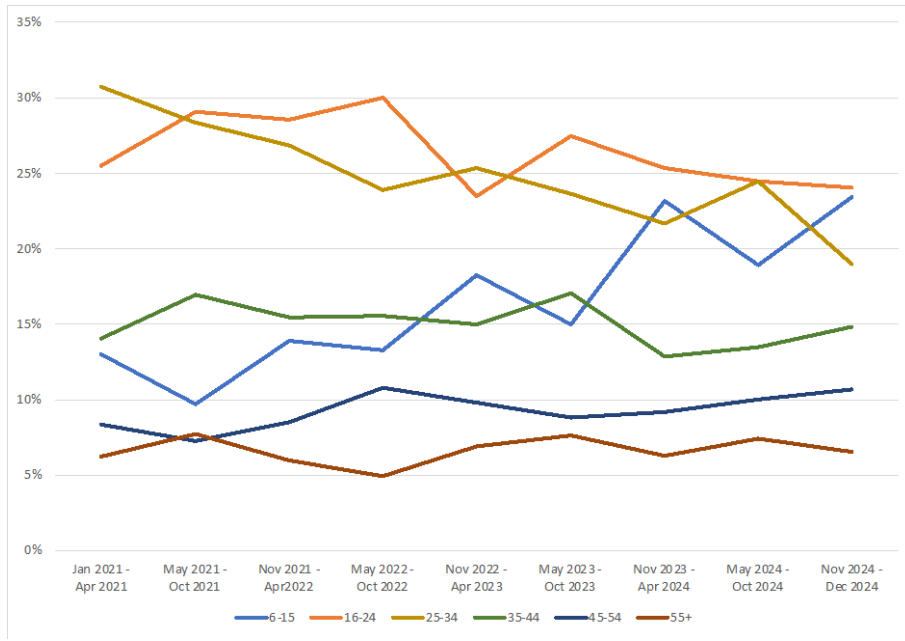
The data was produced by conducting key word searches on a range e-mobility related terms within the free text 'Injury Description' field completed by the Triage Nurse at the time of a patient's initial presentation to the ED.

This search contained terms such as 'e-scooter', 'e pmd' or 'Electric Wheeled Device' and common misspellings like 'escoter' or 'ecooter'. It also incorporated keyword searches for cases involving micromobility providers including 'lime', 'neuron' or 'beam'.

The analysis did not include keyword searches related to e-bikes and instead focussed on other types of e-mobility devices. E-bikes are commonly described as standard bicycles and as such there is significant variability in that data.

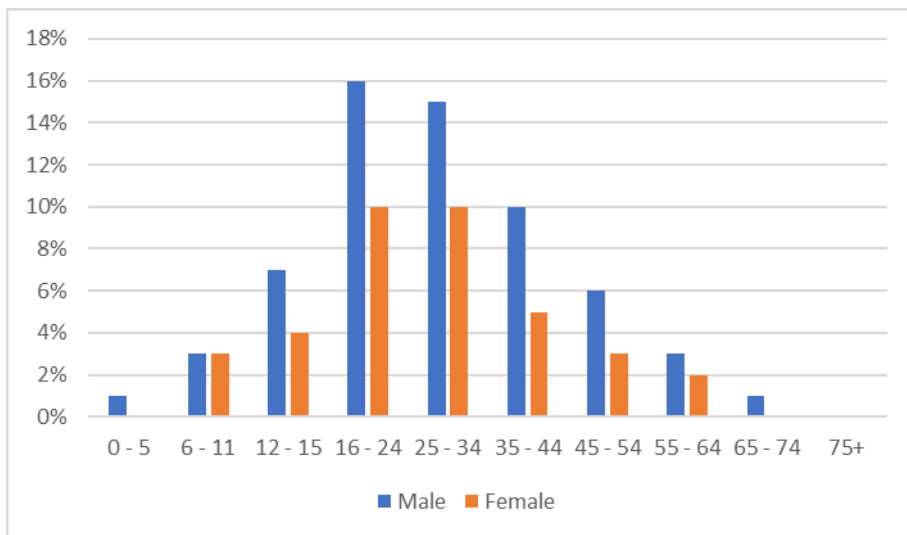
Overall, there are 4,092 PMD related injuries, of which 77 (1.9%) related to pedestrian injuries.

Figure 1: ED Presentations by Age and Date



Over time, the age distribution of injury presentations has shifted towards the 6-15 age range. Presentations among riders aged 35+ have remained relatively stable, while there have been gradual declines in the 16-24 and 25-34 age range. One possible explanation is that uptake among older cohorts has stabilised as many riders in these age ranges may have already trialed e-scooters and become more experienced in operating them. Given that e-scooter injuries are often concentrated among less experienced users, the rising share of injuries in the 6–15 age group may reflect increased participation by younger first-time riders who are still developing their riding skills.

Figure 2: ED Presentations by Age and Sex



Males accounted for the majority (62%) of e-mobility-related ED presentations, which is reflective of lower female usage. Estimates of the share of female e-scooter riders varies across studies and depend on the population and setting examined. For example, a Neuron study across multiple countries (including Australia) reported that females represented

41%²²⁷ of riders, which is broadly comparable to the gender distribution observed in the ED presentation data. Notably, these estimates relate to rider participation and are not directly equivalent to injury likelihood.

Table 1: ED Presentations by Age and Vehicle Type

Age Group	Electric Scooter	Hoverboard	Electric Skateboard	Unspecified	Segway	Electric Unicycle / One Wheel	Total
0 - 5	53	5	0	0	0	0	58
6 - 11	187	111	3	1	5	0	307
12 - 15	487	24	10	6	3	0	530
16 - 24	1,239	3	25	21	1	0	1,289
25 - 34	1,152	3	20	17	4	2	1,198
35 - 44	678	11	19	22	2	0	732
45 - 54	441	1	7	3	6	1	459
55 - 64	234	2	3	3	12	0	254
65 - 74	46	1	0	1	5	0	53
75+	21	0	1	0	0	0	22
Total	4,538	161	88	74	38	3	4,902

E-scooters are a widely used form of e-mobility in Queensland. Accordingly, they account for the majority of e-mobility-related ED presentations (92.5%). However, the comparatively small number of presentations associated with other device types limits the ability to draw robust conclusions about device-specific trends over time.

Notwithstanding this limitation, the data suggest the propensity for age profiles to differ by device type. Hoverboard-related presentations are concentrated among younger riders, with the 6–11 age group most frequently represented. In contrast, electric scooter presentations are predominantly observed in the 16–34 age range, which is broadly consistent with published patterns of use and injury in e-mobility literature.²²⁸

Table 2: ED Presentations by Age and Party Injured

Age Group	PMD rider	Pedestrian	Unspecified	PMD passenger	Other device rider	Total
0 - 5	30	7	1	15	5	58
6 - 11	291	11	3	0	2	307
12 - 15	512	4	10	2	2	530
16 - 24	1,259	9	9	8	4	1,289
25 - 34	1,168	12	13	2	3	1,198
35 - 44	708	9	10	2	3	732
45 - 54	447	7	2	0	3	459
55 - 64	242	11	1	0	0	254
65 - 74	47	5	0	0	1	53
75+	20	2	0	0	0	22
Total	4,724	77	49	29	23	4,902

In most incidents involving personal mobility devices, the injured party presenting to the ED was the PMD rider, which is consistent with the predominance of single-rider events (falls) observed in comparable studies. In contrast, incidents involving pedestrians appear to be relatively uncommon in the available data, despite PMDs operating in shared environments such as footpaths and shared paths where there is higher risk of injury to pedestrian in a collision. The predominance of fall-related incidents is reflected in Table 3 below, which shows that more than 70% of e-mobility-related ED presentations during the analysis period were attributable to falls.

The low number of pedestrian injury presentations provides some reassurance that there is unlikely to be a large cohort excluded from CTP based recourse.

Table 3: Age Group Injuries by Party Injured

Mechanism	Age Group										Total
	0 - 5	6 - 11	12 - 15	16 - 24	25 - 34	35 - 44	45 - 54	55 - 64	65 - 74	75+	
Falls	37	239	394	895	824	510	311	184	38	13	3,445
Fall NFS	34	227	375	854	794	480	294	172	38	13	3,281
Thrown over handlebars	0	3	7	10	5	6	1	1	0	0	33
Going through uneven ground	0	1	1	8	0	3	3	3	0	0	19
While trying to brake	2	8	8	18	17	16	11	5	0	0	85
Swerving to avoid object	1	0	3	5	8	5	2	3	0	0	27
Collision	18	55	96	218	194	127	85	34	10	8	845
Collision with/struck by a vehicle	0	15	34	67	74	45	26	9	1	1	272
Collision with stationary object	2	15	43	112	88	54	41	11	4	5	375
Collision with/struck by PMD	11	13	7	23	20	17	11	10	5	2	119
Stuck by part of PMD	5	12	12	16	12	11	7	4	0	0	79
Unspecified	2	11	38	169	176	93	57	34	4	1	585
Injured while stepping off PMD	0	0	1	4	2	2	4	2	0	0	15
Injured when trying to avoid PMD	0	1	0	3	2	0	1	0	1	0	8
Burn or Fire	1	1	1	0	0	0	1	0	0	0	4
Total	58	307	530	1,289	1,198	732	459	254	53	22	4,902

Falls remain the dominant mechanism for ED presentations, with collisions representing the next largest category. Collisions involving stationary objects appear to be slightly over-represented among older age groups (particularly 65–74 and 75+) relative to other mechanisms. However, given the limited number of observations in these age bands, this pattern should be interpreted cautiously and may reflect sampling variability rather than a stable trend.

Uneven ground contributed only a small share of ED presentations, despite the theoretical stability constraints of e-scooters. While the literature reports mixed findings on the role of surface irregularities, the limited number of relevant records and the use of non-specific mechanism coding (e.g., not further specified) in this dataset restrict the strength of conclusions that can be drawn.

Table 4: ED Day and Time of Initial Presentation

Day of Presentation	Time of Presentation				Total
	00:00 - 05:59	06:00 - 11:59	12:00 - 17:59	18:00 - 23:59	
Monday	83	172	221	167	643
Tuesday	48	141	200	200	589
Wednesday	56	155	208	207	626
Thursday	73	133	207	179	592
Friday	82	127	206	258	673
Saturday	182	161	291	254	888
Sunday	209	191	270	221	891
Total	733	1,080	1,603	1,486	4,902

ED presentation timing is broadly consistent with expected e-mobility usage patterns. Presentations peak in the afternoon, when device use is typically highest, and increase again on Friday nights and during early-morning weekend hours, aligning with higher activity levels associated with nightlife and busier urban environments.

Table 5: Body Region by Injury Type

Body Region	Fracture	Unspecified Injury	Superficial Injuries	Wounds and Lacerations	Intracranial Injury	Sprain or Strain	Dislocation	Other	Dental Injury	Multiple Injuries	Injury to Internal Organ	Injury to Muscle or Tendon	Total
Upper Limb	913	205	115	104	0	239	93	10	0	0	0	17	1,696
Forearm	347	27	26	15	0	0	0	1	0	0	0	2	418
Shoulder	160	73	19	1	0	35	68	1	0	0	0	11	368
Hand	164	55	41	47	0	32	12	6	0	0	0	3	360
Wrist	121	22	4	2	0	100	2	0	0	0	0	0	251
Elbow	74	13	20	35	0	49	11	0	0	0	0	1	203
Upper Arm	47	15	5	4	0	23	0	2	0	0	0	0	96
Head and Neck	199	324	206	389	186	26	0	5	41	0	0	0	1,376
Face	123	280	71	162	0	1	0	3	41	0	0	0	681
Head	69	31	131	226	186	0	0	2	0	0	0	0	645
Neck	7	13	4	1	0	25	0	0	0	0	0	0	50
Lower Limb	306	152	127	162	0	208	15	15	0	0	0	9	994
Lower Leg	62	21	57	38	0	59	0	6	0	0	0	4	247
Foot	74	55	26	26	0	32	2	3	0	0	0	4	222
Knee	75	35	27	73	0	4	4	1	0	0	0	0	219
Ankle	61	18	5	17	0	100	7	2	0	0	0	0	210
Hip	22	21	11	2	0	13	2	2	0	0	0	0	73
Thigh	12	2	1	6	0	0	0	1	0	0	0	1	23
Unspecified Body Region	5	81	250	8	0	5	0	9	0	0	0	3	361
Trunk	129	84	43	4	0	37	2	2	0	0	32	0	333
Thorax	91	50	24	2	0	19	1	1	0	0	9	0	197
Abdomen and Lower Back	13	30	17	1	0	18	1	1	0	0	18	0	99
Pelvis	25	0	2	1	0	0	0	0	0	0	5	0	33
Spine	0	4	0	0	0	0	0	0	0	0	0	0	4
Multiple Body Regions	3	13	50	36	0	0	0	3	0	37	0	0	142
Total	1,555	859	791	703	186	515	110	44	41	37	32	29	4,902

Fractures were the most frequently recorded injury type, particularly in upper-limb regions such as the forearm, shoulder, hand, and wrist. This distribution is consistent with riders attempting to brace during falls from e-scooters. Facial fractures were also observed, along with lacerations and open wounds to the face and head, which may reflect low helmet use and/or limitations of standard helmet designs that provide limited protection against facial impacts. Consistent with this pattern, 55% of wound and laceration presentations were recorded as affecting the face or head.

