KKH CHILD INJURY SURVEILLANCE REPORT 2022

**"We cannot accept these injuries as just accidents that will happen.
If a disease were killing our children at the rate that unintentional injuries are,
the public would be unbelievably outraged and demand that this killer be stopped."**

– C. Everett Koop, former United States Surgeon General, 2001

Child injuries are a worldwide public health issue. The World Health Organization (WHO) report (2008) on child injury prevention[1] found that 830,000 children below 18 years die each year from unintentional injuries, which are the leading cause of death for children above nine years. Published data from the 2008 WHO report shows that the majority of unintentional fatal injuries in children aged below 18 years worldwide are caused by road traffic injuries, drowning, and fire-related burns.

In addition to fatal injuries, globally, tens of millions of children require hospital care every year for non-fatal injuries, resulting in injury-related, long-term disabilities which are costly to the healthcare system and have significant impact on patients' entire families. The Global Childhood Unintentional Injury Study[2] in five countries showed that almost half the children under the age of 12 who had suffered an unintentional injury severe enough to require emergency room treatment were left with some form of disability after discharge.

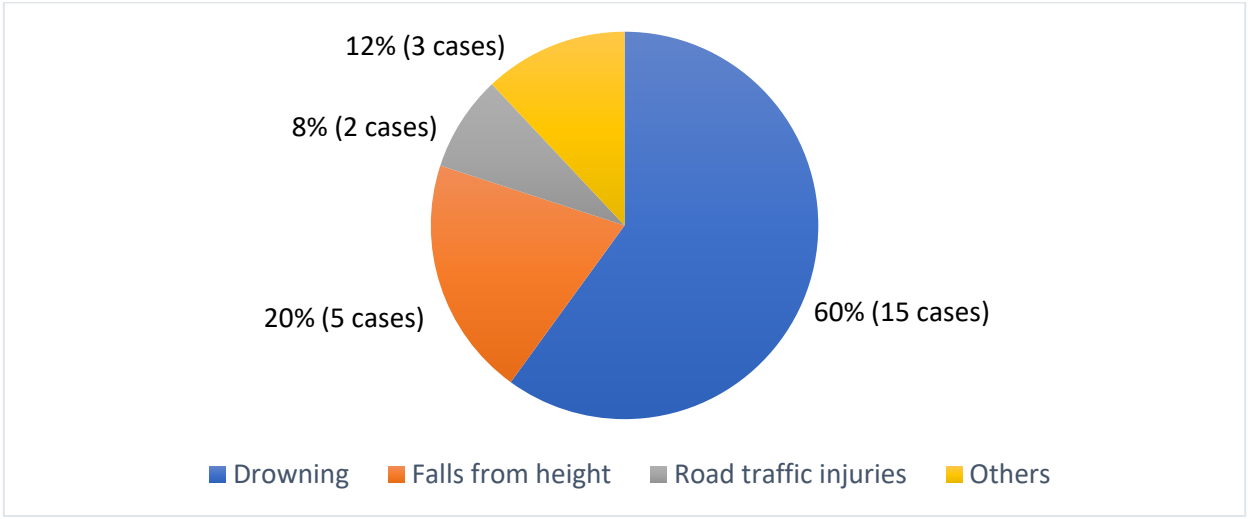
In Singapore, the 1990 to 2017 Burden of Disease study showed that injuries caused 10.7 per cent of total disability-adjusted life years (DALYs) in 2017, with the percentage of total DALYs due to injuries increasing throughout childhood to peak in young adults[3].

TOP CAUSES OF CHILD INJURY MORTALITY IN SINGAPORE

Data from KK Women's and Children's Hospital (KKH) showed that from 2012 to 2020, the top three causes of child injury deaths in children aged 16 years and below (Figure 1) were due to:

1. Drowning (15 cases, 60%)
2. Falls from height (5 cases, 20%)
3. Road traffic injuries (2 cases, 8%)

Figure 1. Child injury deaths by cause for children zero to 16 years (2012-2020)



DROWNING

- From 2012 to 2020, there were a total of **293 child drowning cases.**
  - **15 (5%) child drowning cases resulted in death.** Of the surviving patients, **2 (<1%) sustained hypoxic-ischemic encephalopathy (HIE).**
  - **61 (21%) child drowning cases required high acuity care,** of whom 32 (11%) required intensive care and 29 (10%) required high dependency care.

- The **incidence of drowning cases increased annually** from 2012 to 2017, from 23 in 2012 to 48 in 2017 (Figure 2a).

- 252 (86%) were children aged **7 years and below** (Figure 2b).

