*Rafał Halik, Anna Poznańska, Wojciech Seroka, Bogdan Wojtyniak*

# ACCIDENTAL DROWNINGS IN POLAND IN 2000-2012

Department-Centre of Monitoring and Analyses of Population Health
National Institute of Public Health – National Institute of Hygiene

## ABSTRACT

**OBJECTIVE:** Drowning is a public health problem which is poorly recognized and analyzed in the Polish literature so far.
**MATERIAL AND METHODS:** We analyzed all available sources of information on drowning in Poland, i.e. the data of the Central Statistical Office (causes of deaths, accidents at work) and Police Headquarters (circumstances of drowning). We discussed changes in drowning frequency, analyzing both time and space perspective as well as demographic profiles of fatal drowning cases.
**RESULTS:** In 2000-2012, an estimated 12,702 persons died due to drowning in Poland (median of crude mortality rate - 2.6 per 100,000 population). Mortality due to drowning was on downward trend. Males aged 45-59 years, especially with vocational education, were at the highest risk of drowning. In the period analyzed, the highest and the lowest mortality rates were reported in Warmińsko-mazurskie (median of mortality rate - 4.7) and Śląskie voivodships (median of mortality rate - 1.2), respectively. The highest drowning frequency was noted in the period from June to August in which a total of 5,981 cases were registered, i.e. 47.1% of all recorded drownings.
**CONCLUSIONS:** A risk of death due to drowning in Poland is higher compared to the average in other EU countries. There is a necessity for public health intervention in this field. Furthermore, reporting systems regarding drowning in Poland should be unified.

**Key words:** *accidental drowning, mortality, water safety*

## INTRODUCTION AND STUDY OBJECTIVE

From medical perspective, drowning is defined as "the process of experiencing respiratory impairment from submersion/immersion in liquid" (1). Drowning is a serious public health problem worldwide. According to the estimates of the World Health Organization (WHO), an estimated 359,000 persons die due to drowning annually, i.e. 7% of accidental deaths (2). The problem especially affects developing countries. In Poland, annual number of fatal drowning cases ranged from 862 to 1,148 persons in 2000-2012 (data of Central Statistical Office - CSO). Compared to the average in other EU countries, a risk of death due to drowning in Poland is significantly higher (standardized mortality rate – 2.2 per 100,000 Polish population *vs* 1.2 in EU in 2012). WHO classifies drowning as a potentially preventable cause of death provided there are prevention strategies adopted (2). There is an insufficient recognition of drowning and its circumstances in Poland. Such assumption is motivated by marginal number of publications related to epidemiological analysis of drowning.

## MATERIAL AND METHODS

WHO recommendations based on the International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10) were used as a criterion to select accidental drowning cases. Pursuant to ICD-10, this notion excludes the cases of intentional self-harm, assault and accidents to watercraft causing drowning, including accidents to boat and sport equipment. According to these recommendations, the cases of accidental drowning are coded with ICD-10 codes: W65-W74. All available sources of information on drowning in Poland were analyzed, i.e. the data of the Central Statistical Office (CSO) on the causes of deaths in Polish population, which are employed by the National Institute of Public Health – National Institute of Hygiene (NIPH-NIH) for the purpose of studies on

Polish population health status as well as CSO data on accidents at work. Furthermore, the Police Headquarters provided the data on drowning in 2000-2012. WHO Mortality Database was used to compare mortality rates between different countries.

Crude and age-standardized mortality rates due to drowning in Poland were calculated. Direct standardization of mortality rates, using Standard European Population, was applied.

Data regarding the entire population as well as data on gender, age (6 age groups: 0-14, 15-29, 30-44, 45-59, 60-74 and 74+), education (data as of 2010-2012 based on the National Census of Population and Housing of 2011), place of residence (voivodship), place and circumstances of drowning were subject of analysis. For the groups selected on a basis of demographic profiles, standardized mortality rates were compared. Mortality level in voivodships was assessed using crude mortality rates as an indicator of drowning prevalence.

Linear regression was employed in the analysis of long-term trends in annual mortality rates. Fisher's exact test was used to determine the significance of relations observed.

## RESULTS

According to CSO data, a total of 12,702 persons died due to accidental drowning (W65-W74 codes) in Poland in 2000-2012. Having analyzed the same period, 501, 37 and 28 drowings due to intentional self-harm (X71), assault (X92) and accidents to watercraft causing drowning (V90 and V92) were reported, respectively.