Figure 3: Alcohol Usage in ED Presentations

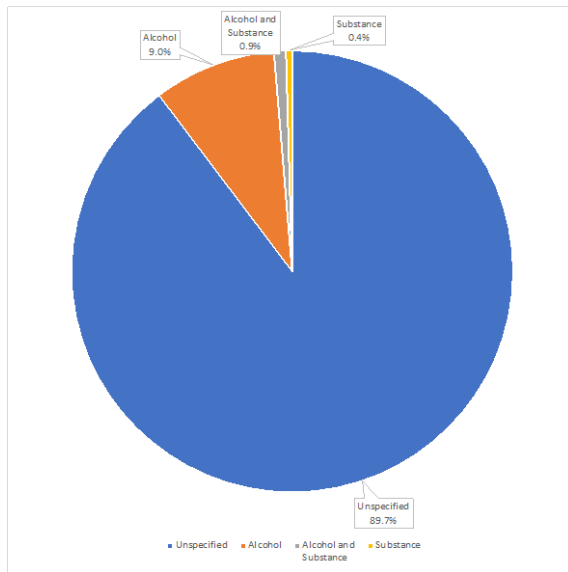
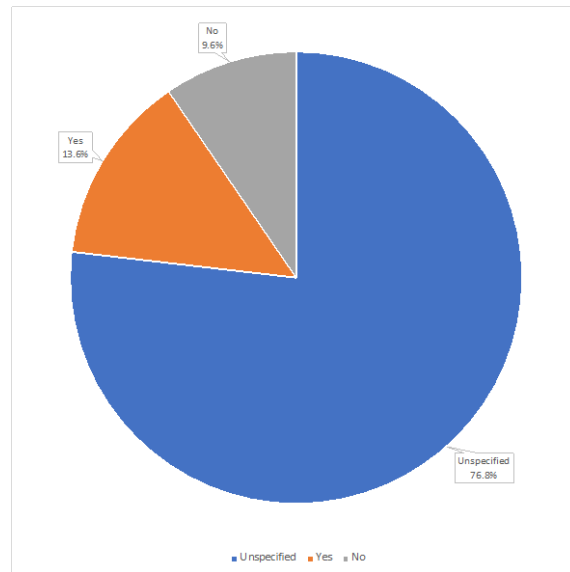


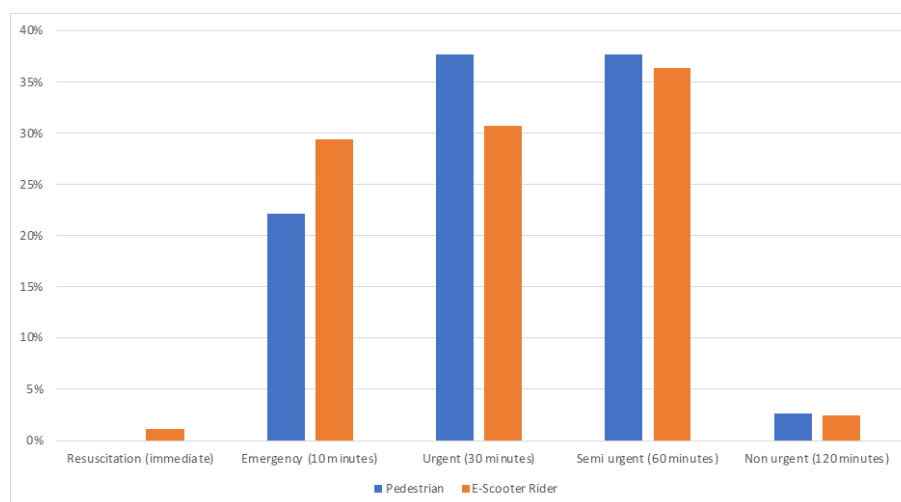
Figure 4: Helmet Usage in ED Presentations



Over 10% of riders presenting to the ED were recorded as being affected by drugs and/or alcohol, with alcohol being the most common impairment. This is notable given that operating an e-scooter while intoxicated is unlawful. However, this figure is likely to understate the true prevalence of impairment because impairment status may not be consistently assessed during triage.

Similarly, the recorded rate of non-helmet use (13.6%) is also likely to be underestimated. Triage documentation is completed under time constraints and prioritises information that is immediately relevant to clinical management. As a result, behavioural variables such as impairment and helmet use may be left unspecified, limiting the completeness and interpretability of these measures.

Figure 5: Pedestrian vs PMD Presentations Triage Category



Pedestrian presentations were less likely to be classified as Emergency or Resuscitation than presentations involving e-scooter riders and passengers. This difference is consistent with the underlying collision mechanisms. Incidents involving motor vehicles typically involve

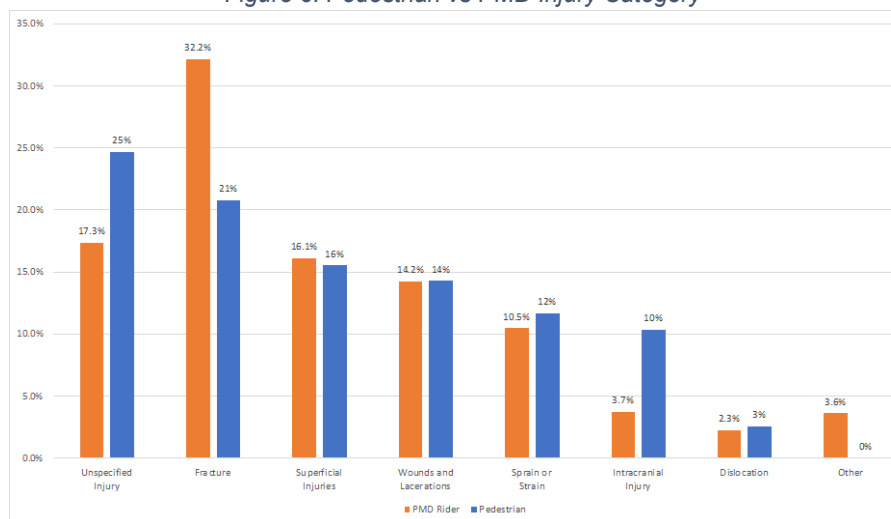
higher operating speeds and greater vehicle mass, increasing the likelihood of high-severity trauma relative to collisions between e-scooters and pedestrians.

Table 6: Injury Mechanism by Age for Pedestrians

Mechanism	Age Group										Total
	0 - 5	6 - 10	11 - 15	16 - 20	21 - 25	26 - 30	31 - 35	36 - 40	41 - 45	46 - 50	
Collision	6	10	4	7	9	9	4	11	3	2	65
Collision with/struck by PMD	6	9	3	7	9	8	4	9	3	2	60
Stuck by part of PMD	0	1	1	0	0	1	0	1	0	0	4
Collision with stationary object	0	0	0	0	0	0	0	1	0	0	1
Injured when trying to avoid PMD	0	1	0	2	1	0	1	0	1	0	6
Falls	1	0	0	0	2	0	2	0	1	0	6
Fall NFS	1	0	0	0	2	0	2	0	1	0	6
Total	7	11	4	9	12	9	7	11	5	2	77

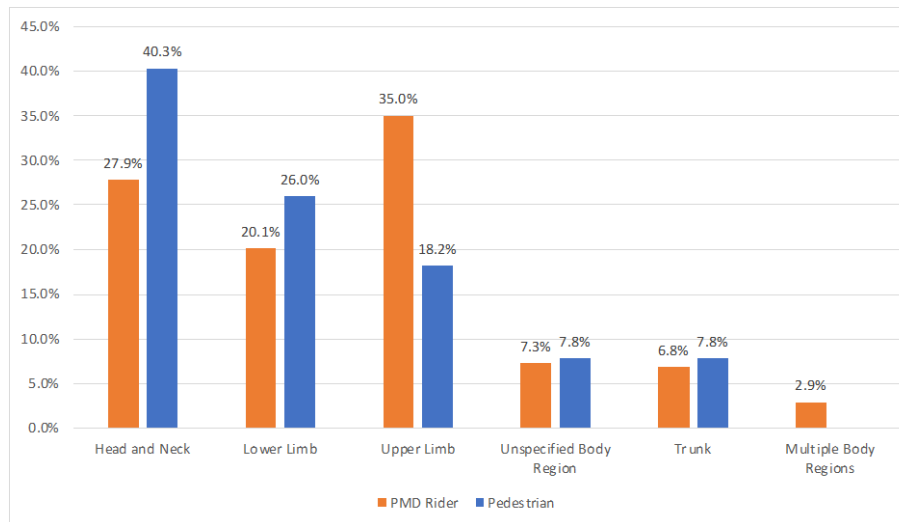
Pedestrian injury presentations were most associated with collisions involving a PMD. The relatively high representation of children in the dataset may reflect a combination of factors, including age-related differences in hazard perception and reaction time, as well as potentially higher exposure in shared public spaces relative to older age groups, which record fewer presentations. Differences in injury susceptibility may also contribute, as children may experience more severe outcomes than adults in comparable collision events thus requiring ED presentation. However, interpretation is constrained by the limited number of observations and the absence of exposure data. The observed pattern may be influenced by sampling variability rather than representing a underlying trend.

Figure 6: Pedestrian vs PMD Injury Category



Compared with PMD riders and passengers, pedestrians recorded a higher proportion of intracranial injuries, which is consistent with findings reported in other studies.²²⁹ This difference may reflect the use of protective equipment among riders (e.g., helmets), which can reduce the likelihood or severity of head injury. The substantial over-representation of children among pedestrian presentations may also contribute to this pattern, as larger size and mass differentials between children and PMD riders may increase vulnerability to head impact and more severe injury in comparable collision events.

Figure 7: Pedestrian vs PMD Injury Type



Similarly, pedestrian presentations show a higher proportion of head and neck injuries, whereas PMD riders record a larger share of upper-limb injuries, consistent with bracing behaviour during falls. Overall, these differences align with the underlying mechanisms observed in the data: PMD rider injuries are more frequently associated with falls, while pedestrian injuries are more commonly associated with collision events.

Victorian Experience

Victoria has a diverse e-mobility environment, with both e-bikes and e-scooters used widely. Shared e-bike trials commenced in Melbourne in early 2020,²³⁰ and shared e-scooter schemes entered the market in early 2022.²³¹

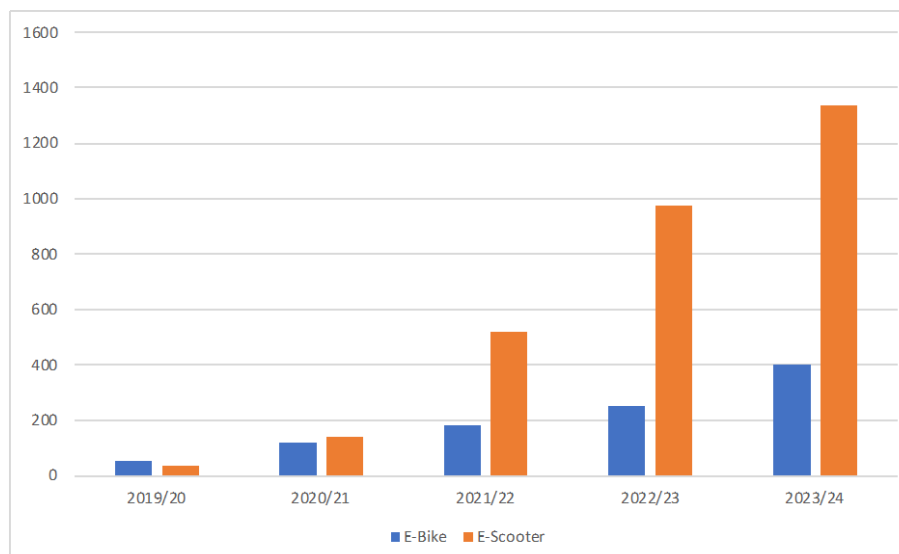
In late 2024, shared e-scooters were banned within the City of Melbourne,²³² while privately owned e-scooters remained permitted. Prior to the ban, shared e-scooter usage was substantial. Accordingly, the analysis in this report is limited to periods prior to the ban to maintain comparability over time. While this approach supports a more consistent basis for interpretation, further adjustments may be required in future analyses to account for changes in vehicle availability and operating conditions.