- **252 (86%) drowning cases occurred in swimming pools** (Figure 2c). This is an increase from previous published figures of 52%[4].
  - Of the children who drowned in private pools, 60% were discovered by their family members and 3% were discovered by lifeguards. 37% received bystander CPR.
  - Of the children who drowned in public pools, 50% were discovered by their family members and 35% were discovered by lifeguards. 40% received bystander CPR.

Water safety tips for parents and caregivers:

- Actively supervise children in and around water during play.
- Avoid distractions such as reading or talking on the phone while supervising your children.
- Drain the tub immediately after bath time is over.
- Keep toilet lids and bathroom doors closed to prevent drowning.

Figure 2a. Yearly incidence of child drowning (2012-2020)

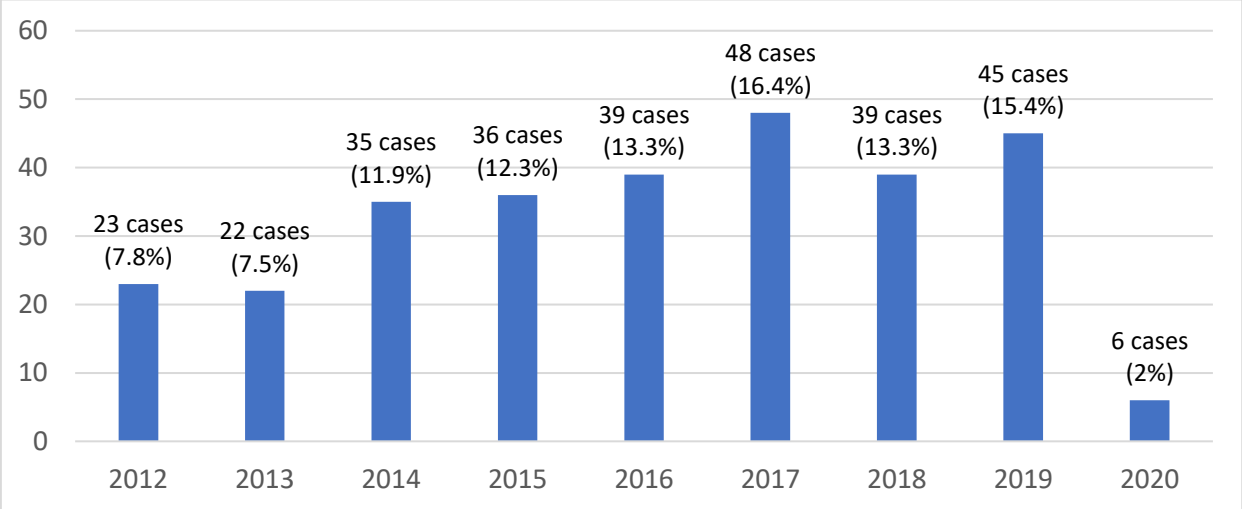


Figure 2b. Age distribution of child drowning cases (2012-2020)

