



Epidemiological aspects of drowning and non-fatal drowning in the waters of Amsterdam



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ABSTRACT

We examined who, when, and where people non-fatally drowned or drowned in Amsterdam between January 2011 and December 2015 so that in the future more targeted and effective measures can be taken to prevent drowning. Data on non fatal drownings (N = 515, fire department database) were combined with the forensic medicine data on drowning fatalities (N = 88). Who drowns in Amsterdam? The majority of those who drowned were men (82%). A high percentage of the people who drowned were under the influence of alcohol or drugs (up to 55%). No children drowned in the Canal District during the study period. The majority of those who drowned in the Canal District (67%) were not official inhabitants of Amsterdam (e.g., tourists and homeless people.) When do people non-fatally drown in Amsterdam? Forty-seven percent of the non-fatal drownings in the Canal District occurred on Saturday and Sunday nights between midnight and six o'clock in the morning. No specific hot times could be defined for other parts of Amsterdam. Where do people non-fatally drown or drown in Amsterdam? Compared to the non-fatal drownings, there are fewer drowning cases in the Canal District than in other parts of Amsterdam. Given the high number of non-fatal drownings and the remaining drownings in the Canal District, further prevention is necessary and should focus on hot times and hotspots. Additional measures must be taken to enable those who fall into the canals to climb out.

1. Background

There is a lot of water in the Amsterdam region. The famous Canal District alone has 75 km of canals.¹ Amsterdam has 840,000 inhabitants, and each year more than 5 million tourists visit the city.¹

In recent years, several incidents of missing people who were suspected to have drowned in Amsterdam have caused public concern. There is no clear risk profile of those who non-fatally drowned or drowned. In addition, it is unclear whether the combination of large numbers of tourists and the large amount of water in the Canal District actually leads to more fatal or non-fatal drownings. It's known that international tourists, including children, have higher drowning rates.^{2–4}

The aim of this study is to profile drownings and non-fatal drownings in Amsterdam. This will be done by determining *who* drowns, *when*, and *where* drowning incidents happen in Amsterdam.

A clear profile offers opportunities to more effectively take preventative measures, both in Amsterdam and in comparable cities worldwide.

2. Method

2.1. Who drowns in Amsterdam?

Data from the register of the forensic medicine *Formatus*, was used to determine who drowns in public water in Amsterdam. This register contains all recorded external examinations of non-natural deaths in Amsterdam. All deceased persons found in the water from January 2011 to December 2015 and for whom it was determined that they had likely drowned were classified as “drownings” and were included. This group thus contains both accidental drownings and drownings in the context of suicide. Demographic data and intoxication data of those “drownings” were recorded. Toxicological screening is the standard procedure for every non-natural death in the study population, which includes urine and blood screening. Alcohol use was indicated as positive if the blood alcohol concentration (BAC) was above 0,5‰ (the limit in the Netherlands for driving). Drugs were indicated as positive if the screening on XTC, methamphetamine, amphetamine, THC, methadone, morphine, heroin or cocaine tested positive. There was no

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demographic data available for the non-fatal drownings.

2.2. When do people non-fatally drown in Amsterdam?

Data on rescue attempts made by the fire department of Amsterdam in the period from January 2011 to December 2015 was used to find out when people non-fatally drowned in public water. The fire department is always called when there is fear that someone may drown, except when somebody can climb out by himself or with help from bystanders. Therefore, the fire department data represents a complete overview of all “severe” non-fatal drownings. There was no useful data available for those who were found dead to reference when they had fallen into the water.

2.3. Where do people non-fatally drown or drown in Amsterdam?

Data from *Formatus* was used to determine where people drown in Amsterdam. The place in which the deceased person was found in the water was noted. This information about drowning was combined with the data from the fire department, which shows where people non-fatally drowned. Therefore, the location of fatal drownings and non-fatal drownings could be evaluated.

2.4. Definitions

In this study, a post-mortem external examination is defined as a thorough, exterior assessment of a deceased person.

A drowning is defined as a person who was submersed in water and died because of this submersion. Drownings can be accidental or intentional (ICD-10 codes: W65-70, W73, W74, X71, X92, Y21). A non-fatal drowning is defined as a person who was submersed in water but survived after the involvement of emergency services.

