Emergency Medicine: Open Access

Kolev et al., Emerg Med (Los Angel) 2017, 7:1
DOI: 10.4172/2165-7548.1000345

Research Article OMICS International

Retrospective Analysis of Drowning Incidents at a University Hospital in Switzerland

Mirjam Kolev[1*], Corinne Meister[2], Meret E Ricklin[1] and Aristomenis K Exadaktylos[1]

[1]*Department of Emergency Medicine, Inselspital, University Hospital Bern, Freiburgstrasse, Bern, Switzerland*

[2]*University of Bern, Hochschulstrasse, Bern, Switzerland*

[*]**Corresponding author:** Mirjam Kolev, Department of Emergency Medicine, Inselspital, University Hospital Bern, Freiburgstrasse, Bern, Switzerland, Tel: +41 31 632 24 42; E-mail: mirjam.kolev@gmail.com

Received date: February 07, 2017; **Accepted date:** February 16, 2017; **Published date:** February 23, 2017

Abstract

Background: The annual rate of accidental fatal drowning in Switzerland is about 50 deaths/year (0.6/100 000). We report on the fatal and non-fatal drowning incidents among adults that were treated at the University Hospital in Bern, Switzerland, between 2000 and 2014.

Methods: Retrospective analysis of the electronic database of the emergency centre for adults of the university hospital in Bern. Between 2000 and 2014 all fatal and non-fatal drowning incidents were analysed using specific medical keywords.

Results: 126 patients were included. Ninety-one (72%) were male, 94 (76%) aged between 16-44 years, 107 (89%) of the incidents occurred in rivers. In 83 (68%) cases the activity during the incident was swimming. Twenty-two (18%) were non-accidental drowning incidents, 14 (11%) of all the drowning patients needed reanimation and 6 (4.8%) died within 24 h.

Conclusion: Our analysis shows that it is important to have a closer look at the efforts and effectiveness of prevention done against drowning of young men in high-risk aquatic settings. Further there is a need to report drowning incidents according to international standards in order to draw conclusions for prognostic factors and therapy in the future.

Keywords: Drowning; Injuries; Utstein-style; Suicide

Abbreviations

ACLS: Advanced Cardiac Life Support; CPR: Cardiopulmonary Reanimation; EMS: Emergency Medical System; ED: Emergency Department; GCS: Glascow Coma Scale; ICU: Intensive Care Unit; NACA score: National Advisory Committee for Aeronautics for Accidents in Aviation; PEA: Pulse less Electrical Activity; VF: Ventricular Fibrillation; VT: Ventricular Tachycardia

Introduction

Drowning accounts for more than half a million deaths annually worldwide [1]. Almost half of those deaths occur in children and adolescents from 0-15 years [2,3]. Low and middle-income countries have the highest rates of drowning and account for more than 90% of such fatalities, Africa having the highest mortality rate (13.1/100000) [3]. In comparison to this magnitude of deaths worldwide, the rate of fatal drowning in Switzerland is low with 0.6/100000 habitants, and also low compared to deaths from road traffic accidents in Switzerland (3.8/100000) [4].

Drowning is an injury with particular etiological patterns that change according to age group, aquatic setting and activity [2,3]. Infants often drown in bathtubs, young children in pools and older children and adults tend to drown in rivers, lakes or the ocean during recreational activities. Conditions increasing the risk of drowning in open water include currents, rips, waves and cold water. Intoxication with alcohol or other drugs contributes to at least 10-30% of drowning particularly in older age group [5]. Tourists have a higher risk of drowning than locals [6]. Of all deaths due to unintentional injury, drowning shows the greatest seasonal variation with two-thirds of deaths occurring from May-August in the US [7]. Drowning is also more common during the weekends [8,9].

Materials and Methods

The emergency medicine department at the University hospital in Bern is the only Level I trauma centre in the Canton of Bern. It serves about 1.8 million people and treats more than 40,000 cases per year, caring for patients older than 16 years [10].

