

U.K. Drownings

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During 9-15 April 1998, river flooding hit middle England, killing five people. During Autumn 2000, floods affected hundreds of locations throughout the U.K., inundating thousands of properties and severely disrupting transportation. These two events were a strong impetus towards bringing flooding onto the political agenda, particularly at the national level but also at the local level in many areas. Much of the U.K.'s national, regional, and local flood management policies have been developed and refined due to these two events.

While Scotland has taken a more comprehensive approach, these policies in England and Wales have tended to focus on the risk to property and reducing the economic costs of flooding. The risk to life from flooding is gaining prominence but is still often sidelined in order to tackle property and economic aspects.

At times, information provided on U.K. flood events downplays the risk to life. In their 31 October 2001 analysis of the Autumn 2000 floods, DEFRA (the Department for Environment, Food and Rural Affairs which is responsible for flood management policy in England) states "Fortunately there was no loss of life directly attributable to the flooding". The EA (Environment Agency) implements much of the flood management policy in England and Wales. Their report "Environment Action - Floods Special" in December 2000 differs from DEFRA's comments by stating that two people had died in the floods to that date, although no further details are provided.

The media reported at least four inland water drownings in England during the Autumn 2000 floods:

- A woman in her twenties drowned in the River Tavy at Tavistock near Dartmoor while on a canoe trip on 12 November 2000.
- A 28-year-old man was presumed drowned in a swollen tributary of the River Nene in Northampton after jumping in to save a woman's dog at the end of October.
- Also at the end of October, a suspected shoplifter was presumed drowned after being chased by security staff and falling into the swollen River Thames in Birmingham.
- BBC reported on 14 December 2000 that "An extensive search for a teenager who fell into a swollen river in Greater Manchester has failed to find any trace of him".

Directly attributing any of these drownings to the flooding or to the storms is a contention which can be neither defended easily nor refuted easily. While drownings clearly occurred during the Autumn 2000 floods, the number of drownings resulting from the Autumn 2000 floods is difficult to determine.

Additionally, two people died on 8 December 2000 in Devon when they drove off a bridge into a flooded river. Whether they were killed by drowning, the floods, the storms, bad driving, or bad luck is an open question. The storm systems during Autumn 2000 which caused the floods killed many more people due to falling trees, falling off boats into the sea, or vehicle crashes. Whether or not the storms pushed fatality rates above the normal background level for these causes is difficult to ascertain.

Perfectly categorizing, and playing statistical games with, people's deaths should not be the objective. The issue is the incorrect message that fatalities from these storm systems are not of concern. These

hazard events kill, by drowning and otherwise, as seen by the deaths which occurred. DEFRA's statement leads to complacency and misdirects policy. Instead, they should use any opportunity to educate the public about the dangers to health and life which occur during flood and storm events.

For example, in mid-October 2000, several people were rescued from the roofs of their cars near Uckfield in southeast England. One man in Uckfield was swept away by the current but was rescued. In October 2001, at least ten people were rescued from vehicles during the floods across eastern England. These anecdotes underscore the ignorance surrounding people's behavior in floods: you should never drive or walk through moving flood water, even shallow depths. The lack of vehicle and swiftwater-related drownings was due more to luck than to lack of danger from flood water (Figure 1).

Other behavior observed during floods in England illustrates the dangers. Darwin College, built beside the River Cam in Cambridge, was inundated in February 2001 with water reaching the power mains for one building (Figure 2; note the level of the flood line). In order to shut down power, an employee waded through the water to reach the mains. As with those rescued from vehicles, this employee was lucky because electrocution is a major health hazard in floods. Three of the 22 deaths in Houston, Texas attributed to Tropical Storm Allison in June 2001 resulted from electrocution. Following the February 2001 floods, Darwin College reconfigured and raised the power mains only to witness a higher flood almost reach them in October 2001 (Figure 3; note the level of the flood line). This time, specialist help was brought in to shut down the power.

Another flood-related health concern relates to contact with contaminated flood water. The photographs in Figure 4 were taken in Yalding, Kent. While pumping out the affected property, the firefighters were being doused with sediment-laden water (Figure 4a). Waterfowl along the river suggest likely contamination from bird feces. Since many houses were

Figure 1: Near Grantchester, Cambridgeshire in February 2001.



Figure 2: Darwin College in February 2001.



Figure 3: Darwin College in October 2001.



Figure 4a: Contaminated flood water in Yalding, Kent.



Figures 4b and 4c: Firefighter munching while pumping.



inundated, a strong possibility also exists of oil, paint, and other household substances in the water. One of the firefighters is eating in the midst of his pumping work while being soaked by the flood water (Figures 4b and 4c). All flood water should be assumed to be unfit for consumption.

