



A 10 YEAR ANALYSIS OF DROWNING IN AQUATIC FACILITIES

Exploring Risk at Communal,
Public and Commercial
Swimming Pools



ROYAL LIFE SAVING
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Royal Life Saving is a public benevolent institution (PBI) dedicated to reducing drowning and turning everyday people into everyday community lifesavers. We achieve this through: advocacy, education, training, health promotion, aquatic risk management, community development, research, sport, leadership and participation and international networks.

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78 PEOPLE DROWNED IN COMMUNAL, AND PUBLIC AND COMMERCIAL SWIMMING POOLS IN AUSTRALIA BETWEEN 1 JULY 2005 AND 30 JUNE 2015

COMMUNAL SWIMMING POOLS

(POOLS LOCATED IN 'RESIDENTIAL CLASS 3 BUILDINGS')

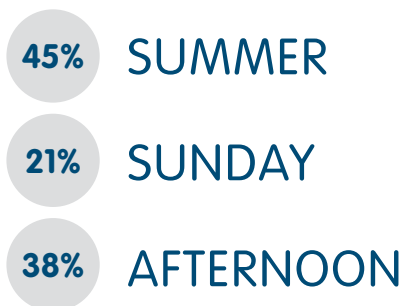
Examples include: hotel and motel pools, caravan park pools, apartment complex pools and retirement village pools



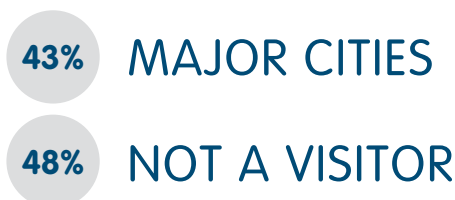
AGE



TIME



LOCATION



KEY RISK FACTORS

- Lack of active supervision by parents or carers for children
- Pre-existing medical conditions
- Alcohol consumption and drug use (prescription medication)
- Lack of swimming ability and water safety knowledge

PREVENTION STRATEGIES

- Active supervision by parents or carers of children
- Be aware of pre-existing medical conditions and physical limitations
- Avoid alcohol consumption
- Understand possible adverse effects of medications
- Follow safety rules displayed around the pool area
- Follow directions issued by staff at the establishment
- Learn swimming and water safety skills

IMPACT ON INDUSTRY

- Promote safe aquatic behaviour through clear safety signage, including the need for adults to actively supervise children and non-swimmers
- Consider ways to improve safety through use of the Guidelines for Safe Pool Operations, trained personnel, alarms, CPR charts and defibrillators
- Ensure there are ways for patrons to call for assistance in the event of an emergency, such as an emergency telephone
- Improve strategies for restricting intoxicated persons from entering the swimming pool area

PUBLIC AND COMMERCIAL SWIMMING POOLS

(POOLS LOCATED IN 'PUBLIC AND COMMERCIAL CLASS 9B BUILDINGS')

Examples include: public pools, aquatic centres, school pools and fitness centre pools



AGE



TIME



LOCATION



KEY RISK FACTORS

- Lack of active supervision by parents or carers for children
- Pre-existing medical conditions
- Drug use (prescription medication)
- Lack of swimming ability and water safety knowledge

PREVENTION STRATEGIES

- Active supervision by parents or carers of children
- Be aware of pre-existing medical conditions and physical limitations
- Understand possible adverse effects of medications
- Follow safety rules displayed around the pool area
- Follow directions issued by staff and lifeguards
- Inform a lifeguard if a non-swimmer, or of any relevant medical conditions
- Learn swimming and water safety skills

IMPACT ON INDUSTRY

- Promote safe aquatic behaviour through clear safety signage, including the need for adults to actively supervise children and non-swimmers
- Reinforce the importance of minimising both fatal and non-fatal drowning incidents in lifeguard training and continued professional development, including scanning techniques and optimal positioning around the pool
- Ensure a comprehensive child supervision program such as Keep Watch or Watch around Water is in place
- Improve the volume and quality of incident data collected for both fatal and non-fatal incidents
- Align data reporting forms and systems to National Guidelines
- Expand swimming and water safety programs to all ages within the local community

A 10 YEAR ANALYSIS OF DROWNING IN AQUATIC FACILITIES: EXPLORING RISK AT COMMUNAL, PUBLIC AND COMMERCIAL SWIMMING POOLS

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DID YOU KNOW?

- Between 1 July 2005 and 30 June 2015, 78 people drowned in Communal, and Public and Commercial swimming pools
- Of these, 42 drowning deaths occurred in Communal pools and 36 occurred in Public and Commercial pools

COMMUNAL SWIMMING POOLS

Fatal drowning

- Males accounted for 79% of drowning deaths
- The leading age group for drowning was people aged 25-34 years (19%), followed by people aged 65-74 years (14%)
- Drowning deaths most commonly occurred in summer (45%), on Sundays (21%) and during the afternoon (38%)
- Queensland recorded the largest number of deaths (52%), followed by NSW (19%)
- Half of those who drowned were visitors to the location where they drowned (50%)
- The most common activity being undertaken prior to drowning was swimming and recreating (88%), while 10% of people fell into the pool
- Risk factors for drowning included pre-existing medical conditions (69%), alcohol consumption (21%) and drug use (41%), namely prescription medication
- Among drowning deaths involving children aged 0-14 years, there was no parental or carer supervision in 75% of cases
- Those who drowned were most commonly first observed by a resident or guest (24%), or a family member or friend (24%) but often retrieved from the pool by hospitality staff (29%)
- In almost all cases emergency services were contacted (95%), most commonly by hospitality staff (33%) and treatment was administered in almost three quarters of drowning cases (74%)
- People of all skill levels drowned, including poor swimmers (12%), competent swimmers (12%) and strong swimmers (7%)
- Deaths most commonly occurred in the deep end of the pool (26%), followed by the middle of the pool (7%)
- Swimming pools commonly had 1 (64%), 2-5 (7%) or 6-10 (2%) patrons in the pool
- Coronial recommendations were not made in any drowning cases

Non-fatal drowning

- There were 105 cases of non-fatal drowning in Communal swimming pools
- Males accounted for 66% of incidents
- The leading age group for non-fatal drowning was children aged 0-4 years (45%), followed by children aged 5-9 years (25%)

PUBLIC AND COMMERCIAL SWIMMING POOLS

Fatal drowning

- Males accounted for 81% of drowning deaths
- The leading age group for drowning was children aged 5-9 years (19%), followed by people aged 45-54 years (17%)
- Drowning deaths most commonly occurred in spring (36%), on Sundays (22%) and during the afternoon (56%)
- Queensland recorded the largest number of deaths (31%), followed by NSW (25%)
- The vast majority of people who drowned were not visitors to the location where they drowned (94%)
- The most common activity being undertaken prior to drowning was swimming and recreating (83%), while 6% of people fell into the pool
- Risk factors for drowning included pre-existing medical conditions (61%), alcohol consumption (8%) and drug use (39%), namely prescription medication
- Among drowning deaths involving children aged 0-14 years, there was no parental or carer supervision in 78% of cases
- Those who drowned were most commonly first observed by an adult bystander or witness (39%) but often retrieved from the pool by staff (44%), including lifeguards
- In two thirds of drowning cases at least one lifeguard was present (67%), while other pools were either not required to have a lifeguard or did not have one due to the operating conditions at the time of the incident
- In the majority of cases emergency services were contacted (89%), either by pool staff (8%) or a bystander (8%) and treatment was administered in the majority of drowning cases (86%)
- People of all skill levels drowned, including non-swimmers (14%), poor swimmers (8%), competent swimmers (22%) and strong swimmers (22%)
- Swimming pools were commonly owned by a government entity (Local or State Government) and operated by another organisation, such as a professional management company
- Deaths most commonly occurred in the deep end of the pool (31%), followed by the side of the pool (8%)
- Swimming pools commonly had 1 (6%), 2-5 (8%), 6-10 (3%), 11-100 (14%) or 501-1000 (6%) patrons in the pool
- Coronial recommendations were made in 17% of cases, referencing swimming ability, safety standards and features, supervision and education

Non-fatal drowning

- There were 257 cases of non-fatal drowning in Public and Commercial swimming pools
- Males accounted for 58% of incidents
- The leading age group for non-fatal drowning was children aged 0-4 years (45%), followed by children aged 5-9 years (21%)



EXECUTIVE SUMMARY

BACKGROUND

There are an average of 285 drowning deaths each year in Australian waterways, with swimming pools the fourth leading location for fatal drowning, accounting for 15% of deaths. Although extensive research has been conducted regarding drowning deaths in home swimming pools, Communal, Public and Commercial swimming pools have not received the same level of attention.

Goal seven of the Australian Water Safety Strategy 2016-2020 recognises the importance of public swimming pools, aiming to 'Reduce drowning deaths by strengthening the aquatic industry'. A collaborative approach is needed to achieve this goal, with a focus on safety and improving risk management strategies. Alongside existing State and Territory legislation, the Guidelines for Safe Pool Operations (GSPO) is a facility based risk management tool published by Royal Life Saving and targeted towards pool operators to assist in satisfying any applicable legislative requirements and providing a high standard of care to patrons.

Despite drowning prevention programs such as Keep Watch @ Public Pools and Watch Around Water, fatal and non-fatal drowning incidents continue to occur in aquatic facilities. These incidents occur among people of all ages and abilities, including competent, adult swimmers. In order to gain a greater understanding of drowning incidents at Communal, Public and Commercial swimming pools, this study was undertaken to examine fatal and non-fatal drowning nationally, including the identification of important risk factors, leading to the development of evidence-based prevention strategies.

METHODS

All unintentional, drowning deaths in Communal, Public and Commercial swimming pools, which occurred between 1 July 2005 and 30 June 2015 were included. The locations of these incidents were classified in accordance with the 'National Aquatic Facility Classifications'. Swimming pools located in 'Residential Class 3 Buildings' were referred to as 'Communal' pools, while swimming pools located in 'Public and Commercial Class 9b Buildings' were referred to as 'Public and Commercial' pools. Information was collated from State and Territory Coronial Offices, the National Coronial Information System (NCIS) and media reports. This report contains information correct as at 4 September 2017.

Non-fatal drowning incidents that occurred in Australia between 1 July 2005 and 30 June 2015 were collated using hospitalisation data. Data were obtained from the Australian Institute of Health and Welfare's (AIHW) National Hospital Morbidity Database (NHMD) (10). Hospital separations where the principal diagnosis was any code in ICD-10-AM Chapter XIX Injury, poisoning and certain other consequences of external causes (S00-T98) and the first reported external cause of morbidity was Accidental Drowning and Submersion (W65-W74) were included.

The number of non-fatal incidents classified under other ICD codes was estimated based on the observed ICD code distribution of fatal incidents in swimming pools over a four year period and added to the total reported non-fatal counts to match the methodology used to identify fatal incidents. Cases were aligned as closely as possible with the 'National Aquatic Facility Classifications' and reported as Communal, or Public and Commercial swimming pools.



**DROWNING DEATHS, ON
AVERAGE, EACH YEAR IN
AUSTRALIAN WATERWAYS**

RESULTS

Fatal drowning

Between 1 July 2005 and 30 June 2015, 78 people drowned in Communal and Public and Commercial swimming pools. Of these, 42 drowning deaths occurred in Communal pools and 36 occurred in Public and Commercial pools.

Communal swimming pools

Males accounted for 78.6% of drowning deaths in Communal pools, with the highest number of deaths occurring among people aged 25-34 years (19.0%). Almost half of deaths occurred among people born in Australia (45.2%), with the next most common country of birth being China (11.9%). Deaths peaked in summer (45.2%), on Sundays (21.4%) and during the afternoon (38.1%).

More than half of incidents occurred in Queensland (52.4%), with the Northern Territory recording the highest fatal drowning rate. Almost half of those who drowned were locals (47.6%), while pre-existing medical conditions (69.0%), alcohol consumption (21.4%) and drug usage (40.5%) (namely prescription medication) were all important risk factors for drowning in Communal pools.

In three quarters of child drowning cases, there was no parental or carer supervision at the time of the incident (75.0%). Those who drowned were most likely to be observed by a resident or guest (23.8%), or family member or friend (23.8%) but retrieved from the pool by a member of staff (28.6%). Poor (11.9%), competent (11.9%) and strong swimmers (7.1%) all drowned, with pools most commonly having only 1 patron in them (64.3%). Coronial recommendations were not made following any of the drowning deaths in Communal pools.

Public and Commercial swimming pools

Males accounted for 80.6% of drowning deaths in Public and Commercial pools, with the largest number of deaths occurring among children aged 5-9 years (19.4%). Half of deaths occurred among people born in Australia (50.0%). Deaths peaked in spring (36.1%), on Sundays (22.2%) and during the afternoon (55.6%).

Almost a third of incidents occurred in Queensland (30.6%), with the Northern Territory recording the highest fatal drowning rate. The vast majority of people who drowned were locals (94.4%), with all of these people residing within 25km of the incident location. Important risk factors for drowning in Public and Commercial pools included pre-existing medical conditions (61.1%) and drug usage (38.9%), namely prescription medication.

In more than three quarters of child drowning cases, there was no parental or carer supervision (77.8%). Those who drowned were most likely to be observed by an adult bystander or witness (38.9%) but retrieved from the pool by staff (44.4%), including lifeguards. In two thirds of drowning cases at least one lifeguard was present (66.7%), with other pools being unsupervised community facilities, low patronage pools or pools which do not require a lifeguard (e.g. school pool, fitness centre pool).

Non-swimmers (13.9%), poor (8.3%), competent (22.2%) and strong swimmers (22.2%) all drowned. Pools were commonly owned by a government entity (Local or State Government) and operated by another organisation, such as a professional management company. Coronial recommendations were made in 16.7% of cases and included references to identifying swimming ability, safety standards and procedures, supervision by lifeguards, community education and regulatory authorities.

Non-fatal drowning

Between 1 July 2005 and 30 June 2015, there were 362 cases of non-fatal drowning in Communal and Public and Commercial swimming pools. Of these, 105 cases of non-fatal drowning occurred in Communal pools and 257 occurred in Public and Commercial pools. In both locations, children aged 0-4 (44.7% and 45.4% respectively) were the leading age group for non-fatal drowning, followed by children aged 5-9 years (25.2% and 21.2% respectively).

CONCLUSION

Despite popular opinion, this study has shown that people of all ages, backgrounds and swimming abilities can drown. In addition to a lack of appropriate parental or carer supervision for children, important risk factors for drowning in Communal, Public and Commercial swimming pools include pre-existing medical conditions, alcohol consumption and drug use. Continued advocacy and engagement with the aquatic industry, police and State and Territory coroners will improve data collection and collation efforts, as well as furthering the issue within an influential group of stakeholders.

NEXT STEPS

NEXT STEPS RELATED TO COMMUNAL, PUBLIC AND COMMERCIAL SWIMMING POOLS

Policy, programs and advocacy

- Increasing awareness
 - o Targeted distribution of report findings to increase awareness of the issue of drowning in Communal, Public and Commercial swimming pools, particularly among relevant industry stakeholders
 - o Community education regarding drowning in Communal, Public and Commercial pools, highlighting the fact that people of all swimming abilities can drown (including competent and confident swimmers)
 - o Continue existing public awareness programs (such as Keep Watch @ Public Pools and Watch Around Water), as well as expanding current programs
- Promoting active supervision by parents and carers
 - o Increasing promotion of current drowning prevention programs to parents and carers, as well as lifeguards (such as Keep Watch @ Public Pools and Watch Around Water) including the different supervision requirements depending on the age and swimming ability of a child
- Promoting safe aquatic behaviour
 - o Encourage patrons to be aware of their own limitations and ability in the water, including any changes in fitness levels or overall health status
- Incident reporting
 - o Develop a national capability for the collection, analysis and promotion of aquatic injuries and near misses
 - o Develop a capability for the investigation and advancement of lessons learnt from drowning incidents and injuries

Research agenda

- Improving data
 - o Continued advocacy work with police, Worksafe authorities, healthcare systems and aquatic facilities in order to improve data collection and incident investigation practices
 - o Develop national safety reporting criteria, definitions and methodology for items such as Risks, Incidents, Evaluation, Staff, Patronage/Visitation, Equipment, Training and Visitors in Aquatic Environments, which would be included in the GSPO
 - o Collect location-specific exposure or visitation data to improve the accuracy of calculated drowning rates
- Monitoring trends
 - o Ongoing analysis and evaluation of trends and patterns related to drowning in Communal, Public and Commercial pools, utilising such findings to update drowning prevention programs and strategies where required
- Understanding behaviours
 - o Investigate the knowledge, attitudes and beliefs of pool users (e.g. frequency of pool visits, activities undertaken, perceived value of pool visits)
- Ongoing advocacy
 - o Working with coroners to highlight the vital role they play in drowning prevention and ways to improve the identification and implementation of lessons learnt through targeted, evidence-based coronial recommendations
- Evaluating progress
 - o Ensuring continual data collection, collation and analysis, which will allow drowning prevention programs and strategies to be evaluated over time

NEXT STEPS RELATED TO COMMUNAL SWIMMING POOLS

Policy, programs and advocacy

- Engaging stakeholders
 - Build relationships with new Communal pool stakeholders (such as the hospitality and tourism sectors) across Australia
- Reducing risk
 - Exploration of the feasibility of installing public rescue equipment and help points at Communal pools, where no such facilities currently exist
- State specific strategy – Queensland
 - Focus advocacy efforts on Queensland, particularly in regards to the tourism sector

NEXT STEPS RELATED TO PUBLIC AND COMMERCIAL SWIMMING POOLS

Policy, programs and advocacy

- Promoting safe aquatic behaviour
 - Encourage patrons to report any pre-existing medical conditions to pool staff, so that lifeguards may be aware of specific supervision needs and areas of increased risk
 - Encourage non-swimmers and poor swimmers to identify themselves to pool staff, so lifeguards may be aware of specific supervision needs and areas of increased risk
- Targeting drowning prevention messages
 - It is clear that deaths in Public and Commercial pools are occurring among local people, suggesting safety messages should be targeted to the immediate local community and delivered prior to people attending the facility
 - Key safety messages should be delivered to high risk demographics, at times of heightened risk
- Campaigning for change
 - Develop a national campaign to support aquatic facilities to engage with their local community in relation to public pool drowning prevention strategies
- Improving training practices
 - Investigation of ways to improve the rapid identification of a drowning person by pool staff
- Engaging stakeholders
 - Continued engagement with existing Public and Commercial pool stakeholders
- State specific strategy – Queensland
 - Advocate for the National Aquatic Safety Committee to work with Royal Life Saving Society Queensland and Australian Leisure Facilities Association Queensland (ALFAQ) for a targeted strategy in Queensland to reduce Public and Commercial pool drowning deaths

BACKGROUND

There are an average of 285 drowning deaths each year in Australian waterways, with swimming pools the fourth leading location for fatal drowning, accounting for 15% of deaths (1). The Royal Life Saving National Fatal Drowning Database defines a swimming pool as a “permanent or temporary excavation, structure or vessel that is capable of filling with water to a depth of 300mm or more and is solely intended or principally used for human aquatic activity” (2).