From 01/01/2000-02/21/2014 patient data was collected and saved at the university department of emergency medicine in an electronic patient record database (ECARE/Qualicare). The database was browsed for the key words “drowning”, “near-drowning”, “drowning accident”, “swimming accident” and “Aare (local river)” and manually analysed for its accuracy. In the database we found 126 patients who were admitted to the emergency department after a drowning incident. Since this medical database allows access to past diagnostic reports, consultations, X-rays, laboratory results and other relevant documents, the authors were able to analyse retrospectively the identified patients, as far as available.

From this data set we performed a retrospective analysis and extracted the data from drowning according to the recommended guidelines for nomenclature and uniform reporting of data from drowning "Utstein style" [11,12].

We added variables like the day of the week or season in order to analyse patterns of drowning incidents. We used the scoring system for severity in cases of medical emergencies that had been developed by the National Advisory Committee for Aeronautics for accidents in aviation (NACA-Score 0-VII) in order to quantify the severity of the caseload (Table 1) [13].

Score	Definition
NACA 0	No injury or disease
NACA I	Injuries/diseases without any need for acute medical care. Including: abrasions and contusions.
NACA II	Injuries/diseases requiring examination and therapy by a physician but hospital admission are not indicated. Including: finger and tooth fractures and tympanum perforation.
NACA III	Injuries/diseases without acute threat to life but requiring hospital admission. Including: psychological problems requiring hospitalisation and spinal fractures.
NACA IV	Injuries/diseases which can possibly lead to deterioration of vital signs. Including: hypothermia and massive aspiration.
NACA V	Injuries/diseases with acute threat of life. Including: haemodynamic shock and cardiac infarction.
NACA VI	Injuries/diseases which needed resuscitation
NACA VII	Lethal injuries or diseases (with or without resuscitation attempt)

Table 1: Definition of the National Advisory Committee for Aeronautics (NACA) score to determine the severity of the condition.

We defined icy water as a water temperature below 10°C, as this is a life threatening temperature [14]. As the mean water temperature in the local river is below 10°C between December-April, we chose to define drowning in the open water in this time period as icy [15].

Calculations and Graphs were done in excel.

This study was performed according to Swiss law and GCP guidelines. As datasets were exported anonymously no patients consent was necessary.

Results

Overall

126 patients were included in this study, 91 male (72%) and 35 female (28%). One third (37 patients) were between 16-24 years, one third (36 patients) between 25-34 years and 21 (17%) between 35-44 years. Incidences decreased further by age (Table 2).

Eighty-seven percent of the incidents occurred in the Canton of Bern and 44% happened on the weekend. Seventy-five percent of the time it was during the summer, 10% in fall, 8% in spring and 7% in winter (90% non-icy water, 10% icy water). Eighty-nine percent of drowning events happened in rivers, 3% in lakes and 4% in public pools (Figure 1). The activity during the accident was in 68% swimming, in 18% suicide, making diving, boating and activity outside the water minor variables (Table 3).

Age group in years	Male in %	Female in %
16-24	22	7
25-34	23	6
35-44	11	6
45-54	6	3
55-64	2	3
65-74	4	0
75-84	2	2
>85	1	1

Table 2: Age distribution per gender. A comparison of the age groups (years) among all patients (%), included with subdivision into men (filled) and women (hatched). There was no woman in the age group of 65 to 74 years. As data from one patient were missing, 125 patients were used as total to calculate the percentages.

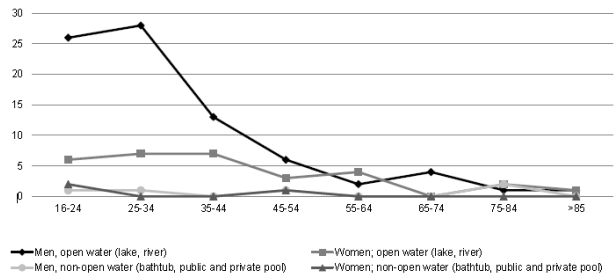

Figure 1: Body of water by gender and age. Body of water split by gender and age (absolute numbers). There were a total of 119 patients, 86 male and 33 female. In 7 cases, no information was available.