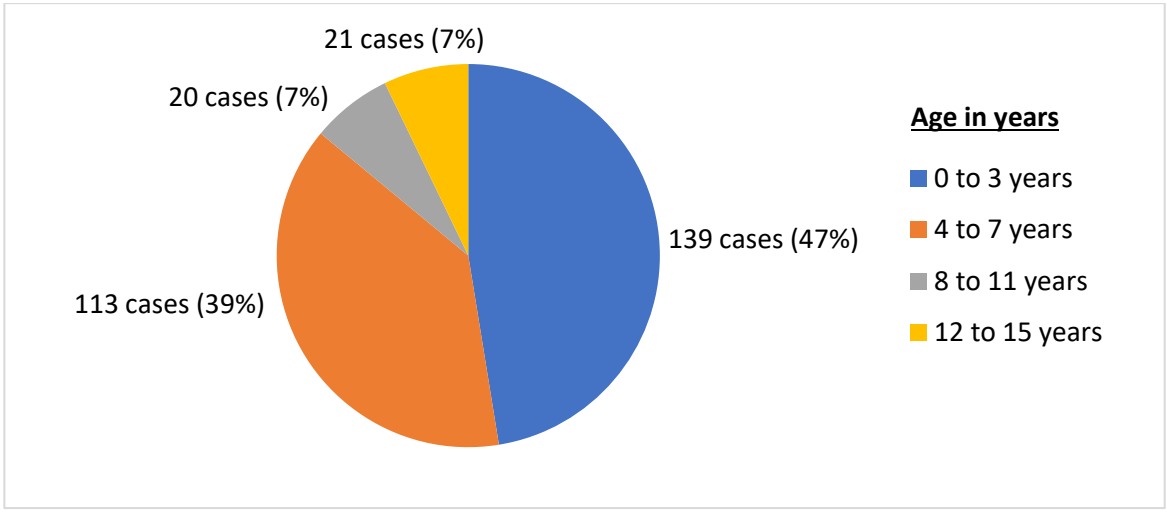
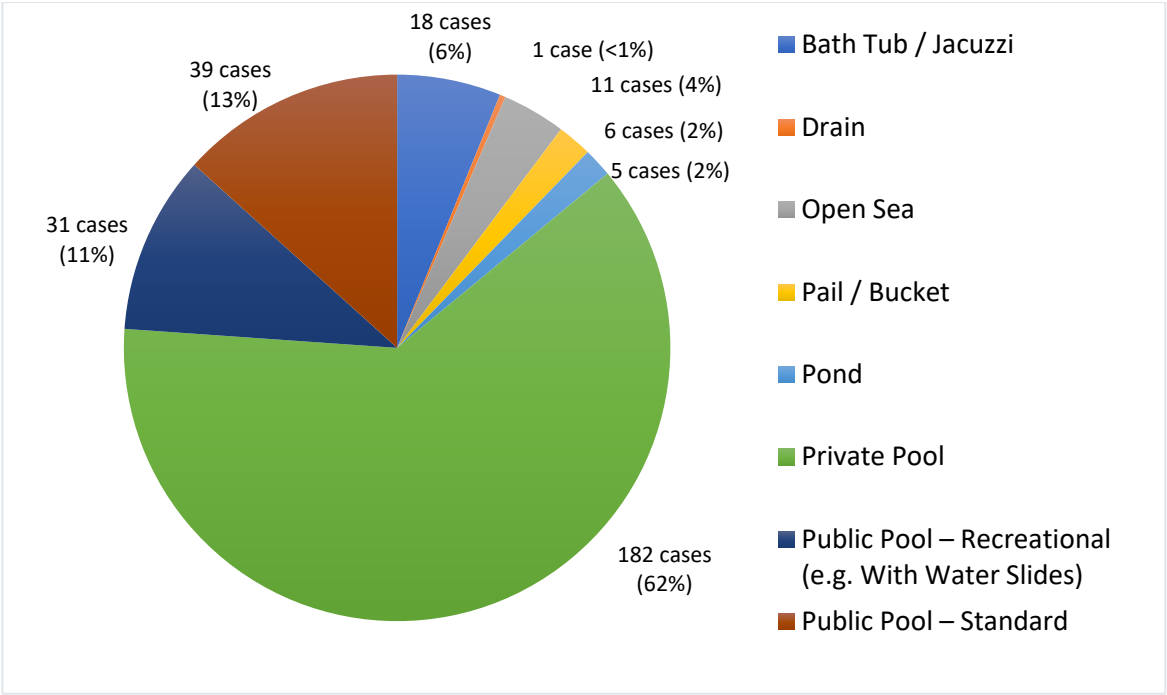


Figure 2c. Water body in which drowning occurred (2012-2020)



Notes:

i. Public Pool Standard refers to public pools without water slides or wave pool(s).

ii. Public Pool Recreational refers to public pools with water slides or wave pool(s).

iii. Private Pools refer to pools located in private housing estates and hotels.

FALLS FROM HEIGHT

- From 2012 to 2020, there were a total of **100 cases of child falls from height** (defined as falls from >1 storey or >3 metres) (Figure 3a).
    - **5% (5) of falls from height resulted in death.**
    - **33% (33) of children who fell from height required high acuity care**, of whom 22% (22) required intensive care and 11% (11) required high dependency care.

- **36% (36) of those who fell from heights were teens aged 12 to 16 years** (Figure 3b).
- **52% (52) of falls took place at home,** 16% (16) in public places, 14% (14) at school (Figure 3c).
- Of the falls which occurred from buildings, 35 (49%) were from windows (Figure 3d), of which 31 (89%) occurred at home.
- There were also a few separate reports of injuries sustained due to parkour, which had caused the child to fall from height.

Fall prevention tips for parents and caregivers:

- Install proper window grilles and safety gates.
- Ensure that gates and grilles are locked at all times.
- Keep babies and young kids strapped in when using highchairs, swings and strollers.