Having considered the differences in age structure of males and females, a risk of death due to accidental drowning was more than 5-fold higher in males compared to females (standardized mortality rates in 2012: males – 3.8 per 100,000 population *vs* females - 0.7). In case of females, mortality rate was increasing significantly for those aged more than 45 years and it was the highest in the age group 75+. Males aged 45-59 years were at the highest risk of death due to drowning (Fig. 1).

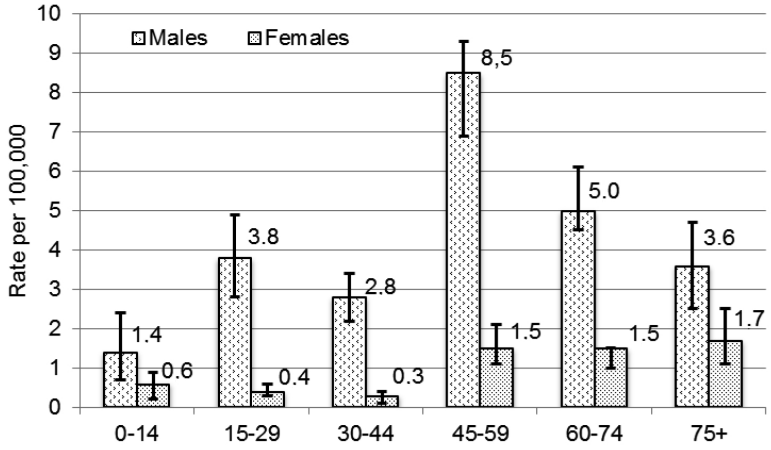
In 2000-2012, a statistically significant decrease in the number of deaths in the successive years was observed in Poland (17 cases annually, applying linear trend; p=0.005), which corresponds to a significant reduction of mortality rates for both genders (Fig. 2). A decreasing trend was observed for almost all age groups, excluding persons aged 60-74. For them, an increase (statistically insignificant) in the mortality rate was noted.

Education strongly affects the risk of death due to accidental drowning, especially in case of males. Having compared males with vocational and higher education, this risk was 7-fold higher in the former group than in the latter. In case of females the risk of drowning was comparable irrespective of education. (Fig. 3).

Seasons of a year are also strongly associated with drowning prevalence (Tab. I.). The highest risk of drowning is observed in the period from June to August. In this period, a total of 5,981 fatal cases were reported, i.e. 47.1% of all registered drownings compared to 1,566 drownings (12.3%) noted in the period from December to February.

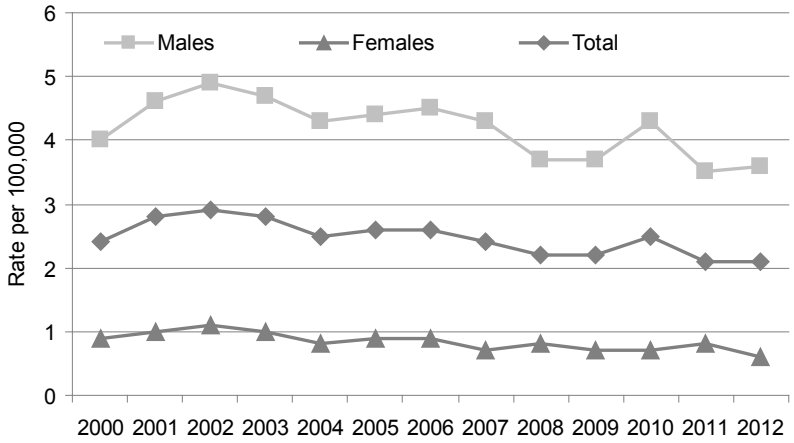
The highest average mortality rate due to accidental drowning was observed in Warmińsko-mazurskie voivodship (4.6 per 100,000 population). High mortality was also noted in other voivodships where there are many water areas, with the exception of Zachodniopomorskie voivodship (3). The lowest mortality (median of annual rates – 1.2 per 100,000) was noted in highly urbanized Śląskie voivodship (Tab. II.).