Swimming pools can be located in a number of different environments, for example a home swimming pool at a domestic residence, a public swimming pool at an aquatic facility or a publically accessible swimming pool at a hotel or motel (2). Extensive research has been conducted regarding drowning in home swimming pools, predominantly regarding young children (3-10), however, Communal, Public and Commercial swimming pools have not received the same level of attention.

As stated in the Australian Water Safety Strategy 2016-2020, “public swimming pools are promoted as safe places for people to enjoy the water”. The strategy outlines eleven goals; areas in which progress must be made in order to move closer to the aspirational target of a 50% reduction in drowning by 2020 (11). Under priority area two, goal seven aims to ‘Reduce drowning deaths by strengthening the aquatic industry’, with a focus on safety and risk management (11).

Relevant State and Territory legislation exists across a number of areas, including occupational health and safety and public health guidelines, although the applicable acts and regulations vary between different jurisdictions (12). The Guidelines for Safe Pool Operations (GSPO) is a facility based risk management tool published by Royal Life Saving (13). It includes information related to general and technical operations, first aid, facility design, supervision and programs (13). It is designed for operators to assist in satisfying any applicable legislative requirements and providing a high standard of care to patrons (13).

The GSPO provides specific information related to industry best practice in a number of areas vital to drowning prevention, for example, lifeguard requirements and pool safety specifications (14). Guidelines also exist regarding swimming pools within the hospitality environment, for example, hotels, motels, camping and caravan grounds (15).

Previous research has examined the circumstances related to child drowning in public pools across Australia, focusing on contributing factors and coronial recommendations. A lack of parental or carer supervision was a key contributing factor in almost all drowning deaths, while other identified factors included carers or guardians being responsible for multiple children, supervision for younger children left to older children and a busy environment at the pool (16). Coronial recommendations focused on education and enforcement, in areas such as supervision, signage, public awareness campaigns, educational materials and risk assessments (16).

A state-based project in Victoria identified drowning deaths which occurred at public swimming pools, including council owned aquatic facilities, as well as non-council owned pools, such as privately owned fitness centres or hotels and resorts (17). The report identified key trends related to sex and age, as well as important risk factors for drowning, including lack of parental or carer supervision and pre-existing medical conditions (17).

Child drowning prevention programs, such as Keep Watch @ Public Pools and Watch Around Water encourage parents and carers to supervise their children at public pools, aiming to help them understand their responsibilities and the dangers of leaving children unattended (18, 19). The Keep Watch @ Public Pools Policy stipulates minimum supervision requirements for different age groups (18):

- Children (under 10 years) are not allowed entry unless under active supervision of a person 16 years or older.
- Parents and guardians should actively supervise their children at all times and be dressed ready to enter a pool. For 0–5 year olds and non-swimmers, a parent or guardian needs to be in the water at all times and within arms’ reach of the child. It is best if you are engaging with your child i.e. playing with them, talking to them.
- Constant active supervision is required for children aged 6–10 years old. Parents and carers must be prepared to enter the water with this age group.
- For 11–14 year olds it is recommended that parents regularly check on their child by physically going to where they are in or around the water.

AIMS

It also defines 'active supervision' (18):

- Be prepared – Ensure you have everything you need before getting into the water, such as towels and dry clothes.
- Be close – Always be within arms' reach of your child.
- All of your attention – Focus all of your attention on your child and get into the pool and talk and play with them.
- All of the time – You should never leave your child alone in the water, nor should they be left in the care of an older child or with the assumption that your responsibility diminishes due to the presence of lifeguards.

Although such programs have been in place for many years with the aim of reducing the number of children drowning at public pools, fatalities in this demographic are still occurring. However, it is not only young children who drown at public facilities, with people of all ages getting into difficulty. Drowning deaths among older age groups have been investigated in other aquatic locations, with alcohol consumption a key risk factor among drowning deaths in young and middle-aged adults (20, 21) and pre-existing medical conditions often present in cases of older Australians drowning (22, 23).

In order to gain a greater understanding of drowning incidents at Communal, Public and Commercial swimming pools, this study was undertaken to examine fatal and non-fatal drowning nationally, including the identification of important risk factors, leading to the development of evidence-based prevention strategies.

This study aimed to:

- Gain a greater understanding of drowning in Communal, Public and Commercial swimming pools across a ten year period (1 July 2005 to 30 June 2015)
 - Quantify the scale of drowning, including fatal and non-fatal drowning
 - Investigate the circumstances of drowning deaths
 - Identify relevant risk factors for drowning deaths
- Propose recommendations going forward, including prevention strategies targeting Communal, Public and Commercial swimming pools

METHODS

FATAL DROWNING

All unintentional, drowning deaths in Communal, Public and Commercial swimming pools, which occurred between 1 July 2005 and 30 June 2015 were included in this report. Drowning deaths among all age groups were included.

For the purposes of this report, swimming pools were classified as per the 'National Aquatic Facility Classifications' as endorsed by the National Aquatic Industry Safety Committee (24). This classification system (as used to classify the swimming pools included in this report) is detailed below, along with examples of each type of swimming pool (Table 1).

As shown below, swimming pools located in 'Residential Class 3 Buildings' are henceforth referred to as 'Communal' pools and swimming pools located in 'Public and Commercial Class 9b Buildings' are referred to as 'Public and Commercial' pools.

Table 1: Classification of swimming pools as per the 'National Aquatic Facility Classifications'

Type of classification	Terminology used in report	Examples of types of facilities
Residential Class 3	Communal swimming pools ('Communal')	Hotel/motel/resort/caravan park pool Apartment complex pool Retirement village pool Healthcare staff residential facility pool
Public and Commercial Class 9b	Public and Commercial swimming pools ('Public and Commercial')	Aquatic facility (public pool) Water park School pool Health and fitness club pool

Information for this report has been collected from State and Territory Coronial Offices, the National Coronial Information System (NCIS) and media reports. It has been collated and analysed by Royal Life Saving Society – Australia.

Royal Life Saving uses a media monitoring service (both electronic and print media) all year round to identify drowning deaths reported in the media. The information is then corroborated with information from the NCIS, police and Royal Life Saving State and Territory Member Organisations before being included in this report.

All care is taken to ensure that the information is as accurate as possible. Please note that the figures from more recent financial years may change depending upon the outcomes of ongoing coronial investigations and findings. This report contains information correct as at 4 September 2017. As of this date, 98.7% of cases were closed (i.e. no longer under coronial investigation).

Exclusions from this data include: drowning deaths known to be as a result of suicide or homicide, deaths from natural causes, shark and crocodile attack, or hypothermia where known. All information presented is about drowning deaths or deaths where drowning was a factor.

The crude fatal drowning rate was calculated using ten year Australian population figures between June 2006 and June 2015 from the Australian Bureau of Statistics (ABS) (25).

The remoteness classification was defined by the Australian Standard Geographical Classification – Remoteness Area (ASGC-RA) system (26). The distance between the incident and residential postcode was determined using Google Maps (27). A distance of less than 100km was considered 'not a visitor', more than 100km but within the same state was 'visitor - intrastate', a different state was 'visitor - interstate' and an overseas residential postcode as 'visitor - overseas'. In cases where the incident or resident postcode was unknown, this was entered as 'unknown'.

Among cases which were classified as 'not a visitor', this was further broken down to provide greater detail. The more specific visitor status categories used were '0-25km', '26-50km' and '51-100km'. These distances were also calculated using Google Maps (27).

The time of drowning was coded into four bands: early morning (12:01am to 6am), morning (6:01am to 12pm), afternoon (12:01pm to 6pm) and evening (6:01pm to 12am).

A Blood Alcohol Concentration (BAC) greater than or equal to 0.05 (0.05 grams of alcohol per 100 millilitres of blood) was considered relevant and contributory to the drowning death. Additionally, for the purposes of this report, all prescribed medications were considered to be legal. Illicit drugs, such as cannabis and methamphetamine, were considered illegal drugs.

The circumstances related to a drowning death were recorded as free text and coded following examination of all relevant cases (Table 2).

Table 2: Variables investigated and relevant coding

Variable	Coding used
Supervision (for children aged 0-14 years, as per the Royal Life Saving Keep Watch @ Public Pools program) by parents or carers	Yes (supervision present) No (supervision absent) Yes with limiting factors such as a child supervised by siblings or other children (supervisor was aged 12 years and under or supervisor was aged over 12 years) Unknown (relevant information not available)
The type of supervision (children aged 0-14 years)	None (child left completely unattended for a period of time) Indirect (supervising adult was in the vicinity of the child but not giving his or her full attention to the task of supervising) Direct (supervising adult was giving the child their full attention) Unknown
The person responsible for supervision (children aged 0-14 years)	Mother Father Other relative Teacher Other Unknown
Observed or found by	Bystander/witness – adult Bystander/witness – child Pool staff (including lifeguard, pool attendant, swimming coach/instructor) Hospitality staff (including staff at a hotel/motel/resort etc) Resident or guest Family member or friend (including spouse) Professional (including carer, teacher or emergency services officer) Other Unknown
Retrieved by	Bystander/witness – adult Bystander/witness – child Pool staff (including lifeguard, pool attendant, swimming coach/instructor) Hospitality staff (including staff at a hotel/motel/resort etc) Resident or guest Family member or friend (including spouse) Professional (including carer, teacher or emergency services officer) Other Unknown *It should be noted that in cases where more than one person retrieved the deceased, the more detailed category descriptor was used preferentially (i.e. family member rather than bystander, pool staff rather than bystander)
Presence of lifeguards	Yes No N/A Unknown (relevant information not available)
If lifeguards present, how many?	1 (including cases with at least one lifeguard present) 2 (including cases where more than one lifeguard present but limited detail as to how many) 3 4 5 6 N/A Unknown *It should be noted that where information regarding the number of lifeguards on duty differed within the one coronial case, the more conservative figure was used

Emergency services contacted	Yes No Unknown (relevant information not available)
If emergency services were contacted, who contacted them	Bystander (including neighbours, friends, unspecified witnesses) Pool staff (e.g. public pool) Hospitality staff (e.g. staff at hotel/motel/resort/facility) Another resident or guest Unknown
Police attendance	Scene Hospital Home of the deceased Unknown
Involvement of a Workplace Health and Safety-related organisation	Yes No Unknown
Treatment administered	Yes No Unknown (relevant information not available)
State of patient	Noted in free text where available
Swimming ability (as reported by a witness, family member or friend etc)	Non-swimmer (could not swim) Poor swimmer (minimal swimming ability) Competent swimmer (good swimming skills, regular swimmer) Strong swimmer (strong swimming ability) Unknown
Ownership and management of swimming pool	Noted in free text where available
Method of access to swimming pool	Jumped/dived in Steps/ramp Specialised disabled access Inflatable device/slide Fall Unknown
Location of incident within swimming pool	Deep end of the pool Shallow end of the pool Middle of the pool (including lanes 3-6) Side of the pool (including lanes 1 and 8) Other (spa/hydrotherapy pool) Unknown
Number of patrons	1 2-5 6-10 11-100 101-500 501-1000 Unknown *It should be noted that in some cases estimates regarding patronage were only available for the whole day (rather than the specific time when the incident occurred) or for the whole facility (rather than the specific pool where the incident occurred)
Signage at swimming pool	Yes No Unknown (relevant information not available)
Coronial findings or recommendations	No finding available Finding but no recommendations Recommendations Finding but no new recommendations (recommendations from previous cases discussed/evaluated) Unknown
References to Royal Life Saving or affiliated content/ programs	Yes No Unknown (relevant information not available)

Data were analysed using SPSS Version 21 (28). Descriptive statistics were utilised, as well as chi squared analysis. Statistical significance was deemed $p < 0.05$.

NON-FATAL DROWNING

The non-fatal drowning data used in this report were made available by the Australian Institute of Health and Welfare (AIHW). Data were provided in aggregate format by the AIHW, whereby individual drowning events could not be distinguished. As such, no identifying data or case histories were available. The authors are responsible for the use made of the data in this report.

Non-fatal drowning incidents that occurred in Australia between 1 July 2005 and 30 June 2015 were collated using hospitalisation data. Hospital separations (a process by which an episode of care for an admitted patient ceases, for example, due to their discharge from hospital or their transfer to another facility) were used to calculate the number of hospitalisations related to a non-fatal drowning event.

Hospitalisations related to a drowning incident were excluded for one of two reasons. Firstly, if the patient died in hospital, and secondly, if the patient was transferred from another acute care facility. The mode of separation field was used to exclude patients who died in hospital. This was done to avoid an overlap between fatal and non-fatal drowning cases. The mode of admission field was used to exclude patients who were transferred from another acute care hospital. This was done to avoid double counting drowning cases where the patient was admitted to one hospital but then transferred to another facility, within the same episode of care.

Data were obtained from the Australian Institute of Health and Welfare's (AIHW) National Hospital Morbidity Database (NHMD) (10). Hospital separations where the principal diagnosis was any code in ICD-10-AM Chapter XIX Injury, poisoning and certain other consequences of external causes (S00-T98) and the first reported external cause of morbidity was Accidental Drowning and Submersion (W65-W74) were included.

This methodology is likely to produce an undercount of non-fatal drowning incidents, which may occasionally be classified under different primary ICD codes. In order to produce a count of non-fatal incidents comparable to the fatal incidents captured in the Royal Life Saving Drowning Database, a case study was conducted over four financial years (2007/08-2010/11) to determine the frequency with which fatal drownings in swimming pools (including private pools) are classified with primary ICD codes other than Accidental Drowning and Submersion. This analysis suggested that approximately 8% of non-fatal drowning incidents in swimming pools are likely to be excluded from the NHMD count.

In order to produce a count of non-fatal incidents which is directly comparable to the fatal incident figures used, the NHMD non-fatal figures were "upscaled" by 9% to reflect the number of cases meeting the Royal Life Saving definition of drowning likely to have been excluded from the initial count. Figures in this report reflect this estimated total count of non-fatal incidents.

For the purposes of this report, cases of non-fatal drowning were only included where they occurred in Communal, Public and Commercial swimming pools. The relevant swimming pool specific location categories available using International Classification of Diseases (ICD)-10-AM are shown below (Table 3).

Table 3: Classification of swimming pools as per the 'International Classification of Diseases (ICD)-10-AM'

Place of occurrence code	Examples of specific locations within place of occurrence code	Type of classification (as per the 'National Aquatic Facility Classifications')
Residential institution	Aged care facility pool (e.g. nursing home, retirement village)	Communal
Trade and service area	Hotel pool	Communal
School, other institution and public administration area	School pool	Public and Commercial
Sports and athletics area	Swimming centre Fitness centre pool	Public and Commercial

All efforts were made to extract all non-fatal drowning incidents in Communal and Public and Commercial swimming pools, however, this was not always possible. For example, an 'apartment' swimming pool although categorised as a Communal pool, is located within the 'home' category within ICD-10-AM. As this report does not include home swimming pools, any non-fatal drowning in an apartment complex would not be included in this report. This grouping was excluded to prevent capturing a large number of non-fatal drowning incidents in home or backyard swimming pools located at private residences.

Other relevant location codes within ICD-10-AM were also broad. For example, 'School, other institution and public administration area' could include not only swimming pools at schools but also pools at health service areas (e.g. health centres, hospitals) and public administrative areas (e.g. assembly halls, clubhouses, youth centres). Similarly, 'Trade and service area' could include not only hotel and motel swimming pools but also pools at shopping malls and transport stations (e.g. airport, railway station). It is important to note that drowning incidents at these other locations are highly unlikely, or at the very least, rare, and it is more probable that any recorded non-fatal drowning incidents within these location groupings are relevant to the specific purpose of this report.

RESULTS

FATAL DROWNING

All drowning deaths during the study period occurred in either Communal pools (Residential Class 3 Buildings, e.g. hotel/motel/resort/caravan park pool, apartment complex pool, retirement village pool) or Public and Commercial pools (Public and Commercial Class 9b Buildings, e.g. aquatic facility, school pool, health and fitness club pool), as per the 'National Aquatic Facility Classifications'.

Overall

Between 1 July 2005 and 30 June 2015, 78 people drowned in Communal and Public and Commercial swimming pools. Of these, 42 drowning deaths occurred in Communal pools and 36 occurred in Public and Commercial pools.

Communal swimming pools

Financial year

The number of drowning deaths occurring in Communal pools from a low of 1 per year (2011/12) to a high of 7 per year (2013/14) (Figure 1).

