Public holidays, school holidays, and long weekends: Effects on drowning rates in New South Wales

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Abstract

Objective: To quantify drowning rates and fatal to non-fatal drowning ratios on public holidays, school holidays, weekdays and long weekends in New South Wales from January 2010 to June 2022.

Methods: Using a linked administrative dataset comprising ambulance (paper-based and electronic records), emergency department presentations and death registry, rates of drowning and ratios of fatal to non-fatal drowning were calculated.

Results: Across 4,161 total drowning incidents, public holidays (14.21 incidents/100,000 person-years) and weekends (6.77 incidents/100,000 person-years) had higher population-normalised incident rates than regular weekdays (3.18 incidents/100,000 person-years). School holidays (8.58 incidents/100,000 person-years) recorded higher rates than non-school holiday days (3.46 incidents/100,000 person-years). New Year's Day and Australia Day accounted for 4.7% of all incidents (n=197 incidents). Drowning during school holidays was higher than non-school holiday days across all seasons, aside from winter school holidays.

Conclusions: Drowning risk is higher on days typically associated with greater leisure time. This study adds to the growing literature identifying temporal variation in drowning risk and is the first to use linked data.

Implications for Public Health: Those tasked with supervising aquatic locations and the provision of water safety messaging should consider the targeted strategies for holidays and weekends such as extended patrols and media-based risk communication.

Keywords: drowning, exposure, risk, prevention, epidemiology, temporal

Introduction

Drowning is a preventable cause of injury-related mortality and morbidity. In Australia, an average of 271 people die due to unintentional drowning each year,[1] with the burden even greater when intentional drowning fatalities are included.[2] The 8.153 million residents of the Australian state of New South Wales (NSW) have a diverse range of water bodies to choose from including 1,460 km of coastline, a range of rivers, lakes, dams and reservoirs and a high density of private backyard and public pools, particularly in metropolitan locations with a more temperate climate.[3] As the Australian state with the largest population, NSW also records the highest number of unintentional drowning fatalities each year, an annual average of 95 deaths.[1]

In high-income countries, such as Australia, drowning is an injury mechanism strongly linked to recreational activities such as swimming, boating and fishing.[4] Swimming and recreating are regularly the leading activity participated in prior to unintentional all-age drowning in Australia.[1] However, varied activity patterns during the COVID-19 pandemic resulted in boating overtaking swimming as the leading activity prior to unintentional drowning in the coastal environment.[5]

However, fatal drowning is only one part of the picture.[6] Significant health system and rescue organisation response is dedicated to retrieving and treating people who drown. If the individual survives, this is termed a non-fatal drowning.[7] While national studies have examined non-fatal drowning as defined by hospital discharge,[8] sub-

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national studies have used various data sources including ambulance data.[9] Studies of non-fatal drowning using linked data are even more rare.[10]

The significant proportion of drowning fatalities associated with recreational pursuits, indicates a link between available leisure time and exposure to the risk of drowning. Previous studies in Australia have explored the link between increased leisure time during school and public holidays and on weekends, and the impact on drowning fatalities. These studies have found significantly higher risk of drowning deaths on public holidays, 1.73 times higher for all ages and all aquatic locations [11] and 2.40 times higher for children 5–17 years of age during school holidays.[12] For coastal mortality, including drowning, public holidays represent a 2.03 times higher risk of death, increasing to 2.14 times higher risk on long weekends.[13]

No previous study has examined the impact of school and public holidays, and weekends, on the full burden of drowning, that is both fatal and non-fatal drowning in all aquatic locations and for all age groups. Therefore, this study aims to examine the impact of school and public holidays, and weekends on fatal and non-fatal drowning in NSW, Australia.