The data was produced by conducting key word searches on a range of e-micromobility related terms within the free text 'Injury Description' field completed by the Triage Nurse at the time of a patient's initial presentation to the Emergency Department.

To identify e-mobility-related presentations, Victorian Emergency Minimum Dataset (VEMD) records were extracted using keyword searches of the free-text 'Injury Description' field completed by the Triage Nurse at the time of a patient's initial presentation to the Emergency Department. The query was designed to capture a broad range of relevant terms and their common variations. For e-scooter cases, search terms included combinations such as "scooter" and "electric", as well as "e scooter" and "e-scooter". For e-bike cases, terms included "e bike", "e bicycle", "e-bike", "e-bicycle", and combinations of "bike"/"bicycle" with "electric" or "motorised", including variants such as "pushbike". Records containing terms such as "mobility" or "motorised" were excluded where they were likely to refer to mobility scooters rather than e-rideables.

All extracted records were manually reviewed to confirm relevance and were restricted to unintentional injury events. The analysis covers VEMD presentations from July 2019 to June 2024 (i.e., 5-year period), with each record representing a patient's first ED presentation for treatment related to the incident.

Figure 8: E-Bike and E-Scooter Hospital Presentations

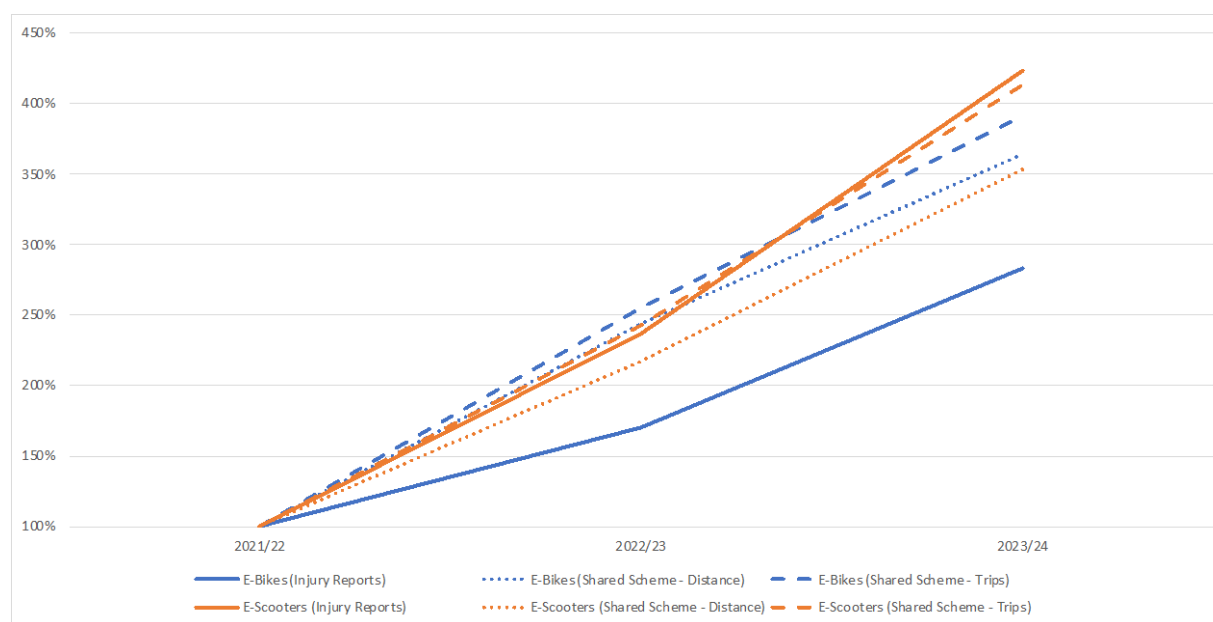


Over the analysis period, uptake of both e-bikes and e-scooters increased, with ED presentations associated with e-scooters rising more rapidly than those associated with e-bikes.

Figure 9 compares growth trends for shared mobility schemes in metropolitan Melbourne, using RideReport data on trip volumes and total distance travelled.

Shared e-scooter trials commenced in Melbourne in February 2022 across the City of Melbourne, City of Yarra and City of Port Phillip. From April 2023, privately owned e-scooters were permitted within the trial areas, and private e-scooters were legalised more broadly in July 2023. E-scooter riders must be at least 16 years old on public roads, whereas e-bikes are treated as bicycles and are not subject to an equivalent age restriction. Shared e-bike schemes were introduced in 2020 and therefore span the full analysis period.

Figure 9: E-Bike and E-Scooter Growth Breakdown

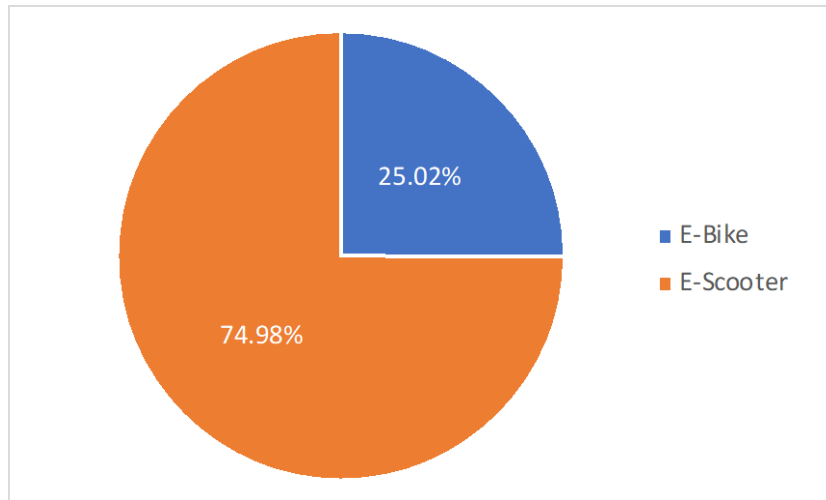


As shared e-scooter operations commenced in the middle of the 2021/22 year, the 2021/22 year-on-year growth rate was adjusted to reflect approximately six months of shared e-scooter activity. After applying this adjustment, growth in e-scooter ED presentations broadly follow the same trajectory as growth in shared-scheme usage. This alignment is expected for the pre-legalisation period (prior to July 2023), when private e-scooter use was not permitted and shared schemes were therefore the primary source of observable market activity captured in the data.

Given that a substantial share of e-scooter injuries involves falls among inexperienced riders, trip volume may be a more informative exposure metric for comparison with ED presentations than distance travelled.

By contrast, e-bike ED presentations reflect a combination of private ownership and shared scheme use, which may contribute to differences in observed growth patterns.

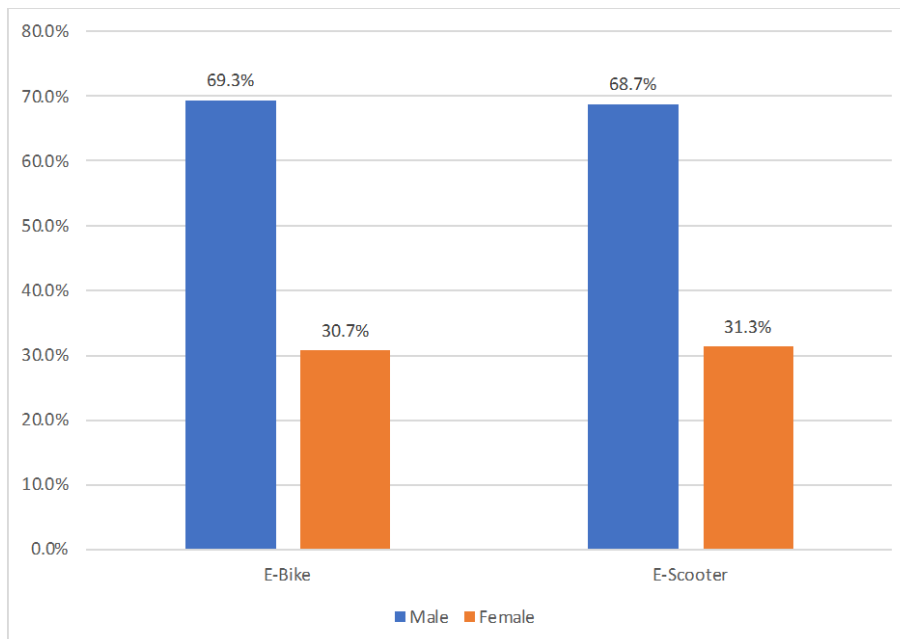
Figure 10: E-Bike and E-Scooter ED Presentation Mix



In the final quarter prior to the City of Melbourne shared e-scooter ban (the last quarter captured in this analysis), RideReport estimates indicate an average fleet of 2,339 shared e-scooters and 844 shared e-bikes in metropolitan Melbourne. This equates to an approximate 73%–27% split, which is broadly consistent with the corresponding split observed in ED presentations over the same period.

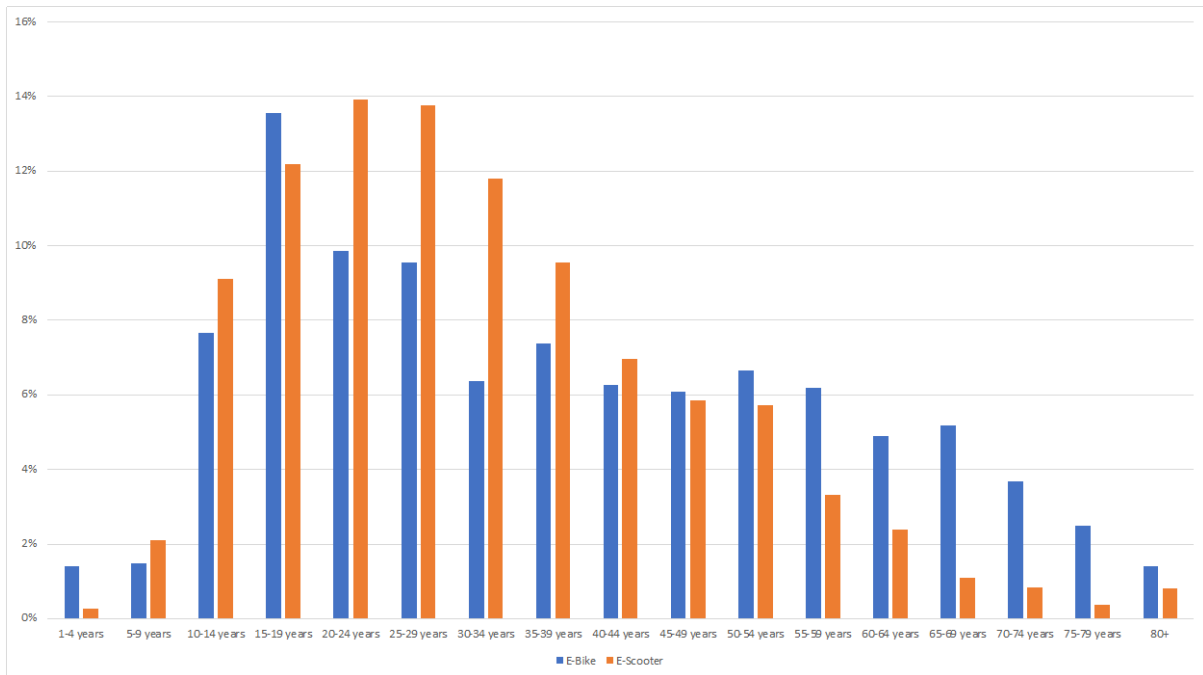
Following the ban, shared e-scooter operators were no longer permitted to operate within the City of Melbourne, while private e-scooters remained permitted. This change is likely to have altered the observed mix of shared vehicles over time. More recent RideReport estimates suggest an average of approximately 1,172 shared e-scooters (around half the pre-ban level) and 811 shared e-bikes (broadly unchanged), implying a shift to roughly a 60%–40% split. Notably, because RideReport reflects shared-scheme activity, any increase in private e-scooter usage would not be captured in these fleet estimates and may further affect the overall distribution of device use and associated ED presentations.

