The Epidemiology of Non Intentional Inland Drowning on open water in Great Britain Between 1989 - 2001

Holly Henderson[1], Richard Wilson[2], Peter Cornall[3]

1 RoSPA Water and Leisure Research Manager and Post Graduate Student, Department of Public Health and Epidemiology, University of Birmingham, Birmingham, B15 2TT

2 Senior Public Health Information Specialist South Birmingham PCT and Honorary Research Fellow, Department of Public Health and Epidemiology, University of Birmingham, Birmingham, B15 2TT

3 RoSPA Head of Water and Leisure, RoSPA, RoSPA House, Edgbaston Park, 353 Bristol Road, Edgbaston, Birmingham, B5 7ST

Correspondence to: Holly Henderson **hhenderson@rospa.com**

Abstract word count – 266
Paper word count, (inc table and titles 2,178)

Abstract

Introduction

Inland water sites are the most common location for drowning in Great Britain. In the 13 years from 1989 to 2001, 3,556 people have drowned in the lakes, reservoirs, rivers, streams and canal. The purpose of this paper is to examine the demography, geography, timing and cause of these drownings.

Data and Methods

Data was drawn from the RoSPA and RLSS UK Drowning statistics. Deaths recorded as suicide were excluded. Population based rates were calculated using the 1991 census data

Results

81.1% (2,877) were male and 18.9% (673) were female. The highest average annual incidence rates were for males aged over 80 years (1.32 per 100,000 per year). Incidence is higher between May and August. 63.9% (2,268) of drownings occurred in rivers, 23.0 % (815) in lakes and 12.6% (449) in canals. The highest count of people who drowned were aged 15 – 29 , 93.3% (854) were male, of these 35.4% (302) got into difficulties whilst in the water, 12.4% (115) mentioned involvement of alcohol, and 11.4% (97) were in a vehicle that entered water. There is a significant correlation between Regions with more kilometres of linear features and the number of drownings (spearman rho=0.817, $p<0.01$).

Conclusion

Inland water drowning is a predominantly male phenomenon. Causation provide a mixture of results, the main issue being that if there was no witness, no knowledge of causation and no chance of rescue. It is seasonal with consistently more drownings in the warmer months and the holiday periods. Canals appear to have higher incident rate than rivers. More work needs to be undertaken in regard to the location and time of drowning to fill the gaps in our knowledge and is vital to prevention strategies.

Introduction

Little is known about those who drown in rivers, streams, lakes, reservoirs and canals and despite the number of drownings there has been little research undertaken in Great Britain into the epidemiology behind these drownings. Much of the research that has been undertaken focuses on child drownings [1-4]. This shows a fall in the number of children drownings at inland locations but an increase in garden pond drownings [2]. Research has also shown there to be a link between epilepsy and the risk of drowning [4-6] predominantly in the bath, [6] swimming ability [4 5], suicides [7-10] of which were mainly in the elderly and ethnic minorities. [7-10]

Recently the Chief Medical Officer (CMO) for England and Wales' [11] *Health Check Annual Report 2004* reported wide regional variations. In particular in the North West. Deaths by drowning of North West residents from 1998 – 2002 were higher than the England and Wales average risk of accidental drowning. The populations of Ashton, Wigan and Leigh Primary Care Trust area having a particularly high risk of drowning with 19 more deaths occurring than expected for their population size [11].

If we are to develop successful education programmes and methods of intervention we need a better understanding of the 'who, where, when, and why' of inland water drowning. Discovering this information will inform decisions on prevention measures such as the introduction of fencing and gates for swimming pools [12], or the use of personal floatation devices [13]. This paper uses the most comprehensive data available on inland drowning to report on those at greatest risk and the most frequent causes to provide that information.

Method

Within Great Britain there is 2,320km of navigable, 900km of un-navigable and 2,100km of abandoned canal [14] compared to 34,000km of designated main rivers of which 3,000 km are navigable [14]. Other than the linear water sites there are 1,982 enclosed water bodies that are 1 hectare or larger in size [15].