Methods

Data source

This study is a retrospective, cross-sectional analysis of administrative data. A linked administrative dataset with patient identifiers removed, based on the cohort of all individuals attended by NSW ambulance for drowning of all intents (unintentional, intentional, undetermined intent) between January 1, 2010, and June 30, 2022, was provided by the NSW Centre for Health Data Linkage (CHeReL).[14] The dataset comprised ambulance data collected through the Patient Health Care Record (PHCR) and electronic medical record (eMR), which were linked with the NSW Emergency Department Data Collection, and deaths data through the Registry of Births, Deaths and Marriages (RBDM).[15]

Ambulance data comprise both PHCRs and eMRs as NSW ambulance transitioned from one system to the other during the study period. In case of a duplicate record across both systems, electronic records were prioritised, such that only the eMR record was retained. If more than one ambulance attended the same patient, if a patient was transferred between hospitals or if they were transferred to another location (e.g. to a morgue), only the primary record was retained.

The patient's sex was recorded in ambulance records, emergency department records and death records, if applicable, and checked for concordance. If the recorded age differed across data sources, the age recorded at the emergency department was used. If an individual was recorded as having an implausible age (defined as >120 years), their age was marked as missing. Thirty-day mortality was defined if a death date was returned from RBDM, and the death occurred within 30 days of the drowning incident. Where RBDM did not identify a death date, but the ambulance recorded the individual as "Deceased on examination", the individual was deemed to have died.

Data were cleaned and analysed using Python 3.12.0 software [16] with the Pandas 2.1.4 library.[17]

Season and leisure day categorisations

The date the ambulance call was received (incident date) was used to derive the Australian season the drowning occurred during, where summer occurs between December and February, autumn between March and May, winter between June and August and spring between September and November. Incident date was also used to categorise incidents by day of the week, public holiday (yes/no) and school holidays (yes/no). "Regular weekdays" were defined as a weekday between Monday and Friday that was not a public holiday and occurred in and out of school holiday periods. Long weekends were defined as public holidays that occurred consecutively with weekend days. Data on public holidays occurring within the range of the incident data were retrieved from Nager.Date,[18] and were validated against the subset of holidays available from the NSW Government Industrial Relations website.[19] When New Year's Day (1 January), Australia Day (26 January), Christmas Day (25 December) or Boxing Day (26 December) fall on a Saturday or Sunday, an additional public holiday is observed on the following Monday. When this occurred, both the weekend day and the observed day were considered public holidays. School holiday dates were retrieved from the NSW Education website,[20] with historical records retrieved from versions stored in Web Archive.[21] The extra week of summer holidays granted to schools in the Western Division of NSW was not incorporated into calculations as very few drowning incidents (n=4) occurred in the corresponding areas.

Analysis

Incident rates per 100,000 person-years were calculated by summing the number of incidents in each day category, dividing the results by the number of times that day type occurred in the dataset, and then dividing by the appropriate number of person-years. This denominator was calculated by taking the 2016 population size [22] for each subgroup (or the total population) and dividing by 100,000 and multiplying by 365.25 days. 2016 census population sizes were used as this occurred at the approximate midpoint of the study period. Fatal:non-fatal ratios were calculated for events found to occur on weekends, public holidays and school holidays; that is the number of non-fatal drownings were divided by the number of fatalities for the corresponding variable under analysis. Similarly, female:male ratios were calculated by dividing the number of incidents involving males by the number of incidents involving females for each day category.

The variations in incident rates by season, weekend, long weekend, public holiday and school holiday days were tested for statistical significance using Pearson's χ^2. The null hypotheses for each analysis were:

- The incident rate was equal for all day types.
- The proportion of incidents in females was the same for all day types.
- The proportion of fatal incidents was the same for all day types.

For incident rate analyses, expected values were normalised by the number of days in each day category. Bonferroni correction was applied to comparisons between regular weekdays and weekend, long weekend, and public holidays to account for multiple comparisons. Analyses were repeated for age and gender subgroups as appropriate.

Results

A total of 4,161 incidents were identified, including 2,220 records from eMR and 1,941 records from PHCR, and for 12 incidents occurring just outside the border of NSW (for which NSW ambulance responded). Half (50.2%) of the incidents occurred in summer (2,089 incidents) and over 2 in 5 (43.4%) occurred on weekends (1,807 incidents; Table 1).