Figure 11: E-Bike and E-Scooter Hospital Presentations Sex Breakdown



The observed gender distribution is relatively stable, with approximately 70% male and 30% female users. This is broadly consistent with survey-based estimates, although the female share observed here sits at the lower end of reported ranges. For example, females have been estimated to comprise around 36%²³³ of e-bike users and approximately 40%²³⁴ of e-scooter users in some studies. These survey figures reflect usage participation rather than injury risk, and therefore are not directly comparable with ED presentation patterns. The higher male representation in injury data may reflect differences in exposure, riding conditions, or behavioural factors (e.g., risk-taking), rather than differences in device access alone.

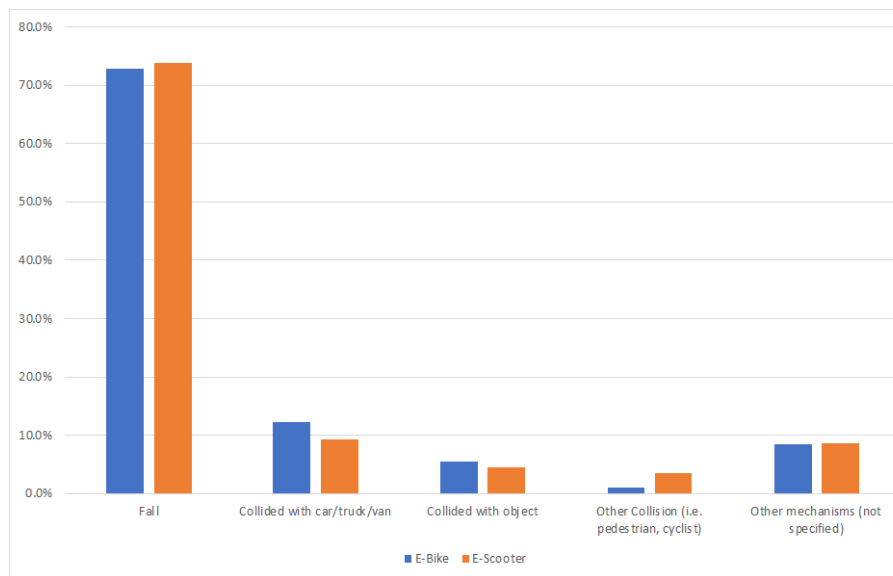
Figure 12: E-Bike and E-Scooter Hospital Presentations Age Breakdown



Age profiles differ between device types. In the Victorian data, e-scooter presentations are concentrated in the younger and middle age groups, whereas e-bike presentations are more prominent in older age cohorts. Based on the available records, the estimated average age is approximately 31 years for e-scooter riders and 38 years for e-bike riders. This pattern is broadly consistent with international observations that e-scooter users tend to be younger than e-bike users.

The lower proportion of ED presentations among older e-scooter riders likely reflects lower uptake of e-scooters in older age groups relative to e-bikes. This may be influenced by differences in device handling and perceived stability; e-scooters generally require greater balance and control, whereas e-bikes operate more similarly to traditional bicycles and may be viewed as less physically demanding. The age distribution may also be shaped by regulatory settings, as riders must be at least 16 years old to legally hire or ride an e-scooter on public roads, while no equivalent minimum age restriction applies to e-bikes (which are treated as bicycles).

Figure 13: E-Bike and E-Scooter Hospital Presentations Mechanism of Injury Breakdown



Falls are the most recorded incident type for both e-bikes and e-scooters in the available data. Collisions involving motor vehicles make up a slightly larger share of e-bike incidents (12.2%) than e-scooter incidents (9.4%). One potential explanation is differing operating environments where e-scooters may be used more frequently on footpaths and shared paths, whereas e-bikes may spend more time on the road. Although the current dataset does not support a robust assessment of this mechanism because location information is incomplete; and under current coding practices, footpaths and roads are captured within the same category, thereby limiting the ability to distinguish where incidents occur and to attribute differences in collision patterns to riding location.

Figure 14: E-Bike Place of Injury

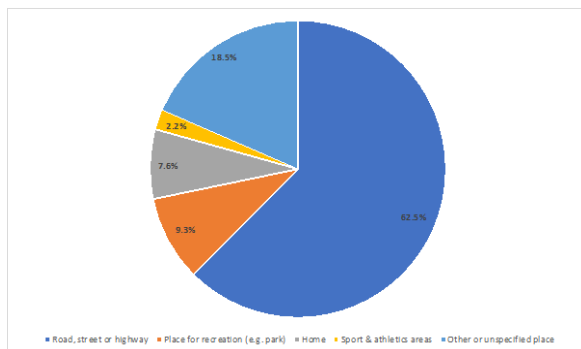


Figure 15: E-Scooter Place of Injury

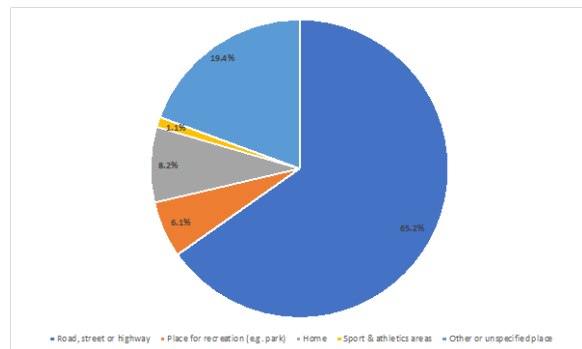
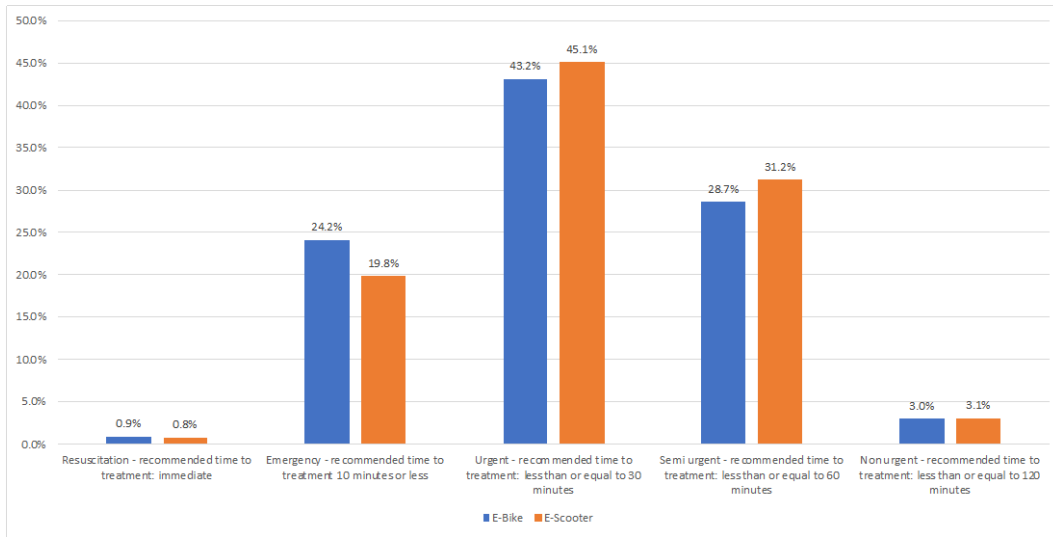
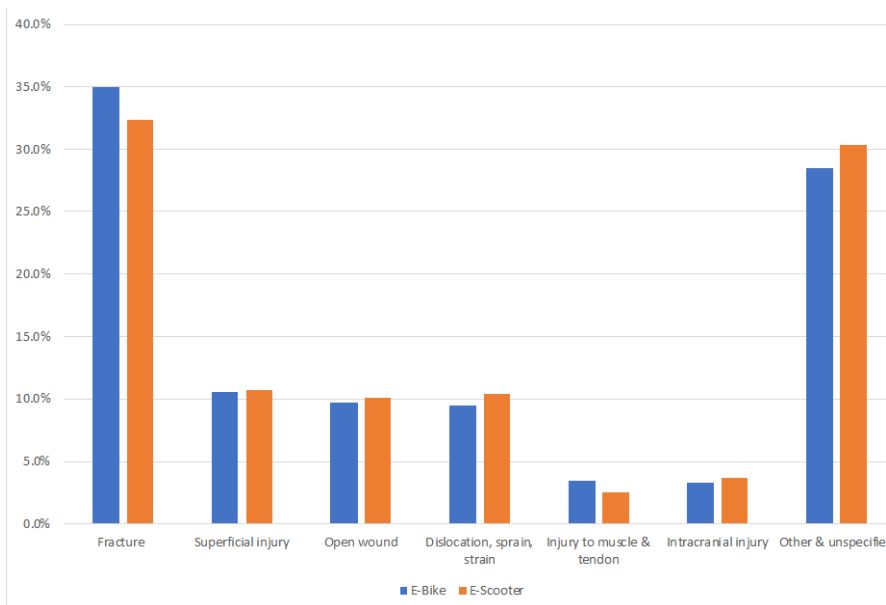


Figure 16: E-Bike and E-Scooter Hospital Presentations Triage Category Breakdown



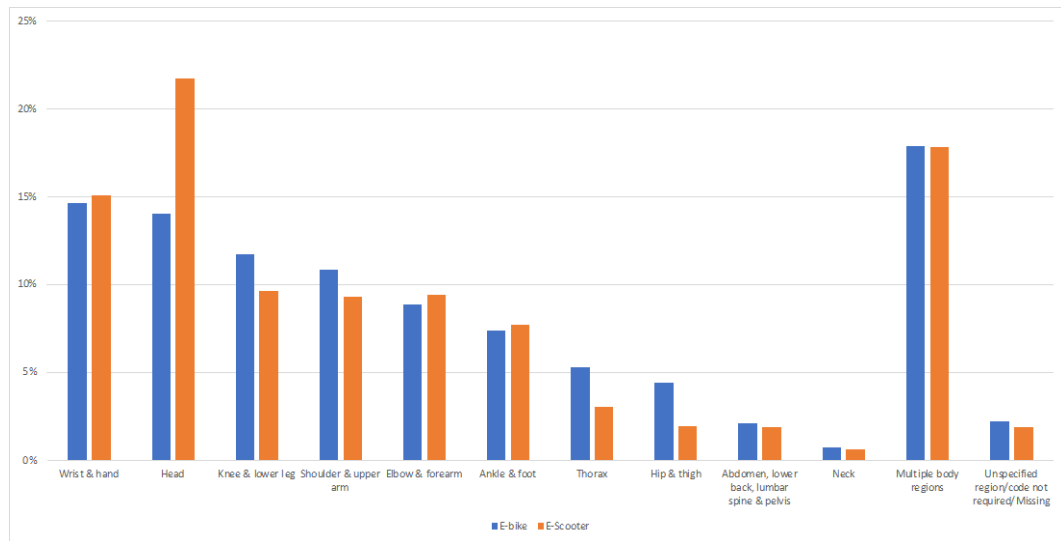
E-bike presentations recorded a slightly higher proportion of cases triaged as urgent or higher compared with e-scooter presentations. This may be partly attributable to the higher share of motor-vehicle collisions among e-bike incidents, which can be associated with greater injury severity. Notably, although falls account for more than 70% of presentations for both device types, approximately 65% of presentations in each group were triaged as urgent or higher. This suggests that fall related incidents can still result in significant injuries requiring timely assessment and treatment.

Figure 17: E-Bike and E-Scooter Hospital Primary Injury Breakdown



Injury profiles among hospital presentations were broadly similar across device types, although e-bike riders recorded a slightly higher proportion of fractures.

Figure 18: E-Bike and E-Scooter ED Presentations Body Region of Injury Breakdown



In terms of injury distribution by body region, e-scooter riders sustained a higher proportion of head injuries than e-bike riders. In contrast, e-bike riders recorded a higher proportion of upper-extremity injuries, which is broadly consistent with patterns reported in the literature.

To better characterise these differences, injury presentations were summarised in a cross-tabulation of injury type by body region. This approach supports comparison across categories and highlights differences in injury patterns between device types. To protect patient privacy, cells with low population counts were suppressed in reporting. This ensures individuals cannot be identified while preserving the overall analytical value of the results.