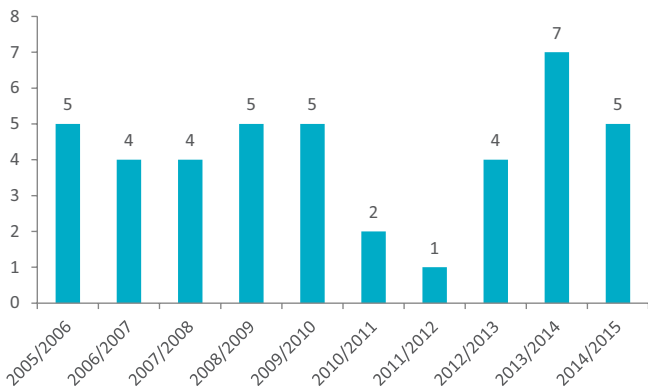


Figure 1: Drowning deaths in Communal pools by financial year, 2005/06 to 2014/15 (N=42)

Demographics

Males accounted for 33 of the 42 drowning deaths in Communal pools (78.6%). The leading age group for drowning was people aged 25-34 years (19.0%), followed by people aged 65-74 years (14.3%) (Figure 2).

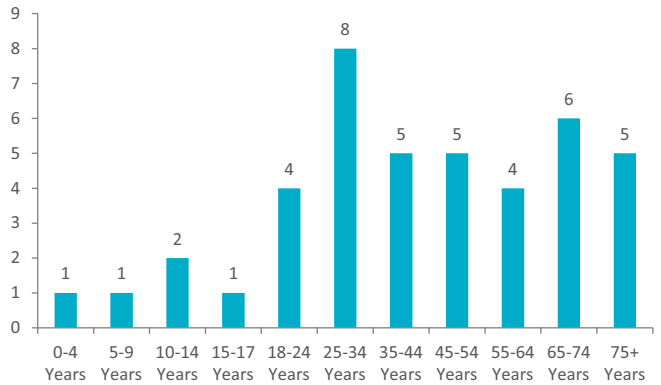


Figure 2: Drowning deaths in Communal pools by age, 2005/06 to 2014/15 (N=42)

Almost half of deaths occurred among people born in Australia (45.2%), while people who were born overseas accounted for 47.6% of deaths. The next most common country of birth was China (11.9%). The country of birth was not available for all cases, with this information missing in 7.1% of all cases. Among those who drowned, 2 (4.8%) were Aboriginal or Torres Strait Islander.

Time of drowning

Season

Drowning deaths occurred throughout the year, peaking in the warmer months. Almost half of all deaths occurred in summer (45.2%), with a further 26.2% occurring in spring (Figure 3).

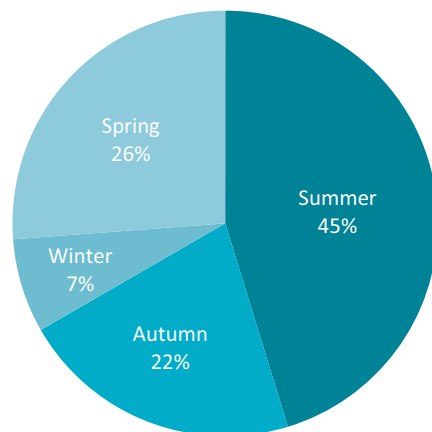


Figure 3: Drowning deaths in Communal pools by season, 2005/06 to 2014/15 (N=42)

Day of the week

The highest number of drowning deaths occurred on Sundays, accounting for 21.4% of all incidents. Almost a fifth of incidents occurred on both Fridays (16.7%) and Saturdays (16.7%) (Figure 4).

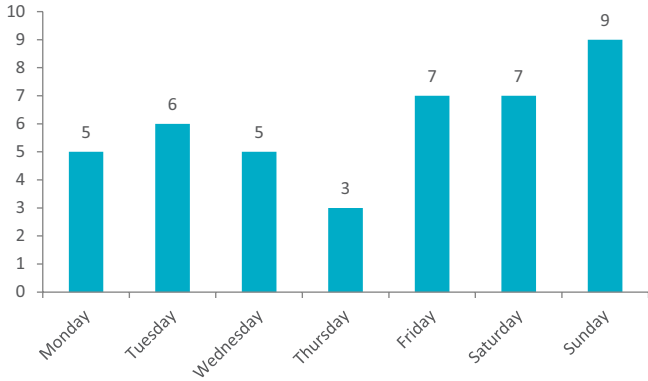


Figure 4: Drowning deaths in Communal pools by day of the week, 2005/06 to 2014/15 (N=42)

Time

Drowning deaths were most common during the afternoon between 12:01pm and 6pm (38.1%) and evening between 6:01pm and 12am (31.0%) (Figure 5). Among those who drowned during the afternoon, the most common time was between 4:01pm and 5pm specifically (5 of 16 deaths), while those who drowned in the evening most commonly drowned between 6:01pm and 7pm specifically (9 of 13 deaths).

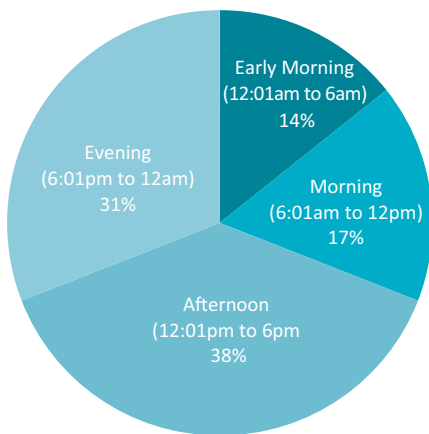


Figure 5: Drowning deaths in Communal pools by time of the day, 2005/06 to 2014/15 (N=42)

Location and activity

State

The highest number of drowning deaths occurred in Queensland, accounting for more than half of incidents (52.4%), followed by NSW (19.0%) and WA (14.3%). The Northern Territory recorded the highest crude fatal drowning rate (0.13 per 100,000 population) (Figure 6).

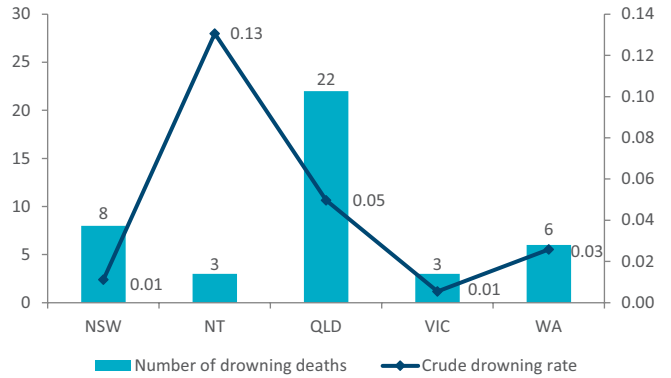


Figure 6: Drowning deaths in Communal pools by State or Territory of incident location with crude drowning rate, 2005/06 to 2014/15 (N=42)

Remoteness classification

The largest number of deaths occurred in major cities (42.9%), followed by outer regional areas (26.2%) (Figure 7).

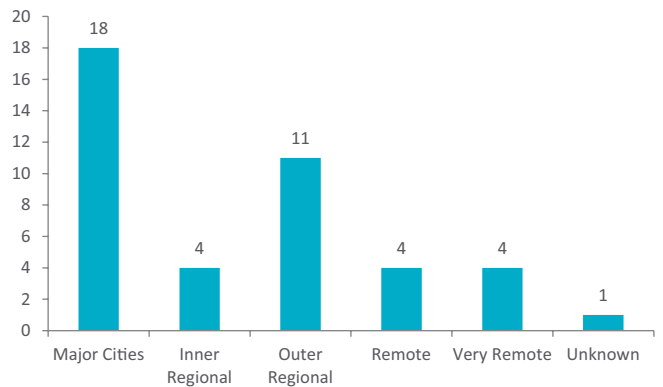


Figure 7: Drowning deaths in Communal pools by remoteness classification of incident location, 2005/06 to 2014/15 (N=42)

Visitor status

Almost half of those who drowned were not visitors to the location where they drowned (47.6%), with 50.0% found to be visiting the area. More than a fifth were overseas tourists (23.8%), while 26.2% were either interstate or intrastate visitors (Figure 8). Those who drowned in Communal pools were significantly more likely to be an overseas visitor than those who drowned in Public and Commercial pools ($X^2=9.8$, $p<0.05$).

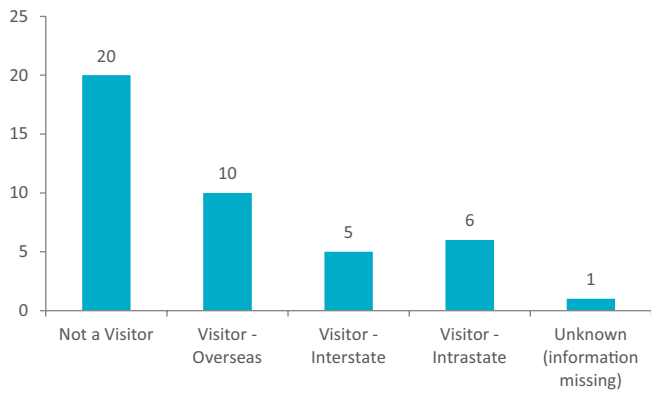


Figure 8: Drowning deaths in Communal pools by visitor status, 2005/06 to 2014/15 (N=42)

Among the locals who drowned (ie. those who were 'not a visitor'), 90.0% drowned within 25km of their residence while the remaining 10.0% drowned within 51-100km of their residence (Figure 9).

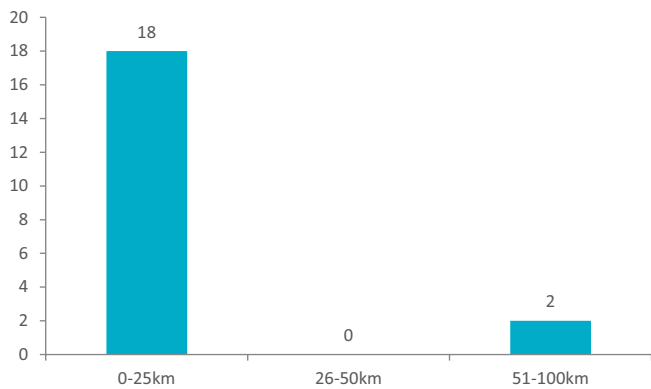


Figure 9: Drowning deaths in Communal pools by more detailed visitor status among those who were 'not a visitor', 2005/06 to 2014/15 (N=20)

The most common activity prior to drowning was swimming and recreating (88.1%), indicating the majority of those who drowned had deliberately entered the water. A further 9.5% of deaths occurred following an unexpected fall into water (Figure 10).

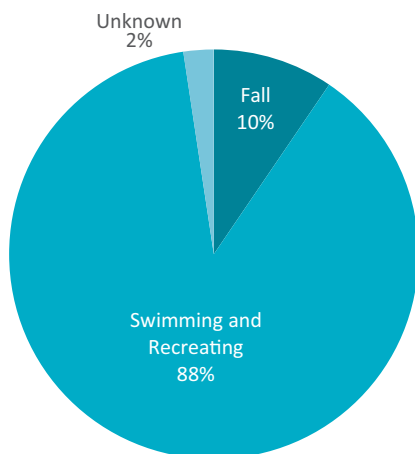


Figure 10: Drowning deaths in Communal pools by activity undertaken prior to drowning, 2005/06 to 2014/15 (N=42)

Risk factors

Pre-existing medical conditions

More than two thirds of people who drowned had a pre-existing medical condition (69.0%) (Figure 11). Recorded pre-existing medical conditions included: cardiac conditions (most commonly ischaemic heart disease), asthma, epilepsy, dementia, diabetes, genetic conditions, mental health disorders, movement disorders and substance abuse disorders. In all cases of drowning involving people aged 65 years and over, a pre-existing medical condition was recorded.

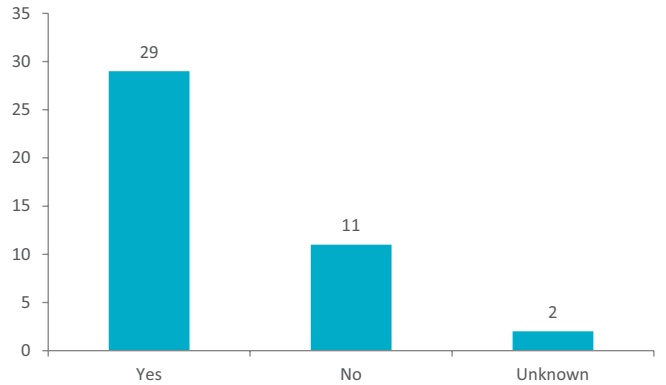


Figure 11: Drowning deaths in Communal pools by presence of pre-existing medical conditions, 2005/06 to 2014/15 (N=42)

Alcohol

Alcohol was known to be present in more of a fifth of drowning cases (21.4%). In 7 cases (16.7%) this information was not available (Figure 12). In all 9 cases where alcohol was present (100.0%), the amount of alcohol recorded was deemed contributory to the drowning (i.e. BAC \geq 0.05%). If only adults are considered (i.e. 18 years and over), alcohol was known to be present in 24.3% of cases.

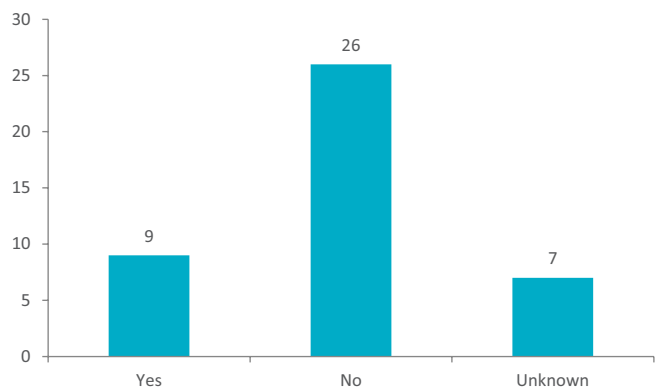


Figure 12: Drowning deaths in Communal pools by presence of alcohol, 2005/06 to 2014/15 (N=42)

Drugs

Drugs were known to be present in 40.5% of all drowning cases. In 7 cases (16.7%) this information was not available (Figure 13). Illegal drugs (cannabis and methamphetamine) were recorded in 2 of the 17 cases where drugs were present. More commonly these cases involved legal drugs, namely prescription medications.

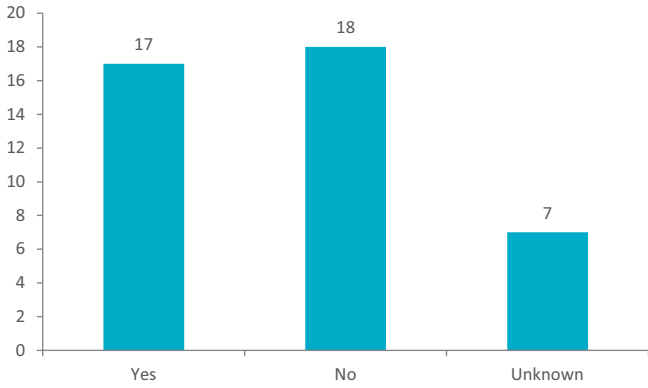


Figure 13: Drowning deaths in Communal pools by presence of drugs, 2005/06 to 2014/15 (N=42)

Circumstances related to the drowning
Supervision

Four children aged 0-14 years drowned in Communal pools (1 aged 0-4 years, 1 aged 5-9 years and 2 aged 10-14 years).

In 75.0% of these cases there was no parental or carer supervision at the time of the incident. In the remaining 25.0% of cases there was supervision but with limitations, in this case the child was supervised by other children aged 12 years and under (Figure 14).

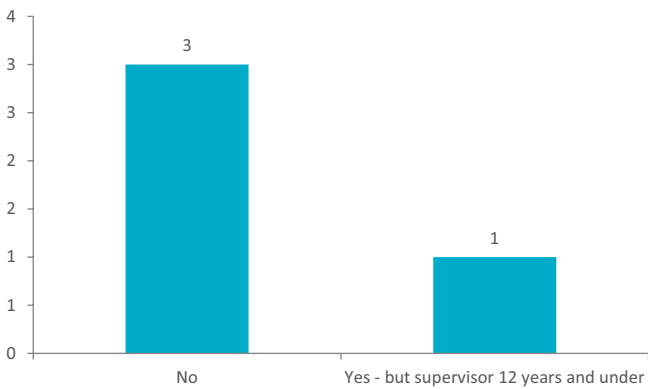


Figure 14: Drowning deaths in Communal pools by presence of supervision, 2005/06 to 2014/15 (N=4)

Of the 3 cases where parental or carer supervision was noted to be absent, it was entirely absent in 1 case (33.3%). In the remaining 2 cases, supervision was classified as indirect (supervising adult was in the vicinity of the child but not giving his or her full attention) (66.7%) (Figure 15).

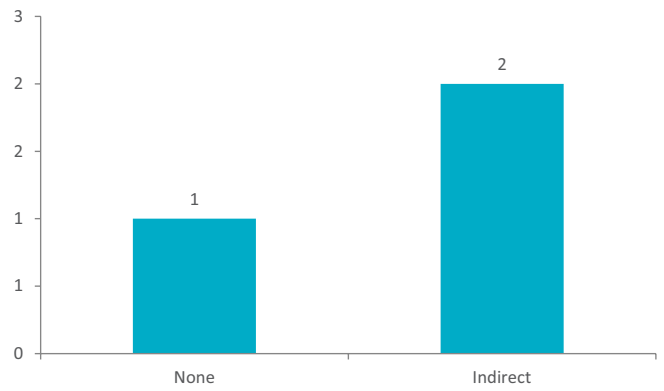


Figure 15: Drowning deaths in Communal pools by type of supervision, 2005/06 to 2014/15 (N=3)

Among cases where parental or carer supervision was noted to be absent (3 cases), a friend or family friend was responsible for supervision in 66.7% of cases. In the remaining case there was no designated supervisor with the incident occurring during a social gathering (Figure 16).