Public holidays had a much higher incident rate (14.21 incidents/100,000 person-years), as did school holidays (8.58 incidents/100,000 person-years) and weekends (6.77 incidents/100,000 person-years), compared with regular weekdays (3.18 incidents/100,000 person-years). These differences were all statistically significant. Public holidays on New Year's Day (January 1) and Australia Day (January 26) contributed a large proportion of incidents (197 incidents; 4.7% of all incidents), at 31.88 and 24.70 incidents/100,000 person-years, respectively; including incidents occurring on the following Monday where the public holiday fell on a weekend (**Figure 1**).

This pattern was observed across all age and sex categories; however, the increase in drowning incidents for weekends/long weekends compared to regular weekdays was not significant for older adults aged 65+. The effect of a school holiday differed across seasons (Figure 1); with a distinct increase in drowning incidents observed for all seasons except winter, where the number of incidents/day was similar during holiday and non-holiday periods.

There were a total of 258 (6.2%) fatal incidents, with an average of 15.13 non-fatal incidents for each fatal incident (fatal:non-fatal ratio 1:15.13; Table 2). The fatal:non-fatal ratio varied by age, sex, seasons, public holidays and school holidays. Ages 5–17 had the highest fatal:non-fatal ratio (74.27), compared with ages 65+ who had the lowest (3.66). Summer (19.68) and weekends (19.08) had significantly higher fatal:non-fatal ratios than winter (10.7) and regular weekdays (12.69).

While children aged 5–17 years had the highest fatal:non-fatal ratio, the number of fatal incidents was too low to provide meaningful ratios at different times of the year. The highest fatal:non-fatal ratio was observed in summer for all other age groups. Children aged 0–4 years did not have significantly varying ratio for season or day of the week; however, they had a significantly higher ratio in school holidays (50.0) compared with non-school holidays (18.93). No significant variations were observed for day type in adults aged 18–64 or older adults aged 65+.

Females had a higher fatal:non-fatal ratio compared with males overall (females 22.98 vs males 12.17) and during all time categories except winter (females 10.0 vs males 10.43). This was driven by a statistically significant seasonal variation in incident rate in females, which was absent in males. In contrast, males had a significantly higher ratio in weekends compared with weekdays (13.3 vs 10.1). Variations in the female fatal:non-fatal ratio were particularly pronounced for school holiday periods compared with non-school holiday periods (43.09 vs 18.28) as were gender differences in school holidays (females 43.09 vs males 10.43), long weekends (females 39.33 vs males 11.62), public holidays (females 30.50 vs males 12.87) and weekends (females 34.12 vs males 15.32).

Overall, for each incident involving a female, there were 1.88 incidents involving males (female:male ratio 1:1.88); however, the ratio varied by season and for weekends, public holidays and school holidays (Table 2). The lowest female:male ratio was observed for children aged 0–4 during winter (1.06) and the highest for older adults aged 65+ on long weekends (17.0). Statistically significant increases in the female:male ratio were observed for weekends, long weekends and public holidays compared with regular weekdays (2.12, 2.71 and 2.53 vs 1.65) and for school holidays compared with non-school holidays (2.11 vs 1.76). The weekday differences were driven by adults aged 18–64 for weekends, long weekends and public holidays compared with regular weekdays (2.84, 3.70 and 3.36 vs 2.15). Seasonal variations in female:male ratio were not statistically significant.

Analysis of overlapping day categories (Supplementary table 1; Supplementary table 2) revealed higher drowning incident rates/100,000 person-years on weekends, ranging from non-significant 1.07 (long weekend days) to statistically significant 2.16 (non-school-holiday days) times the weekday rates. Similarly, public holidays had significantly higher incident rates ranging from 1.62 (long weekend days) to 3.99 (weekdays) times the corresponding non-public holiday rates, except for winter, where the rate was not significantly different (0.90 times). This was also observed in school holidays, where the rates were significantly higher, ranging from 1.28 (spring) to 2.66 (long weekends) higher than the corresponding non-school holiday rates, again excepting winter (non-significant 0.84 times).