3. Results

3.1. Who drowns in Amsterdam?

A total of 88 drownings were found in the public water of Amsterdam in the period between January 2011 and December 2015. Of these cases, 27 (33%) were found in the Canal District. The 88 drowning fatalities included 19 known cases of suicide.

3.1.1. Demographic data

Men accounted for 82% of the drowning fatalities. The average age of those who drowned in the Amsterdam region was 46 years old, and in the Canal District the average was 43 years old. One of those who drowned was a child (5 years of age), but within the Canal District, no children drowned. Most drownings in the Amsterdam region were residents of Amsterdam (67%). However, in the Canal District only 33% were residents of Amsterdam. This difference may be due to the relatively high number of tourists visiting in the Canal District (Table 1).

3.1.2. Intoxication

In the Amsterdam region, 40% of the drownings showed signs of alcohol or drug usage, while 55% of the cases found in the Amsterdam Canal District showed those signs.

3.2. When do people non-fatally drown in Amsterdam?

Between 2011 and 2015, the fire department reported 515 non-fatal drownings in the entire Amsterdam region; 276 of these were in the Canal District and the remaining 239 were in other parts of Amsterdam.

In the Canal District ($N = 276$), 47% of the non-fatal drownings occurred on Saturday and Sunday nights between 0:00 and 6:00. We classified those times as hot times. For the other parts of Amsterdam ($N = 239$), clear hot times could not be identified.

Table 1
Results Who, When, and Where people non-fatally drown or drown.

| | Amsterdam Canal District | Amsterdam region |
|--|---|---------------------|
| Who (Formatus) | | |
| <u>Drowning fatalities</u> | $N = 27$ | $N = 61$ |
| Men | 82% | 82% |
| Age | 43 years | 46 years |
| Children (< 18 yr) | 0 | 1 |
| Resident of Amsterdam | 33% (9/27) | 67% (41/61) |
| Alcohol or drug usage | 55% | 40% |
| When (fire department database) | | |
| <u>Rescue attempts</u> | $N = 276$ | $N = 239$ |
| Hot-times for rescue attempts | Saturday and Sunday night between 0:00 and 6:00 (47%) | Were not identified |
| Where (Formatus and fire department database) | | |
| <u>Drowning fatality/rescue attempt ratio</u> | 1: 10,2 | 1: 3,9 |
| Hotspots for rescue attempts | Old city | Were not identified |

3.3. Where do people non-fatally drown or drown in Amsterdam?

From January 2011 to December 2015, 27 drownings and 276 non-fatal drownings were recorded in the Canal District (a drowning to non-fatal drowning ratio of 1:10.2). In the rest of Amsterdam there were 61 drownings and 239 non-fatal drownings in the same period (a drowning to non-fatal drowning ratio of 1:3.9).

The Canal District can be divided into the historical city centre (which includes the Red Light District) and the rest of the inner city. In the historical city centre there was a high density of non-fatal drownings, but there were no actual drownings (Fig. 2). The historical city centre is considered to be a hot spot for Amsterdam with respect to non-fatal drowning.

In the Canal District there are relatively more non-fatal drownings, while in the rest of Amsterdam there are relatively more drownings.

4. Discussion

4.1. Who drowns in Amsterdam?

There appears to be a high percentage of males among the drowning fatalities, which is in line with other studies worldwide.^{5–11}

A clear explanation for this high percentage is not provided by previous studies. It is most likely due to more risky behaviour in general in combination with alcohol and/or drug usage.^{12,13} One recent study concludes that several factors contribute to high drowning rates in men such as elevated risks for exposure, risk taking, alcohol use, and interaction between overestimation of abilities combined with heavy alcohol use.¹⁴

Alcohol and drug intoxication is relatively common among people who have visited bars and nightclubs, as well as among more marginalized groups such as homeless people and people with alcohol and/or drug dependency.

Being under the influence of alcohol and/or drugs seems to be a risk factor for drowning. Previous studies reported that a high percentage of drowning cases (25–65%) involved alcohol.^{12,15,16} In the Canal District 55% of the drownings showed signs of alcohol intoxication and/or drug usage. Being intoxicated may increase the risk of falling into the water and may impair the ability to get out of the water independently. Another hypothesis for the relationship between drowning and the high percentage of drug abuse is that some drugs can induce a long QT-syndrome that may contribute to drowning.¹⁶

One popular explanation for the high proportion of males among

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