Figure 3a. Yearly incidence of child falls from height (2012-2020)

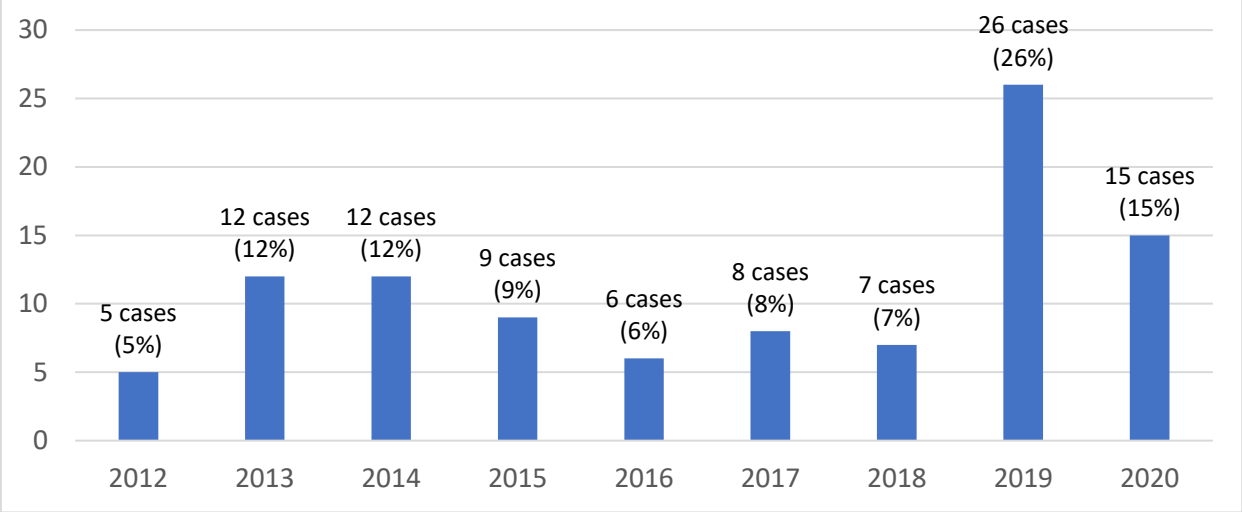


Figure 3b. Age distribution of child falls from height (2012-2020)

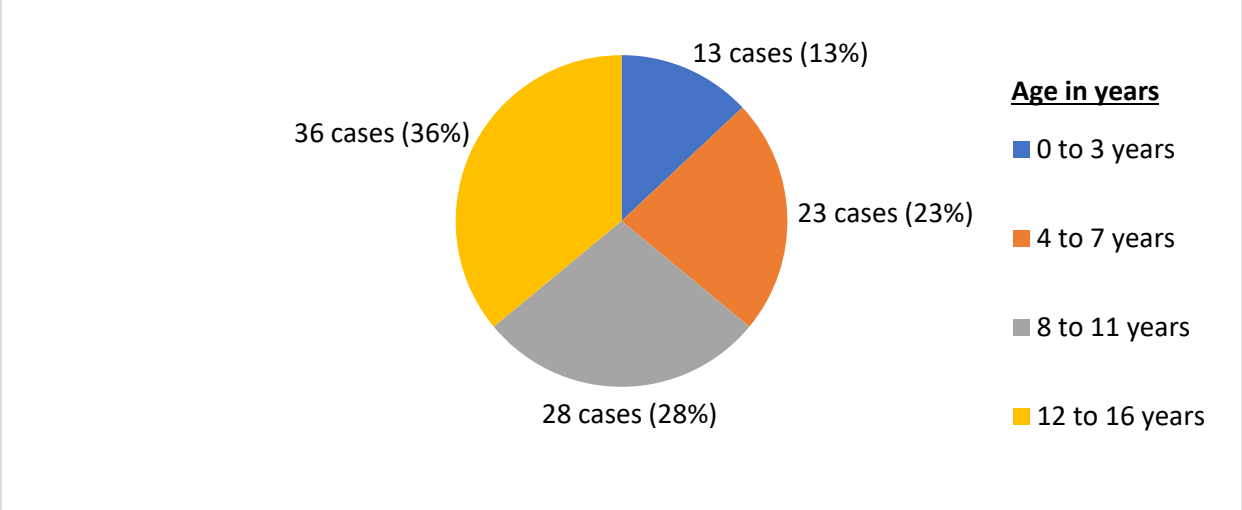


Figure 3c. Locations of child falls from height (2012-2020)