Discussion

Drowning risk is strongly influenced by exposure to water both via visitation to aquatic locations and participation in activities in, on or around water.[23] In high-income contexts, this exposure commonly occurs during leisure time, as a result of participation in recreational activities such as swimming, boating and fishing.[1,5] This study aimed, for the first time, to use linked data from the pre-hospital setting through to hospital and death registry (in cases of fatal drowning), to examine the effect of presumed increased leisure time during public and school holidays, as well as weekends on fatal and non-fatal drowning in NSW. Overall, public holidays and weekends had higher rates of drowning than regular weekdays, and school holidays recorded higher drowning rates than non-school holiday days across all seasons, aside from the winter school holidays.

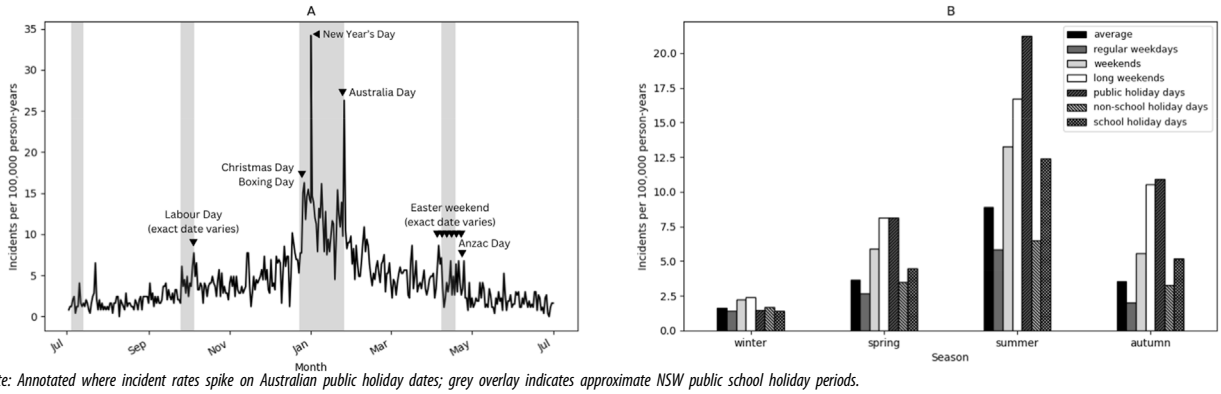
Public holidays were shown to have the strongest impact on drowning risk. Public holidays had the highest incident rate per 100,000 person-years, 2.11 times higher than the weekend rate and 4.50 times higher than the rate on regular weekdays. This is consistent with previously conducted studies at the national level on this topic, including all-age unintentional fatal drowning risk in all aquatic locations [11] and drowning and other causes of death in the coastal environment.[13] Of note, New Year's Day and Australia Day were identified as two public holidays with a significant proportion of drowning incidents. This is likely due to increased exposure and alcohol consumption as has been identified at popular river locations, in particular on Australia Day.[24] Given alcohol is a known contributor to drowning risk,[25] drowning prevention advocates may consider timed public awareness campaigns ahead of major public holidays. Policy makers expanding, and enforcing, alcohol free zones around water during high-risk times may help reduce drowning incidents. Planning for, and public facing communication around, events held near water on public holidays should avoid creating an alcogenic environment,[26] including the restriction of alcohol outlets near waterways.[27] Event organisers must also consider the increased drowning risk that may be present for those who may travel to attend

Table 1: Ambulance-attended drowning incident counts and incidents/100,000 person-years occurring in each season, in weekends, public holidays, and school holidays, New South Wales, 2010-2022.