The drowning death data at inland water sites was extracted from the Royal Society for the Prevention of Accidents (RoSPA) annual drowning statistics. This data is collected by an external press cuttings agency (Durrants). From the 1st January 1998 the data set was enhanced though the addition of Royal Life Saving Society's (RLSS) combining their Police drowning report form system into the RoSPA statistics. The data set contains demographic information, location details and information on cause. Deaths recorded as suicide were excluded. Inland is defined being either linear (rivers, streams, canals) or enclosed (lakes, reservoirs, quarries, loughs and lochs). Ponds, swimming pools, baths, estuaries, beaches and open sea are excluded. Population based rates were calculated using 1991 Census data.

Results

This study found that a total of 3,556 people were reported to have drowned at inland water sites in Great Britain between 1989 – 2001.

Demography

Of those who drowned 81.1% (2,877) were male and 18.9% (673) were female, only 0.1% (6) had no gender reported. Most males were aged between 15 and 29 (Fig 1). The highest average annual incidence rates were found amongst males aged over 80 years (1.32 per 100,000 per year), and between 15 and 29 years (peaking at 1.12 per 100,000 per year). For females the incidence rate increased with age to a peak of 0.34 per 100,000 per year in those aged 75-79.

Fig 1: Drownings by count and average annual age/sex specific rate per 100,000, Great Britain

1989-2001

Temporal
Drownings are highest between May and August (Fig 2). These four months accounted for 42% (1,491) of drownings.

Fig 2: Monthly variation in drownings, 1989-2001

Figure 3: Drownings by year, 3 year moving average, 1989 to 2001.

Up to 1998 the number of drownings appeared to be decreasing slowly (Fig 3), however, as stated previously the data collection changed in 1998, which saw an artificial increase in drownings due to an improved ascertainment, then the trend continues downward.

Cause and Water body

Table 1 breaks down the drownings by activity prior to drowning and water body. 63.9% (2,268) of drownings occurred in rivers, 23%(815) in lakes and 12.6% (449) in canals. In 43.7% (1557) of the cases the cause was unknown and reported as 'found', 66.4% (1034) were in rivers. 15% (531) of those who entered the water involuntarily, for example through a slip, trip or fall, 60.5% (321) occurred at riversides and 34.1% (181) at lakesides. Other frequent reported causes are swimming (8.6%), entering the water in a vehicle (6.4%) boating (5.5%) and fishing (3.1%).

There was an average 0.65 (0.55 to 0.75 95% confidence interval) drownings per 100 KM of canal per year and 0.51 (0.46 to 0.57) drownings per 100 KM of river per year. The incidence of drowning in a canal is 1.26 times higher per KM than rivers, although this is not statistically significant.