Further evidence of water-related health concerns in the U.K. comes from RoSPA (the Royal Society for the Prevention of Accidents). RoSPA notes that the Home Office collected U.K. drowning statistics until 1981 and RoSPA started collecting their own data in 1983.

RoSPA reports 569 drownings in the U.K. in 1999, a similar figure to 1998, but reports 438 drownings in 2000 (see Table 1. Different sources give different numbers, varying by up to three for annual drowning figures. The numbers reported here should be taken as being approximate rather than exact.). The drop in 2000 is attributed to the relatively poor summer weather that year. RoSPA suggests that in

1998, 21 drownings were directly attributable to flooding whereas two drownings were directly attributable to flooding in 1999. RLSSUK (the Royal Life Saving Society UK) states that 2000 saw “45 people drowning as a result of floods or exceptionally high tides”. RLSSUK also highlights attempted rescues as a factor in drowning in 2000: “15 people drowned while attempting to rescue someone else. In only a couple of instances did the original casualty also drown.”

Table 1: Sample Data for the Number of U.K. Drownings (from RoSPA)

By Location	1999	2000	Examples of Activities or Behavior	1999	2000
Rivers and streams	248	199	Angling From Boat	14	10
Coastal	112	79	Angling From Land	10	8
Lakes and reservoirs	84	51	Fell in	81	51
Canals	43	44	Alcohol	78	79
Home baths	31	27	Swimming	45	34
Docks and Harbors	19	17	Boating	25	21
Garden Ponds	18	8	In Vehicles	14	15
Swimming Pools	14	13	Playing	11	8
Total	569	438	Sub aqua	7	13
			Canoeing	5	4
			Cycling	3	5

Table 1 yields questions to be resolved, such as whether any activity in which alcohol was involved is labeled as “Alcohol” rather than as any other category. Also, the “Fell in” category is ambiguous.

The death rate across the U.K. due to drowning is currently approximately 0.96 per 100,000 people whereas in 1983 this rate was 1.17. Drowning is reported as the third most common cause of accidental death amongst people younger than age 16 in the U.K.

A danger exists of becoming enamoured by numbers games, yet drowning statistics are useful because to save lives policy must be based on credible data. Data indicates who is drowning (for example, demographic data of the victims) along with how and why they are drowning (for example, data on the situation, environment, victim’s actions, and others’ actions such as calling emergency services and attempting rescue). To understand whether or not policies and actions are saving or taking lives, these data must be compared through time.

Despite the significant numbers of inland water drownings, no coordinated system exists for recording rescues and fatalities inland in the U.K. In comparison, a national database is maintained for sea and coastal incidents. For example, in 1998, 12,136 people were assisted during 10,193 rescue incidents. 286 fatalities occurred, a figure which includes non-drowning deaths such as cliff falls or physical trauma aboard vessels. In 2001, 16,487 people were assisted in 12,514 rescue incidents during which 284 people died. Analyses from this database help to identify locations and activities of highest risk thereby permitting rescue and education activities to be specifically targeted. This approach should be applied to inland water incidents, possibly funded by DEFRA.

Returning to drownings in floods, past events indicate the tolls which can occur in the U.K.:

- The 11-12 March 1864 Dale Dyke dam break disaster in Sheffield killed at least 240 people.
- The Lynmouth flood disaster on 15 August 1952 killed more than 30 people.

- The 31 January to 1 February 1953 storm surge killed more than 300 people on land in eastern England, mainly due to drowning, exposure, and physical trauma. More than 150 people died at sea around the U.K. during the accompanying storm.
- The 11 January 1978 storm surge killed at least 20 people in eastern England.

A North Sea storm surge comparable to the 1953 event could cause immense loss of life on land because the urban population of coastal, eastern England has grown rapidly during the past fifty years (for example, see Figure 5). Between 1951 and 1991, the U.K.'s population increased 12% while the population of many coastal areas in eastern England increased between 17% and 92%. This expansion

Figure 5: A recent development of bungalows with an ironic name sited just behind the sea defences near Trusthorpe between Maplethorpe and Skegness in eastern England.



continues. According to the U.K. government, the east coast English counties from Essex on the Thames Estuary to Humberside on the Humber Estuary are expected to gain 322,000 new households, 10% of England's projected need, between 2001 and 2021.

When the next major east coast storm surge occurs or when the next dam or reservoir fails, dozens or hundreds of people could die unless they are warned in time and, as important, react appropriately to the warnings. Similarly, day-to-day water-related activities—such as swimming in dangerous areas, mixing alcohol and water sports, and instinctively jumping in to save someone at risk from drowning—threaten hundreds of lives each year. As with floods, education and awareness programs could ensure that these people are warned in time of the dangers and, as important, react appropriately to the warnings.