In the majority of cases, drownings occurred in the voivodships of the residence of drowned persons. In 2000-2012, the highest percentage of persons who



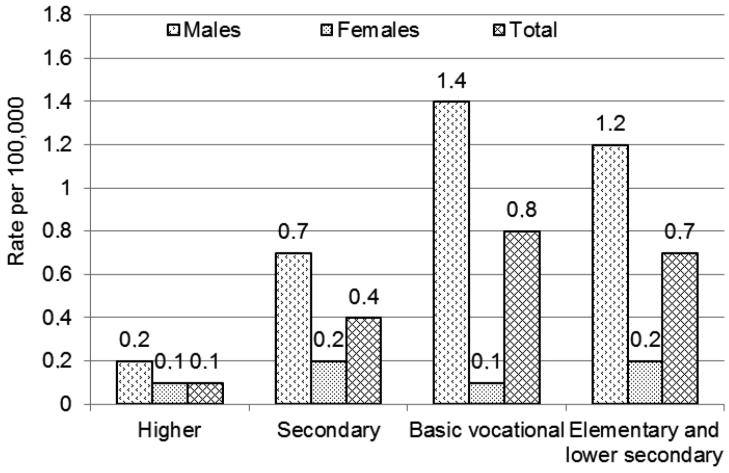

Source: Own elaboration based on CSO data.

Fig. 1. Median of standardized mortality rate due to unintentional drowning (W65-W74) per 100,000 population by gender and age group in 2000-2012 in Poland (ranges of mortality rates in analyzed period are marked on bars).




Source: Own elaboration based on CSO data.

Fig. 2. Standardized mortality rate due to unintentional drowning per 100,000 population in 2000-2012 in Poland.




Source: Own elaboration based on CSO data.

Fig. 3. Standardized mortality rate due to unintentional drowning (W65-W74) by education in 2010-2012 in Poland.

died due to drowning outside their voivodship of residence was noted in highly urbanized areas, i.e. Śląskie – 18.3%, Łódzkie – 15.2% and Mazowieckie voivodships– 14.7% (Tab. II).

ICD-10 classification, which is used for the purpose of establishing and reporting the causes of deaths, enables, in some cases, to determine the circumstances of drowning. In the analyzed period (2000-2012), there was an improvement of establishing the circumstances of drowning – the percentage of other unspecified drownings decreased from 35.8% to 5.1%. When analysing the type of water area where drowning occurred, the most common place is natural water (W69) which in particular years accounted for 41.1% to 75.5% of all drownings. The percentage of drowning while in bath-tub or following fall into bath-tub (W65-W66) and while in swimming-pool or following fall into swimming-pool (W67-W68) did not exceed 5% of all drownings in 2000-2012 on average.

Drowning accidents in workplace are registered by CSO within the frame of public statistics (Z-KW statistical form). Available data from 2007-2012 indicate that such accidents affected 182 employees, of whom 80 died (2.8% of all fatal accidents in a workplace in the same period).

Information on drowning can be also obtained from the statistics of the Police Headquarters which registers interventions undertaken mainly by police officers of Water Police. Definition of drowning for the purpose of Police reporting system is not the same as WHO definition. It includes all together drownings due to accidents, intentional self-harm, accidents to the watercraft and assaults. Events which are not classified as drowning on a basis of medical criteria with an example being heart attack during a swimming may also be included in this case. Therefore, direct comparison of Police data with the data of public statistics based on ICD-10 classification should not be applied. In 2000-2012, Police reported merely 5,530 drownings.

Water areas with the highest number of drowning were: lakes (25.0% of registered cases) and rivers (21.3%). Rather low number of drownings was reported in sea (3.7%). However, it should be highlighted that

Table I. Reported number of accidental drownings (W65-W74) by voivodship of residence, month of occurrence and median of annual crude mortality rate per 100,000 population in 2000-2012 in Poland