Table 7: ED presentations for injuries relating to electric bikes, injury type by injured body region

	Head	Neck	Thorax	abdomen, lower back, lumbar spine & pelvis	shoulder & upper arm	elbow & forearm	wrist & hand	hip & thigh	knee & lower leg	ankle & foot	multiple body regions	Unspecified body region	Code not required/missing	Total
0.00 superficial injury	28	0	*	*	5	9	6	7	14	*	28	0	0	106
1.00 open wound	28	0	0	*	*	5	14	5	28	6	7	*	0	98
2.00 fracture	20	*	34	6	63	51	87	20	32	29	7	*	*	352
3.00 dislocation, sprain & strain	0	*	5	*	25	*	15	*	17	21	*	0	0	95
5.00 injury to blood vessels	*	0	0	0	0	*	0	0	0	0	0	0	0	*
6.00 injury to muscle & tendon	*	*	5	*	*	0	5	*	5	*	*	0	*	35
7.00 crushing injury	0	0	0	*	0	*	*	0	*	*	0	0	0	5
8.00 traumatic amputation	0	0	0	0	0	*	*	0	*	*	0	0	0	*
9.00 other & unspecified injury	24	*	*	6	12	18	16	5	18	8	132	8	6	260
10.00 eye injury- excl foreign body	*	0	0	0	0	0	0	0	0	0	0	*	0	*
11.00 intracranial injury	33	0	0	0	0	0	0	0	0	0	0	0	0	33
12.00 injury to internal organs	*	0	*	*	0	0	0	0	0	0	0	0	0	*
13.00 foreign body	0	0	0	0	0	0	0	0	0	0	*	*	0	*
14.00 burns	0	0	0	*	0	0	*	*	*	*	0	0	0	7
Total	141	7	53	21	109	89	147	44	118	74	180	13	9	1005

Table 8: ED presentations for injuries relating to electric scooters, injury type by injured body region

	Head	Neck	Thorax	abdomen, lower back, lumbar spine & pelvis	shoulder & upper arm	elbow & forearm	wrist & hand	hip & thigh	knee & lower leg	ankle & foot	multiple body regions	Unspecified body region	Code not required/missing	Foreign body	Total
0.00 superficial injury	128	*	10	6	9	16	21	13	31	9	78	0	*	0	323
1.00 open wound	161	*	0	5	*	8	17	6	60	19	13	7	*	0	304
2.00 fracture	91	7	42	10	141	194	267	22	83	105	6	5	0	0	973
3.00 dislocation, sprain & strain	5	*	13	*	72	15	79	6	43	65	7	*	0	0	313
4.00 injury to nerves & spinal cord	0	0	0	*	0	0	0	0	0	0	0	0	*	0	*
5.00 injury to blood vessels	*	0	0	*	*	*	0	0	0	0	0	0	0	0	*
6.00 injury to muscle & tendon	*	*	*	*	17	9	14	*	14	5	*	0	0	0	77
7.00 crushing injury	6	0	*	0	0	*	5	*	*	*	0	0	0	*	27
9.00 other & unspecified injury	130	*	12	21	37	36	50	7	55	26	428	21	17	0	843
10.00 eye injury- excl foreign body	9	0	0	0	0	0	0	0	*	*	*	0	0	0	9
11.00 intracranial injury	110	0	0	0	0	0	0	0	0	0	0	0	0	0	110
12.00 injury to internal organs	10	0	5	8	0	0	0	0	0	0	0	*	0	*	24
13.00 foreign body	0	0	0	0	0	0	0	0	0	0	0	0	0	*	*
14.00 burns	0	*	0	0	0	0	0	0	0	0	*	0	0	0	*
Total	654	19	91	57	280	284	453	58	290	232	537	35	20	*	3011

Fractures and other/unspecified injury were the most frequently recorded injury types, with superficial injury, open wound, and dislocation/strain/sprain occurring at similar rates to each other. The other/unspecified injury category often appears to involve multiple body regions; however, the current coding does not disaggregate this information. Accordingly, inclusion of this category may contribute to elevated counts across body-region summaries, although the extent of this effect cannot be determined from the available data.

Fractures are the predominant injury type and are most recorded in the wrist and hand, elbow and forearm, and shoulder and upper arm, consistent with riders attempting to brace during a fall. A notable proportion of presentations also involve head fractures and/or intracranial injuries, indicating that head impacts contribute materially to severe outcomes. In addition, superficial head injuries and open wounds are frequently recorded among e-scooter presentations and appear more prominent than superficial injuries to upper-extremity regions, where fractures are more commonly observed.

Overall, injury patterns across e-bikes and e-scooters are broadly similar. Key differences include a higher proportion of fractures among e-bike presentations and a higher proportion of head injuries among e-scooter presentations.

6. Impact on Personal Injury Insurance

E-bikes and e-scooters can have a significant impact on the insurance market. Increased uptake is likely to result in more injuries, adding pressure to the healthcare system and increasing private health insurance claims. Where riders cause accidents, claims may arise under personal liability cover within a home and contents insurance policy which may also face claims linked to battery or charging related fires.

This section focuses on Compulsory Third Party (CTP) and Workers' Compensation insurance and how these mobility devices interact with them. As these schemes are state based, outcomes may vary across jurisdictions, reflecting differences in local regulations and the region-specific e-mobility landscape.

Compulsory Third Party Insurance

Compulsory Third Party (CTP) insurance laws vary between Australian states, and these differences can significantly affect the insurance eligibility of e-mobility riders. In most jurisdictions, a rider will only be eligible for CTP coverage if the accident involves an interaction with a motor vehicle.²³⁵ Thus, only a narrow subset of e-mobility incidents fall within the scope of CTP schemes.

In practice, relatively few reported e-mobility devices accidents involve collisions with motor vehicles, which further limits access to CTP coverage.^{236,237,238} When such collisions occur, they most commonly take place at intersections.²³⁹ By contrast, e-mobility accidents are more frequently reported as single-vehicle incidents,^{240,241,242} often occurring on sidewalks rather than on the road.^{243,244} The prevalence of sidewalk riding varies across studies^{245,246} and is strongly influenced by the availability and quality of dedicated infrastructure.^{247,248,249,250,251,252}

Where an e-mobility rider collides with a pedestrian, CTP coverage generally does not apply.²⁵³ In such cases, the rider may instead face claims under public liability insurance.²⁵⁴ However, pedestrian access to CTP benefits may differ depending on the jurisdiction and the legal classification of the device involved. While e-mobility devices are typically not considered motor vehicles²⁵⁵ under state legislation, devices that exceed permitted speed limits may be classified as unregistered motor vehicles,²⁵⁶ potentially allowing injured pedestrians to access CTP benefits in some states.

Currently, no Australian state requires e-bikes or e-scooters to be registered, which complicates their inclusion within existing CTP schemes. Most CTP systems rely on vehicle registration as the primary mechanism for premium collection and scheme funding. Incorporating e-mobility devices without a comparable funding mechanism would therefore undermine the viability and equity of these schemes.

Following recent recommendations from the Queensland inquiry in 2025, the Queensland government is considering the introduction of licensing requirements for e-mobility devices. If implemented, Queensland would be the first Australian jurisdiction to mandate licensing for such devices, potentially creating a pathway for future inclusion in CTP schemes, as seen in some international contexts.^{257,258} The inquiry proposed a learner-permit style system for riders,²⁵⁹ a recommendation that has been agreed to in principle.²⁶⁰ While such a system may improve safety and rider awareness, the associated administrative and compliance costs may also discourage e-mobility uptake.²⁶¹

Workers' Compensation Insurance

Australia has one of the highest proportions of part time workers globally, contributing over \$200 billion to the economy annually.²⁶² Within this broader labour market, the food delivery sector has expanded rapidly in recent years and is estimated to be worth approximately \$2 billion.^{263,264,265} E-bikes are commonly used by food delivery²⁶⁶ riders due to their ability to travel at higher speeds, navigate congested urban environments efficiently, and reduce physical exertion.²⁶⁷ Industry estimates suggest that more than 86,000 riders²⁶⁸ undertake food delivery work nationwide, with thousands of delivery trips occurring each day. Some platforms have partnered with e-bike suppliers to facilitate rider access to suitable vehicles,²⁶⁹ and observational studies in Victoria have found that delivery e-bikes account for nearly half of all two-wheeled delivery vehicles.²⁷⁰

Food delivery riders predominantly operate within the gig economy and are generally classified as independent contractors rather than employees. As a result, riders injured while performing delivery work are typically not covered under platform-provided workers' compensation insurance schemes.^{271,272} While e-bikes lower financial and physical barriers to entry into the food delivery market,²⁷³ the nature of delivery work substantially increases riders' exposure to road-related risks.

Delivery riders spend significantly more time on public roads each day than cyclists, increasing their exposure to traffic and the likelihood of road incidents.²⁷⁴ The risk of injury is significantly higher in the gig economy²⁷⁵ due to a combination of factors including high traffic density, tight delivery timeframes²⁷⁶ and the use of illegally modified high speed e-bikes.²⁷⁷ Riders are also required to interact frequently with mobile phone applications for navigation and job management which can contribute to distraction.²⁷⁸ Platform payment and job allocation systems typically prioritise delivery volume and speed,²⁷⁹ which may incentivise risk-taking behaviours such as traffic code violations.²⁸⁰ Riders may also experience reduced access to work or account deactivation if they decline delivery requests or fail to meet platform activity thresholds.²⁸¹ Consistent with these conditions, delivery riders have been observed to experience a higher rate of traffic incidents compared to other e-mobility riders.²⁸² Approximately one third of food delivery workers report being injured while working,²⁸³ despite having limited workplace protections. The risk of injury may be further elevated at night when there is a higher demand for food delivery²⁸⁴ and riding conditions are less safe.²⁸⁵

Despite these elevated risks, insurance coverage for food delivery riders remains fragmented. Most platforms rely on bespoke private insurance arrangements rather than inclusion within state-based workers' compensation schemes.²⁸⁶ Historically, some platforms have contributed to workers' compensation systems. Prior to 2018 Deliveroo contributed approximately \$800,000 in annual premiums before arranging alternative insurances for its riders which reduced its premiums to \$200,000 related primarily to the cost of head office staff.²⁸⁷ During this period, claims relating to food delivery riders totalled approximately \$1.9 million.²⁸⁸

The absence of legislative requirements mandating minimum insurance coverage for app-based delivery riders results in significant variability in benefits between platforms.²⁸⁹ Riders may need to purchase their own supplementary insurance at significantly higher costs,²⁹⁰ however, this cover may still provide lower protection than statutory compensation schemes.²⁹¹ This contributes to underinsurance among riders and may delay recovery, as injured individuals may feel compelled to return to work prematurely.²⁹² This is particularly relevant for food delivery riders whom may take longer to return to work due to the strenuous activities required as part of their occupation.²⁹³

Despite these arrangements, current entitlements under private insurance provide less comprehensive coverage than would be available under a statutory workers' compensation scheme.²⁹⁴ While others contend that private arrangements enable faster claims processing and more consistent benefits across Australian jurisdictions, reducing administrative overheads and complexity for businesses operating nationally.

This issue is further complicated by the widespread practice of riders using multiple delivery platforms simultaneously, which can create uncertainty regarding liability and income replacement when accidents occur. Multi-platform use is a common practice that allows riders to optimise routes and maximise earnings by selecting higher value jobs. But it can create uncertainty about which insurer is responsible when an accident occurs.²⁹⁵ Even when this can be identified, income replacement may only be calculated on earnings attributable to that platform rather than the rider's total income.²⁹⁶

In November 2025, Uber Eats and DoorDash entered into a national agreement with the Transport Workers Union, introducing minimum pay guarantees²⁹⁷ and accident insurance.^{298,299} While this represents a significant development, limited information is currently available regarding the scope, administration, and long-term implications of these arrangements. Consequently, their overall impact on rider protection and the broader insurance framework cannot yet be fully assessed.

7. Lithium-ion Battery Fire Risk

Risk Characteristics

Lithium-ion batteries are the most widely used rechargeable battery type and are found in many everyday devices, including laptops and mobile phones.³⁰⁰ They are valued for their compact size, high energy density, minimal charge loss when not in use, and the absence of a memory effect.³⁰¹ However, lithium-ion batteries are also highly flammable under certain failure conditions. They are the primary battery technology used in e-bikes and e-scooters,³⁰² with EN15194 becoming the most widely adopted rating standard used for electric bikes. Changes to the Australian Design Rules meant that compliance with this standard was no longer mandatory which led to the importation of cheap, unsafe devices with poor quality batteries. Poor quality batteries often lack essential safety measures such as battery management systems and have a much higher likelihood of containing a defect³⁰³ compared to batteries with safety systems designed with European Standard EN15914 in mind.