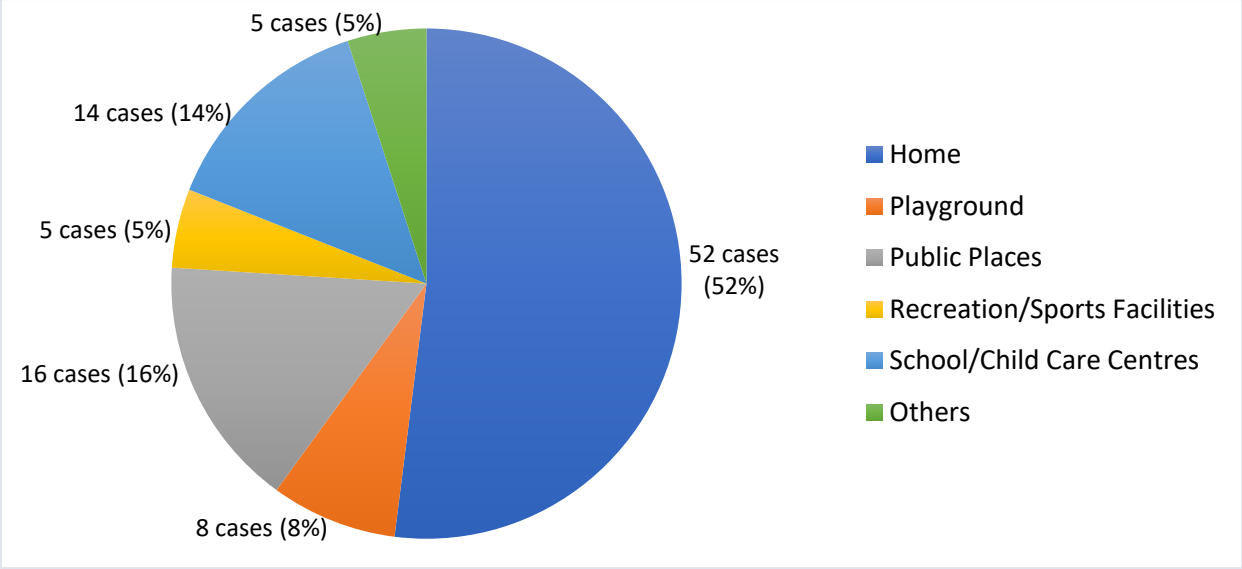
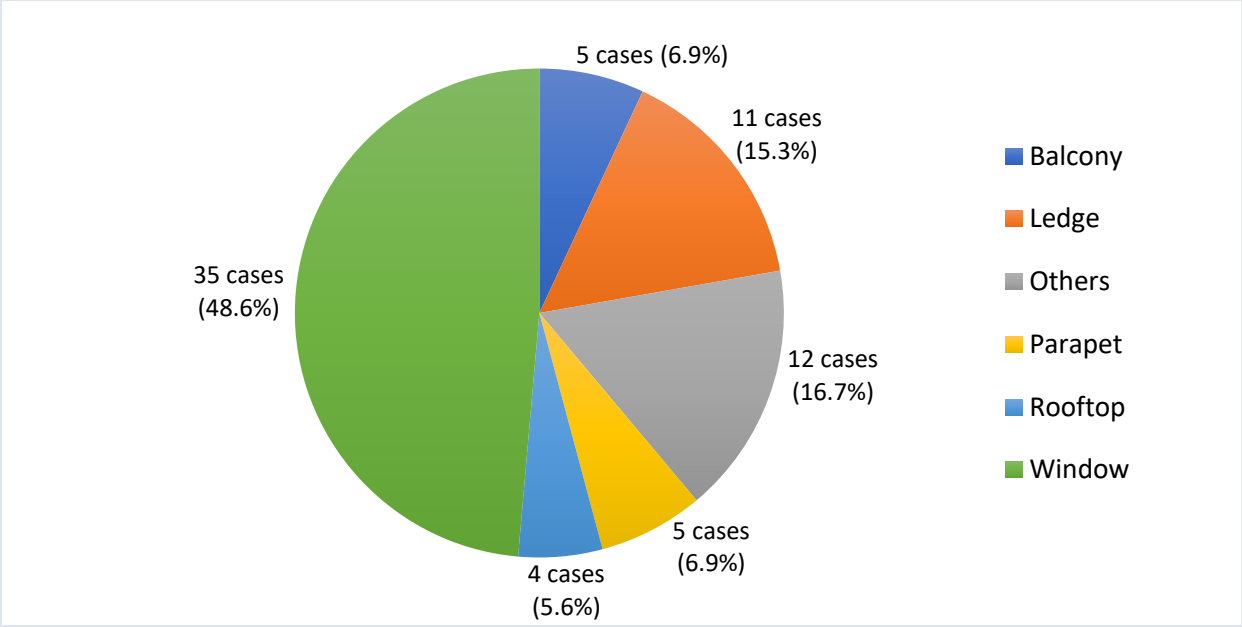