| Voivodship | Number of deaths due to accidental drowning by months | | | | | | | | | | | | Median of crude mortality rate |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII | |
| Warmińsko-mazurskie | 51 | 49 | 58 | 61 | 92 | 98 | 150 | 108 | 75 | 59 | 47 | 51 | 4.6 |
| Pomorskie | 52 | 41 | 76 | 65 | 69 | 115 | 204 | 153 | 79 | 69 | 33 | 48 | 3.6 |
| Podlaskie | 25 | 14 | 35 | 41 | 48 | 60 | 153 | 84 | 45 | 32 | 26 | 29 | 3.6 |
| Lubuskie | 16 | 20 | 25 | 31 | 32 | 41 | 79 | 58 | 26 | 20 | 15 | 18 | 3.2 |
| Kujawsko-pomorskie | 28 | 32 | 48 | 52 | 74 | 87 | 107 | 107 | 58 | 37 | 28 | 26 | 2.9 |
| Lubelskie | 13 | 22 | 39 | 56 | 93 | 124 | 160 | 119 | 54 | 45 | 54 | 40 | 2.8 |
| Dolnośląskie | 55 | 33 | 67 | 69 | 81 | 116 | 167 | 176 | 57 | 74 | 67 | 52 | 2.7 |
| Świętokrzyskie | 17 | 11 | 25 | 38 | 43 | 63 | 87 | 51 | 29 | 28 | 20 | 18 | 2.6 |
| Podkarpackie | 38 | 19 | 46 | 44 | 72 | 95 | 130 | 103 | 64 | 47 | 44 | 33 | 2.6 |
| Opolskie | 12 | 12 | 16 | 31 | 26 | 37 | 63 | 61 | 26 | 17 | 20 | 22 | 2.6 |
| Łódzkie | 23 | 31 | 62 | 60 | 88 | 91 | 142 | 130 | 58 | 37 | 50 | 52 | 2.5 |
| Małopolskie | 33 | 43 | 58 | 81 | 86 | 129 | 203 | 144 | 81 | 53 | 64 | 46 | 2.4 |
| Wielkopolskie | 44 | 49 | 70 | 65 | 91 | 129 | 183 | 163 | 61 | 64 | 57 | 58 | 2.3 |
| Mazowieckie | 36 | 47 | 76 | 107 | 153 | 230 | 387 | 274 | 104 | 80 | 68 | 45 | 2.2 |
| Zachodniopomorskie | 23 | 22 | 43 | 40 | 46 | 55 | 106 | 79 | 37 | 30 | 30 | 27 | 1.9 |
| Śląskie | 28 | 30 | 53 | 62 | 61 | 96 | 158 | 126 | 58 | 36 | 37 | 32 | 1.2 |
| POLAND | 494 | 475 | 797 | 903 | 1,155 | 1,566 | 2,479 | 1,936 | 912 | 728 | 660 | 597 | 2.6 |

Source: Own elaboration based on CSO data.

Table II. Voivodship of the residence of drowned persons and voivodship of drowning occurrence in 2000-2012

| | | Voivodship of drowning occurrence | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Dolnośląskie | Kujawsko-pomorskie | Lubelskie | Lubuskie | Łódzkie | Małopolskie | Mazowieckie | Opolskie | Podkarpackie | Podlaskie | Pomorskie | Śląskie | Świętokrzyskie | Warmińsko-mazurskie | Wielkopolskie | Zachodniopomorskie |
| Voivodship of the residence of drowned persons | Dolnośląskie | **917** | 2 | 1 | 15 | 0 | 2 | 0 | 22 | 1 | 1 | 11 | 1 | 0 | 3 | 17 | 21 |
| | Kujawsko-pomorskie | 2 | **626** | 0 | 0 | 2 | 0 | 5 | 0 | 0 | 3 | 29 | 0 | 0 | 3 | 9 | 5 |
| | Lubelskie | 3 | 0 | **744** | 1 | 1 | 1 | 27 | 1 | 6 | 1 | 11 | 2 | 2 | 12 | 2 | 5 |
| | Lubuskie | 7 | 0 | 0 | **350** | 1 | 0 | 3 | 0 | 0 | 0 | 3 | 1 | 0 | 1 | 4 | 11 |
| | Łódzkie | 7 | 13 | 1 | 0 | **699** | 1 | 21 | 5 | 1 | 0 | 24 | 3 | 3 | 8 | 29 | 9 |
| | Małopolskie | 6 | 1 | 2 | 3 | 0 | **938** | 7 | 3 | 12 | 1 | 13 | 23 | 3 | 3 | 3 | 3 |
| | Mazowieckie | 1 | 10 | 25 | 2 | 12 | 3 | **1371** | 3 | 1 | 31 | 51 | 1 | 4 | 75 | 6 | 11 |
| | Opolskie | 10 | 0 | 0 | 0 | 1 | 1 | 1 | **316** | 0 | 0 | 3 | 2 | 0 | 1 | 3 | 5 |
| | Podkarpackie | 2 | 0 | 2 | 1 | 2 | 12 | 4 | 0 | **689** | 2 | 3 | 1 | 10 | 2 | 0 | 5 |
| | Podlaskie | 1 | 0 | 0 | 0 | 0 | 0 | 12 | 0 | 2 | **538** | 6 | 0 | 0 | 29 | 3 | 1 |
| | Pomorskie | 2 | 3 | 0 | 2 | 1 | 0 | 2 | 0 | 0 | 2 | **966** | 1 | 0 | 13 | 1 | 11 |
| | Śląskie | 7 | 3 | 0 | 3 | 10 | 28 | 5 | 10 | 2 | 4 | 21 | **635** | 10 | 21 | 3 | 15 |
| | Świętokrzyskie | 0 | 0 | 0 | 1 | 4 | 4 | 12 | 2 | 12 | 2 | 7 | 2 | **380** | 2 | 0 | 2 |
| | Warmińsko-mazurskie | 1 | 4 | 0 | 0 | 0 | 3 | 8 | 0 | 1 | 8 | 22 | 1 | 0 | **849** | 2 | 0 |
| | Wielkopolskie | 5 | 8 | 0 | 8 | 4 | 2 | 4 | 4 | 0 | 1 | 4 | 1 | 0 | 4 | **968** | 21 |
| | Zachodniopomorskie | 0 | 0 | 1 | 3 | 0 | 0 | 3 | 0 | 0 | 1 | 11 | 0 | 0 | 1 | 6 | **512** |
| Drownings in voivodships other than place of residence (%) | | 9.6% | 8.5% | 9.2% | 8.1% | 15.2% | 8.1% | 14.7% | 7.9% | 6.3% | 9.1% | 3.8% | 18.3% | 11.6% | 5.6% | 6.4% | 4.8% |