Thermal runaway is a major risk for lithium-ion batteries, occurring when a cell becomes uncontrollable and self-heating.³⁰⁴ This process involves a chain of exothermic chemical reactions that generate substantial heat and release toxic gases.^{305,306} Thermal runaway can be triggered by physical battery damage, overheating or short circuiting³⁰⁷ with the risk of fires substantially increasing from batteries that are poorly designed or constructed.³⁰⁸

Lithium-ion battery fire characteristics can differ significantly from conventional fires, which can make them more difficult to control and increase repair costs. Once ignited, battery fires are extremely difficult to extinguish and can re-ignite after initial suppression.^{309,310,311} These suppression difficulties arise from the chemical composition of the batteries. Lithium-ion batteries contain chemicals that act as oxidising agents which allows fires to burn self-sufficiently.³¹² As a result, firefighters are often forced to allow the batteries to burn to self-extinguishment.³¹³

Lithium-ion batteries can pose a heightened fire risk in e-mobility devices as they typically use higher-capacity battery packs than consumer electronics such as laptops or smartphones.³¹⁴ E-mobility devices commonly use multi-cell battery packs, meaning individual cells may fail and ignite independently.³¹⁵ Heat generated from an initial cell failure can trigger thermal runaway in adjacent cells, increasing the available fuel, and enlarging the overall hazard.^{316,317} Fire behaviour can vary depending on the location of the initial cell ignition.³¹⁸ Battery pack design also influences the speed and spread of fires following thermal runaway³¹⁹ which can complicate suppression effort.

Overcharging can occur for several reasons, including battery management system (BMS) failure, malfunctioning battery components, or the use of an incompatible charger.³²⁰ The state of charge (SOC) of a battery (i.e. 0%-100%) can also influence fire behaviour and severity. Carbon monoxide (CO) is a dominant toxic hazard in fire smoke and a major contributor to fire fatalities.³²¹ This is especially relevant for lithium-ion battery fires, as experimental studies have reported that higher SOC is associated with faster and greater CO release.³²² Higher SOC has also been linked in some tests to thermal runaway occurring at lower temperatures, resulting in more intense fires.^{323,324} One study reported that e-bike batteries were typically charged or swapped at an average SOC of approximately 49.2%.³²⁵

Experts recommend that lithium-ion powered devices are charged outdoors in dry, ventilated areas.³²⁶ In practice, this may not be feasible, particularly for users living in high density apartment complexes where space is limited.³²⁷

In New York there are over 65,000 app-based food couriers who predominantly live high density apartments.³²⁸ The increase in fires and related casualties has been linked to mobility devices and the growth of app-based food delivery services.³²⁹ In response, legislation introduced in 2023 requires mobility devices and their batteries to be independently certified³³⁰ to increase safety precautions.

Modern urban infrastructure was not originally designed to accommodate the risks associated with lithium-ion battery fires. As a result, some buildings have introduced restrictions on storing or charging electric devices in car parks or have implemented additional safety measures.³³¹ More broadly, knowledge and practice in fire protection have not kept pace with the rapid growth in lithium-ion battery use,³³² and existing building codes and fire protection systems may not be well suited to managing these emerging risks.³³³

When electric vehicles are stored inside an apartment, combustible materials from the lithium-ion battery packs can ignite nearby furnishings and increase the overall fire risk.³³⁴ Flashover may occur rapidly, reducing the time between smoke emerging and flames developing and limiting the effectiveness of warning and evacuation measures.³³⁵ This creates significant risk for occupants, even where occupants are alert, as lithium-ion battery fires can reach very high temperatures (i.e. over 800°C) within seconds.³³⁶

Australian Experience

Relevant lithium-ion battery fire data is not always readily accessible because information is often recorded only in unstructured internal documents, such as individual investigation notes, attendance reports, incident logs, or situation reports. These records are typically maintained as free-text fields, meaning the information must be manually identified and extracted. This limits many departments' ability to efficiently retrieve, analyse, and report on lithium-ion battery-related incidents.

For this section of the report, we have relied on the information provided by the South Australian Metropolitan Fire Services as outlined in Appendix A – Data Sources.

Figure 19: Quarterly Number of e-mobility Fires and Average Loss

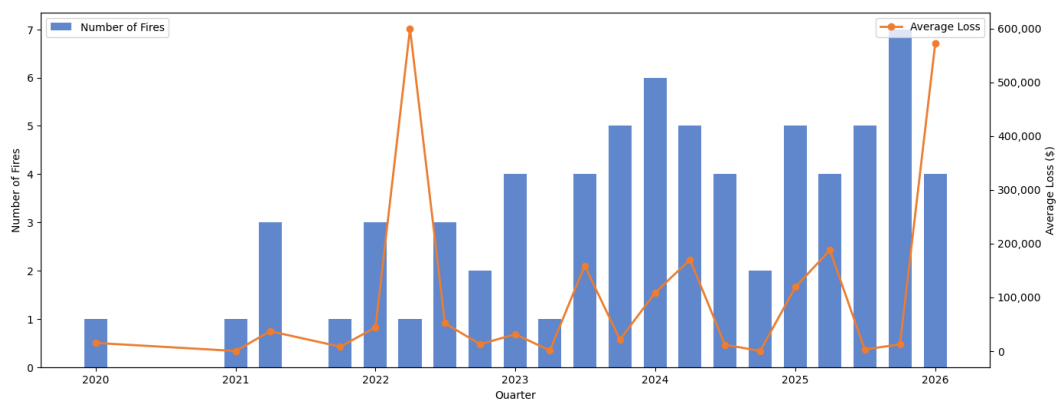
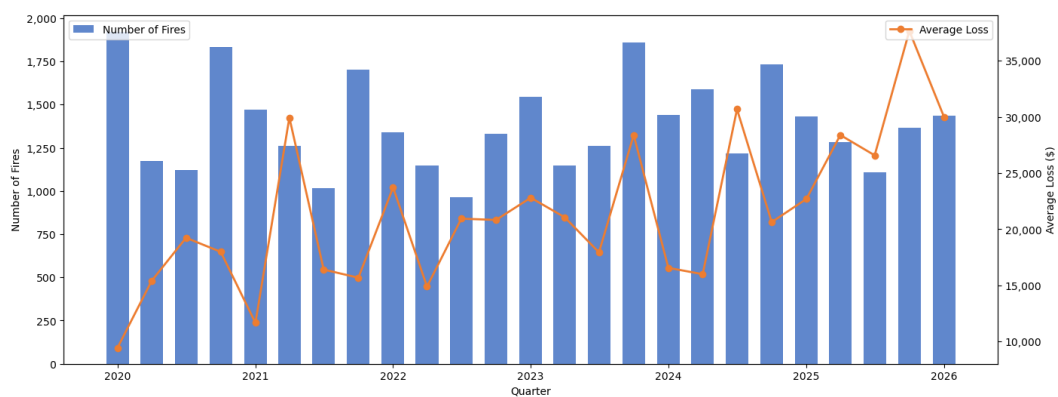


Figure 20: Quarterly Number of Fires and Average Loss

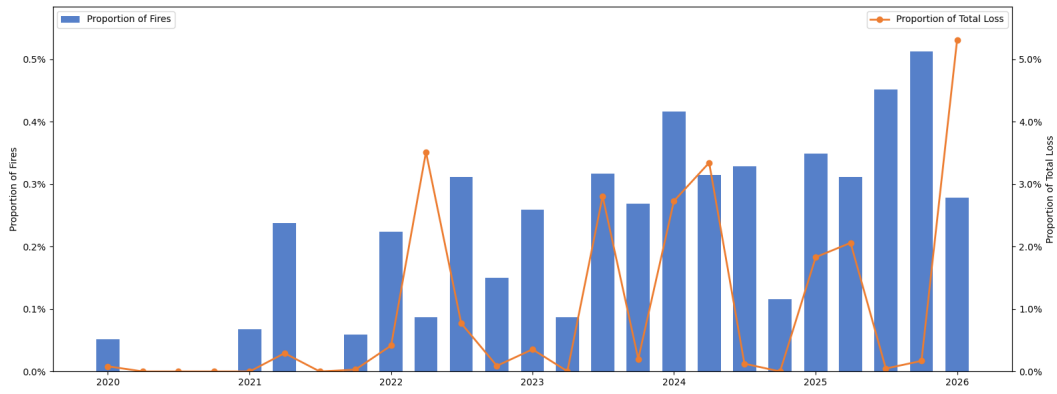


Since 2020, the number of fires involving e-mobility devices has increased, while overall fire incident volumes have remained relatively stable. However, e-mobility fires remain infrequent in absolute terms, with quarterly counts to date peaking at seven incidents.

To date, the average cost per e-mobility fire has been higher than the average cost per fire across all incidents. However, quarterly e-mobility costs are more volatile because incident volumes are low and a small number of high-value claims can materially influence quarterly averages.

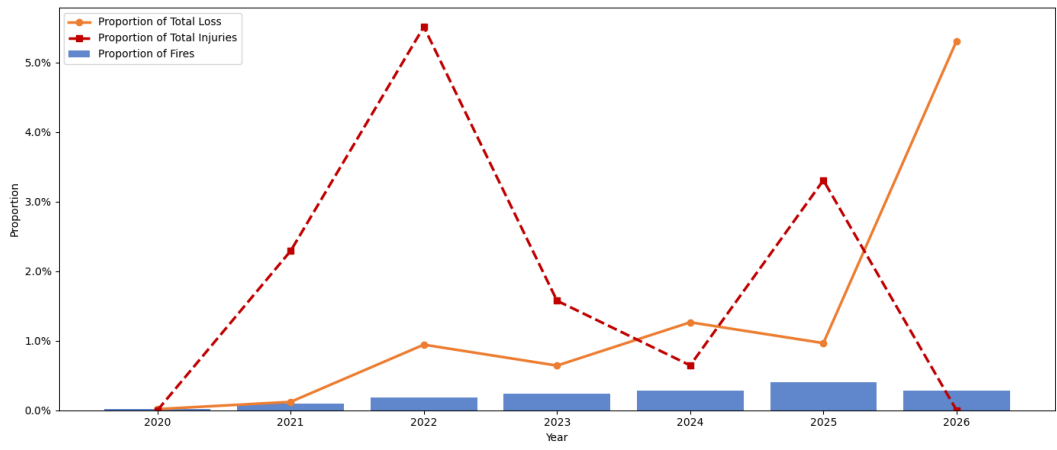
Across all fire incidents, average costs appear to have trended upward since 2020. This upward trend is less evident for e-mobility fires, reflecting the smaller sample size and the greater sensitivity of e-mobility cost metrics to high-cost outliers. All values are recorded at the time of investigation; accordingly, no discounting or adjustment for inflation has been applied.

Figure 21: Quarterly Proportion of e-mobility Fires and Loss



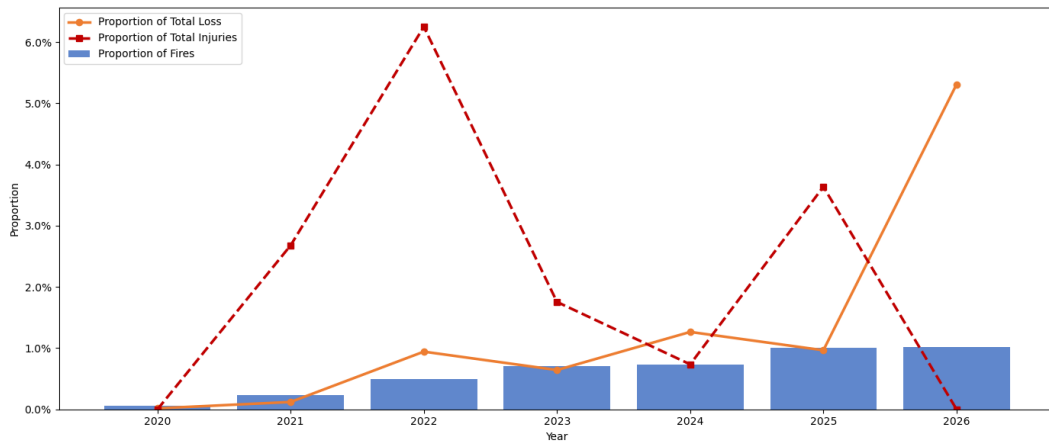
E-mobility fires account for a small proportion of total fire incidents, but they represent a disproportionately large share of estimated total losses. However, the relationship between incident share and loss share is not consistent over time. Quarterly movements in loss share do not reliably track changes in the proportion of incidents, reflecting volatility driven by low incident volumes and occasional high-cost events.

Figure 22: Yearly Proportion of Fires, Total Loss and Total Injury



Similarly, injuries associated with e-mobility fires represent a material share of the South Australian dataset. This proportion is generally higher than the corresponding incident and loss proportions, and the relationship between these measures is not consistent over time. Given that injuries are comparatively infrequent outcomes and can be driven by a small number of events, greater volatility and weaker alignment is not unexpected.

Figure 23: Yearly Proportion of Fires, Total Loss and Total Injuries



When analysis is limited to fires with non-zero damage estimates, the incident share and the share of total loss are broadly aligned. The main exception is the current year, where results are more volatile due to limited observations. However, the share of total injuries associated with these fires remains disproportionately high.