Category	Male N	%	Female N	%
Swimming	66	54	17	14
Diving	1	1	1	1
Boating	4	2	0	0
Surfing	1	1	0	0
Activity outside water	6	6	1	1
Suicide	9	7	13	11
Others	2	2	2	2

Table 3: Activity during the incident by gender: Activity during the drowning incident for each gender (men filled, women hatched). Percentages calculated from a total of 123 patients. There was no woman boating or surfing. In 3 patients, there was no information available.

Only 12.7% had a NACA score of 0. Most of the patients had a NACA score of I (31%) or II (24.6%). 12.7% respectively 8% patients had a NACA score of III or IV, meaning middle-severe consequences of the drowning. Fourteen patients needed reanimation, eight (6.3%) survived and six (4.8%) died (NACA VI and VII). None had a NACA score of V. Patients younger than 35 years where more likely to have a low NACA score between 0-128 II (Figure 2).

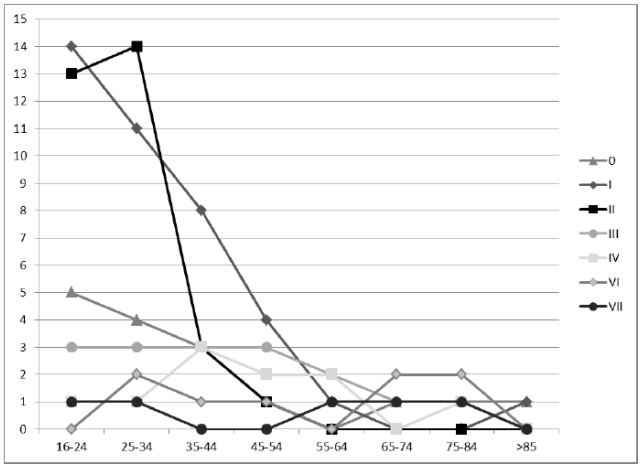

Figure 2: NACA score by age. The NACA score (National Advisory Committee for Aeronautics) of patients (absolute numbers) in relation to their age group (years). There was a total of 126 patients. No patient included in our study had an NACA score of five.

In 13 (10%) patients alcohol was a precipitating factor, 6 (4.8%) patients had consumed drugs (cannabis, cocaine or heroin). All of these patients had a NACA score of less than V. 132.

In order to analyse the data more precisely we divided the patients in three groups. First the accidental drowning, second the patients with cardiac arrest and as a third group the non-accidental (suicidal) drowning. Suicidal patients that needed reanimation were analysed in both groups.

Accidental drowning

If we analyse the data of the accidental drowning without suicides, 83% happened during the summer and 52% on the weekends (Figure 3). The vast majority of patients had a NACA score of 0-II (78%), 11.5% were moderate-severely injured (NACA III-IV) and 10.5% needed reanimation and/or died (NACA VI-VII).

Victim information

A total of 14 patients with out-of-hospital-cardiac arrest due to drowning and attempted resuscitation were enrolled. The mean age was 53.5 years (range 24-83 years). Of those 78.6% were male. Two cases occurred in spring (14.3%), seven in summers (50%), two in fall (14.3%) and three in winter (21.4%). The precipitating event was unknown for most patients (71.4%). Three patients committed suicide. Drug or alcohol abuse as a precipitating event was not reported in any of the patients.

Nine patients (64.3%) had no known or reported medical problems. One person had diabetes mellitus, one had a seizure disorder, one had a cardiopulmonary disease and two had known psychological problems.

Forty-three percent of the patients died. Among those that died, 50% were female and male respectively. All of the survivors were male.