	Overall	Season						Weekday type										School holiday			
		Summer	Autumn	Winter	Spring	χ^2 (3 df)	*p*	Regular weekday	Weekend	χ^2 (1 df)	*p*	Long weekend	χ^2 (1 df)	*p*	Public holiday	χ^2 (1 df)	*p*	Not school holiday	School holiday	χ^2 (1 df)	*p*
Total incidents recorded in the study period																					
Overall	4161	2089	869	386	817	1536.4	<0.01[a]	2054	1807	554.3	<0.01[a]	464	621.0	<0.01[a]	454	924.8	<0.01[a]	1558	2603	729.0	<0.01[a]
Age group																					
0-4	884	409	168	112	195	230.8	<0.01[a]	491	348	59.3	<0.01[a]	65	37.8	<0.01[a]	61	55.2	<0.01[a]	306	578	107.4	<0.01[a]
5-17	828	489	130	52	157	541.3	<0.01[a]	380	367	136.1	<0.01[a]	103	174.7	<0.01[a]	111	308.4	<0.01[a]	357	471	258.7	<0.01[a]
18-64	1981	976	473	166	366	709.8	<0.01[a]	883	940	418.6	<0.01[a]	264	499.3	<0.01[a]	253	684.2	<0.01[a]	744	1237	351.8	<0.01[a]
65+	317	139	71	48	59	62.4	<0.01[a]	206	99	1.5	0.22	18	1.6	0.21	19	7.0	0.02[a]	100	217	23.6	<0.01[a]
Missing	151	76	27	8	40			94	53			14			10			51	100		
Sex																					
Male	2621	1318	568	240	495	975.9	<0.01[a]	1224	1191	450.2	<0.01[a]	328	545.9	<0.01[a]	319	783.4	<0.01[a]	1023	1598	549.5	<0.01[a]
Female	1391	694	274	132	291	503.2	<0.01[a]	741	562	118.1	<0.01[a]	121	100.8	<0.01[a]	126	181.3	<0.01[a]	485	906	175.1	<0.01[a]
Missing	149	77	27	14	31			89	54			15			9			50	99		
Incidents / 100,000 person-years																					
Overall	4.45	8.93	3.55	1.66	3.65			3.18	6.77			10.79			14.30			8.12	3.51		
Age group																					
0-4	15.21	28.12	11.03	7.76	14.02			12.24	20.96			24.31			30.90			25.64	12.52		
5-17	5.58	13.17	3.34	1.41	4.42			3.71	8.65			15.08			22.02			11.71	3.99		
18-64	3.44	6.77	3.13	1.16	2.66			2.22	5.71			9.96			12.93			6.29	2.70		
65+	2.08	3.65	1.78	1.27	1.62			1.96	2.28			2.57			3.68			3.20	1.80		
Sex																					
Male	5.69	11.44	4.71	2.10	4.49			3.85	9.05			15.48			20.39			10.82	4.37		
Female	2.93	5.85	2.21	1.12	2.57			2.26	4.15			5.55			7.83			4.98	2.41		

[a]Statistically significant result

Figure 1: Rate of ambulance-attended drowning incidents per 100,000 person-years in New South Wales between 2010 and 2022, by day of the year (Panel A) and by day category and season (Panel B).



Panel A note: Annotated where incident rates spike on Australian public holiday dates; grey overlay indicates approximate NSW public school holiday periods.
Panel B note: Regular weekdays are defined as weekdays (Monday-Friday) that are not public holidays.

the event such as international visitors or those unfamiliar with local conditions.

Aside from the winter season, school holidays also represented a peak time for drowning. We identified a drowning incident rate 2.31 times higher during school holidays than non-school holiday days. Previous research found that the April and October school holidays, and to a lesser extent the July school holidays were associated with high-levels of leisure-related mobility in Australia.[28] This may indicate travel is being undertaken by families to new or less familiar aquatic locations which may present unfamiliar hazards and risks. This impacts drowning risk not just of the children at school, as has been previously documented,[12] but also for parents and caregivers who may get into trouble in the water themselves, or drown in the act of trying to rescue their children.[29] Our study results also identified higher drowning rates for pre-school-aged children (0-4 years), particularly for male children, during school holiday periods than non-school holiday periods, potentially reflecting supervision challenges or changes in routine brought about by the school holidays of older siblings or other family. We recommend child safety and drowning prevention organisations, reiterate the importance of supervision to parents and carers ahead of these high-risk times, including practical strategies to reduce drowning risk when working from home or while travelling with children.

