

JOURNAL

of Health Inequalities

Drownings in Poland in the years 2013-2021 – trends, changes, inequalities, and preliminary conclusions for public health

Rafał Antoni Halik 

Department of Population Health Monitoring and Analysis, National Institute of Public Health – National Research Institute, Warsaw, Poland

ABSTRACT

Introduction: Despite progress in the field of water safety, Poland has been experiencing much higher mortality due to drowning than in other countries of the EU region. The main aim of the paper is to examine the changes in drowning frequency and their causes.

Material and methods: All available sources of data on drowning in Poland were analysed. Crude and age-standardized mortality rates due to drowning were calculated. A jointpoint regression model was employed in the analysis of long-term trends in annual mortality rates.

Results: In total, 7350 persons died due to various types of drowning (ICD-10 codes: W65-W74, V90, V92, X37-X39, X71, Y21) in Poland in the years 2013-2021. The most frequent type of registered drowning was a drowning in natural waters – 3990 (54.3% of registered cases). The second cause of death due to drowning were falls into the water – 914 (12.4% of cases). Age-standardized death rates of males due to drowning in the years 2013-2021 dropped from 4.3 to 2.7 per 100,000. Among females the age-standardized rate decreased from 0.8 to 0.6 per 100,000. The annual percentage change of mortality (APC) in Poland was –4.0%. The downward trend of mortality was only significant among males (APC = –4.4% vs. APC = –2.6% among females). Mortality reduction was especially high among the youngest age groups: 0-14 years old (APC = –7.9%) and 15-29 years old (APC = –6.5%).

Conclusions: There is a need to properly address drowning prevention tailored to groups with risk factors in Poland such as males, elderly people, and people with low socio-economic status.

KEY WORDS: public health, drowning, accidents, water safety, injury epidemiology.

ADDRESS FOR CORRESPONDENCE: Rafał Antoni Halik, Department of Population Health Monitoring and Analysis, National Institute of Public Health – National Research Institute, Chocimska 24, 00-791 Warsaw, Poland, tel.: +48 504540922, e-mail: rhalik@pzh.gov.pl

INTRODUCTION

According to the World Health Organization (WHO), drowning caused 236,000 deaths in 2019 and remains one of the major causes of injury-related deaths around the world. The highest frequency of drowning is observed in low-income and middle-income countries, where 90% of fatal drownings occur [1]. The lowest risk of drowning is observed in developed countries, where according to the WHO the risk of drowning is over 3 times lower than in high-income countries [2]. It should be emphasized that risk factors and patterns of drowning are specific for

each society. For instance, in low-income and middle-income countries more frequent drowning of children and drowning caused by natural disasters can be observed compared to high-income countries. Taking into consideration these differences, it is necessary for each country to conduct systematic epidemiological surveillance of drowning, which enables the diagnosis of risk factors of drowning and allows proper public health activities to be set up focused on risk factors and risk groups [3].

Poland has been experiencing much higher mortality due to drowning than other countries in the EU region.

This is an Open Access Journal. All articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International (CC BY-NC-ND 4.0). License: <https://creativecommons.org/licenses/by-nc-nd/4.0/>

TABLE 1. The number of reported deaths due to drowning by drowning category according to ICD-10 classification

Year	Drowning in natural water (W69)	Fall into water (W70)	Suicide (X71)	Drowning in a bathtub (W65-W66)	Drowning in a swimming pool (W67)	Watercraft accidents with drowning (V90, V92)	Natural disaster (X37-X39)	Violence (X92)	Unspecified or unknown cause (Y21, W73, W74)
2021	258	112	24	15	4	1	2	2	286
2020	386	116	21	10	5	2	0	1	256
2019	352	118	11	12	8	2	2	2	228
2018	448	110	13	11	7	0	1	0	265
2017	387	100	19	14	8	3	1	0	264
2016	402	112	23	12	7	1	0	0	229
2015	518	89	23	9	13	1	1	0	170
2014	556	69	12	8	13	1	1	0	185
2013	683	88	23	18	1	1	0	0	194
Total	3990	914	169	109	66	12	8	5	2077
Percentage	54.3%	12.4%	2.3%	1.5%	0.9%	0.2%	0.1%	0.1%	28.3%