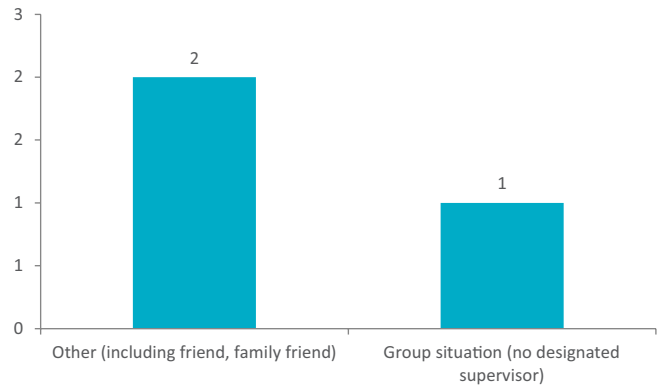


Figure 16: Drowning deaths in Communal pools by person responsible for supervision, 2005/06 to 2014/15 (N=3)

Observation and retrieval

Those who drowned were most commonly first observed by a resident or guest (23.8%), or a family member or friend (23.8%). In a further 19.0% of cases hospitality staff found the person who drowned (Figure 17).

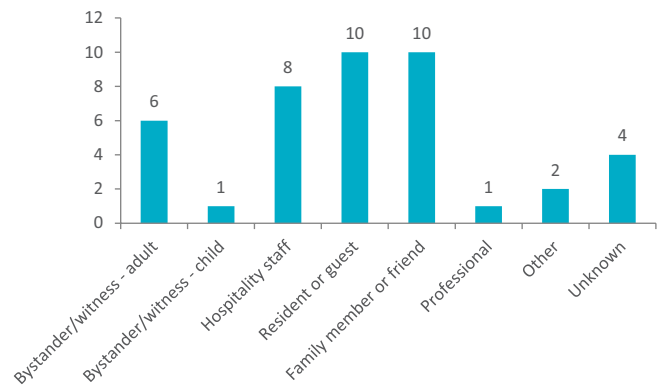


Figure 17: Drowning deaths in Communal pools by who observed or found the person, 2005/06 to 2014/15 (N=42)

When it came to retrieval of the person who drowned, hospitality staff removed the person from the water in 28.6% of cases and a resident or guest in another 19.0% of cases. Further details on the retrieval of the person were unavailable in 21.4% of cases (Figure 18).

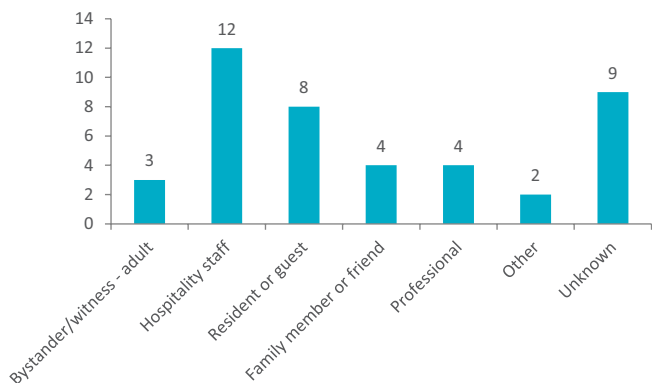


Figure 18: Drowning deaths in Communal pools by who retrieved the person, 2005/06 to 2014/15 (N=42)

Presence of lifeguards

The types of swimming pools categorised as Communal pools (e.g. hotel/motel/resort pools, apartment complex pools and retirement village pools) are generally not required to have a lifeguard on duty. As such, in 97.6% of cases this variable was not applicable. In one case this was not known due to very limited information being available (Figure 19).

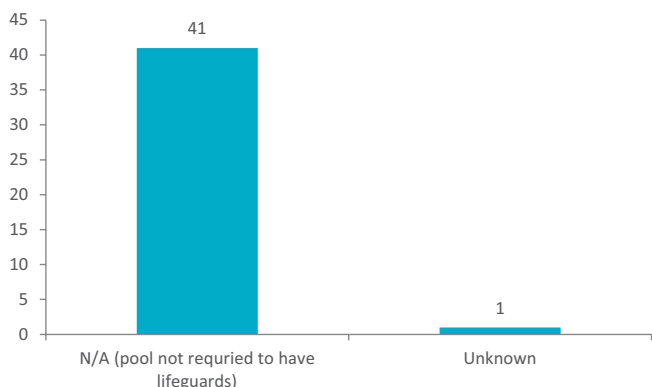


Figure 19: Drowning deaths in Communal pools by presence of lifeguards, 2005/06 to 2014/15 (N=42)

Response to the emergency

In almost all cases emergency services were contacted (95.2%). This information was unavailable in 4.8% of cases (Figure 20).

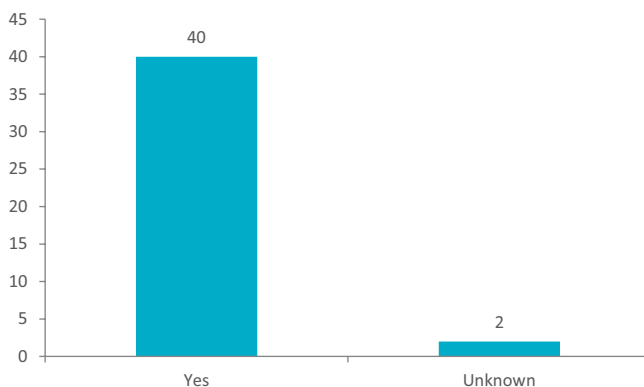


Figure 20: Drowning deaths in Communal pools by whether or not emergency services were called, 2005/06 to 2014/15 (N=42)

In almost a third of cases hospitality staff called emergency services (32.5%), followed by a bystander (10.0%) or another resident or guest (7.5%). However, in half of cases this information was unknown (50.0%) (Figure 21).

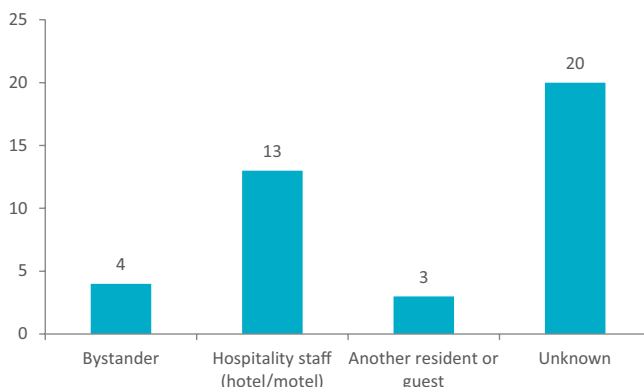


Figure 21: Drowning deaths in Communal pools by who called emergency services, 2005/06 to 2014/15 (N=40)

In more than half of all cases police attended the scene of the emergency (54.8%). In a further 9.5% of cases police attended the hospital, while this information was unknown in the remaining 35.7% of cases (Figure 22).

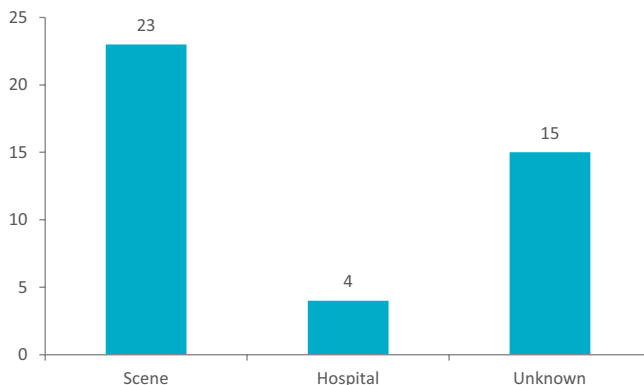


Figure 22: Drowning deaths in Communal pools by whether police attended the scene or the hospital, 2005/06 to 2014/15 (N=42)

A Workplace Health and Safety-related organisation was involved in investigating 5 of the drowning deaths (11.9%). In more than a quarter of cases (26.2%) it was not known whether such an organisation was involved in the investigation (Figure 23).

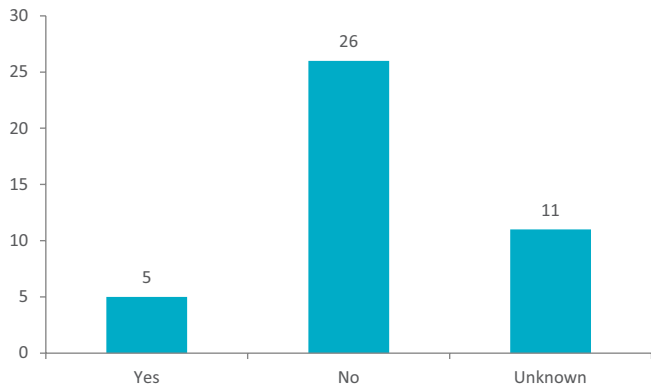


Figure 23: Drowning deaths in Communal pools by whether a Workplace, Health and Safety-related organisation was involved, 2005/06 to 2014/15 (N=42)

The state of the patient was described in 64.3% of drowning cases. Common language used included “no signs of life”, “not breathing”, “no pulse”, “unconscious” and “unresponsive”.

Treatment was administered in almost three quarters of drowning cases (73.8%). It was known that treatment was not administered in a further 23.8% of cases (Figure 24).

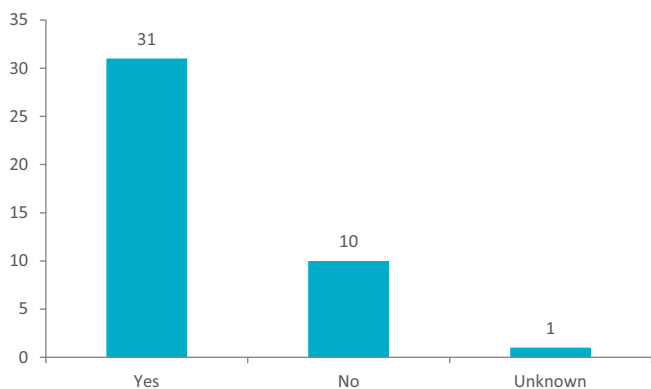


Figure 24: Drowning deaths in Communal pools by whether or not treatment was administered, 2005/06 to 2014/15 (N=42)

Swimming ability

The people who drowned were either poor swimmers (11.9%), competent swimmers (11.9%) or strong swimmers (7.1%). The swimming ability of the person who drowned was not known in more than two thirds of drowning cases (69.0%) (Figure 25).

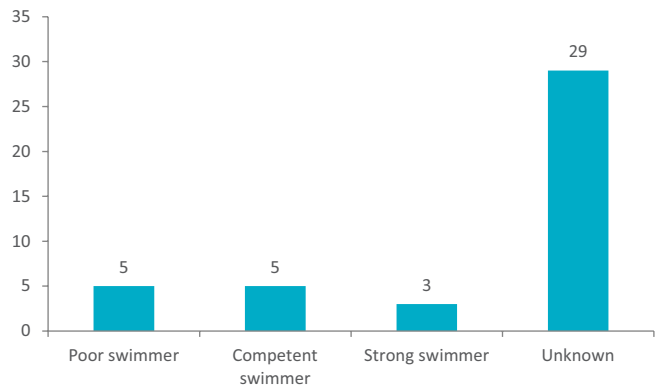


Figure 25: Drowning deaths in Communal pools by swimming ability, 2005/06 to 2014/15 (N=42)

Swimming pool characteristics

Information relating to the method of access to the swimming pool was rarely recorded, with the method of entry unknown in 85.7% of cases. In 7.1% of cases the person who drowned fell into the water, while the remaining people who drowned either jumped or dived in (4.8%), or entered via steps or a ramp (2.4%) (Figure 26).

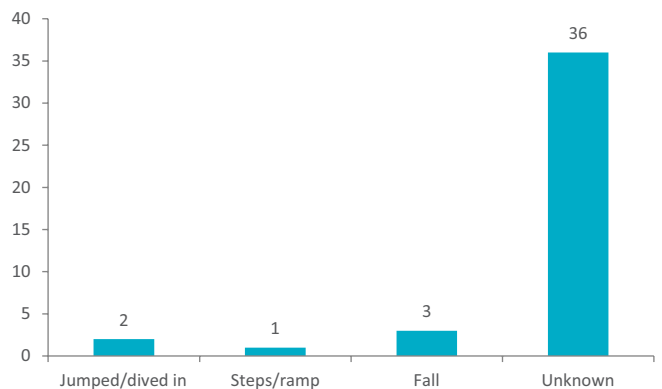


Figure 26: Drowning deaths in Communal pools by method of access, 2005/06 to 2014/15 (N=42)

Drowning deaths most commonly occurred in the deep end of the pool (26.2%), followed by the middle of the pool (7.1%). The specific location of the incident within the swimming pool was unknown in the remaining 66.7% of cases (Figure 27).

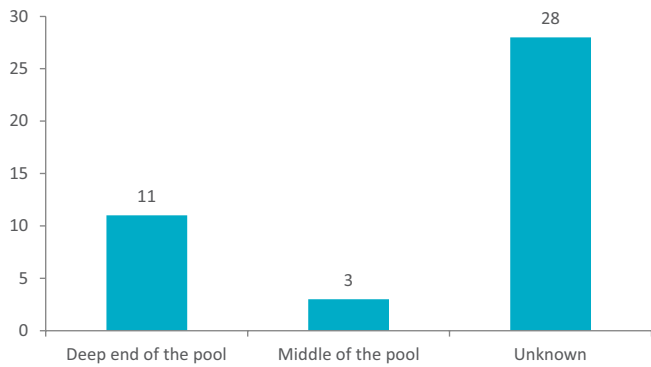


Figure 27: Drowning deaths in Communal pools by location of incident within swimming pool, 2005/06 to 2014/15 (N=42)

Communal swimming pools had 1 (64.3%), 2 to 5 (7.1%) or 6 to 10 (2.4%) patrons in them. The number of patrons in the pool was not known in approximately a quarter of cases (26.2%) (Figure 28).

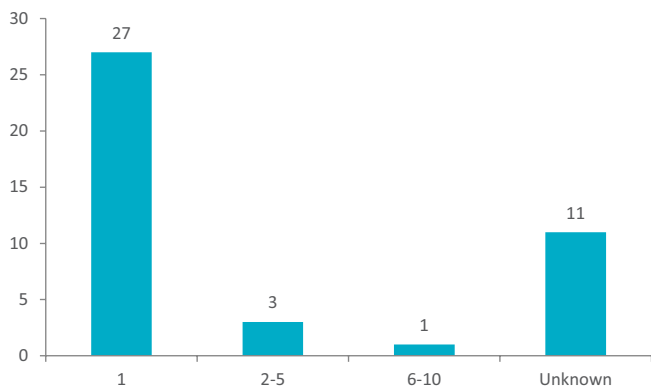


Figure 28: Drowning deaths in Communal pools by number of patrons in swimming pool, 2005/06 to 2014/15 (N=42)

Coronial findings and recommendations

In almost three quarters of cases, a coronial finding was available but no recommendations were made (71.4%). In a further 28.6% of cases a coronial finding was not available (Figure 29).

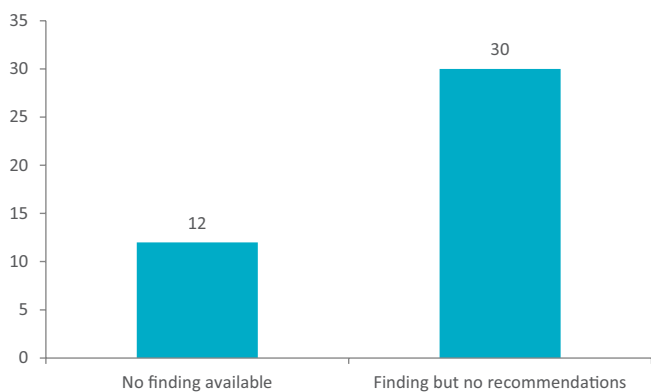


Figure 29: Drowning deaths in Communal pools by presence of coronial findings or recommendations, 2005/06 to 2014/15 (N=42)

In 4 drowning deaths relevant signage was referenced (9.5%). This signage included material related to unsafe behaviours (e.g. no diving or jumping), emergency response (e.g. CPR procedure), supervision (e.g. requirement for adult supervision of children or absence of lifeguards) and risk (e.g. swimming at the individual's own risk) (Figure 30).

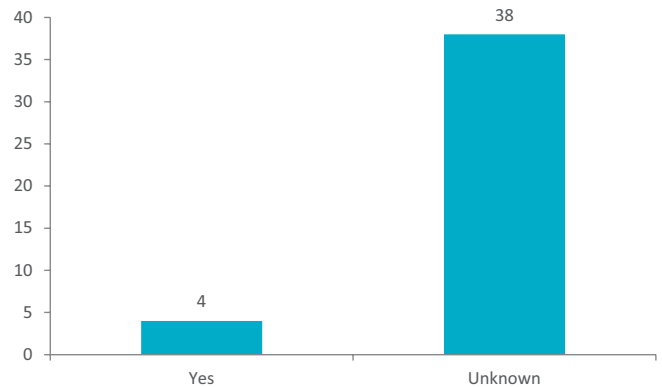


Figure 30: Drowning deaths in Communal pools by reference to signage in coronial file, 2005/06 to 2014/15 (N=42)

Public and Commercial swimming pools

Financial year

The number of drowning deaths occurring in Public and Commercial pools ranged from a low of 1 per year (2011/12) to a high of 7 per year (2009/10) (Figure 31).