Figure 24: Equipment Involved in Ignition: Number of Fires and Average Loss

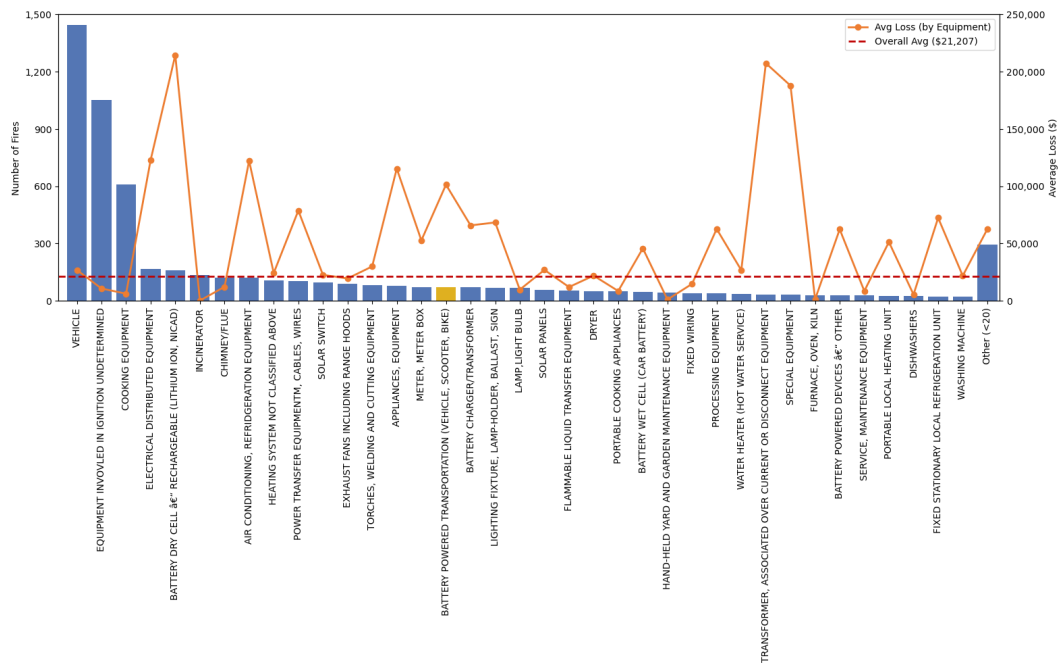


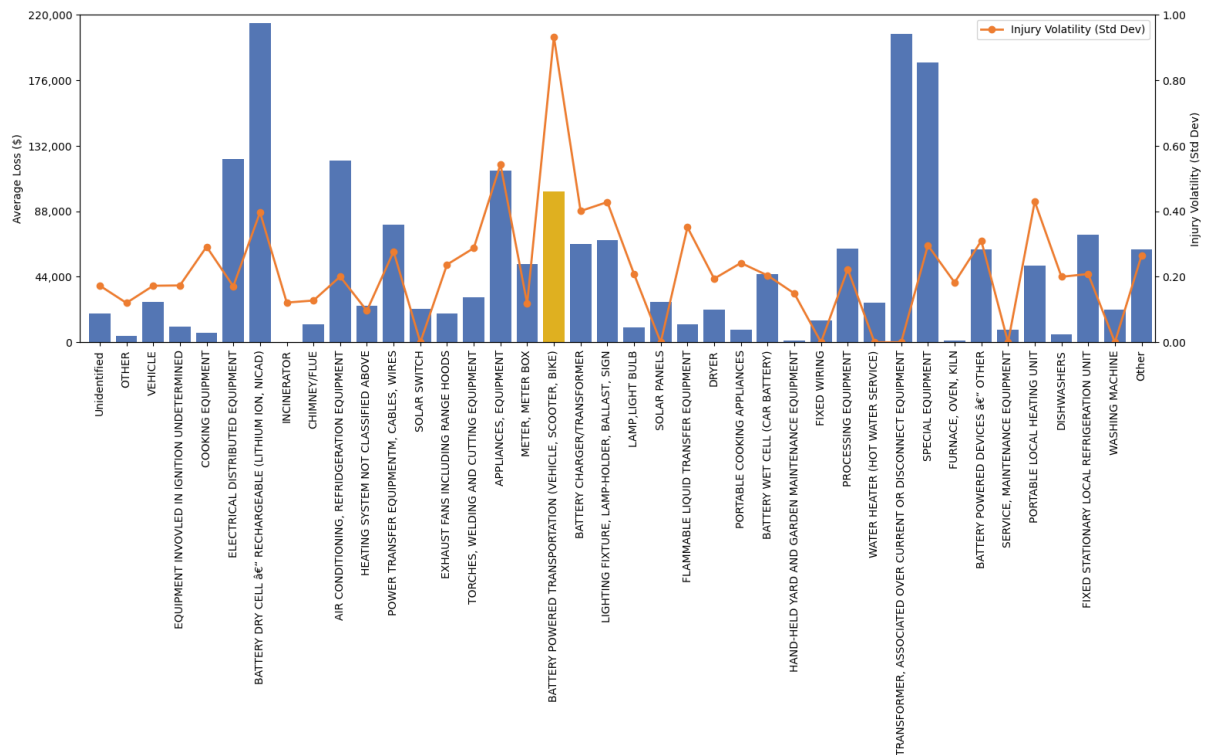
Figure 24 presents the number of fires and the average estimated loss by ignition type. Incidents where no equipment was identified as involved in ignition are excluded to improve interpretability. These excluded incidents largely comprise vegetation (e.g., grass or stubble, trees) and waste related fires and account for approximately 75% of total fires in South Australia.

The overall average fire cost of \$21,207 is calculated across all fires, including those with no equipment involved in ignition. Given the large volume of these incident types, their average estimated loss is broadly similar to the overall average. To reduce visual clutter, ignition

categories with fewer than 20 incidents have been aggregated into a single group labelled “Other (<20)”.

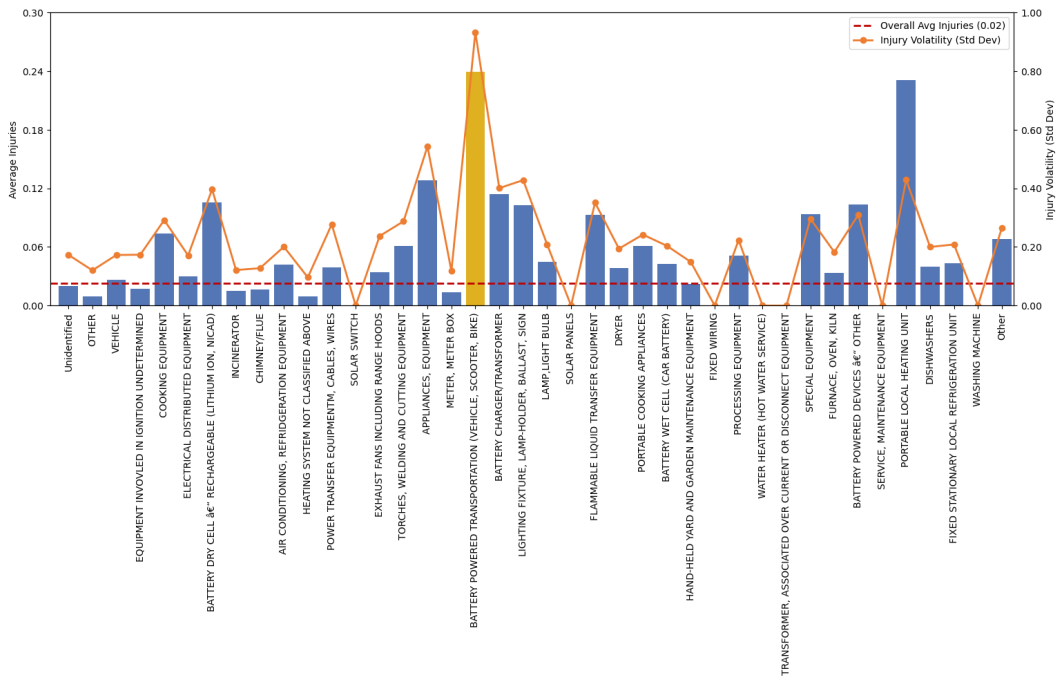
Comparing ignition types indicates that fires involving e-mobility devices are among the highest cost categories on average. Similarly, incidents involving small lithium-ion rechargeable batteries (commonly found in mobile phones and laptops) record the highest average estimated loss among the categories presented. These are typically smaller versions of the batteries used in e-mobility devices and are commonly indisposed of incorrectly which might contribute to this higher cost.

Figure 25: Equipment Involved in Ignition: Average Loss and Injury Volatility



When injury volatility is plotted against the average number of injuries across all ignition types (including undefined ignition sources), e-mobility fires demonstrate both a higher average injury count and greater variability than other ignition categories. This finding aligns with the operational challenges of suppressing lithium-ion battery fires and the potential for rapid fire development that reduces available warning and evacuation time (Section 7).

Figure 26: Equipment Involved in Ignition: Average Injuries and Injury Volatility



E-mobility fires are associated with a higher proportion of incidents involving injuries. However, interpretation is constrained by the small number of observed events, with injury proportions heavily influenced by a limited number of large incidents involving multiple injuries. While there are similarities between patterns in average loss and the average fire injuries across ignition sources, these relationships are less stable across sources with low case counts. As a result, observed differences should be interpreted cautiously, as they may reflect event-level volatility rather than systematic variation.

Figure 27: Proportion of Fires resulting in \$0 Loss by Equipment

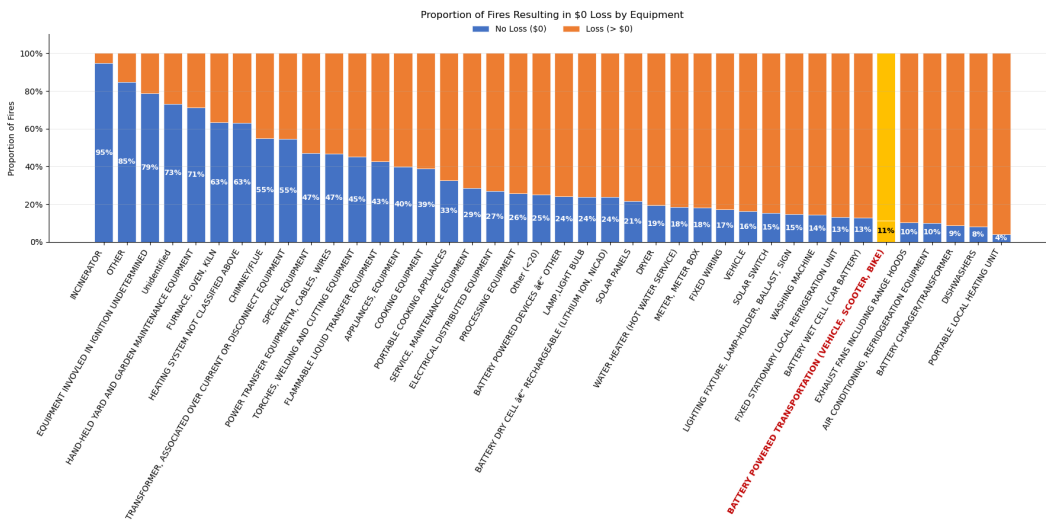


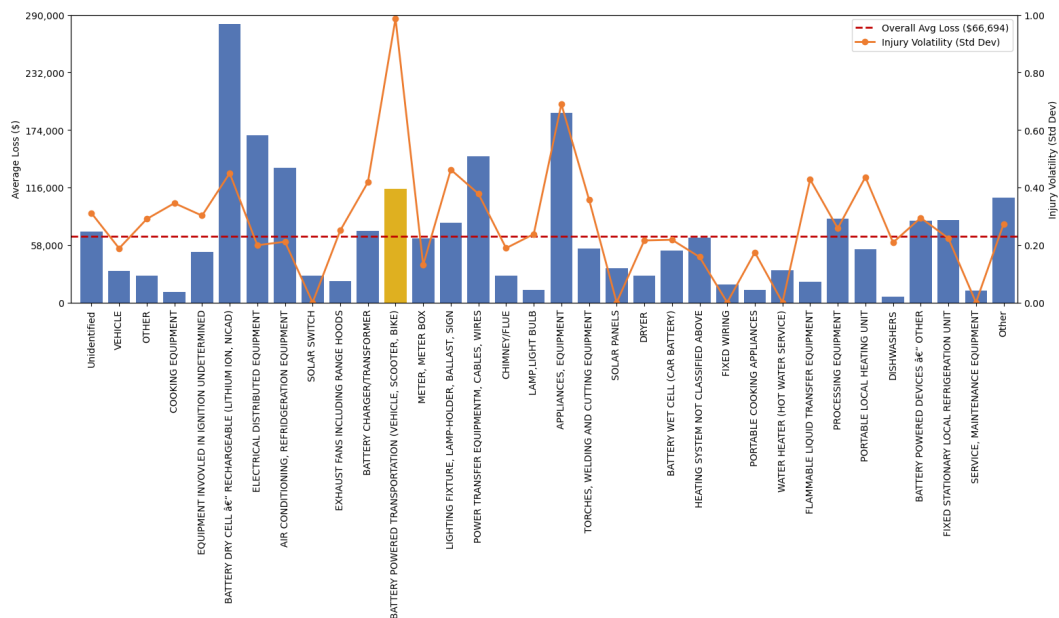
Figure 26 shows the proportion of incidents recorded with a \$0 estimated loss by ignition type. E-mobility devices have one of the lowest proportions of \$0-loss incidents, with only 11% recorded as incurring no cost (i.e., most e-mobility incidents have a non-zero estimated loss).