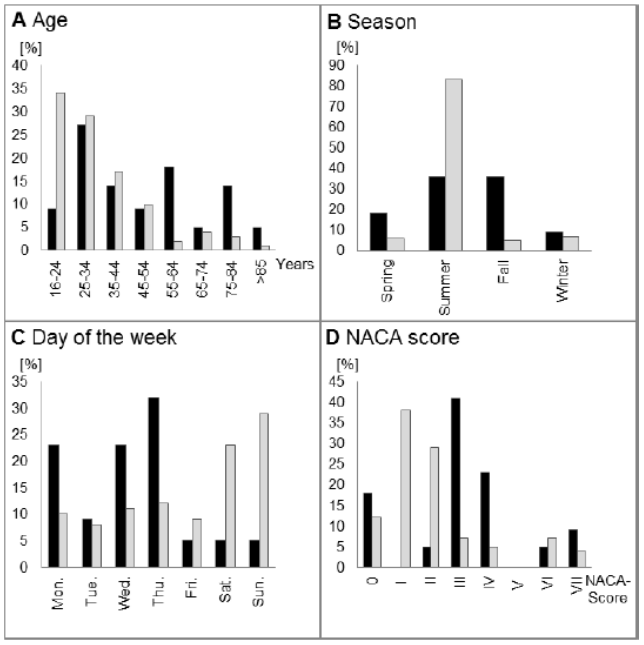

Figure 3: Suicidal versus non-suicidal patients. Comparison of the suicidal (black bars) and non-suicidal (grey bars) patients. The percentages were calculated for the corresponding subgroups. (A) The age groups are given in years. There were 22 suicidal and 103 non-suicidal patients. Data missing in one patient. (B) Comparison of 22 suicidal and 104 non-suicidal patients in relation to the season in which the incident took place. (C) Weekday of the drowning incident (22 suicidal and 104 non-suicidal patients). (D) The NACA score comparing 22 suicidal and 104 non-suicidal patients. No suicidal patient had an NACA score of one and no patient had an NACA score of five.

Cardiac arrest at scene and fatal drowning (Table 4)

	Total, n=14 (%)	Survivors, n=8 (%)	Non-Survivors, n=6 (%)
Age (years; mean ± range)	53.5 ± 24-83	55.8 ± 26-83	52.0 ± 24-80
Male	11 (78.6)	8 (100)	3 (50.0)
Precipitating event			
Unknown	10 (71.4)	7 (87.5)	3 (50.0)
Suicide	3 (21.4)	1 (12.5)	2 (33.3)
Others (weakness)	1 (7.1)	0 (0)	1 (16.7)
Pre-existing illness			
No	9 (64.3)	7 (87.5)	2 (33.3)