People's reactions to warnings, whether for a specific, extreme event or for general, day-to-day behavior, are partly based on how people perceive their vulnerability. Perception of vulnerability is linked to inaccurate messages, such as that no one died directly from a specific flood event. We have a responsibility to ensure that the power and danger of water are understood and communicated.

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To obtain: Drowning

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OBJECTIVES: To determine the effects of training in swimming and water safety on young preschool-children's ability to recover safely from a simulated episode of falling into a swimming pool. **DESIGN:** Randomized trial of 12 or eight weeks' duration water safety and swimming lessons for children 24 to 42 months old. **OUTCOME MEASURES:** Swimming ability, deck behavior, water recovery, and swimming to side after jumping into pool were measured before, during, and after the training program. **RESULTS:** 109 children completed the study (61 in the 12 week group, 48 in the eight week group). The average age was 34.2 months, 54% were male. Swimming ability, deck behavior, water recovery, and jump and swim skills improved over baseline levels in both groups. By the end of training, the 12 week group improved more than the eight week group only in swimming ability. Improvements in water recovery and jump and swim skills were associated positively with changes in swimming ability. **CONCLUSIONS:** Swimming ability and safety skills of young preschool children can be improved through training. Such programs may offer some

protection for children at risk of drowning and there was no indication that this program increased the risk of drowning. However, pool fencing, other barriers around water, and parental supervision still remain the most important prevention strategies to reduce drowning in young children.

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OBJECTIVES: This study estimated the effects of local pool-fencing ordinances and other factors on the rate of childhood drowning in Los Angeles County, California. **METHODS:** Stage 1 was a retrospective dynamic cohort study of all drownings among children younger than 10 years that occurred in residential swimming pools in Los Angeles County between 1990 and 1995. Stage 2 was a matched case-control study that compared pools in which childhood drownings occurred (cases) with randomly selected pools in which drownings did not occur (controls). **RESULTS:** The drowning rate was relatively high among toddlers (aged 1-4 years), boys, and African Americans and in areas with a high density of residential swimming pools. Pool-fencing ordinances were not associated with a reduced overall rate of childhood drowning. **CONCLUSIONS:** Local ordinances enacted in Los Angeles County before 1996 do not appear to have been effective in reducing the rate of childhood drowning in residential pools. Possible reasons for this ineffectiveness are insufficient building codes for isolating pools from homes, inadequate enforcement of the ordinances, and inadequate operation or maintenance of fencing equipment by pool owners.

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We present the results of a residence-based study of drownings among Sacramento County, California children and adolescents ages 0-19 years for the years 1974-84. Children ages 1-3 had the highest drowning rates. The majority of drownings in this group, and one-third of all drownings in the study, occurred in residential swimming pools. Males ages 15-19 had a high drowning rate as well; at least 38 per cent of drownings in that age group were alcohol-associated. The implications for preventive efforts are discussed.

To obtain: Flood Fatalities

Centers for Disease Control and Prevention. Flood-related mortality--Missouri, 1993
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Combs DL, Parrish RG, McNabb SJ, Davis JH. Deaths related to Hurricane Andrew in Florida and Louisiana, 1992. Int J Epidemiol. 1996 Jun;25(3):537-44.

BACKGROUND. Information about circumstances leading to disaster-related deaths helps emergency response coordinators and other public health officials respond to the needs of disaster victims and develop policies for reducing the mortality and morbidity of future disasters. In this paper, we describe the decedent population, circumstances of death, and population-based mortality rates related to Hurricane Andrew, and propose recommendations for evaluating and reducing the public health impact of natural disasters. **METHODS.** To ascertain the number and circumstances of deaths attributed to Hurricane Andrew in Florida and Louisiana, we contacted medical examiners in 11 Florida counties and coroners in 36 Louisiana parishes. **RESULTS.** In Florida medical examiners attributed 44 deaths to the hurricane. The mortality rate for directly-related deaths was 4.4 per 1 000 000 population and that for indirectly-related deaths was 8.5 per 1 000 000 population. In Louisiana, coroners attributed 11 resident deaths to the hurricane. Mortality rates were 0.6 per 1000 000 population for deaths directly related to the storm and 2.8 for deaths indirectly related to the storm. Six additional deaths occurred among non-residents who drowned in international waters in the Gulf of Mexico. In both Florida and Louisiana, mortality rates generally increased with age and were higher among whites and males. **CONCLUSIONS.** In addition to encouraging people to follow existing recommendations, we recommend emphasizing safe driving practices during evacuation and clean-up, equipping shelters with basic medical needs for the population served, and modifying zoning and housing legislation. We also recommend developing and using a standard definition for disaster-related deaths, and using population-based statistics to describe the public health effectiveness of policies intended to reduce disaster-related mortality.