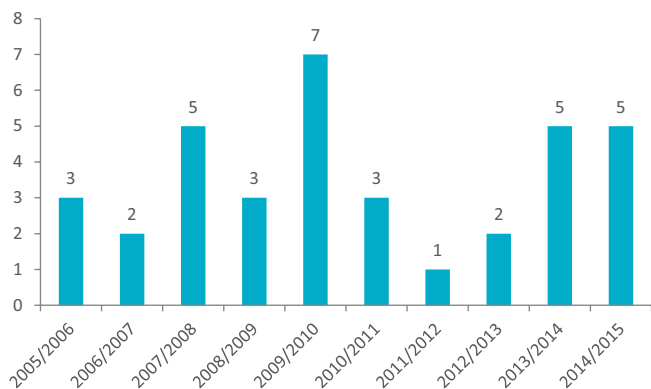


Figure 31: Drowning deaths in Public and Commercial pools by financial year, 2005/06 to 2014/15 (N=36)

Demographics

Males accounted for 29 of the 36 drowning deaths in Public and Commercial pools (80.6%). No significant differences were observed between males and females in relation to drowning in Communal, or Public and Commercial pools.

The leading age group for drowning was children aged 5-9 years (19.4%), followed by people aged 45-54 years (16.7%) (Figure 32). Those who drowned in Public and Commercial pools were significantly more likely to be aged 5-9 years than those who drowned in Communal pools ($\chi^2=6.1$, $p<0.05$).

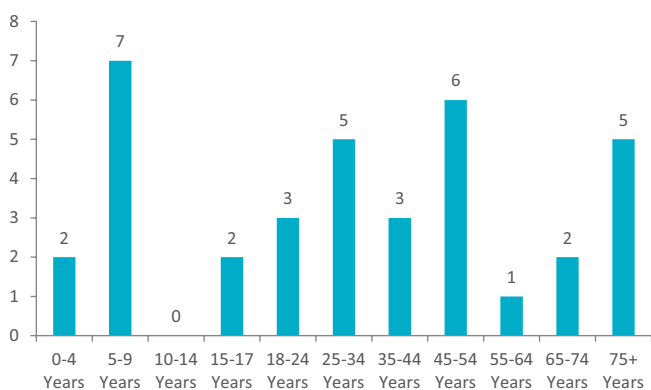


Figure 32: Drowning deaths in Public and Commercial pools by age, 2005/06 to 2014/15 (N=36)

Half of deaths occurred among people born in Australia (50.0%), with people born overseas accounting for 27.8% of drowning cases. In 22.2% of cases the country of birth was not known. One person who drowned was Aboriginal or Torres Strait Islander (2.8%).

Time of drowning

Season

Drowning deaths in Public and Commercial pools occurred throughout the year, however, the highest number of incidents occurred in spring (36.1%), followed by summer (30.6%) (Figure 33).

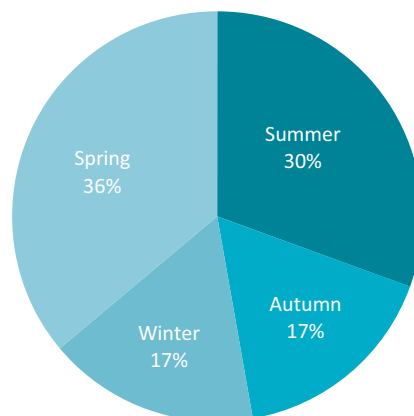


Figure 33: Drowning deaths in Public and Commercial pools by season, 2005/06 to 2014/15 (N=36)

Day of the week

More than a fifth of deaths occurred on Sundays (22.2%), with a further 19.4% occurring on both Wednesdays and Saturdays (Figure 34).

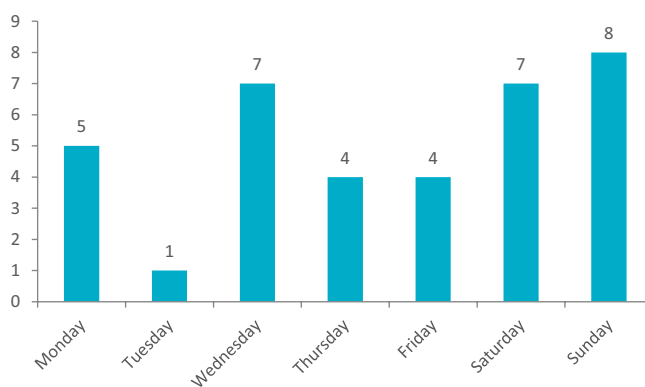


Figure 34: Drowning deaths in Public and Commercial pools by day of the week, 2005/06 to 2014/15 (N=36)

Time

More than half of drowning deaths occurred during the afternoon between 12:01pm and 6pm (55.6%). A further 27.8% occurred during the morning between 6:01am and 12pm (Figure 35). Among those who drowned during the afternoon, the most common time was between 3:01pm and 4pm specifically (7 of 20 deaths).

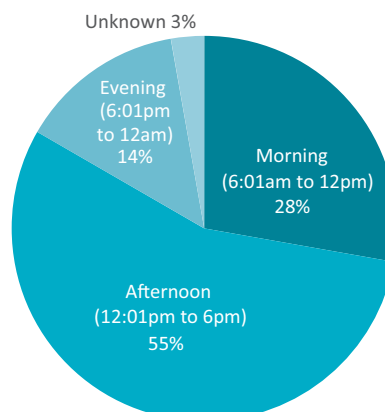


Figure 35: Drowning deaths in Public and Commercial pools by time of the day, 2005/06 to 2014/15 (N=36)

Location and activity

State

Drowning deaths were recorded in every State and Territory. The highest number of incidents occurred in Queensland (30.6%), followed by NSW (25.0%). The Northern Territory recorded the highest crude fatal drowning rate (0.09 per 100,000 population) (Figure 36).

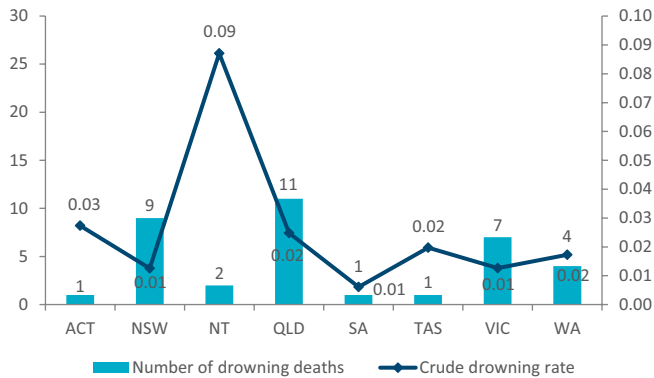


Figure 36: Drowning deaths in Public and Commercial pools by State or Territory of incident location with crude drowning rate, 2005/06 to 2014/15 (N=36)

Remoteness classification

Almost two thirds of deaths occurred in major cities (63.9%), with a further 19.4% occurring in inner regional areas (Figure 37).

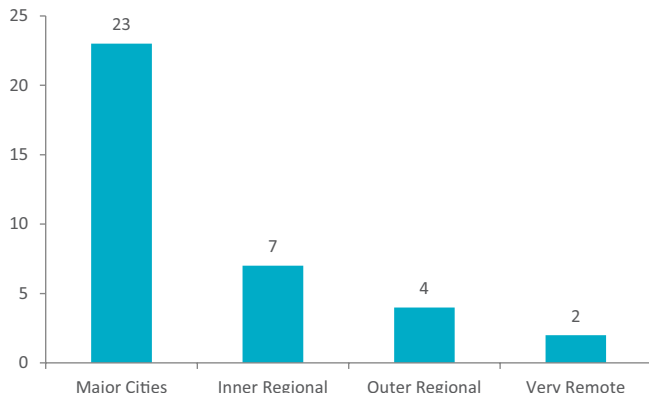


Figure 37: Drowning deaths in Public and Commercial pools by remoteness classification of incident location, 2005/06 to 2014/15 (N=36)

Visitor status

The vast majority of people who drowned were not visitors to the location where they drowned (94.4%). Only 5.6% of those who drowned were either interstate or intrastate visitors (Figure 38). Those who drowned in Public and Commercial pools were significantly more likely to be a local (i.e. 'Not a visitor') than those who drowned in Communal pools ($\chi^2=19.1$, $p<0.05$).

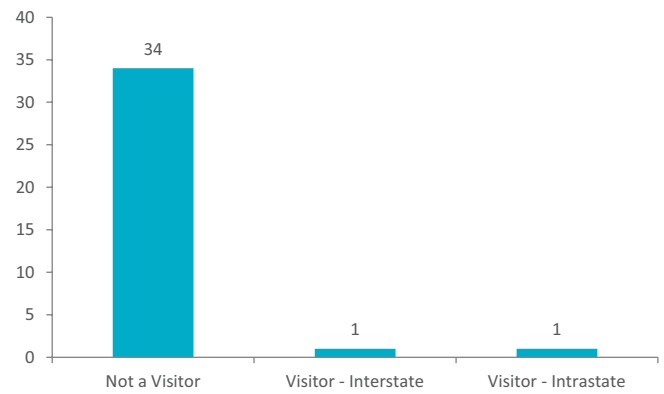


Figure 38: Drowning deaths in Public and Commercial pools by visitor status, 2005/06 to 2014/15 (N=36)

In 100.0% of cases where the person who drowned was a local (i.e. 'not a visitor') the person drowned within 25km of their residence (Figure 39).

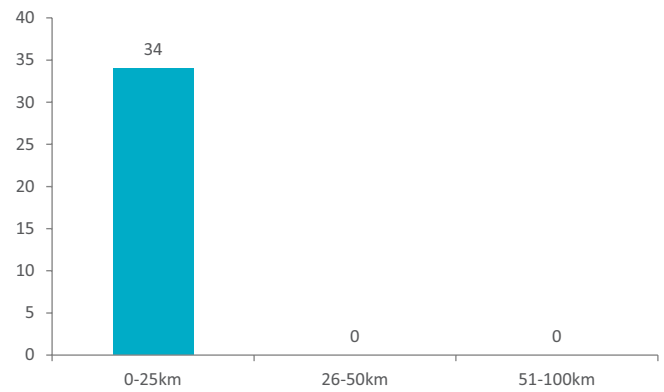


Figure 39: Drowning deaths in Public and Commercial pools by more detailed visitor status among those who were 'not a visitor', 2005/06 to 2014/15 (N=34)

The most common activity prior to drowning was swimming and recreating (83.3%). In 5.6% of cases the person who drowned fell into the water (Figure 40).

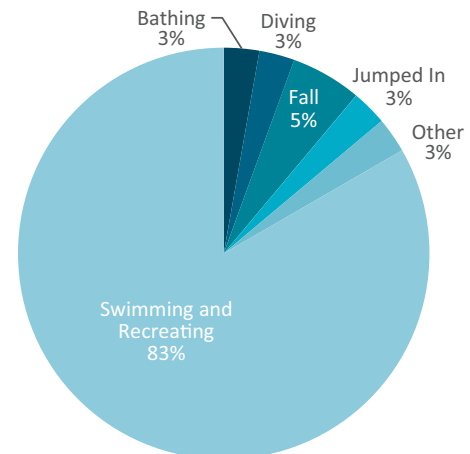


Figure 40: Drowning deaths in Public and Commercial pools by activity undertaken prior to drowning, 2005/06 to 2014/15 (N=36)

Risk factors

Pre-existing medical conditions

More than half of people who drowned had a pre-existing medical condition (61.1%) (Figure 41). Recorded pre-existing medical conditions included: cardiac conditions (most commonly ischaemic heart disease), degenerative conditions, epilepsy, dementia, diabetes, mental health disorders and neurological disorders. In all cases of drowning involving people aged 35 years and over, a pre-existing medical condition was recorded.

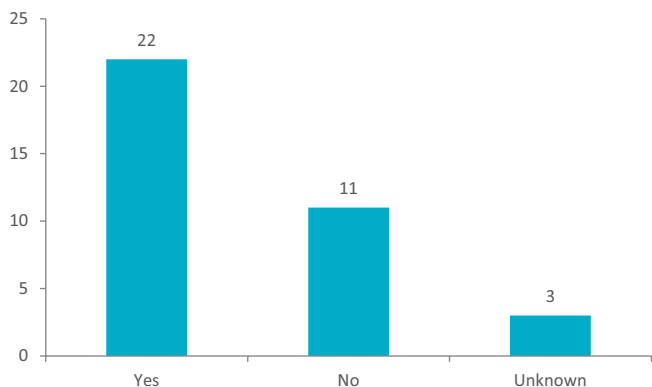


Figure 41: Drowning deaths in Public and Commercial pools by presence of pre-existing medical conditions, 2005/06 to 2014/15 (N=36)

Alcohol

Alcohol was known to be present in 8.3% of all cases. In 5 cases (13.9%) this information was not available (Figure 42). In 1 case where alcohol was present (33.3%), the amount of alcohol recorded was deemed contributory to the drowning (i.e. BAC \geq 0.05%). If only adults are considered (i.e. 18 years and over), alcohol was known to be present in 12.0% of cases.

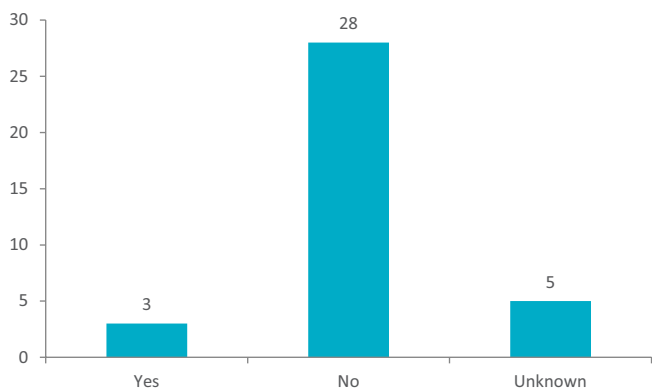


Figure 42: Drowning deaths in Public and Commercial pools by presence of alcohol, 2005/06 to 2014/15 (N=36)

Drugs

Drugs were known to be present in 38.9% of all drowning cases. In 5 cases (13.9%) this information was not available (Figure 43). Illegal drugs (cannabis) were recorded in 2 of the 14 cases where drugs were present. More commonly these cases involved legal drugs, namely prescription medications.

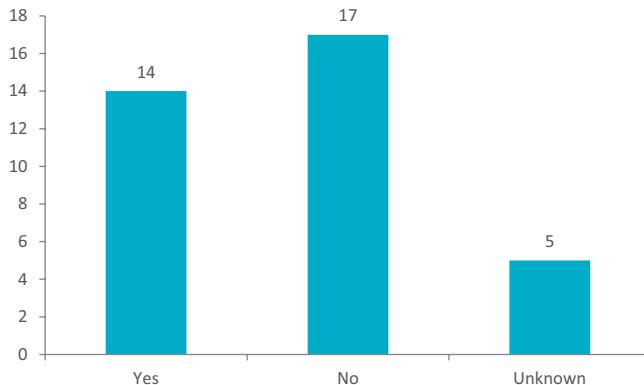


Figure 43: Drowning deaths in Public and Commercial pools by presence of drugs, 2005/06 to 2014/15 (N=36)

Circumstances related to the drowning

Supervision

Nine children aged 0-14 years drowned in Public and Commercial pools (2 aged 0-4 years and 7 aged 5-9 years).

In 77.8% of cases there was no parental or carer supervision at the time of the incident. In 11.1% of cases there was supervision but with limitations (supervisor was aged over 12 years) and in the remaining 11.1% of cases this information was not available (Figure 44).

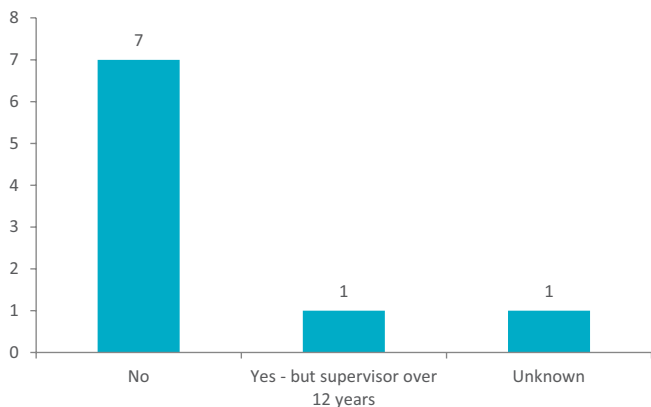


Figure 44: Drowning deaths in Public and Commercial pools by presence of supervision, 2005/06 to 2014/15 (N=9)

Of the 7 cases where parental or carer supervision was known to be absent, it was entirely absent in 2 cases (28.6%). However, in 5 cases (71.4%) supervision was deemed to be indirect (supervising adult was in the vicinity of the child but not giving his or her full attention) (Figure 45).

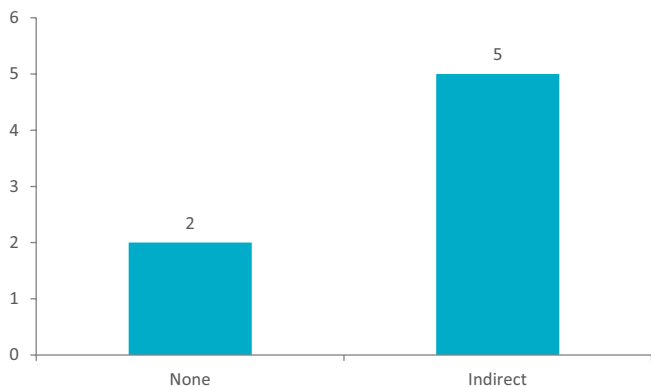


Figure 45: Drowning deaths in Public and Commercial pools by type of supervision, 2005/06 to 2014/15 (N=7)

Among cases where parental or carer supervision was known to be absent, the person responsible for supervision included the father (28.6%), mother (14.3%), another relative (14.6%), teacher (14.6%) or another person such as a friend (14.6%). In one case there was no designated supervisor with the incident occurring during a social gathering (Figure 46).