Figure 3d. Site of child falls from height within buildings (2012-2020)



ROAD TRAFFIC INJURIES

- From 2012 to 2020, there were a total of **3,562 cases of child road traffic injuries** (Figure 4a).
    - **There were 2 cases (<1%) which resulted in death.**
    - **1,165 (33%) required hospital admission,** of which 136 (3.8%) required high acuity care, 55 (1.5%) required intensive care and 81 (2.3%) required high dependency care.
    - **Between 2016 and 2020, about half of child passengers aged up to 16 years old were unrestrained at the time of road traffic injuries involving motor vehicles.** For children who were transported in taxis, about three quarters were unrestrained.

- **Children of all age groups were equally affected** (Figure 4b).

- **2,119 (60%) were motor vehicle passengers**, followed by pedestrians (902 cases, 25%) and cyclists / cyclist pillions (421 cases, 12%) (Figure 4c).

- Combined data from KKH and National University Hospital (January 2012 to April 2016) showed that **half (51%) of all children and adolescents with road traffic injuries were not in a child car restraint; two thirds (65%) of infants (<1 year old) were not restrained at the time of incident**[5] (Figure 4d).

- A qualitative study by KKH showed that parents cited **knowledge deficits, doubt of importance / effectiveness and inadequate installation skills** as barriers to the use of **child car restraints**, despite this being mandated by Singapore law[6].

Car safety tips for parents and caregivers:

- Use an age-appropriate booster or child car seat.
- Install child car seat properly.
- Ensure seatbelt is fastened every time.
- Never leave your child alone in a vehicle.

Figure 4a. Yearly incidence of child road traffic injury cases (2012-2020)

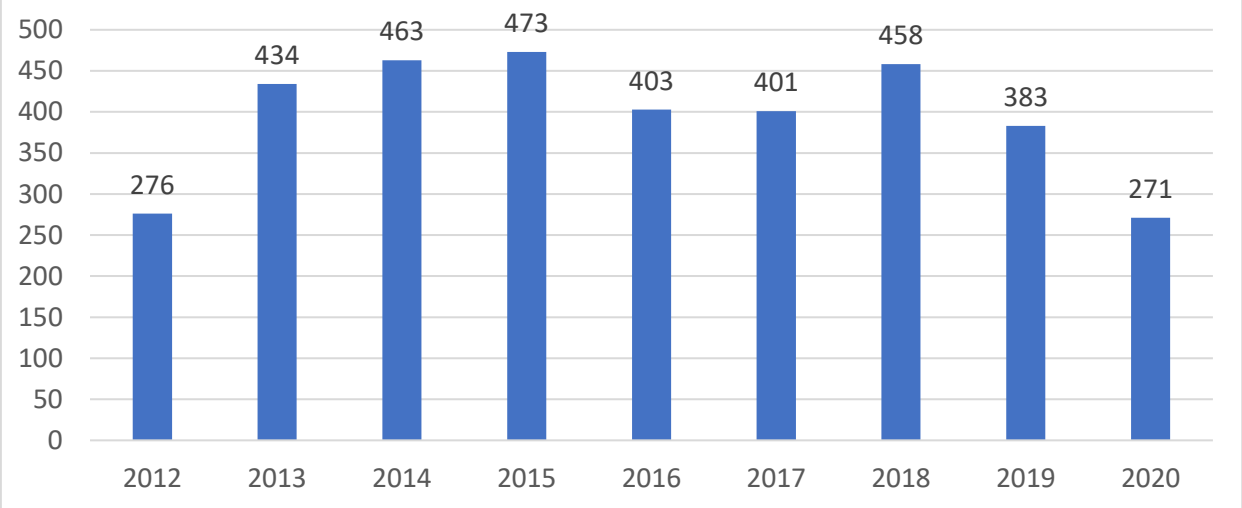


Figure 4b. Age distribution of child road traffic injuries (2012-2020)