Incidents categorised as lithium-ion battery fires have a higher \$0-loss proportion (24%), which may reflect differences in typical device configuration and event circumstances, noting that e-mobility devices generally contain higher-capacity battery packs that may be more likely to result in measurable damage when ignition occurs.

Across most ignition types, most incidents are associated with a non-zero estimated loss, although average losses may remain low in absolute terms. Unidentified ignition sources account for approximately 75% of the South Australian dataset and have a high \$0-loss proportion (73%), indicating that many of these incidents are recorded with no estimated damage. This distribution is consistent with established fire severity patterns where a smaller number of high-severity events drive a substantial share of total losses.

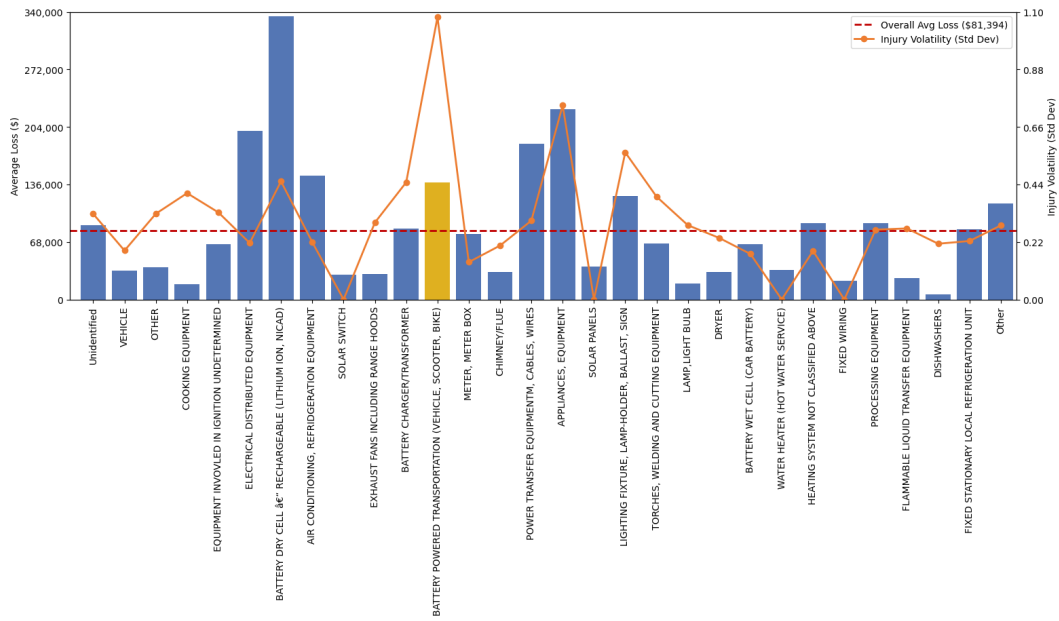
To better align the analysis with the types of claims an insurer is likely to observe, incidents with a \$0 estimated loss were excluded on the assumption that these events would not result in a claim. Under this assumption, the overall average estimated loss increases to \$66,694.

Figure 28: Cost of Fires resulting over \$0 Loss by Equipment



A further adjustment was then applied to approximate the effect of a policy excess. Incidents with an estimated loss of \$500 or less were excluded as an illustrative deductible (noting deductibles commonly vary between \$500 and \$2,500). Under this additional assumption, the overall average estimated loss increases to \$81,394, which is broadly consistent with industry benchmark levels.³³⁷

Figure 29: Cost of Fires resulting over \$500 Loss by Equipment



Using this assumption, an e-mobility fire could cost an insurer approximately \$138,000 per incident on average. Lithium-ion battery-related fires record the highest average cost in the dataset; however, this result is materially influenced by a single high-cost incident. Excluding this claim reduces the average cost for lithium-ion battery fires to a level broadly comparable with e-mobility fires (approximately \$142,000). While these estimates are lower than some published figures, this may reflect differences in methodology and volatility effects, including the treatment of catastrophe losses, noting that results are based on a comparatively small cohort and experience may vary.³³⁸

8. Concluding Remarks

The rise of e-bikes and e-scooters has had a substantial impact on Australian society. While these devices offer convenience and mobility benefits, they also present significant risks to both riders and pedestrians.

Injury characteristics and severity among Australian e-bike and e-scooter riders presenting to emergency departments are broadly consistent with international findings. However, it is likely that many injuries remain unreported. While e-bikes and e-scooters have much in common, they have markedly different usage patterns and injury profiles, leading to differing insurance claim characteristics.

The lithium-ion batteries used in e-mobility devices also pose a considerable fire risk. Fires involving these batteries are extremely difficult to extinguish due to their chemical composition. The importation of low-quality batteries has further exacerbated risks to both personal safety and property.

The insurance landscape for e-bikes and e-scooters is highly complex. At present, there are limited insurance options that adequately respond to injuries involving these devices. Insurance coverage is typically available to large group policies via shared scheme operators or bicycle clubs. Individual riders may have some coverage through their Home and Contents insurance policies, but the coverage is often limited. As a result, injured riders may have little or no recourse for reimbursement of medical and recovery costs. While injured pedestrians may pursue personal liability claims against riders, such claims do not provide immediate financial support for early recovery.

There is an insurance gap and the need for appropriate insurance solutions is therefore urgent. Legislative changes may create pathways for these injuries to be incorporated into existing or new insurance schemes; however, without careful planning and preparation, there are significant risks.

There are clear opportunities for insurers to better address the risks associated with e-bikes and e-scooters. These include providing more comprehensive and tailored coverage, increasing transparency and certainty for users, offering a broader range of insurance products, and delivering improved support for injured riders and pedestrians. Achieving these outcomes will require significant improvements in underlying data, including:

- reliable and detailed exposure data (e.g., distance travelled, trip frequency, travel routes, time travelled)
- consistent data collection across jurisdictions
- standardised recording processes of injuries (e.g., minimising reliance on free-text entries)
- detailed information on injury characteristics and severity
- data relating to user behaviour

In summary, improved data quality and data storage are essential to enable insurers to accurately assess risk and confidently enter this market. These data initiatives can also support governments in developing more effective safety regulations, licensing frameworks, and insurance requirements, and in considering the feasibility or establishment of any government-backed insurance schemes.

9. Acknowledgments

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Appendix A - Data Sources

Queensland Injury Surveillance Unit

The Queensland Injury Surveillance Unit (QISU) collects injury data from emergency departments (ED) at participating hospitals across Queensland. The data is estimated to represent roughly one quarter to one fifth of all ED injury presentations in the state depending on the age group and injury type studied. The QISU database contains injury data collected since 1999. Not all hospitals have participated in data collection during this period. The list of hospitals for which data is collected is listed in Appendix A. Data is coded for Injury Surveillance by using the National Data Standards for Injury Surveillance (NDSIS v.2c).

QISU data is collected at the point of triage; when the triage nurse ticks yes to an injury this triggers an injury module to open for completion by the triage nurses. The injury module fields are not mandatory, allowing the triage nurses to skip part of or all the injury fields depending on clinical flow priorities. Consequently, the data may have missing codes in the injury data fields. QISU coders can supplement coded fields based on information in the injury description field (triage text in EDIS and the Injury Surveillance field in FirstNet).

Each record is validated and coded in accordance with the National Data Standards – Injury Surveillance (NDS-IS) (National Injury Surveillance Unit 1998). This process lags several months behind data intake. In some situations, machine validation can be used to include more recent data.

The QISU provided data for the period from 1 January 2021 to 31 December 2024. Each record represents the first presentation for treatment of injuries arising from an incident. If a patient was to subsequently return, they would not be included in the dataset.

The “Injury Description” consists of a brief free text field entered by the Triage Nurse when a person initially presents to the ED with an injury. This free text is examined to elicit additional non coded information in relation to the injury event. This analysis is limited by the fact that the entry in this field can vary depending upon triaging style and clinical circumstances at the time when the nurse is attending to the injured person.

Each case was manually reviewed to ensure that only relevant cases were included. The reviewer checked the following categories for relevance; product type, mechanism of injury, and excluded cases based on product involvement/injury circumstances.

However, it should be recognised that the triage nurse is reliant on the patient’s or second-hand bystander descriptions to complete the narrative.

The QISU provided this “QISU Report for 1880 Evaluation of PMD Regulations_DeID.pdf” which going forwards will be referred to as “QISU Data” or “QLD Injury Data”.

Victorian Injury Surveillance Unit

The Victorian Injury Surveillance Unit (VISU) is situated within the Monash University Accident Research Centre (MUARC) and is funded by the Department of Health (DH) Victoria. The main aim of the VISU is to reduce the number and severity of injuries in the community. This involves a program of ongoing injury surveillance through identifying hazards, disseminating data and information, supporting research and monitoring trends.

The Victorian Emergency Minimum Dataset (VEMD) contains de-identified demographic, administrative and clinical data detailing presentations at Victorian public hospitals with 24-hour Emergency Departments. Currently there is 100% statewide coverage of these hospitals applying from 2004 with forty-one hospitals contributing data to the VEMD collection. The data is collected in accordance with National Minimum Data Standards for injury surveillance. While data is not coded using the ICD-10-AM system, the code set is similar and comparable.

The DH supplies VISU with a de-identified subset of injury ED presentations annually. Variables provided in standard output include: age, sex, injury cause, location, activity, nature of main injury, body region, human intent and departure status. Other collected variables include procedure information, country of birth, local government area of residence and a 250-character text description of the injury event.

The “Injury Description” consists of a brief free text field entered by the Triage Nurse when a person initially presents to the ED with an injury. This free text is examined to elicit additional non coded information in relation to the injury event. This analysis is limited by the fact that the entry in this field can vary depending upon triaging style and clinical circumstances at the time when the nurse is attending to the injured person.

Each case was manually reviewed to ensure that only relevant cases were included. The reviewer checked the following categories for relevance; product type, mechanism of injury, and excluded cases based on product involvement/injury circumstances.

However, it should be recognised that the triage nurse is reliant on the patient’s or second-hand bystander descriptions to complete the narrative.

VEMD data for the period July 2019 - June 2024 was analysed for this report with each record representing the first presentation for treatment of injuries arising from an incident.

The VISU provided this “ebike & scooter injuries 2019_2024.xlsx” which going forwards will be referred to as “VISU Data” or “VIC Injury Data”.

South Australian Metropolitan Fire Services

The South Australian Metropolitan Fire Services (SA MFS) operates 37 fire stations across the state and is responsible for protecting the community from the effects of fires, road crashes, hazardous materials, and other emergencies.

The data utilised by the SA MFS is collected in a multi-stage process involving dispatch records and post-incident reporting by fire crews utilising the national Australian Incident Reporting System (AIRS) framework. AIRS is a mechanism for fire services to collect data as to the incidence of fire and is used to identify trends in fires and incidents.

For small fires, their lack of total damage means they are not reported to fire services, hence the AIRS system would not contain data for these events.

It should also be noted that the estimated dollar loss is based on an estimation of the fire-fighter producing the report and thus there remains a large amount of variability in the result. In situations where a more formal process is followed the AIRS system is not updated with insurance information or investigation logs.

The data only contains information for lithium-ion batteries where they are the primary source of the fire. For example, if a kitchen fire ignites an electric vehicle which causes the fire to expand this would not be captured in the data.

For the purposes of this report the SA MFS has provided data regarding fires from 01/01/2020 – 05/03/2026.

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