Diabetes mellitus	1 (7.1)	0 (0)	1 (16.7)
Seizure disorders	1 (7.1)	0 (0)	1 (16.7)
Psychological disorder	2 (14.3)	0 (0)	2 (33.3)
Cardiopulmonary disease	1 (7.1)	1 (12.5)	0 (0)
Witnessed	10 (71.4)	6 (75.0)	4 (66.7)
Body of water			
River	10 (71.4)	5 (62.5)	5 (83.3)
Public pool	3 (21.4)	3 (37.5)	0 (0)
Bathtub	1 (7.1)	0 (0)	1 (16.7)
Duration of submersion			
Unknown	8 (57.1)	4 (50.0)	4 (66.7)
Time (minutes; mean ± S.D.)	1.8 ± 1.0	1.8 ± 1.0	2.0 ± 1.4
Resuscitation before EMS[1] arrived			
Unknown	4 (28.6)	3 (37.5)	1 (16.7)
Yes	8 (57.1)	5 (62.5)	3 (50.0)
No	2 (14.3)	0 (0)	2 (33.3)
Time until EMS arrival			
Unknown	6 (42.9)	5 (62.5)	1 (16.7)
Time (minutes; mean ± S.D.)	12.4 ± 3.1	12.0 ± 5.2	12.6 ± 1.8
Initial rhythm			
Unknown	5 (35.7)	3 (37.5)	2 (33.3)
VF[2]/VT[3]	2 (14.3)	2 (25.0)	0 (0)
PEA[4]	2 (14.3)	1 (12.5)	1 (16.7)
Asystole	5 (35.7)	2 (25.0)	3 (50.0)
Arrival at the ED[5] after the event			
Unknown	8 (57.1)	5 (62.5)	3 (50.0)
Interval (minutes; mean ± S.D.)	59.0 ± 23.9	72.7 ± 27.5	45.3 ± 3.3
Vital signs at the ED			
Blood pressure (mmHg; mean ± S.D)	82.0 ± 79.0/46.5 ± 49.4	143.5 ± 38.8/81.4 ± 37.8	0 ± 0/0 ± 0
Unknown	0 (0)	0 (0)	0 (0)
Heart rate (x/min; mean ± S.D)	51.3 ± 54.0	95.3 ± 35.0	0.0 ± 0.0
Unknown	1 (7.1)	1 (12.5)	0 (0)
Core Temperature (°C; mean ± S.D)	31.9 ± 3.8	32.5 ± 4.3	31.1 ± 3.0
Unknown	7 (50.0)	4 (50.0)	3 (50.0)
Blood pH (mean ± S.D)	6.9 ± 3.8	6.9 ±0.3	6.8 ± 0.0
Unknown	8 (57.1)	4 (50.0)	4 (66.7)
Pupillary reaction			
Unknown	1 (7.1)	0 (0)	1 (16.7)
Normal	2 (14.3)	2 (25.0)	0 (0)
Lethargic	4 (28.6)	4 (50.0)	0 (0)
Wide/fixed	7 (50.0)	2 (25.0)	5 (83.3)
GCS			
Unknown	1 (7.1)	1 (12.5)	0 (0)
03-08	12 (85.7)	6 (75.0)	0 (0)
09-12	0 (0)	0 (0)	0 (0)
13-15	1 (7.1)	1 (12.5)	6 (100)

Table 4: Baseline characteristics among patients with cardiac arrest due to drowning.

Scene Information

Ten patients (71.4%) were witnessed, seven of these by a layperson and one by a professional (two patients witnessed, but unclear by whom). Two incidents were not witnessed and in two there was no information available. Among the survivors, six (87.5%) were witnessed and among those that died three (50%) were witnessed (two unknown). Ten (71.4%) events occurred in the river, three in public pools (21.4%) and one in a bathtub. Five events in the river were fatal (50%). All three events in the public pools were non-fatal. The drowning incident in the bathtub was fatal.

Both patients with previously reported psychological disorders were females and jumped in the river and drowned. The other fatal drowning incidents were reported as sudden drowning. The female drowning in the bathtub had a known history of epilepsy.

When rescued from the water, they were all with Glasgow coma scale (GCS) of 3, no spontaneous breathing and no palpable pulse. Wide/fixated pupils were mentioned in six cases; five of these died in the later course and in one case follow up was not possible. The time of submersion was reported in six (43%) cases being a mean of 1.8 minutes in the survivor and 2 minutes in the non-survivor group (Table 4).

Among all patients, eight (57%) received resuscitation before EMS arrived, two (14.3%) did not and four (28.6%) remain unknown. Among those that survived, five patients received CPR before EMS arrived (three by a layperson, two by a professional) and three are unknown. In those that died three (50%) had CPR by a layperson two had no pre-EMS resuscitation (33.3%) and in one patient (16.7%) there was no information available.

The time until EMS arrived was 12.4 (+/- 3.11 min) and was reported in eight patients (57.1%), with no difference in the survivor and non-survivor group (Table 4).

Two (14.3%) had a shockable rhythm, two (14.3%) a pulseless electric activity (PEA) and five asystole (35.7%). In five cases it was not reported. The two persons with a shockable rhythm both survived.