Source: Own elaboration based on CSO data.

Table III. Place of occurrence, sobriety and circumstances of drownings reported by Police in 2000-2012

| | Males | Females | Total |
|---|---|---|---|
| **Place of occurrence** | | | |
| Lake | - | - | 25.0% (1,384) |
| River | - | - | 21.3% (1,177) |
| Reservoir | - | - | 10.7% (590) |
| Pond/pool | - | - | 8.0% (443) |
| Sea | - | - | 3.7% (207) |
| Other | - | - | 13.5% (748) |
| Unknown – lack of data | - | - | 17.7% (981) |
| **Sobriety** | | | |
| Sober | 33.4% (1,430) | 51.4% (424) | 36.3% (1,854) |
| Under influence of alcohol | 27.4% (1,173) | 9.9% (82) | 24.6% (1,255) |
| Unspecified | 38.9% (1,665) | 38.4% (317) | 38.8% (1,982) |
| Other | 0.3% (15) | 0.3% (2) | 0.3% (17) |
| **Drowning circumstances (data of 2000-2011)** | | | |
| Swimming in unguarded yet unforbidden place | 28.0% (1,201) | 16.0% (132) | 26.1% (1,333) |
| Watercraft capsizing | 21.4% (916) | 33.0% (272) | 23.3% (1,188) |
| Swimming in forbidden place | 11.1% (474) | 7.2% (59) | 10.4% (533) |
| Carelessness while being at water areas | 6.4% (275) | 6.4% (53) | 6.4% (328) |
| Unknown – lack of data | 11.1% (474) | 14.4% (119) | 11.6% (593) |
| Other | 22.0% (946) | 23.0%(187) | 22.2% (1,133) |

Source: Own elaboration based on PH data.

the place of drowning was not determined in case of 18% drownings (Tab. III).

From the perspective of public health, information on circumstances of drowning is essential. According to available Police data of 2000-2011, the most common reasons of drowning were: swimming in unguarded yet unforbidden places (1,333 cases; 26.1% of registered events), watercraft capsizing (1,188; 23,3%) and swimming in forbidden places (533; 10.4%). Police could not determine circumstances of drowning in case of 593 persons (11.6% of registered cases).

In 2000-2011, 24.6% of fatal drowning cases were under influence of alcohol. This percentage was substantially higher in males (27.4%) compared to females (9.9%). Police did not determine the sobriety of 1,982 fatal cases (38.8% of all analyzed events). Thus, these percentages may be higher. Presence of other psychoactive substances was diagnosed in nine persons only while alternative substances, i.e. legal highs, were determined in eight males.

## DISCSUSION

Based on CSO and WHO data, it may be concluded that the risk of death due to drowning in Poland in 2000-2012 was 2-fold higher compared to the EU average. A distinctive feature for Poland was the highest frequency of drowning in males aged 45-59 years.