Table 1: Activity prior to drowning activity by location, 1989 to 2001

	Water body				
Activity	Canal	Lakes	Rivers	Unknown	Grand Total
Boating	**28**	14.1%	**82**	41.2%	**88**	44.2%	**1**	0.5%	**199**	100%			6.2%		10.0%		3.9%		4.5%		5.5%			
Canoeing	**8**	15.4%	**11**	21.2%	**31**	59.6%	**2**	3.8%	**52**	100%			1.8%		1.3%		1.4%		9.0%		1.4%			
Deliberate Access	**17**	9.7%	**44**	25.1%	**113**	64.6%	**1**	0.6%	**175**	100%			3.8%		5.4%		5.0%		4.5%		4.9%			
Fishing	**8**	7.1%	**19**	16.8%	**86**	76.1%	**0**	0.0%	**113**	100%			1.8%		2.3%		3.8%		0.0%		3.1%			
Immersion Watersport Other	**5**	21.7%	**4**	17.4%	**14**	60.9%	**0**	0.0%	**23**	100%			1.1		0.5%		0.6%		0.0%		0.6%			
In Vehicle	**33**	14.3%	**34**	14.8%	**161**	70.0%	**2**	0.9%	**230**	100%			7.3%		4.2%		7.1%		9.0%		6.4%			
In Voluntary Access	**29**	5.5%	**181**	34.1%	**321**	60.5%	**0**	0.0%	**531**	100%			6.5%		22.2%		14.2%		0.0%		14.9%			
Non Immersion Watersports Other	**0**	0.0%	**0**	0.0%	**2**	100.0%	**0**	0.0%	**2**	100%			0.0%		0.0%		0.1%		0.0%		0.0%			
Sub Aqua	**4**	7.3%	**16**	29.1%	**35**	63.6%	**0**	0.0%	**55**	100%			0.9%		2.0%		1.5%		0.0%		1.5%			
Swimming	**51**	16.6%	**64**	20.8%	**191**	62.2%	**1**	0.3%	**307**	100%			11.4%		7.8%		8.4%		4.5%		8.6%			
Unknown / Found	**208**	13.3%	**303**	19.2%	**1034**	66.4%	**12**	0.3%	**1557**	100%			46.3%		37.1%		45.6%		54.5%		43.7%			
Other	**12**	20.7%	**13**	22.4%	**33**	56.9%	**0**	0.0%	**58**	100%			2.7%		1.6%		1.5%		0.0%		1.6%			
Wading	**21**	19.6%	**23**	21.5%	**62**	57.9%	**1**	0.9%	**107**	100%			4.7%		2.8%		2.7%		4.5%		3.0%			
Walking	**20**	18.3%	**12**	11.0%	**75**	68.8%	**2**	1.8%	**109**	100%			4.5%		1.5%		3.3%		9.0%		3.0%			
Waterside Activity Other	**5**	13.2%	**11**	28.9%	**22**	57.9%	**0**	0.0%	**38**	100%			**1**	1.1%	1.3%		1.0%		0.0%		1.0%			
Grand Total	**449**	12.6%	**817**	23.0%	**2268**	63.9%	**22**	0.5%	**3556**	100%			100%		100%		100%		100%		100%			

In the 15 – 29 age group, 93.3% (854) were male, of these 35.4% (302) got into difficulties, 12.4% (115) mentioned the involvement of alcohol, 11.4% (97) were in a vehicle that entered water, and 10.8% (92) fell. 62.1% (531) of them drowned in rivers, 24.9% (213) in lakes and 12 % (103) in canals. 27.9 % (239) of these drowning occurred in May and June. For females (n=72), the most likely reported cause (25% (18)) was having been in a vehicle that entered water.