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Krug EG, Kresnow M, Peddicord JP, Dahlberg LL, Powell KE, Crosby AE, Annett JL. Suicide after natural disasters. *N Engl J Med.* 1998 Feb 5;338(6):373-8.

BACKGROUND: Among the victims of floods, earthquakes, and hurricanes, there is an increased prevalence of post-traumatic stress disorder and depression, which are risk factors for suicidal thinking. We conducted this study to determine whether natural disasters affect suicide rates. **METHODS:** From a list of all the events declared by the U.S. government to be federal disasters between 1982 and 1989, we selected the 377 counties that had each been affected by a single natural disaster during that period. We collected data on suicides during the 36 months before and the 48 months after the disaster and aligned the data around the month of the disaster. Pooled rates were calculated according to the type of disaster. Comparisons were made between the suicide rates before and those after disasters in the affected counties and in the entire United States. **RESULTS:** Suicide rates increased in the four years after floods by 13.8 percent, from 12.1 to 13.8 per 100,000 ($P<0.001$), in the two years after hurricanes by 31.0 percent, from 12.0 to 15.7 per 100,000 ($P<0.001$), and in the first year after earthquakes by 62.9 percent, from 19.2 to 31.3 per 100,000 ($P<0.001$). The four-year increase of 19.7 percent after earthquakes was not statistically significant. Rates computed in a similar manner for the entire United States were stable. The increases in suicide rates were found for both sexes and for all age groups. The suicide rates did not change significantly after tornadoes or severe storms. **CONCLUSIONS:** Our study shows that suicide rates increase after severe earthquakes, floods, and hurricanes and confirms the need for mental health support after severe disasters.

Retraction in:

Krug EG, Kresnow M, Peddicord JP, Dahlberg LL, Powell KE, Crosby AE, Annett JL. *N Engl J Med.* 1999 Jan 14;340(2):148-9.

Comment in:

N Engl J Med. 1998 Jun 18;338(25):1851-2.

Lew EO, Wetli CV. Mortality from Hurricane Andrew. *J Forensic Sci.* 1996 May;41(3):449-52. Hurricane Andrew, a category 4 storm, made landfall in South Florida on August 24, 1992, and caused extensive structural and environmental damage. The Dade County Medical Examiner Department investigated 15 deaths directly related to the storm and another 15 natural deaths indirectly related to the storm. The aftermath of the hurricane continued to create circumstances that lead to 32 accidental deaths, five suicides, and four homicides over the next six months. Traffic fatalities due to uncontrolled intersections accounted for one-third of the post-storm accidental deaths. Dyadic deaths (homicide-suicide) doubled in rate for the six months following the storm. The limited number of direct hurricane deaths is attributed to advance storm warnings, its occurrence on a weekend, the storm's passage through less populated areas of the county, and the relatively modest amount of accompanying rainfall.

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In January 1981 natural floods occurred in large areas of the semi-arid Karoo area. In terms of loss of human life the town most affected was Laingsburg, where over 100 persons were drowned. Most of the bodies were swept downstream in the abnormally swollen river and were never recovered. A flood disaster of this dimension is rare in South Africa. There were very few injuries associated with the disaster and no epidemic diseases followed in its wake, but there were certain aspects of medical services related to the disaster worth recording.

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BACKGROUND. In January 1992, the Commonwealth of Puerto Rico sustained unusually heavy rainfall, which caused flash floods and deaths. **METHODS.** We conducted a descriptive study and a case-control study to determine the circumstances of these deaths and to identify mortality-prevention strategies. We describe the time, place, and circumstances of each death, and compare this information with water-level and rainfall data and the timing of warnings. Using controls selected from the affected population, we estimated the risk of death by age, sex, and vehicle occupancy during the flood. **RESULTS.** Within 7 hours, 23 people died in 17 incidents; 20 of the decedents (87%) were occupants of motor vehicles. The estimated risk of mortality was significantly elevated for motorists (odds ratio = 16, 95% confidence interval: 3.5- 144). Being in a vehicle to evacuate a flash flood area was protective; however, being in a vehicle during the flood for other reasons further increased the risk of mortality. Deaths occurred early during the rapid rise of water and before official warnings were issued. **CONCLUSION.** We recommend improving the sensitivity of the warning system and its ability to disseminate appropriate information rapidly. We also recommend educating officials and the public about the risks of driving on flooded roads and in potential flash flood conditions; and about the unique flash flood risks associated with specific topographical features in their region.

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