Despite improvement of the situation during the last 20 years, the mortality rate due to drowning is still 50% higher than the EU average [4]. The main challenges related to drowning in Poland that were observed in the years 2000-2012 were related to the overrepresentation of middle-aged males in drowning casualties and substantial spatial and socio-economic disparities of the mortality due to drowning [5]. Behavioural risk factors seem to play an essential role in the case of drownings in Europe [6, 7]. The main aim of the paper is to examine changes in drowning frequency and patterns in Poland and to evaluate the current situation, which can be useful to indicate preliminary areas of priorities.

MATERIAL AND METHODS

All available sources of data on drowning in Poland were analysed, including the following: Statistics Poland, National Police Headquarters and National Institute of Public Health – National Research Institute. Crude and age-standardized mortality rates due to drowning (both unintentional and intentional) in Poland were calculated. Direct standardization of mortality rates using the 2013 European standard population (ESP) was applied. Data regarding the entire population as well as data on gender, age (5 age groups: 0-14, 15-29, 30-44, 45-64, and over 65 years), education, place of residence (voivodship), and the place and circumstances of drowning were subject to analysis. Mortality levels in voivodships were assessed using crude mortality rates as an indicator of drowning frequency. A Joinpoint regression model was employed in the analysis of long-term trends in annual mortality rates [8] using Joinpoint Trend Analysis Software (version 4.9.1.0) from National Institute of Cancer in USA. Moreover, data on hospital discharges due to drowning (ICD 10 code T75.1) from the Nationwide General Hospital Morbidity Study were analysed [9].

RESULTS

In total 7350 persons died due to various types of drowning (ICD-10 codes: W65-W74, V90, V92, X37-X39, X71, Y21) in Poland in the years 2013-2021. The most frequent type of registered drowning was a drowning in natural waters – 3990 (54.3% of registered cases). The second cause of death due to drowning were falls into the water – 914 (12.4% of cases). Much less common were drowning caused by suicides – 169 (2.3% of cases) and drowning in bathtubs – 109 (1.5% of cases). 28.3% of all registered drowning cases the circumstances or causes were not specified clearly (Table 1).

A persistent phenomenon in Poland is the several times higher risk of fatal drowning among males compared to females. Age-standardized death rates of males due to drowning in the years 2013-2021 fell from 4.3 to 2.7 per 100,000. In females the age-standardized rate decreased from 0.8 to 0.6 per 100,000 (Figure 1). Higher standardized death rates due to drowning are also characteristic for inhabitants of rural areas, where the stan-

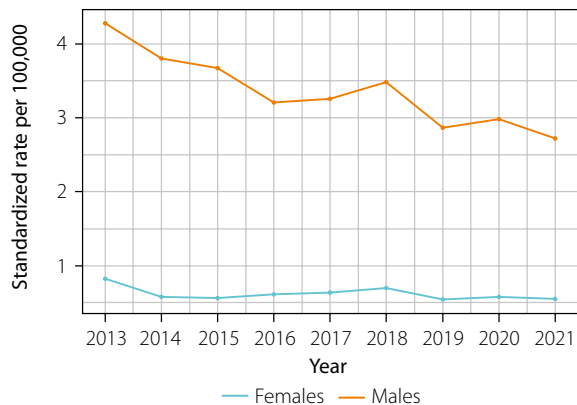


FIGURE 1. Age-standardized death rates due to drowning (W65-W74, V90, V92, X37-X39, X71, Y21) per 100,000 population by gender in the years 2013-2021

standardized death rate fell from 3.1 to 2.1 per 100,000 vs. 2.1 to 1.3 per 100,000 in urban areas, respectively, in the years 2013-2021.