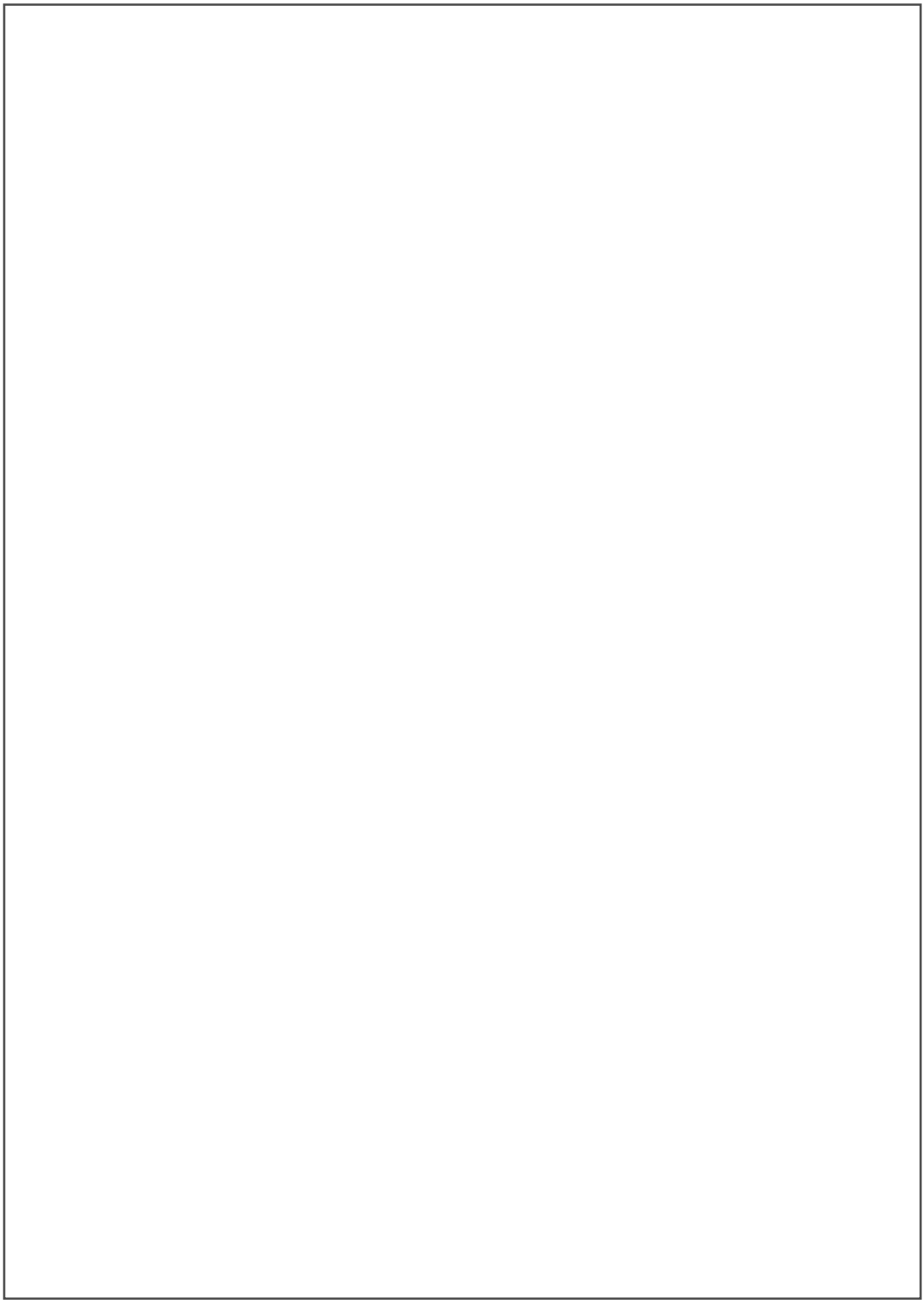
In the 85 and over age group, 66.1% (39) were male and 33,8% (20) were female. 39% (23) were found in the water and there is no history available for analysis. 22% (13) went missing from home, 8.5% (5) had a plausible medical condition, which could have led to non intentional immersion and 6.8% (4) suffered from a mental illness. 76.3% (45) of drownings occurred in rivers, 16.9% (10) in lakes and 6.8 % (4) in canals. 33.8% (20) occurred in April.

Geography

Due to the lack of data on the number of people accessing waterside amenities it is not possible to calculate standardised exposure rates. Standardising by resident populations will underestimate the true population exposure in areas with a large influx of tourists and leisure users such as the Lake District, Scottish Highlands and North Wales. Therefore figure 4 presents the frequency of drownings by County. The counties with the highest frequency are the large urban conurbations of London, Greater Manchester, West Midlands and Glasgow. The rural county with the most drownings is Hereford and Worcester.

There is a significant correlation between counties with more kilometres of linear features and the number of drownings (spearman rho=0.817, $p<0.01$). There is no significant relationship between the area of enclosed features in a region and the number of drownings (spearman rho=-0.383, p=ns).