Emergency department assessment

All patients arrived intubated in the emergency department. The six patients that died were transferred to the hospital under on-going cardiopulmonary resuscitation (CPR), but after a reassessment CPR was discontinued in five patients and one were diagnosed with severe hypoxic brain ischemia. This patient had a medically supported circulation and was transferred to the intensive care unit (ICU) where he died within 24 h due to brain death. The patients that survived were intubated as well, but all had a spontaneous circulation. Initial core temperature detected by ear-temperature was 32.5°C in the survival group (four missing) and 31.1°C in the non-survival group (three missing). The mean venous pH was 6.9 in the survivors and 6.8 in the non-survivors.

Follow up

All the patients mentioned as survivors were transferred to the intensive care unit or internal medicine for further diagnosis and therapy without possible follow up. It is out of our knowledge whether they died in the later course as there is no available register of deaths in Switzerland.

Suicides

Twenty-two (18%) patients tried to commit suicide by drowning. Fourteen (63.6%) were female versus eight (36.4%) male respectively. More non-accidental drowning than accidental drowning occurred in the age group 55-64 years, 75-84 years and >85 years (Figure 3A). Four (18.2%) incidents happened in spring, eight (36.4%) in summer, eight (36.4%) in fall and two (9.1%) in winter. Five (23%) non-accidental drowning happened on Monday, five (23%) on Wednesday and seven (32%) on Thursday, with only two (9%) on Tuesday and one (5%) on Friday-Sunday respectively (Figures 3B and 3C).

Thirteen patients (59%) were known for a psychological disorder, two for cardiopulmonary diseases (9%), one for diabetes mellitus (4.5%) and one (4.5%) for others (renal insufficiency).

Only eight (36.4%) incidents had been witnessed. Circumstances of the accident was most often a jump in the water (10, 45.5%), two (9.1%) were sudden drowning incidents, three (13.6%) unknown and seven (31.8%) other circumstances.

Most incidents occurred in the river (86.4%), 4.5% in a lake, public pool and bathtub respectively. In three cases CPR was necessary, two of which died.

NACA-score of suicidal patients was 0 in 18.2%. No one had a NACA of I and only one (4.5%) had a NACA of II. In 63.7% the NACA was moderate to severe (III or IV) and 13.6% needed reanimation or died (VI or VII) (Figure 3D).

Discussion

Accidental drowning without cardiac arrest

As in previous reports also in our analysis there was a striking predominance of young males in high-exposure aquatic settings (risk for submersion) that drowned [16-18]. The higher drowning rate for males has been explained by greater exposure to aquatic environments, overestimation of swimming ability, higher risk-taking, and greater alcohol use [18]. The behavioural differences reflect more fundamental factors distinguishing the sexes (e.g. different socialisation for risk taking, testosterone) as men have higher injury rates overall. In our study we can again only describe the fact of this pattern. But it would be important to have a closer look at the prevention strategies that are already used or that could be of importance and to reflect on further possible steps to improve prevention for this group of drowning victims.

Accidents most often happened in rivers and the activity during the incident was most often swimming. This result is according to our expectations as the river Aare is located in the canton and city of the hospital and widely used for recreational activities. Swimming in rivers is more dangerous than in pools due to possible dangerous currents and unexpected turbulences. As an additional factor, there are only lifeguards around public pools and not around lakes or rivers. It could be assumed that experienced swimmers would be in less danger of drowning in the river, even though until now there is no study that could clearly confirm this assumption [10,16]. But as this was a retrospective analysis it was not possible to analyse for swimming ability.

In congruence with previous publications, more accidents happened on the weekends and during the summer, as this is the time for recreational activities in high-exposure aquatic settings [7-9].

Cardiac arrest at scene

Regarding the prognosis of drowning victims it is known that the following factors are poor prognostic features: submersion greater than 5-10 min, resuscitation not attempted for more than 10 minutes after rescue, more than 25 min of resuscitation, GCS less than 5 or unreactive pupils on arrival to hospital, pulseless and apnoeic on arrival to hospital, pH less than 7.1 on initial arterial blood gas [5]. Approximately one-third of patients admitted to hospital unconscious after drowning will die. Half will survive with no or minimal neurological deficit and the remainder will have moderate to severe neurological impairment [19].