There is an assumption that if external causes of mortality account for the majority of deaths in young persons, then the prevalence of fatal accidents is the highest in this age group. In fact in Poland and other European countries, the risk of death due to these causes (ICD-10 codes: V01-X59) is the highest in persons aged 75+ while the lowest in children (0-14 years) and young persons (15-29 years). In 2012 in Poland, crude mortality rate per 100,000 population in the oldest age group amounted to nearly 175 while in the age groups 0-14 and 15-29 it was 5 and 39, respectively. Persons in middle age (45-59 years) are especially exposed to drowning. Probably, elder persons benefit from water areas and other forms of water recreation less often and more cautiously.

American study aimed at comparing aquatic behaviours in males and females, which was conducted in a group of 3,042 respondents, found that compared to females, males are more frequently involved in aquatic activities. Furthermore, they are more likely to undertake risky behaviours such as swimming alone or in unguarded and forbidden places (4). Police Headquarters data from 2000-2011 confirm that similar effect is observed in Poland (39% males and 23% females drowned in unguarded or forbidden water areas).

In several studies it was determined that males more frequently use psychoactive substances while undertaking aquatic activities than females (5,6). In Poland, the percentage of fatal drowning cases under influence of alcohol was higher in males (27%) compared to females (10%). However, it should be emphasized that these percentages may be higher as Police did not determine the sobriety in case of nearly 39% persons. Polish study analyzing 184 court cases with drowning incident, where alcohol concentration was determined in fatal cases on a basis of toxicology

testing, showed that 64% of them were intoxicated while in case of 45% persons alcohol concentration in serum exceeded 0.5‰ (7). In case of merely one person, the presence of psychoactive substance was identified. Studies conducted in Scandinavian countries (Denmark, Finland, Sweden) and Ireland (8-11) estimated that intoxication in fatal drowning cases ranged from 38% in Sweden to 61% in Ireland. In Swedish study at least one psychoactive substance was identified in blood of 40% fatal drowning cases.

More than 81% of drownings in Poland occurred in the voivodship of residence of the drowned persons. Simultaneously, higher drowning rates are observed in voivodships where there are many water areas (Warmińsko-mazurskie, Pomorskie voivodships). Improving supervision over water areas seems to be an appropriate intervention which would ensure water safety. Additionally, there is a necessity to conduct further studies on behavioural circumstances of drowning accidents in our country as to develop targeted health educational programmes.

Aforesaid studies conducted in Denmark, Sweden and Finland (8,9,10) suggest that the number of drowning is underestimated due to different definitions of accidental drowning adopted in reporting systems. In Poland, according to Police Headquarters data, a total of 1,188 drownings were associated with watercraft capsizing while CSO register of deaths, which is based on ICD-10 classification, reports 28 drownings resulting from accidents to watercraft (V90 and V92) in 2000-2012. Analyses from other countries demonstrate that the number of intentional self-harm and assault by drowning (X71 and X92) may be underestimated (8,9). There are no Polish data that would allow to verify this observation however much lower number of deaths due to suicide by drowning (538 in years 2000-2012) was reported by CSO when comparing to Police. These data show that similar problem may exist in Poland as well. Above mentioned facts suggest that statistical systems in Poland reporting drownings should be coordinated and apply common criteria.

Important component of drowning problem is estimating the number of persons who experience submersion and consequently near drowning which leads to severe complications frequently resulting in serious health problems or disability (12). Neither analysis of available sources of data associated with public statistics system nor Police or literature review data allowed for estimation of the number of persons who experience near drowning in Poland. Estimates published from other world regions do not sufficiently report the scale of the problem. According to these data, the number of near drownings is from 2 to 20-fold higher compared to drownings (13,14).

## CONCLUSIONS

A risk of death due to drowning in Poland is higher compared to the average in EU countries. The following public health interventions, aimed at reducing the number of drownings in Poland, should be undertaken immediately:

- improvement of supervision over water areas, which potentially could serve as swimming areas,
- implementation of effective health promotion programmes on water safety,
- inclusion of water safety issues in prevention of addiction .

Furthermore, there is a necessity to enhance the cohesion of drowning reporting systems run by different institutions with regard to definitions adopted, type of data collected and methods of data processing.

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**Address for correspondence**
Rafał Halik, MA
Departament-Centre for Monitoring and Analyses of Population Health
National Institute of Public Health – National Institute of Hygiene
Chocimska 24
00-791 Warsaw
email: rhalik@pzh.gov.pl