Figure 4: The frequency of drownings by County, 1989-2001



Conclusions

In the 13 years from 1989 to 2001 a total of 3,556 people have drowned in the lakes, reservoirs, rivers, streams and canals found in Great Britain. This equates to an average of 290 a year over the given time period. This figure is as high as coastal drowning fatalities, which report an average of 300 fatalities a year []. It is difficult to compare countries because each has differing lengths and hectares of coastal and inland water, and therefore each has a differing balance of exposures and risks in relation to where people drown. For example in Australia between 1992-1997 32% of drownings were on the coast, in an estuary or on a beach, in contrast to 17% occurring on non tidal lakes and lagoons [16]. In Denmark, 63% were on the coast (open sea, harbour, and beach) and only 13.8% on a lake or watercourse [17].

In Great Britain inland water drowning is male phenomenon and most are aged 15-29. This reflects previous findings from other countries [16-17 18-21]. The male rate of drowning is four times that of females of the same age, which is higher than the findings from America were the rate was three times [21-22]. The age groups most at risk are the 5 – 14, 19 – 35 and the over 65 year olds [23 24], however, location does vary by age group, for example the 0 – 5 age group have a higher drowning rate in garden ponds [2] and 5 – 14 age groups in swimming pools [22].

In Great Britain inland drowning is a seasonal affliction and this coincides with warmer months and the major holiday period, a pattern similar to that found in Greece where incidents are more frequent between April and September, the warmer months, and during the daytime [24]. However, there is no data on the time of incident in the Great Britain data to relate drinking and driving patterns to. Annual fluctuations in the numbers of drownings could be explained due to poor summers, or one of occurrences such as the foot and mouth crisis and the subsequent 'closure' of the countryside in 2001.

The cause of drowning findings provide a mixture of results; reasons given in literature are, exposure to environment, participation in water activities, swimming ability, risk taking behaviour, the influence of alcohol, [19 21] drugs and vehicle related incidents [17 22]. In the 65+ age group underlying medical conditions were documented as prevalent [17 22]. In Great Britain the main issue being that if there is no witness, there is no evidence of a cause, as well as little chance of rescue! For young males (15 – 29) there is a high record of alcohol involvement. For both males and females in this age group there is a high risk of being submerged in a vehicle that enters the water. For the elderly there is a paucity of evidence on cause, most being reported as going 'missing'. Conditions such as heart attack, 'dizzy spells', 'blackouts' and diabetic hypoglycaemia were given as possible contributory factors in drownings in those over 85 years old.

Canals appear to have a higher incidence of drowning than rivers. This could be because there is a higher exposure, due to the close proximity of urban areas and the increase in housing development by the waterside. Also the lack of education and perception of risk could be lower due to the safe and shallow appearance of the water. There is in general a need for realistic exposure data to inform risk assessment as using the resident population can over estimate the risk for areas of low population.

The papers used to compare and contrast these findings used data that has predominantly come from secondary sources of information, such as coroner reports and national mortality statistics [1,2,4,7, 16,20,].The data collection method of using the media as a surveillance tool has been investigated by others [25 26]. The findings provide mixed results, newspaper cuttings have been seen as useful adjuncts [25]. Although the usefulness of newspaper articles as an injury surveillance tool may be limited [26] as they were deficient in providing prevention information when describing unintentional injury events

This study has found that there is a requirement for a more formal data collection process that is objective rather than subjective. In particular the press cutting service lacks geographical location and time of the incident, hampering risk assessment and direct safety interventions. The RNLI and RoSPA are currently addressing improvements in inland data and data collection through a jointly funded project. This is to create an Inland Water Related Emergency Monitoring

database (INREM), which aims to collate data on inland water incidents, near drowning and drowning. Operators, owners, voluntary services and the existing emergency services need to be contributing data. The success of this project will be an informed intervention strategy to reduce the high death toll from inland drownings. .

References

1 Kemp A, Sibert J. Drowning and near drowning in children in the United Kingdom: lessons for prevention *British Medical Journal* 1992; 304:1143 – 1146.

2 Sibert JR, **Lyons RA**, **Smith BA**, **Cornall P**, **Sumner V**, **Craven MA**, **Kemp A**. Preventing deaths by drowning in children in the United Kingdom: have we made progress in 10 years? Population based incidence study. *BMJ* 2002;324:1070-1071.