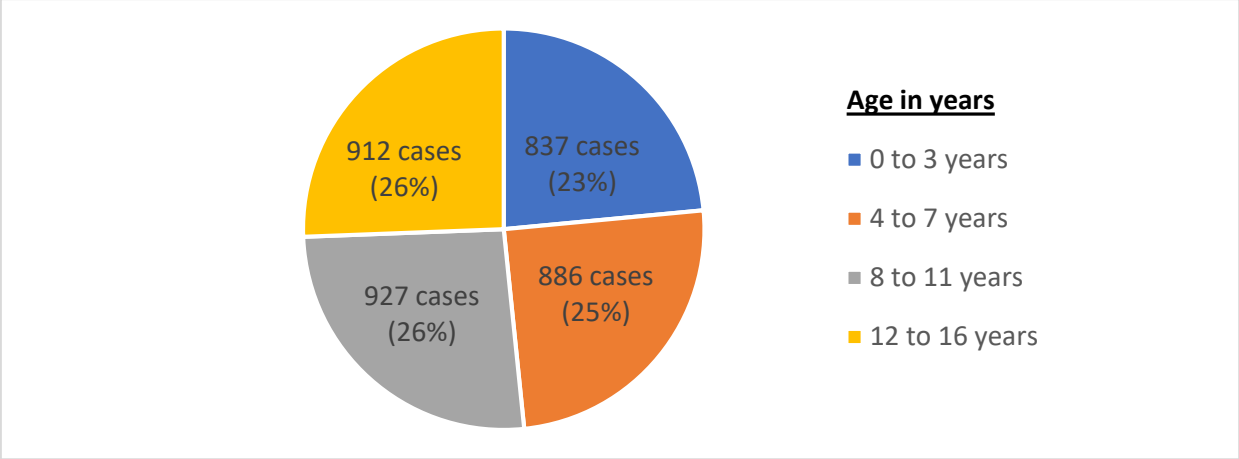


Figure 4c. Type of child road user injured in road traffic collision (2012-2020)

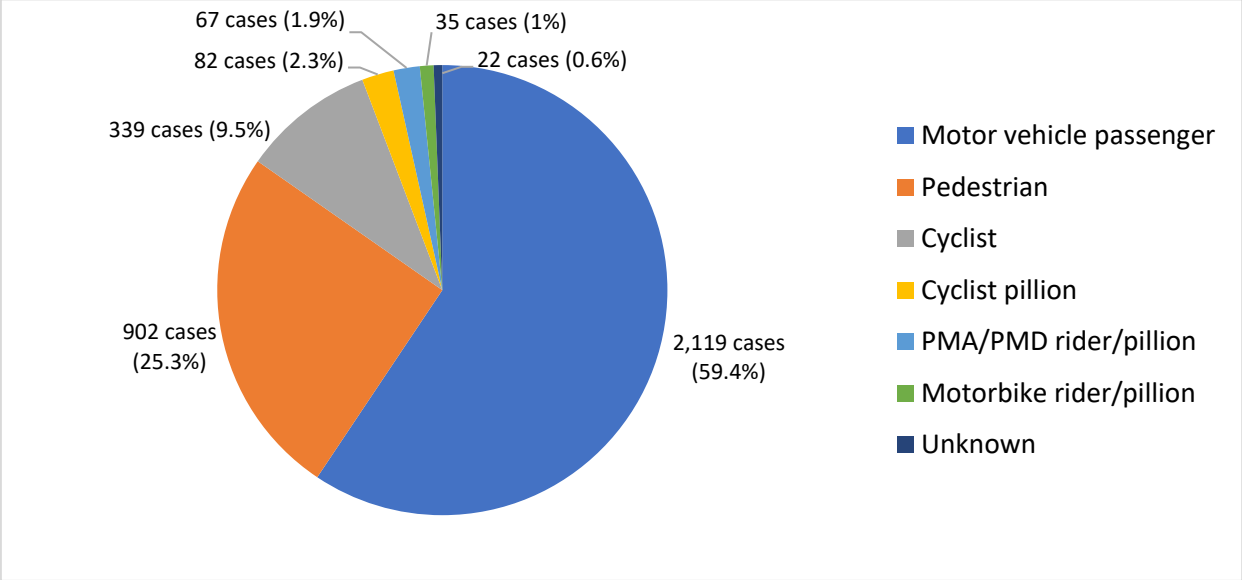


Figure 4d. Children and adolescents injured in road traffic collisions correlated with use of restraints[5]

Injured Person Type and Restraint Use by Age.