In our study the submersion time (reported in 42.9%) was less than 5 min. There is a tendency of better survival at discharge from the emergency department (ED) when resuscitation was attempted before the emergency medical system (EMS) arrived (Table 1). Most of the patients arrived at the ED with a GCS of 3, which is also due to the fact that patients in Switzerland get intubated on scene if indicated. But all but one of the patients that died within 24 hours had unreactive pupils on arrival to the hospital, whereas the survivors had reactive pupils. There was not a marking difference in pH (6.9 versus 6.8) and only a slight difference in body temperature (32.5°C versus 31.1°C) in survivors and non-survivors. Six out of 14 patients that needed reanimation died (42.9%).

In our study 83.3% of the fatal drowning incidents happened in the river. However, in the Study by the Swiss Life-Saving-Organisation fatal drowning occurred to 90% in lakes and rivers to a comparable amount [16]. This difference might be due to other hospitals that are located closer to the area with the lakes in the canton of Bern that also have the expertise to treat drowning victims.

In congruence with previous reports one third of the patients that needed CPR where non-locals. None of them died.

Medical conditions associated with an increased risk of drowning include epilepsy, arrhythmias, cardiomyopathies, coronary artery disease, cerebrovascular disease, diabetes mellitus and depression [5]. In our study the majority of the patients that died had one of these pre-existing illnesses.

Taken together, results were congruent with already published data. But the attempt to report the cases with cardiac arrest on scene in an "Utstein style" failed due to a lack of specific data. We do understand that mentioning all the data in a letter of communication is challenging, first of all in a setting where the focus is on resuscitation or in cases with a fatal outcome.

Suicides

So far Mondays were in the focus of being the day of the week with increased suicide rates [20]. But there are also some data that show a shift from Monday to Wednesday, with a drop again on Thursdays [21]. The shift from Monday to the middle of the week is not understood yet. It might be due to increased stress load at work. However, the different cultures, working mentalities and social factors in these studies have to be considered before speaking of a new trend in suicide patterns.

In our analysis we had most suicidal attempts on Mondays, Wednesdays and Thursdays, representing both trends of the previously published weekdays.

Earlier studies showed an increase of suicides in winter and spring. Yet again, more recent data in a nation-wide analysis in the USA could not confirm these findings and found almost no seasonal effect. This might be due to a better connectedness through internet and cell phones [21] that decreases depressions during the winter. In our analysis we had the lowest rates of suicides in winter and the highest rates in summer and fall. Maybe this represents a psychological deception that the water is not an obvious option in winter times.

It is notable that most of the non-accidental drowning patients had a moderate-severe NACA score, in comparison to the accidental drowning victims that mostly had NACA scores of I-II. This seems to be in accordance to the determination of the occurrence.

Conclusion

As most of the accidental non-fatal drowning victims were young males in high-risk aquatic settings, we suggest a new focus on prevention within this population.

A standardised report of the course of the drowning and resuscitation according to the "Utstein style" is crucial for further studies with the aim of improvement of the resuscitation process. As our analysis showed it is very challenging to give this detailed recount in time sensitive situations through the limitation of retrospective data analysis. Nevertheless it is essential for future studies.

Limitations

Despite a careful review of all available documentation, we cannot guarantee that all eligible patients were included in this study due to potential documentation biases. However, this bias can reasonably expected to be evenly distributed between groups and thus should not affect the conclusions of this study. As our hospital is a university hospital, the collective of patients that are treated in our ED is most likely subject to a selection bias. The number of cases with incomplete documentation of some parameters, owed to the retrospective study-design, was not significantly different between the compared groups and therefore should not compromise the results. Furthermore we do not have access to the information of the treating physician and can therefore not make conclusions if the education, experience or other context factors might influence the outcome. However in the Shock-suite always an experienced tem-leader is present. Nevertheless, further prospective studies should be conducted to confirm our results.