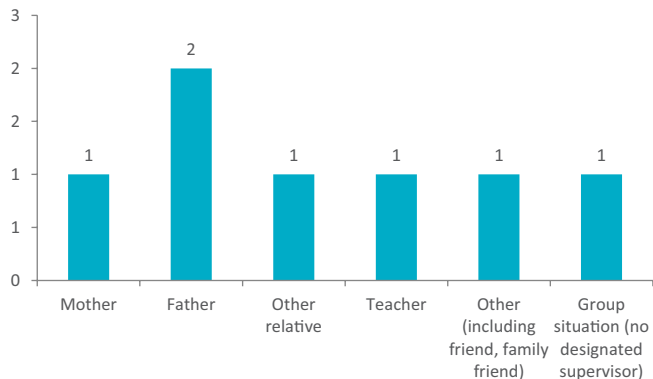


Figure 46: Drowning deaths in Public and Commercial pools by person responsible for supervision, 2005/06 to 2014/15 (N=7)

Observation and retrieval

Those who drowned were most commonly first observed by an adult bystander or witness (38.9%). In a further 22.2% of cases pool staff found the person who drowned (Figure 47).

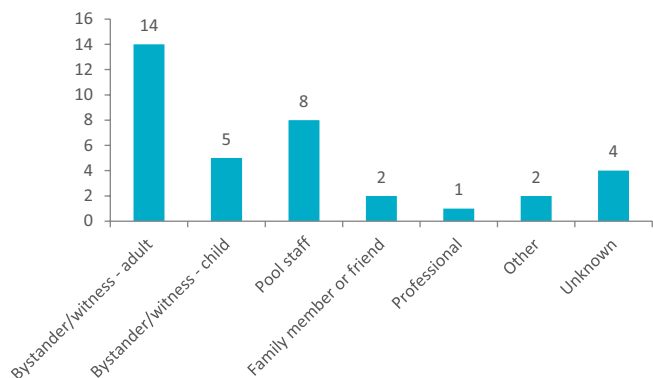


Figure 47: Drowning deaths in Public and Commercial pools by who observed or found the person, 2005/06 to 2014/15 (N=36)

Analysing only those cases where lifeguards were known to be present (n=24), an adult bystander or witness was the first to observe the person who drowned in 45.8% of cases and a member of the pool staff in 33.3% of cases.

In almost half of cases, pool staff retrieved the person who drowned from the pool (44.4%). A further 22.2% of people who drowned were retrieved by an adult bystander or witness (Figure 48).

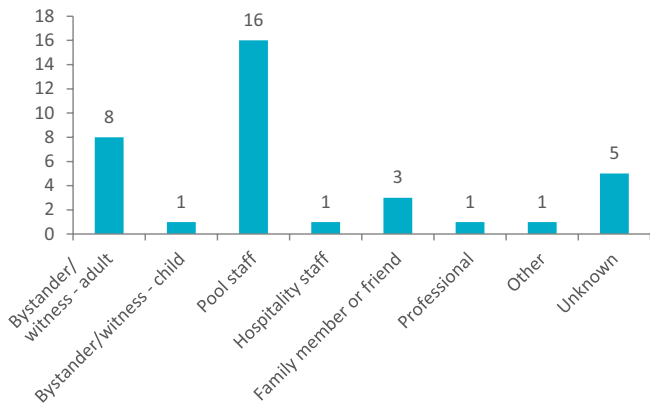


Figure 48: Drowning deaths in Public and Commercial pools by who retrieved the person, 2005/06 to 2014/15 (N=36)

Analysing only those cases where lifeguards were known to be present (n=24), a member of the pool staff retrieved the person who drowned in 66.7% of cases and an adult bystander or witness in 20.8% of cases.

Presence of lifeguards

In two thirds of drowning cases at least one lifeguard was present (66.7%). In a further 11.1% of cases there were no lifeguards on duty. Of these 4 cases, 2 occurred in unsupervised community swimming pools, 1 occurred in a pool operating in low patronage mode and 1 occurred after hours. In 5.6% of cases the type of swimming pool involved in the incident was not required to have lifeguards on duty. Of these 2 cases, 1 occurred in a school swimming pool and 1 in a fitness centre pool. In the remaining 16.7% of cases it was not known whether or not lifeguards were present (Figure 49).

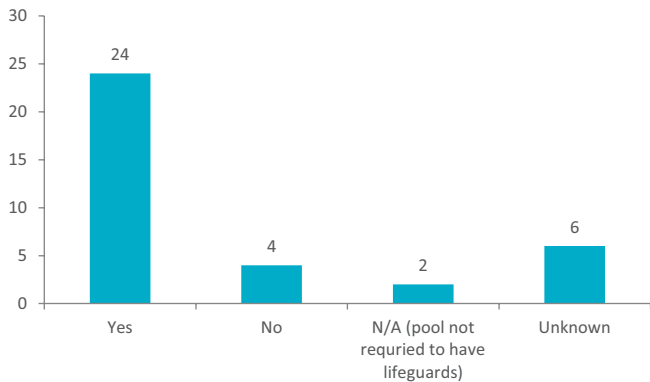


Figure 49: Drowning deaths in Public and Commercial pools by presence of lifeguards, 2005/06 to 2014/15 (N=36)

Among the cases where lifeguards were known to be present, 1 lifeguard was present in 20.8% of cases, 2 were present in 41.7% of cases and 3 were present in 16.7% of cases. The number of lifeguards on duty was unknown in 8.3% of cases (Figure 50).

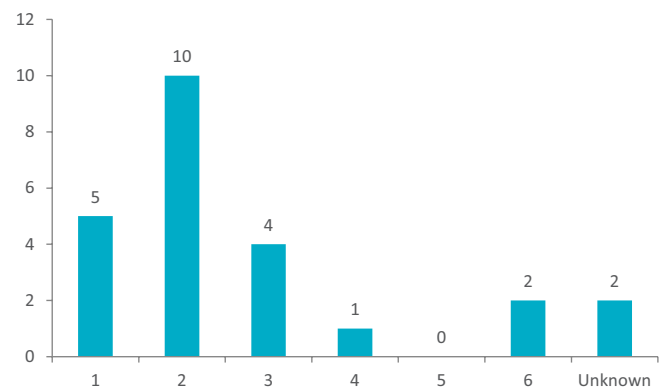


Figure 50: Drowning deaths in Public and Commercial pools by number of lifeguards present, 2005/06 to 2014/15 (N=24)

Response to the emergency

In the majority of cases emergency services were contacted (88.9%). The information was not available in the remaining 11.1% of cases (Figure 51).

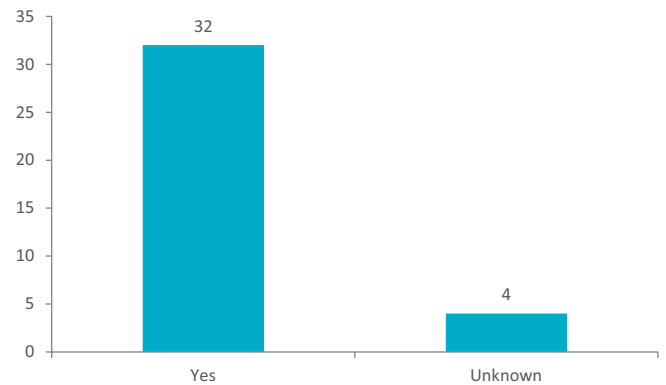


Figure 51: Drowning deaths in Public and Commercial pools by whether or not emergency services were called, 2005/06 to 2014/15 (N=36)

In more than three quarters of cases it was not known who contacted emergency services (81.3%). In 9.4% of cases a bystander called for assistance, while in a further 9.4% of cases it was pool staff who called for help (Figure 52).

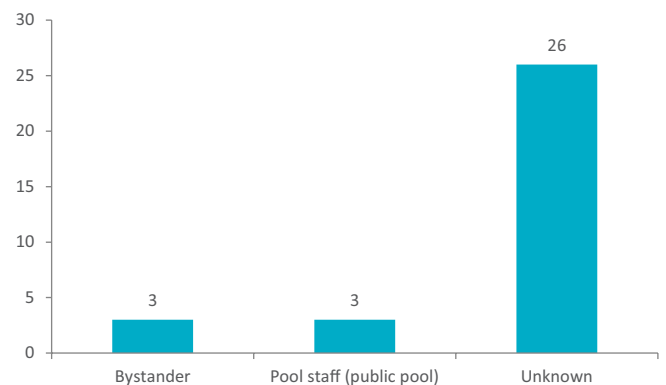


Figure 52: Drowning deaths in Public and Commercial pools by who called emergency services, 2005/06 to 2014/15 (N=32)

Police were known to attend the scene in 36.1% of cases, the hospital in 5.6% of cases and the home of the deceased in 2.8% of cases. It was not known which location the police first attended in the remaining 55.6% of cases (Figure 53).

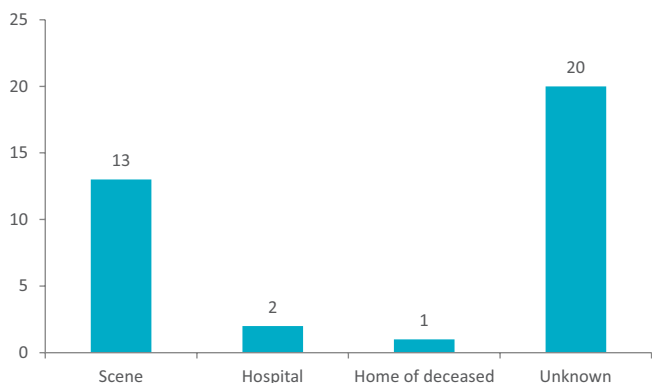


Figure 53: Drowning deaths in Public and Commercial pools by whether police attended the scene, hospital or home of the deceased, 2005/06 to 2014/15 (N=36)

A Workplace Health and Safety-related organisation was involved in the investigation of 7 drowning deaths (19.4%). In a further 55.6% of cases, it was known that such an organisation was not involved in the case (Figure 54).

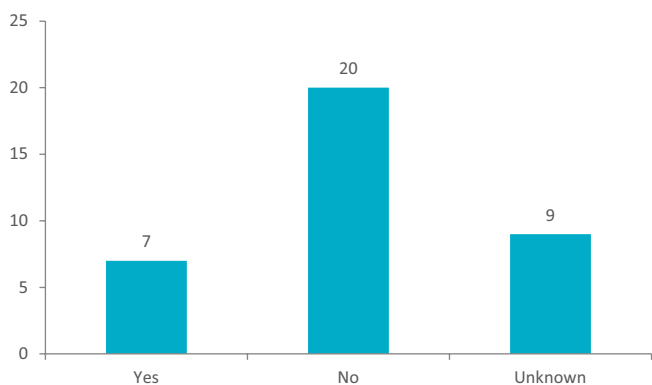


Figure 54: Drowning deaths in Public and Commercial pools by whether a Workplace, Health and Safety-related organisation was involved, 2005/06 to 2014/15 (N=36)

The state of the patient was described in 58.3% of drowning cases. Common language used included "no signs of life", "not breathing", "no pulse", "unconscious" and "unresponsive".

Treatment was administered in the majority of drowning cases (86.1%). In 1 case it was known that treatment was not administered, while in the remaining 11.1% of cases this information was not available (Figure 55).

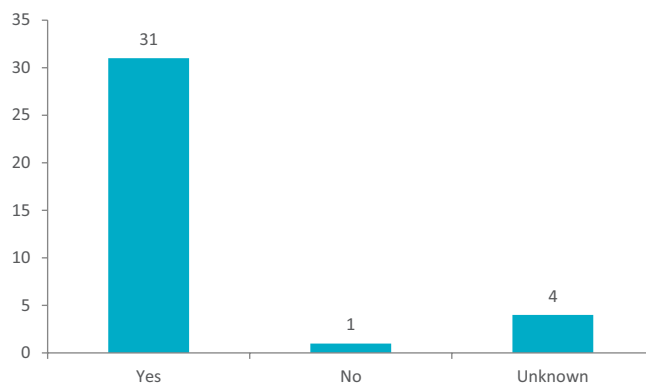


Figure 55: Drowning deaths in Public and Commercial pools by whether or not treatment was administered, 2005/06 to 2014/15 (N=36)

Swimming ability

Among those who drowned, 13.9% were non-swimmers, 8.3% were poor swimmers, 22.2% were competent swimmers and 22.2% were strong swimmers (Figure 56).

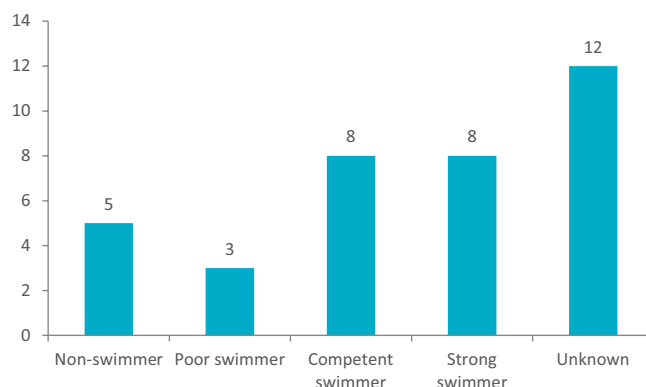


Figure 56: Drowning deaths in Public and Commercial pools by swimming ability, 2005/06 to 2014/15 (N=36)

Swimming pool characteristics

Information relating to the ownership and/or management of the swimming pool was specified in a quarter of cases (25.0%). Among the 9 cases where this information was available, the pool was most commonly owned by a government entity (Local or State Government) and operated by another organisation, such as a professional management company.

The specific method of entry into the water was unknown in 80.6% of cases. Among the remaining cases, 2.8% of people jumped or dived in, 5.6% of people entered via the steps or a ramp, 2.8% of people required specialised disabled access, 5.6% of people entered via an inflatable device or slide and 2.8% of people fell into the pool (Figure 57).

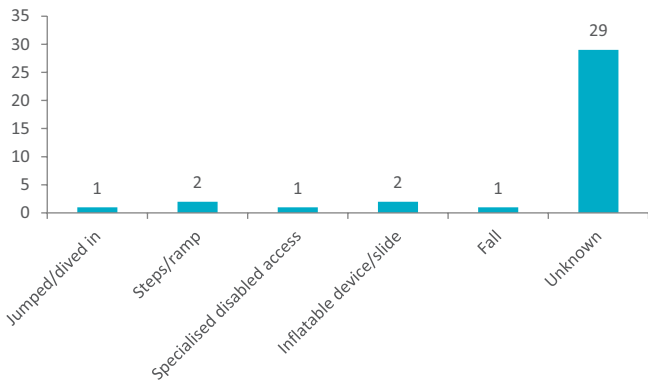


Figure 57: Drowning deaths in Public and Commercial pools by method of access, 2005/06 to 2014/15 (N=36)

Incidents most commonly occurred in the deep end of the swimming pool (30.6%), followed by the side of the pool (8.3%). Incidents were also recorded in the shallow end of the pool (5.6%), middle of the pool (2.8%) or another pool environment, such as a spa or hydrotherapy pool (5.6%) (Figure 58).

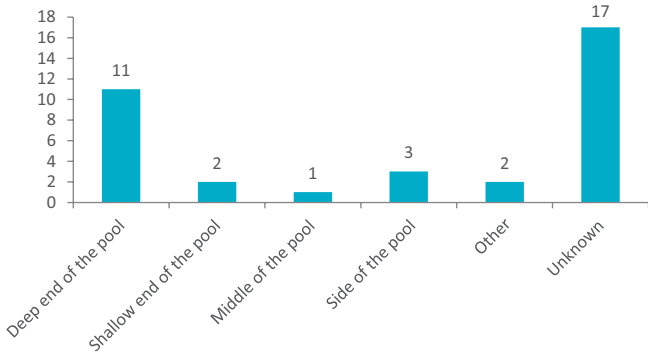


Figure 58: Drowning deaths in Public and Commercial pools by location of incident within swimming pool, 2005/06 to 2014/15 (N=36)

The patronage of Public and Commercial swimming pools was commonly unknown (63.9%). Among the remaining cases, the number of patrons observed in the water included 1 person (5.6%), 2 to 5 people (8.3%), 6 to 10 people (2.8%), 11 to 100 people (13.9%) and 501 to 1000 people (5.6%) (Figure 59).

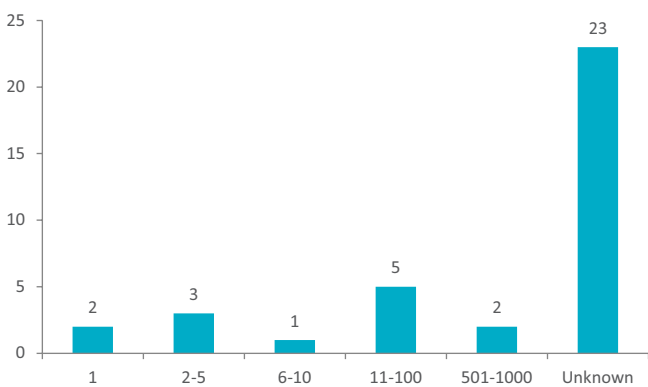


Figure 59: Drowning deaths in Public and Commercial pools by number of patrons in swimming pool, 2005/06 to 2014/15 (N=36)

Coronial findings and recommendations

In more than half of cases, a finding was available (55.6%), while recommendations were also made in a further 16.7% of cases (Figure 60).