	<1year n (%)	1–<2years n (%)	2–<6years n (%)	6–<10 years n (%)	10 years and older n (%)	All patients n (%)
Total N	142	124	576	619	1007	2468
Injured Person Type, n (%)						
Motor Vehicle	140 (9.4)	109 (7.3)	407 (27.4)	401 (27.0)	426 (28.7)	1483 (100)
Front Passenger	19 (6.4)	13 (4.4)	89 (30.1)	75 (25.3)	100 (33.8)	296 (100)
Back Passenger	121 (10.2)	96 (8.1)	318 (26.8)	326 (27.5)	326 (27.5)	1187 (100)
Pedestrian	1 (0.2)	13 (2.0)	110 (17.3)	153 (24.1)	358 (56.4)	635 (100)
Bicyclist	1 (0.3)	2 (0.7)	59 (19.5)	57 (18.9)	183 (60.6)	302 (100)
Rider	–	–	45 (17.4)	45 (17.4)	169 (65.3)	259 (100)
Pillion	1 (2.3)	2 (4.7)	14 (32.6)	12 (27.9)	14 (32.6)	43 (100)
Motorcyclist	–	–	–	8 (16.7)	40 (83.3)	48 (100)
Rider	–	–	–	–	8 (100)	8 (100)
Pillion	–	–	–	8 (20.5)	31 (79.5)	39 (100)
Unknown					1 (100)	1 (100)
No Restraint used among Motor Vehicle Passengers, n/N (%)	92/140 (65.7)	67/109 (61.5)	200/407 (49.1)	193/401 (48.1)	206/426 (48.4)	758/1483 (51.1)
No Restraint used among Bicycle and Motorcycle Users, n/N (%)	1/1 (100)	1/2 (50.0)	34/59 (91.5)	49/63 (77.8)	140/225 (62.2)	224/350 (64.0)

CHILD INJURIES ARE PREVENTABLE

Child injuries are highly preventable. The WHO report on child injury prevention[1] highlights the preventability of unintentional child injuries and the effectiveness of intervention strategies, using a combination of broad approaches to reduce the child injury burden:

- Legislation and enforcement (e.g. mandating the use of child car restraints)
- Product modification (e.g. child-resistant closures)
- Environmental modification (e.g. transport infrastructure around schools)
- Supportive home visits (e.g. home visits by paediatric nurses to high risk families)
- Safety devices (e.g. bicycle helmets)
- Education, skills and behaviour change (not in isolation; underpins other strategies e.g. legislation)
- Emergency (pre-hospital and hospital) medical care (e.g. standardising equipment)

This is important because primary injury prevention costs much less than treating a child for a preventable injury. KKH published data from 2011 to 2017 showed a median cost of SGD$8,361 for inpatient neuro-rehabilitation of moderate to severe traumatic brain injury, with 53% of these patients involved in motor vehicle accidents and 35% having suffered falls.[7] Figure 5 combines data from the 2008 WHO World Report[1] and the 2014 United States Children's Safety Network cost-outcome analysis for injury prevention programmes[8] and provides an overview of cost-effective strategies that would reduce unintentional injuries and save lives.

Figure 5. Financial savings from injury prevention interventions[1,8]

Expenditure of US$1 on	Savings (US$) in direct and indirect healthcare costs
Child car restraints	29-71
Bicycle helmets	29-48
Injury prevention counselling by paediatricians	10
Poison control services	7
Road safety improvements	3

A SAFER SINGAPORE FOR FUTURE GENERATIONS

Injury prevention in children is consistent with Singapore's emphasis on moving *beyond healthcare to health*. The KKH Injury Prevention Working Group envisions "***A safer Singapore for our future generations***" and our mission is to advance childhood injury prevention through the 5 Es: Evaluation (surveillance and research), Education, Empowerment, Environmental changes and Enforcement.

To do this, the KKH Injury Prevention Working Group is working closely with the National Trauma Committee[1] and other stakeholders, to co-develop and provide expert inputs to initiatives to reduce the incidence of preventable injuries in the paediatric population.

[1] Since 2007, the National Trauma Committee was appointed as an advisory committee to the Ministry of Health in the development and review of policies related to Singapore's trauma system, encompassing pre-hospital care, acute care, trauma rehabilitation and injury prevention.

Injury Prevention Resources

General child safety:

- **KKH child safety video:** https://www.youtube.com/watch?v=NIARvZ5Tkh8
- **Home safety brochure for polyclinics:** https://polyclinic.singhealth.com.sg/Documents/HomeSafety.pdf
- **Online resources on KKH hospital website:**
  - **Childhood Injuries**: https://www.kkh.com.sg/patient-care/conditions-treatments/childhood-injuries
  - **Childproof your home**: https://www.kkh.com.sg/patient-care/conditions-treatments/childproof-your-home

Water safety:

- https://www.kkh.com.sg/patient-care/conditions-treatments/submersion-injuries

Road safety:

- **Infographic on age-appropriate child car seats:** https://www.kkh.com.sg/patient-care/conditions-treatments/buckle-up-safely/overview
- **Three steps to car seat safety for baby's first year:** https://www.kkh.com.sg/patient-care/conditions-treatments/car-seat-safety-for-babys-first-year/overview

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