Previous research has shown that visitation to natural waterways, such as those located in national parks, increases during school holidays.[30] Similarly research has shown that the nearest beaches to holiday accommodation are commonly unpatrolled beaches,[31] with proximity and convenience key factors behind unpatrolled beach goers' choice of location.[32] Although data on the aquatic location of the drowning incident are missing from this linked dataset, previous research has shown natural waterways, such as rivers, lakes, dams, beaches and the ocean, to be leading contributors to fatal and non-fatal drowning burden in Australia.[6] Current findings suggest a need for risk communication to parents and carers of school-aged children prior to commencing school holiday-related travel. Online promotion of 'secret' swimming spots and outdoor activities to do in nature on parenting and tourism sites, should include warnings about water safety.

In line with emerging literature, our findings also indicate a need to ensure drowning risk communication is not only targeted at males.[33,34] While males record higher numbers of drowning fatalities, in part due to differing exposure and aquatic activities being undertaken,[35,36] these findings indicate the existence of a hidden drowning burden among females. The finding that females who experienced an incident were less likely to die than males (fatal:non-fatal ratio 22.98 vs males 12.17) suggests that their burden has been less prominent in prior research that focused only on fatal incidents. The difference in fatal:non-fatal ratio between females and males was most pronounced during school holidays (females 43.09 vs males 12.64), long weekends (females 39.33 vs males 11.62), public holidays (females 30.50 vs males 12.87) and weekends (females 34.12 vs males 15.32). Potential differences in caring responsibilities between males and females may be contributing to the sex-based risk differential during school holidays: while the number of drowning incidents increases for both genders on leisure days, the increase is greater for males. Finally, given the age differences highlighting higher instances among older males, drowning risk communication for males should include a focus on the 65+ years age group, as has been identified by previous research,[37] particularly ahead of long weekend and public holiday periods.

Implications for public health

This study highlights that the burden of drowning is greater than the fatalities or hospitalisations previously reported.[1,6,8] Treatment of drowning spans the spectrum of the health system and a public health response commences even prior to ambulance attendance in the preventative actions of volunteer and paid lifesavers and lifeguards,[38] surfers [39] and the general public.[40] To strengthen the water safety awareness and actions of the public ahead of periods of high drowning risk, we encourage close collaboration between drowning prevention organisations and the media, as a low-cost, high exposure approach to drowning prevention. From a research perspective, continuing to expand linked datasets with additional data from the pre-hospital setting in the form of rescues will further illuminate the full burden of drowning and assist in primary prevention efforts.

Strengths and limitations

This study is the first to utilise linked data to examine temporal trends in fatal and non-fatal drowning burden in the Australian state of New South Wales, with a particular focus on public holidays, school

Table 2: Fatal:non-fatal ratios, and female:male ratios for ambulance-attended drowning incidents occurring in New South Wales in each season, on weekends or public holidays and during school holidays, by age group and sex, 2010-2022.