Recommendations included references to identifying non-swimmers and poor swimmers, minimum safety standards and safety features, reviewing safety standards and procedures, supervision of pool patrons by lifeguards, swimming and water safety education, drowning prevention programs and relevant regulatory bodies for public swimming pools. In 2 cases, recommendations were directed specifically to Royal Life Saving.



Figure 60: Drowning deaths in Public and Commercial pools by presence of coronial findings or recommendations, 2005/06 to 2014/15 (N=36)

Signage was referenced in 10 drowning deaths (27.8%). This signage included material related to swimming ability and aquatic experience (e.g. for non-swimmers and weak swimmers), supervision (e.g. requirement for adult supervision of children or absence of lifeguards), pool rules and safety features (e.g. pool depths) (Figure 61).

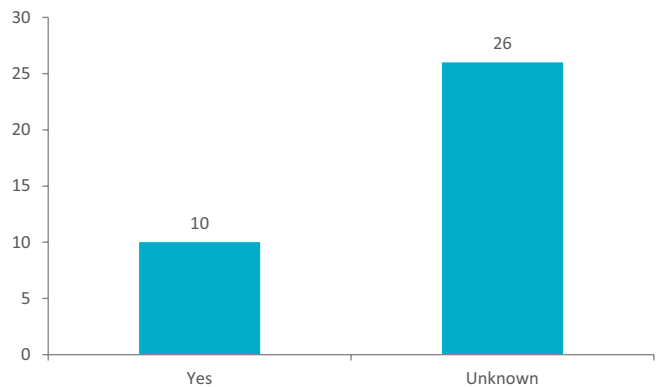


Figure 61: Drowning deaths in Public and Commercial pools by reference to signage in coronial file, 2005/06 to 2014/15 (N=36)

Royal Life Saving was mentioned in 10 of the relevant coronial files. These included references to: qualifications (Pool Lifeguard, Bronze Medallion), programs (Keep Watch @ Public Pools, Swim and Survive, Watch Around Water) and industry standards (GSPO), as well as discussions regarding lifeguard to patron ratios, applicable safety standards and the role of Royal Life Saving in the community.

NON-FATAL DROWNING

Overall

Between 1 July 2005 and 30 June 2015, there were 362 cases of non-fatal drowning in Communal and Public and Commercial swimming pools. Of these, 105 cases of non-fatal drowning occurred in Communal pools (incorporating Residential Institutions, as well as Trade and Service Areas) and 257 occurred in Public and Commercial pools (incorporating School, Other Institution and Public Administration Areas, as well as Sports and Athletics Areas).

Note: Due to the “upscaling” methodology used to estimate the number of non-fatal drowning incidents, totals may not match corresponding categories or total values (“upscaling” calculated independently for each variable to improve accuracy).

Communal swimming pools

Financial year

The number of non-fatal drowning cases occurring in Communal pools ranged from a low of 4 per year (2009/10) to a high of 17 per year (2014/15) (Figure 62).

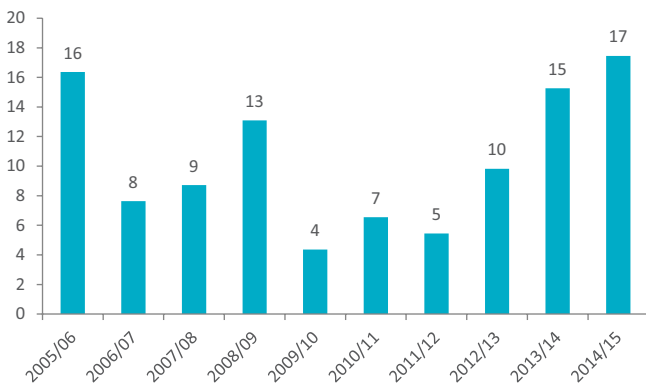


Figure 62: Non-fatal drowning in Communal pools by financial year, 2005/06 to 2014/15 (N=104)

Demographics

Among those who drowned in Residential Institutions or Trade and Service Areas, 65.7% occurred in males and 34.3% in females. The leading age group for drowning was children aged 0-4 years (44.7%), followed by children aged 5-9 years (25.2%) and people aged 25-34 years (7.8%) (Figure 63).

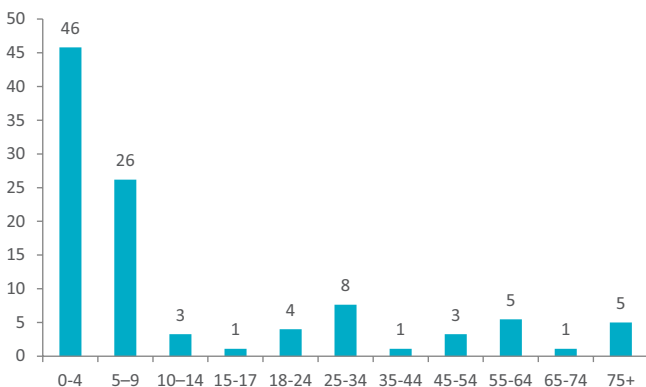


Figure 63: Non-fatal drowning in Communal pools by age, 2005/06 to 2014/15 (N=103)

Public and Commercial swimming pools

Financial year

The number of non-fatal drowning cases in Public and Commercial pools ranged from a low of 15 per year (2009/10) to a high of 38 per year (2013/14) (Figure 64).

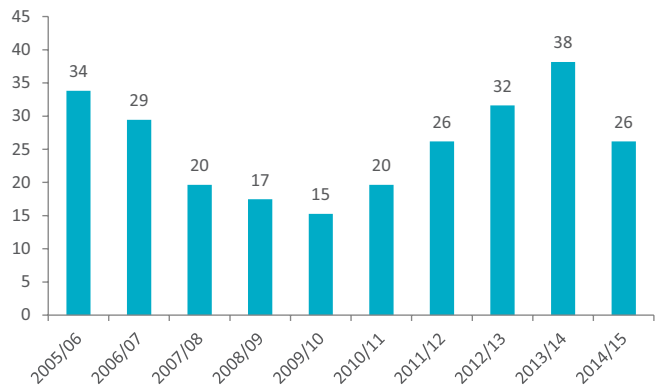


Figure 64: Non-fatal drowning in Public and Commercial pools by financial year, 2005/06 to 2014/15 (N=257)

Demographics

Among those who drowned in School, Other Institution and Public Administration Areas or Sports and Athletics Areas, 58.0% occurred in males and 42.0% in females. The leading age group for drowning was children aged 0-4 years (45.4%), followed by children aged 5-9 years (21.2%) and 10-14 years (11.9%) (Figure 65).

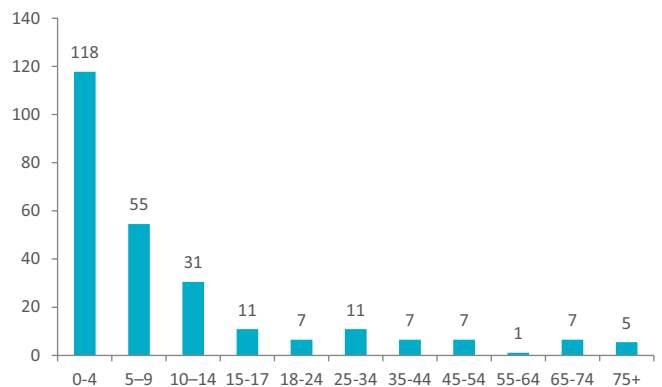


Figure 65: Non-fatal drowning in Public and Commercial pools by age, 2005/06 to 2014/15 (N=260)

FATAL AND NON-FATAL DROWNING

Communal swimming pools

Financial year

The total number of drowning incidents, both fatal and non-fatal, occurring in Communal pools ranged from a low of 6 per year (2011/12) to a high of 22 per year (2013/14 and 2014/15) (Figure 66).

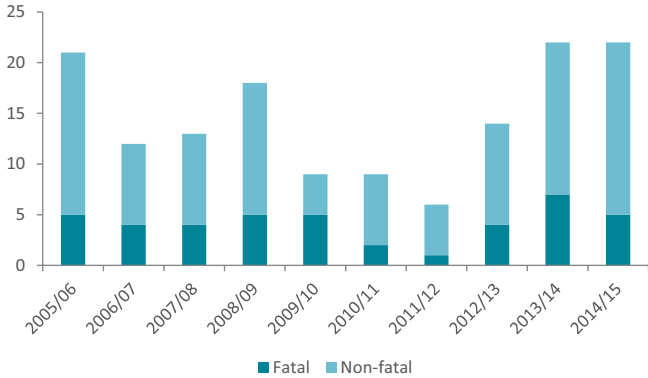


Figure 66: Fatal and non-fatal drowning in Communal pools by financial year, 2005/06 to 2014/15 (N=146)

Demographics

Drowning incidents were most common in children aged 0-4 years, accounting for 32.4% of incidents. Children aged 5-9 years accounted for a further 18.6% of incidents (Figure 67).

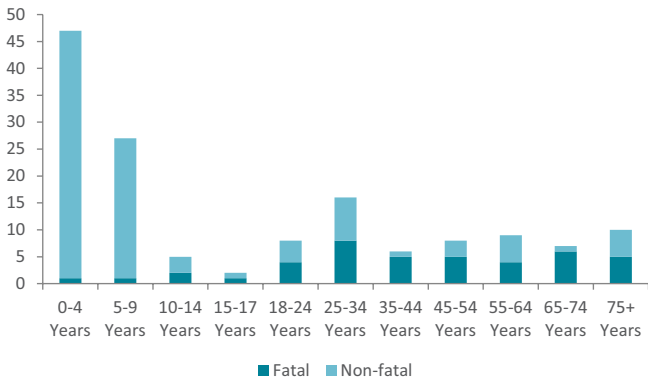


Figure 67: Fatal and non-fatal drowning in Communal pools by age, 2005/06 to 2014/15 (N=145)

In Communal pools, for every 1 fatal drowning, there were 2.5 non-fatal drowning incidents.

Public and Commercial swimming pools

Financial year

The total number of drowning incidents, both fatal and non-fatal, occurring in Public and Commercial pools ranged from a low of 20 (2008/09) to a high of 43 (2013/14) (Figure 68).

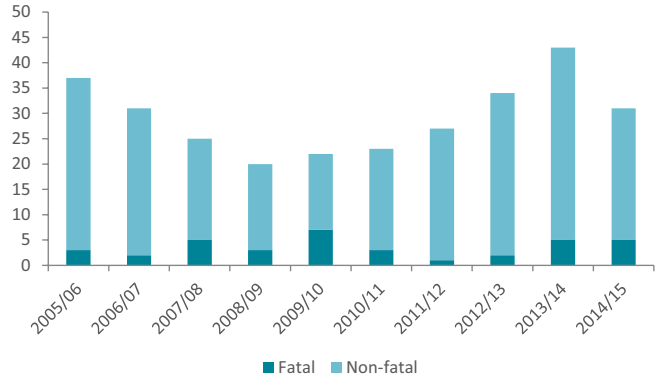


Figure 68: Fatal and non-fatal drowning in Public and Commercial pools by financial year, 2005/06 to 2014/15 (N=293)

Demographics

Drowning incidents were most common in children aged 0-4 years, accounting for 40.5% of incidents. Children aged 5-9 years accounted for a further 20.9% of incidents (Figure 69).

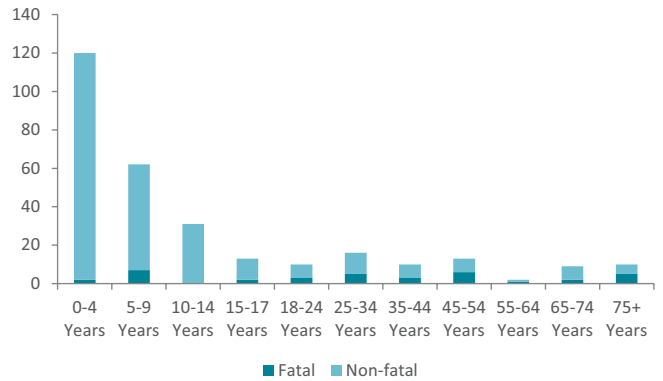


Figure 69: Fatal and non-fatal drowning in Public and Commercial pools by age, 2005/06 to 2014/15 (N=296)

In Public and Commercial pools, for every 1 fatal drowning, there were 7.1 non-fatal drowning incidents.

DISCUSSION

FATAL DROWNING

Demographics

A similar number of drowning deaths occurred in both Communal and Public and Commercial swimming pools during the study period, with both locations recording a low of 1 death per year and a high of 7 deaths per year. In both locations, males were overrepresented in drowning statistics, accounting for approximately 80% of recorded deaths.

There were however, differences in the age profiles of those who drowned. Adults aged 25-34 years were the leading age group for drowning in Communal pools, whereas children aged 5-9 years accounted for the highest number of deaths in Public and Commercial pools. In each case, the leading age group accounted for almost a fifth of recorded deaths. Children aged 0-14 years accounted for a quarter (25%) of deaths in Public and Commercial pools compared to only 10% in Communal pools.

The high proportion of drowning deaths among children in Public and Commercial swimming pools highlights the importance of the Royal Life Saving's Keep Watch @ Public Pools program. Encouraging parents and carers of young children to actively supervise their children while at public pools is critical to reducing the number of young lives lost. One of the program's key phrases for signage, "Lifeguards are not babysitters", underlines the challenges associated with educating parents and carers of their responsibilities at public pools.

Time of drowning

Drowning deaths in Communal pools were most likely to occur in summer, compared to spring in Public and Commercial pools. Although deaths were recorded in all seasons in both locations, a sharper spike occurred in the warmer seasons in Communal pools (six times more incidents in summer than winter), when compared to Public and Commercial pools (twice as many incidents in summer than winter); indicating the more seasonal nature of Communal pools. In contrast, many Public and Commercial pools are patronised all year round, particularly indoor facilities.

In both locations drowning deaths peaked on the weekends, with incidents most commonly occurring during the afternoon. A higher proportion of incidents were recorded in the evening and early morning in Communal pools than Public and Commercial pools, reflective of the differences in typical opening hours at both locations. Information regarding times of heightened risk can and should be utilised by pool owners and operators when designing and running Communal, Public and Commercial swimming pools.

Location and activity

Five Australian States and Territories recorded drowning deaths in Communal pools during the study period, while deaths in Public and Commercial pools occurred in all States and Territories. In both locations, the highest number of incidents occurred in Queensland, followed by NSW. However, there were nearly three times as many deaths in Queensland Communal pools compared to NSW Communal pools, with Queensland incidents accounting for more than half of all deaths in this location. The number of recorded deaths in Public and Commercial pools was more evenly distributed across the jurisdictions.

The disproportionate burden of deaths in Queensland Communal pools is likely reflective of the nature of tourism in the State and the favourable weather conditions for swimming, with Queensland attracting many visitors each year to sites such as The Gold Coast and The Sunshine Coast (29), as well as internationally renowned World Heritage sites such as the Great Barrier Reef (30).

Although the highest number of deaths in both locations occurred in major cities, proportionally, this trend was more apparent in Public and Commercial pools, where almost two thirds of incidents occurred in major cities. A key difference between those who drowned in Communal and Public and Commercial pools was whether or not they were visitors to the area. Almost all those who drowned in Public and Commercial pools were locals (i.e. not visitors). However, just under half of those who drowned in Communal pools were locals, meaning more people were in fact visitors to the location. Given that these events predominately occurred at hotels, motels and resorts, this finding is unsurprising, with people generally travelling to stay at such establishments.

Breaking down those who were deemed 'not a visitor', all of those who drowned in Public and Commercial pools and the majority of those who drowned in Communal pools resided within 25km of the location where they drowned. The magnitude of this finding is particularly relevant to Public and Commercial pools. It is apparent that Public and Commercial pools should be targeting those within the local area when it comes to drowning prevention strategies and general safety programs. This may be especially relevant to Government owned and/or operated swimming pools which are serving the immediate local community, for example a council area.

In both locations, swimming and recreating was the most common activity being undertaken prior to drowning, indicating the majority of people who drowned had deliberately entered the pool to swim or recreate in the water. In a small number of cases people had fallen into the pool, jumped into the pool or been bathing in the water.

Risk factors

Alcohol appeared to be a more significant issue in Communal pools than Public and Commercial pools. Given the more regulated environment that exists in many public swimming pools, this finding is again, unsurprising. Public and Commercial pools are likely to be well staffed with qualified professionals watching over the behaviour of patrons. In addition, they are more likely to have strict codes of conduct and be well signposted with warnings and safety signage. The environment at Communal pools is often more relaxed, compounded by the fact that most visitors to these pools are travellers on holidays. It is interesting to note that where available, all cases where alcohol was known to be present in Communal pool drowning deaths recorded a BAC greater than or equal to 0.05%. At these levels alcohol is known to affect alertness, perception, vision, balance, reaction time and psychomotor skills (31).

Pre-existing medical conditions were common amongst people who drowned in both Communal and Public and Commercial pools, with approximately two thirds of people in both cohorts recording at least one pre-existing condition. Cardiac conditions featured prominently in both cohorts, along with epilepsy, dementia, mental health disorders and genetic conditions. Although pre-existing medical conditions were recorded in almost all age groups, it should be noted that in all cases of older people drowning (ages 65 years and over), a pre-existing medical condition was recorded.

As well as being mindful of physical limitations and abilities, Royal Life Saving advises older Australians to be aware of any medical conditions they may have, including how these conditions may impact their ability in the water. Regular check-ups with a medical practitioner will ensure that any problems are detected early, treated effectively and monitored appropriately.