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this manuscript.

Acknowledgement

We want to thank Sabina Utiger for database queries and Rodney Yeates for the English revision of the manuscript.

References

1. World life expectancy (2015) Educational database.
2. DeNicola LK, Falk JL, Swanson ME, Gayle MO, Kissoon N (1997) Submersion injuries in children and adults. Crit Care Clin 13: 477-502.
3. Wallis BA, Watt K, Franklin RC, Nixon JW, Kimble RM (2015) Drowning mortality and morbidity rates in children andadolescents 0-19 yrs: a population-based study in Queensland, Australia. PLoS ONE 10: e0117948.
4. Peden MM, McGee K (2003) The epidemiology of drowning worldwide. Inj Control Saf Promot 10: 195-199.
5. Hooper AJ, Hockings LE (2011) Drowning and immersion injury. Anaesth Intensive Care Med 12: 399-402.
6. World Health Organization (2014) Injuries and violence prevention. Fact sheet on drowning. Fact sheet N°347.
7. Jiaquan X (2014) Death rates from unintentional drowning, by age group: United States, 1999–2010.
8. Salomez F, Vincent JL (2004) Drowning: A review of epidemiology, pathophysiology, treatment and prevention. Resuscitation 63: 261-268.
9. Idris AH, Hoeller R, Papa L (2002) Lack of uniform definitions and reporting in drowning in resuscitation. Florence, Italy.
10. Idris AH, Berg RA, Bierens J, Bossaert L, Branche CM, et al. (2003) Recommended guidelines for uniform reporting of data from drowning: the "Utstein style". Circulation 108: 2565-2574.
11. Imstepf VA, Braun CT, Ricklin ME, Exadaktylos AK (2015) Time for a break: admissions to an urban emergency department after working out--a retrospective study from Switzerland. Biomed Res Int 2015: 610137.
12. Lamprecht, Sozialforschung S, Beratung (2009) SLRG anniversary study: Water and swimming accidents in Switzerland. Accident, risk factors, prevention, S.L.-G. SLRG.
13. Steensberg J (1998) Epidemiology of accidental drowning in Denmark 1989-1993. Accid Anal Prev 30: 755-762.
14. Howland J, Hingson R, Mangione TW, Bell N, Bak S (1996) Why are most drowning victims men? Sex differences in aquatic skills and behaviors. Am J Public Health 86: 93-96.
15. Layon AJ, Modell JH (2009) Drowning: Update 2009. Anesthesiology 110: 1390-1401.
16. Lukaschek K, Baumert J, Erazo N, Ladwig KH (2014) Stable time patterns of railway suicides in Germany: comparative analysis of 7,187 cases across two observation periods (1995-1998; 2005-2008). BMC Public Health 14: 124.
17. Ohtsu T, Kokaze A, Osaki Y, Kaneita Y, Shirasawa T, et al. (2009) Blue Monday phenomenon among men: suicide deaths in Japan. Acta Med Okayama 63: 231-236.

18. Kposowa AJ, D'Auria S (2010) Association of temporal factors and suicides in the United States, 2000-2004. Soc Psychiatry Psychiatr Epidemiol 45: 433-445.
19. Franklin RC, Scarr JP, Pearn JH (2010) Reducing drowning deaths: the continued challenge of immersion fatalities in Australia. Med J Aust 192: 123-126.
20. Dami F, Golay C, Pasquier M, Fuchs V (2015) Prehospital triage accuracy in a criteria based dispatch centre. BMC Emerg Med 15: 32.
21. Miller TR, Furr-Holden CD, Lawrence BA, Weiss HB (2012) Suicide deaths and nonfatal hospital admissions for deliberate self-harm in the United States. Temporality by day of week and month of year. Crisis 33: 169-177.