3 Kemp AM, Mott Am, Sibert JR. Accident and child abuse in bathtub submersions *Arch Dis Child* 1994;70 (5):435-8.

4 Kemp AM, Sibert JR. Epilepsy in children and the risk of drowning. Arch Dis Child 1993; 68 (5):684-5.
5 Besag FMC. Tonic seizures are a particular risk factor for drowning people with epilepsy *BMJ* 2001; 322: 974-976.
6 Lip GY, Brodie MJ. Sudden death in epilepsy: an avoidable outcome? *J R Soc Med* 1992; 85(10): 609 – 11.
7 Salib E, Cawley S, Healy R. The significance of suicide notes in the elderly. *Aging Mental Health*. 2002; 6(2):186-90.
8 Nowers MP. Suicide by drowning in the bath. *Med Sci Law* 1999; 39 (4): 349-53.
9 Scott KW. Suicide in Wolverhampton (1976-1990). *Med Sci Law* 1994; 34 (2): 99 – 105.
10 Cooper PN, Milroy CM. Violent suicide in South Yorkshire, England. *Journal of Forensic Science* 1994; 39 (3): 657-67.
11 Chief Medical Officer Report (CMO)., 2004. Health Check: CMO Annual Report Department of Health London

12 Calabria D Effects of legislation on pool fencing in Australia *World Drowning Congress Presentation* Amsterdam June 2002
13 Bennett E Cummings P Quan L Marcus Lewis F Evaluation of drowning prevention
14 Environment Agency. Environment Agency Corporate Plan 1999 – 2000 and forward to 2001 *Bristol: Environment Agency,* 1999
15 DEFRA. Water Based Sport and Recreation: The Facts *London: HMSO*, 2001
16 Mackie IJ. Patterns of Drowning in Australia, 1992 – 1997. 1999 www.mja.com.au./public/issues/171_11_061299/mackie/mackie.html (accessed 30 August 2001).
17 Steensberg J. Epidemiology of Accidental Drowning in Denmark 1989 – 1993. *Accident Analysis and Prevention* 1998 ;30 (6): 755-762.
18 Baker SP, O'Neill B, Ginsburg MJ, Li G. The Injury Fact Book, 2nd Edition. *New York Oxford University Press*, 1992.
19 Kobusingye OC. The Global Burden of Drowning: Africa. 2001.www.drowning.nl/csi/drowning.nsf/index/home/$file/index.htm (accessed 29 July 2002)
20 Howland J, Hingson R, Mangione, Bell N, Bak S. Why are most drowning victims men? Sex Differences in aquatic skills and behaviours American Journal of Public Health, 1996; 86 (1): 93-96.
21 The American Academy of Paediatrics Committee on Injury and Poison Prevention. Drowning in Children and adolescents. *The American Academy of Paediatrics Committee on Injury and Poison Prevention* 1993;92: 292-4.
22 Petridou E. Risk Factors for Drowning and Near Drowning Injuries. 2001 www.drowning.nl/csi/drowning.nsf/index/home/$file/index.htm (accessed 29 July 2002)
23 World Health Organisation. Bulletin Report on "Injury – A leading cause of the global burden of disease". *Geneva: WHO*, 1998.
24 Alexe D Dessypris N, Petridou E. Drowning and Near Drowning in Greece: data from emergency departments Injury Surveillance System (EDISS). World Congress on Drowning Book of Abstracts June 26-28 2002. *Amsterdam; Stichting Foundation*, 2002.
campagn in King County Washington *Injury Prevention* 1999; 5: 109-113
24 Fine PR Jones CS Wrigley JM Richards JS Rousculp MD. Are Newspapers a viable source for

intentional injury surveillance data *Southern Medical Journal* 91 (3):234-42, 1998 Mar
25 Baullinger J Quan L Bennett E Cummings P Williams K. Use of Washington State newspapers for submersion injury surveillance *Injury Prevention* 7 (4): 339-42, 2001 Dec