In addition to pre-existing medical conditions, aquatic injury is another concern. In at least one case which occurred in a Communal pool and one which occurred in a Public and Commercial pool, an injury was sustained in the swimming pool, which quite possibly impacted on the individual's swimming ability. Such occurrences were most likely to involve head or neck injuries, reinforcing the importance of safety signage reflecting safe behaviours in and around the pool, for example 'no diving'.

Drugs were another risk factor for drowning in Communal and Public and Commercial swimming pools. Although there were cases involving illegal drugs, such as cannabis and methamphetamine, more commonly legal drugs were detected. In most cases these were prescription medicines, available through a doctor. Royal Life Saving advises people to take all prescription medications as directed by their doctor, being mindful of possible adverse effects of medications, particularly drowsiness or dizziness, which may increase the risk of a fall into water. Although this advice is relevant to all prescription medicines, it is especially important for people with epilepsy who are taking medication to control seizures. Patrons of swimming pools should also be aware of the potential additive effects of alcohol and drugs when consumed together. For example, medications which may cause drowsiness, such as benzodiazepines and other central nervous system depressants, may potentiate the sedating effects of alcohol (32).

Circumstances related to the drowning

Supervision

The presence of parental or carer supervision was only examined in cases of child drowning, where the child was aged 0-14 years as per the Royal Life Saving Keep Watch @ Public Pools program. A lack of appropriate supervision was an issue in drowning deaths at both locations, with approximately three quarters of cases lacking parental or carer supervision at both Communal and Public and Commercial pools. Of these cases without supervision, it was found to be either missing entirely or only indirect. Indirect supervision referred to situations where the parent or carer of the child was physically in vicinity of the child but was not giving his or her full attention to the task. Most commonly, this was because the supervisor was distracted by another task, such as a conversation with another adult or attending to another child in their care.

In both locations, situations were reported where a large group had attended a swimming pool together, with multiple adults and children present. Although a number of adults were present at these events, there was no designated supervisor who was responsible for supervising the children in and around the swimming pool. In cases where more than one adult is present, it should be clear who is responsible for supervising any children in the group, with this role clearly delegated to one of the attending adults. If the designated supervisor needs to leave the pool area, the responsibility for supervision should be passed onto another adult; with this handover clearly communicated to all adults present.

Previous research has examined caregiver supervision at public pools, finding differences in the quality of supervision by age of the child and swimming ability, with younger children and those of poorer swimming ability being more closely supervised (33). The Keep Watch @ Public Pools program emphasises the importance of adult supervision for all children aged under 15 years. However, different advice is provided to parents and carers depending on the age of the child and their swimming ability (18).

Observation and retrieval

In both Communal and Public and Commercial swimming pools, it was most likely that the person who drowned was first observed by a bystander or witness (including a resident or guest), while the actual process of retrieving the person from the water was most likely to have been performed by a member of staff; either hospitality staff in the case of Communal pools or pool staff in the case of Public and Commercial pools. It should be noted that this analysis was repeated a second time with the Public and Commercial pool cases. In this second analysis, only cases where lifeguards were known to be present were included. Although the same trend persisted, the proportion of people both observed and retrieved by lifeguards increased.

It is worth noting the significance of this trend, which has also been identified in international research (34). Even in pools where lifeguards are present, bystanders are still likely to spot someone in difficulty before staff. Given the ratio of lifeguards to patrons in most of these facilities, bystanders will often be closer to someone in the water and therefore, are ideally placed to alert a lifeguard to an emergency situation. The fact that pool staff were more likely to retrieve a person from the water than a bystander, suggests this is exactly what happened in many cases, with lifeguards then able to respond.

In a number of cases which occurred in Communal swimming pools, those who observed or retrieved someone from the water noted the difficulty in identifying that the person was in trouble. This was either due to visual difficulties, where seeing through the water to the bottom of the pool was challenging, or behavioural-related difficulties, where an observer was unsure whether someone in the pool was genuinely in trouble or simply acting deliberately, for example, deliberate breath holding under the water.

Royal Life Saving does not advise anyone to swim alone, regardless of their level of swimming ability or experience. While public swimming pools most likely have lifeguards on duty during operational hours, Communal pools in other locations such as hotels, motels, resorts and fitness centres will not necessarily provide such a service. Swimming alone means no one is present to assist in the case of an emergency, whether this means to call for help or provide direct assistance. Given the high proportion of drowning cases in Communal pools where only one person was in the pool at the time of the incident, avoiding recreating alone is particularly important in such locations where bystanders may not be close by.

In a number of cases, difficulties in removing the deceased from the water were noted, with the initial observer struggling to retrieve the deceased from the pool on their own. They may have been able to move them to shallower water but were forced to gain the help of other people in removing the deceased from the water completely.

Presence of lifeguards

None of the Communal swimming pools where a drowning occurred had a lifeguard on duty. While these pools are not required to have such a service, this obviously increases the risk of drowning for patrons using these facilities. Lifeguards were known to be present in two thirds of cases which occurred at Public and Commercial pools. The remaining cases included unsupervised community pools, pools operating in low patronage mode or pools which did not require a lifeguard to be on duty, such as school or fitness centre pools. In some cases only one lifeguard was present, whereas in larger and busier aquatic facilities up to six lifeguards were on duty at the time of the incident.

Among Public and Commercial pools which were required to have a lifeguard on duty, there was some confusion regarding the roles and responsibilities of these personnel. For example, the separation of supervision duties and administrative duties. In at least two cases the coronial records discussed the delegation and separation of these duties.

Previous work has been conducted to investigate ways to improve lifeguard surveillance at public swimming pools, with interventions designed to introduce new methods of scanning, educate lifeguards on the possible severity of drowning incidents and increase a lifeguard's perception of susceptibility to drowning incidents (35). Given the findings of this study, further research in this area is warranted to build on the existing knowledge surrounding best practice and training methods for pool staff.

Response to the emergency

In the majority of drowning cases, emergency services were contacted, with treatment administered in almost all incidents occurring at Public and Commercial pools but fewer incidents which occurred at Communal pools. In these cases, it was often clear that the person who drowned had been in the water for some time before they were found, rendering treatment futile. In all of these cases the deceased was the only person in the pool at the time of the incident.

Swimming ability

Contrary to the widely held belief that people who can swim will not drown, both competent and strong swimmers drowned in Communal and Public and Commercial swimming pools. Non-swimmers also drowned in Public and Commercial pools, while poor swimmers drowned in both locations. While this is valuable information, it would be even more useful if this level of detail was available for all cases. Among both cohorts, the swimming ability of a significant proportion of people who drowned was unknown; limiting the usefulness of this variable. It should also be noted that swimming ability was reported by a witness, family member, friend or similar, meaning that it was a subjective measure rather than tested against a referenced standard.

Evidence such as this will help to dispel the myth that capable and confident swimmers do not drown. Communicating this message to the general public will be challenging, particularly among experienced swimmers who have confidence in their own ability and skills. Nonetheless, it is important that the general community have an understanding of broader drowning prevention strategies, beyond learning to swim. For example, avoiding known risk factors such as alcohol and drug consumption, as well as being aware of pre-existing medical conditions and any impact these may have on a person's ability in the water.

Although not the sole contributor, a lack of swimming ability was a clear risk factor among non-swimmers and poor-swimmers who drowned. This lack of ability and aquatic experience impacted not only the person who drowned but also their potential rescuers. For example, in one case the first person to attempt the rescue of a drowning child was another person who could not swim themselves. In such situations, more than one life could end up at risk. It is worth highlighting the value of a broad water safety education, that is, beyond teaching children and adults to swim. In many situations safe rescue skills, such as those gained in a Bronze Medallion (36) or Grey Medallion (37), would have proved invaluable.

Swimming pool characteristics

The limited information available regarding the characteristics of the swimming pool where the drowning occurred should be kept in mind when interpreting the results of this study. In a majority of drowning deaths in both Communal and Public and Commercial pools, it was not known how the person who drowned entered the water. In the remaining cases, some people deliberately entered the pool via an action (e.g. jumping in or diving in) or a physical structure (e.g. entering via steps, a ramp, an inflatable device or specialised disabled access), while others only entered the water accidentally after falling in.

Similarly, the location of the incident within the pool was poorly reported, with people most commonly drowning in the deep end of the pool where they would not have been able to stand. Drowning prevention strategies targeting Communal, Public and Commercial swimming pools will need to consider the numerous ways people enter pools and potential locations of heightened danger within the pool, including cases where entry was not a deliberate action. Although as noted, the high proportion of unknowns means these findings should be interpreted with caution.

Communal pools generally had fewer attending patrons than Public and Commercial pools, a finding which reflects the accessibility of these locations. While public pools are open to the general public, Communal pools are generally only available to residents and guests of the facility. Additionally, due to their more targeted customer base, these pools are likely to be smaller in size than Public and Commercial pools. There was however more variation present in the number of people in the water at Public and Commercial pools, with larger aquatic facilities recording hundreds of visitors in the water.

Coronial findings and recommendations

The clear difference between coronial files regarding drowning deaths in both locations was the presence of recommendations accompanying coronial findings. Approximately a fifth of drowning deaths which occurred in Public and Commercial swimming pools had either new recommendations, or evaluated previous coronial recommendations which were produced as a result of a similar incident. However, there were no drowning deaths in Communal swimming pools which led to coronial recommendations.

Among the recommendations made as a result of Public and Commercial pool drowning deaths, multiple statements discussed the possible identification of swimming skill level (i.e. identifying swimmers and non-swimmers, or people of limited swimming ability), supervision of pool patrons by lifeguards (i.e. training and procedures, clarification of roles and responsibilities), reviewing safety standards and procedures (i.e. reviewing and updating the Royal Life Saving Guidelines for Safe Pool Operations, Australian Standards, minimum safety standards) and relevant regulatory bodies for public swimming pools.

Previous research has examined the effectiveness of coronial recommendations, concluding that the lack of mandatory reporting regarding the implementation of coronial recommendations may be limiting the overall effectiveness of the coroner's role (38). Following this report, it would be worth investigating how many of these specific recommendations have been acted upon, including a more detailed analysis of the types of organisations usually involved in such recommendations and their attitudes and beliefs regarding the role of coronial recommendations and their willingness to implement new safety measures proposed through this process.

Looking forward

In some areas of this study a wealth of information was available, however, in other areas there was a distinct lack of detail available. Given that the overwhelming majority of cases included in this report were closed (i.e. no longer under coronial investigation), this reflects a lack of detail within the police report, coronial finding, or both.

The more information that can be made available, the more targeted any drowning prevention initiatives can be. Public health interventions, such as drowning prevention strategies, should be based on the best available evidence. The more comprehensive this evidence is, the more targeted the intervention can be and therefore, the more likely it is to be successful within the target demographic.

While this study examined both fatal and non-fatal drowning in Communal, Public and Commercial swimming pools, it did not consider the broader types of injuries which may occur in these environments. For example, a study in Victoria found common injuries at public swimming pools included minor cuts, bruises and grazes, with injuries typically occurring among children aged 5-14 years (39). Ideally, future research in this area would encompass all injuries sustained at Communal and Public and Commercial swimming pools, whether they occurred in or out of the water.

Using the concept of the Safety Triangle, the number of minor injuries and no injury accidents can be estimated using fatal and non-fatal drowning data as recorded at Public and Commercial swimming pools. Based on the ten year study period in which an average of 27 fatal and non-fatal drowning incidents were recorded at Public and Commercial pools each year, it is estimated there would have been 783 minor injuries, 8100 no injury accidents and even more near-misses over the same ten years (40). Although safety practices have changed considerably since this model was originally proposed, it does give an insight into the broader nature and scale of injuries likely occurring in and around pools, which are not included in this report.

NON-FATAL DROWNING

Almost two and a half times more non-fatal drowning incidents occurred in Public and Commercial swimming pools than Communal pools during the study period. In both locations, males were overrepresented, accounting for approximately 60% of non-fatal drowning cases. However, this was to a lesser extent than that observed in fatal drowning where approximately 80% of all deaths occurred in males.

Within Communal pools, almost all incidents occurred in Trade and Service Areas (e.g. hotels and motels), with few recorded incidents in Residential Institutions (e.g. aged care facilities). Within Public and Commercial pools, the majority of incidents occurred in Sports and Athletics Areas (e.g. public pools and fitness centres), while a small proportion occurred in School, Other Institution and Public Administration Areas (e.g. schools). Noting where the majority of incidents occurred within these broader categories is relevant when interpreting the results of this study.

In both locations, children featured prominently in the top three age groups for drowning. However, this trend was particularly pronounced in Public and Commercial pools where the leading age groups for non-fatal drowning were all below 15 years (0-4, 5-9 and 10-14 years). Children aged 0-14 years accounted for more than three quarters of non-fatal drowning in this location.

As the non-fatal drowning data were only provided in aggregate format, an analysis of the circumstances related to the drowning is not possible. As such, important risk factors cannot be ascertained. However, it is reasonable to presume that these would be very similar to the patterns observed in drowning deaths in Communal, Public and Commercial swimming pools.

LIMITATIONS

Fatal drowning

- A proportion of cases within this report were open (ie. case still under investigation) and as such, a number of variables remain unknown until the case is closed following the completion of any coronial investigation. It should be noted there may be a higher number of unknown variables among cases in regional/rural areas or more recent years where a larger proportion of cases may still be under investigation.
- Amongst cases which were closed, some were still missing information, either because the information was unknown or it was not made available electronically. In such cases, variables were entered as 'unknown', limiting the completeness of the data.
- Much of the circumstantial information related to drowning deaths came from witness reports contained within police reports and coronial files. As such, some details may be unreliable.
- Population figures from the Australian Bureau of Statistics were used to calculate drowning rates. However, these do not take into account exposure or visitation to a particular site. As not all Australians visit Communal or Public and Commercial pools this would have underestimated drowning rates.

Non-fatal drowning

- There were two scenarios which led to hospitalisations related to non-fatal drowning being excluded from the dataset; the situation where a patient died in hospital or was transferred from another acute care facility. However, what cannot be mitigated is the risk of overestimating numbers due to readmissions from the community. It is worth noting that this scenario is not believed to be a common occurrence and any impacts on the results of this study would be negligible.
- The non-fatal data obtained relate to hospital separations and therefore, do not include patients who may have been treated for a non-fatal drowning incident either by ambulance officers/paramedics only or in the emergency department of a hospital only (i.e. outpatient treatment). In order to gain a more complete understanding of the full burden of drowning, figures related to ambulance calls and Emergency Department (ED) presentations would also need to be collated and analysed.
- The non-fatal data obtained do not indicate the severity of the injury experienced. For example, without the length of stay we do not know how long an admitted patient remained in hospital. In the absence of this information, or any other marker which may provide similar insights, we are lacking information regarding the severity of an incident. Similarly, these data do not provide any information regarding the long-term outcomes of patients who experienced a non-fatal drowning incident.
- The available place of occurrence coding for swimming pools was limited in its specificity when compared to the location coding used in the Royal Life Saving National Fatal Drowning Database. The place of occurrence coding within ICD-10-AM is not specific to drowning or aquatic environments, meaning the classifications are relatively broad to encompass a wide variety of possible locations. These were aligned as closely as possible to the 'National Aquatic Facility Classifications' for the purposes of the report but assumptions were made in order to extract relevant cases of non-fatal drowning. For example, all cases of non-fatal drowning within 'Trade and Service Area' were reported, despite this category also including locations that would not be relevant to a report focusing on drowning in Communal, Public and Commercial pools. It was assumed that the majority of drowning incidents coded within this classification would occur in hotel swimming pools and this was therefore interpreted as such for the purposes of this report. Similar assumptions were made regarding the other location categories utilised.
- The non-fatal data obtained by Royal Life Saving is not directly comparable to the fatal data, which contains all unintentional drowning deaths, specifically where drowning was either the primary cause of death or a contributory cause of death. The non-fatal drowning dataset only contains cases where the first reported external cause of morbidity was Accidental Drowning and Submersion (W65-W74). In order to enable a direct comparison of fatal drowning to this narrower non-fatal dataset, a subset of the fatal drowning dataset (limited to W65-W74) was examined for a four year period (2007/08-2010/11). This was used to estimate the portion of the entire fatal drowning database which would be captured under the narrow definition of "drowning". Since directly comparable fatal drowning data was not available for the whole study period, this approach amounts to assuming that the ratios of fatal to non-fatal drowning which persisted over the four year subsample represent an accurate estimate of the ratios in the years for which no comparable data is available.

CONCLUSION

Public swimming pools are a valuable facility for local communities, providing space for physical activity, lifelong learning, social interaction and employment opportunities. There is a strong perception of safety at public pools due to the presence of lifeguards. However, this study has demonstrated that parents and carers often take this to mean that adult supervision is not required, leaving children unattended for a period of time. Royal Life Saving's Keep Watch @ Public Pools program addresses this popular misconception with the tagline "Lifeguards are not babysitters". Unfortunately, it would appear that this message has not been received by all visitors to public pools, suggesting a renewed focus is needed as part of a broader public awareness campaign.

By comparison, swimming pools at hospitality establishments, such as hotels, motels and resorts are not staffed by lifeguards, creating an increased risk for visitors. Despite popular opinion, this study has shown that people of all ages, backgrounds and swimming abilities can drown. In addition to a lack of appropriate parental or carer supervision, important risk factors for drowning in Communal, Public and Commercial pools include pre-existing medical conditions, alcohol consumption and drug use.

Although coronial recommendations have been made following drowning deaths at public pools, there is no mechanism to guarantee their implementation at an industry level, while this study found no coronial recommendations associated with deaths at hospitality establishments. Continued advocacy and engagement with the aquatic industry, police and State and Territory coroners will improve data collection and collation efforts, as well as furthering the issue within an influential group of stakeholders.

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