	Overall	Season						Weekday type										School holiday			
		Summer	Autumn	Winter	Spring	χ^2 (3 df)	*p*	Regular weekday	Weekend	χ^2 (1 df)	*p*	Long weekend	χ^2 (1 df)	*p*	Public holiday	χ^2 (1 df)	*p*	Not school holiday	School holiday	χ^2 (1 df)	*p*
Fatal:non-fatal ratios (1:non-fatal incidents)																					
Overall	15.13	19.68	11.97	10.7	13.33	14.6	<0.01[a]	12.69	19.08	8.9	0.01[a]	14.47	0.4	1.0	15.81	1.0	0.92	14.13	17.12	2.0	0.16
Age group																					
0-4	24.26	33.08	20.00	13.00	26.86	4.5	0.22	24.84	23.86	0.01	1.0	31.50	0.1	1.0	29.50	0.1	1.0	18.93	50.00	4.9	0.03[a]
5-17[b]	74.27																				
18-64	14.36	18.14	11.13	12.83	12.56	5.6	0.13	13.02	16.41	1.5	0.68	12.20	0.1	1.0	12.32	0.0	1.0	13.55	15.91	0.7	0.40
65+	3.66	4.56	3.18	3.80	2.69	2.4	0.50	3.38	4.82	1.3	0.77	1.57	2.3	0.39	2.17	0.7	1.0	4.42	2.57	3.7	0.05
Sex																					
Male	12.17	15.07	9.52	10.43	10.79	7.5	0.06	10.13	15.32	7.0	0.02[a]	11.62	0.4	1.0	12.87	1.0	0.94	11.89	12.64	0.16	0.67
Female	22.98	35.53	20.08	10.00	19.79	12.1	0.01[a]	17.52	34.12	0.1	0.07	39.33	1.9	0.52	30.50	1.1	0.88	18.28	43.09	6.7	0.01[a]
Female:male ratios (1:males)																					
Overall	1.88	1.90	2.07	1.82	1.70	3.7	0.29	1.65	2.12	13.0	<0.01[a]	2.71	18.4	<0.01[a]	2.53	13.9	<0.01[a]	1.76	2.11	6.7	0.01[a]
Age group																					
0-4	1.29	1.31	1.40	1.06	1.32	0.0	0.72	1.22	1.33	0.1	1.0	2.44	0.7	0.05	1.95	0.3	0.32	1.17	1.58	1.5	0.04[a]
5-17	1.38	1.49	1.28	1.60	1.12	0.7	0.42	1.25	1.51	0.8	0.61	1.29	0.0	1.0	1.47	0.1	1.0	1.30	1.50	0.4	0.33
18-64	2.51	2.48	2.70	2.86	2.25	2.0	0.58	2.15	2.84	7.4	0.02[a]	3.70	10.7	<0.01[a]	3.36	7.4	0.02[a]	2.38	2.77	2.2	0.14
65+	2.27	2.16	2.55	1.67	2.93	2.1	0.55	1.90	3.12	3.3	0.21	17.00	6.3	0.04[a]	8.50	4.6	0.10	2.10	2.70	0.9	0.34

[a]Statistically significant result
[b]Fatal:non-fatal ratio breakdown by seasons, weekends, public holidays, and school holidays was not possible for ages 5-17 due to low numbers of fatalities.

holidays and weekends. It provides important insights to aid in the timing of drowning risk communication and reduction measures.

However, this study is not without its limitations. As the study's cohort was defined using ambulance data, those drowning patients who came to hospital via other means of transport such as private car or via aero-medical retrieval and were not admitted to hospital are not included. This may underestimate severe drowning cases and those in rural areas.[41] Fatalities reported in this study use different methodologies to other reports of drowning fatalities,[1,38] including the inclusion of intentional drowning.

As previously discussed, information on the aquatic location of the drowning incident and the activity being undertaken prior to drowning are not available for analysis. Drowning rates presented include non-residents in the numerator (drowning patients) but not the denominator (population data) which impacts the calculation of drowning rates. Rates do not account for exposure, which can significantly influence drowning risk.[35]

While the overall sample size is large, this study is underpowered to detect small differences in female:male ratio or fatal:non-fatal ratios for age subgroups, increasing the likelihood of type 2 error. Larger overall population sizes (for example, a national study) would be required to determine more accurate effect sizes for these measures.

Conclusion

There is significant temporal variation in fatal and non-fatal drowning risk in New South Wales. As a preventable cause of mortality and morbidity, resulting in response across the healthcare system, this study informs the timing of risk communication and on-site drowning risk reduction measures that land managers and others tasked with preventing drowning can undertake. These include extending or varying patrol times during high-risk drowning periods, policy approaches to minimise alcohol consumption around water on public holidays and during associated events and collaboration with media to raise community awareness, including among parents and carers of young children.

Author contributions

Authors EM, PS, C-CS, RM and AP were responsible for project conception. Authors PS and AP were responsible for data acquisition. Authors EM and C-CS were responsible for data curation and analysis. Authors EM and AP developed the first draft. All authors contributed to manuscript review and editing and approved the submitted version.

Data availability

Data are confidential and unable to be publicly shared due to ethical constraints.

Ethics approval

Ethics approval for the study was granted by the NSW Population & Health Services Research Ethics Committee (approval number: HREC/18/CIPHS/19).

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Conflicts of interest

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Appendix A Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.anzjph.2024.100212.