Risk of death due to drowning is higher among less educated people who graduated in primary or vocational schools only or without formal education. In this social group the 2019 estimated crude mortality rate was 2.7 per 100,000, while for people with academic education it was 0.5 per 100,000 (estimation based on data from the census and education level of casualties reported in death certificates).

Despite stereotypes about the especially high risk of drowning among children and younger age groups, the highest risk of drowning was observed for people over 45 years old in Poland during the years 2013-2021 (Figure 2).

Another phenomenon characteristic for Poland is the existence of distinct spatial disparities of fatal drowning frequency. The lowest death rates due to drowning are characteristic for Wielkopolskie and Śląskie voivodships, with substantial urban populations. The highest frequencies of drowning are observed in areas of Poland with higher share of waters: Warmińsko-Mazurskie and Kujawsko-Pomorskie. For regions with higher percentages of their population living in rural areas like Podlaskie and Świętokrzyskie, higher frequencies of drownings are also observed (Figure 3). Such a situation has persisted for the last 20 years; however, much of the progress happened in Lubelskie and Podkarpackie, which are also voivodships with high rates of rural population.

The Jointpoint regression model adopted to estimate trends of mortality rates due to the analysed categories of drowning showed that in the years 2013-2021 a significant stable downward trend was observed. The annual percentage change of mortality (APC) in Poland was -4.0% (Table 2). The decrease of mortality was only significant among males (APC = -4.4% vs. APC = -2.6% among females). Mortality reduction was especially high among the youngest age groups: 0-14 years old

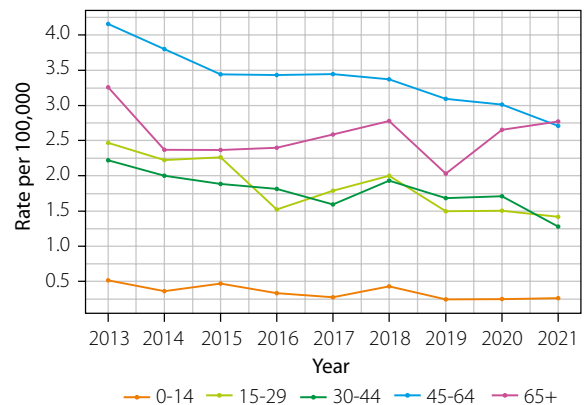


FIGURE 2. Death rates due to drowning (W65-W74, V90, V92, X37-X39, X71, Y21) per 100,000 population by age group in the years 2013-2021

(APC = -7.9%) and 15-29 years old (APC = -6.5%). The risk of fatal drowning did not change much among elderly people in the years 2013-2021. In this demographic group the mortality remained at a similar level since 2013.

Despite positive trends overall for Poland, spatial differences of mortality trends of drowning were observed. The improvement of the situation was much more characteristic for inhabitants of cities (APC = -4.5%) than for inhabitants of rural areas (APC = -3.7%). The highest annual decrease of mortality was observed in Lubelskie voivodship (APC = -7.8%). It is characteristic that the dynamic of a downward trend was not indicated in Opolskie voivodship. Little progress was observed in Podlaskie voivodship (Table 2). The risk of death did not change much also in Kujawsko-Pomorskie voivodship in the years 2013-2021.

A serious public health problem comprises also non-fatal drownings, which often lead to serious disabilities and neurological deficiencies and are especially dangerous among children and adolescents [10, 11]. It is hard to estimate the real ratio of non-fatal drowning frequency due to the complicated coding of hospital discharges and obstacles related to epidemiological observations [12]. The real number of non-fatal drownings could range from 3 to 20 times higher than the fatal drowning rate [13]. Also, in Poland it is difficult to estimate the frequency of non-fatal drownings on the basis of hospital discharges. The reported number of hospitalizations due to unspecified effects of drowning and non-fatal submersion (T75.1) was very low, and it varied in the years 2013-2021 between 44 and 72 cases annually. Most of the hospitalizations were registered for children up to 14 years old (64% of all cases).

Another source of data that can be useful to analyse patterns of drowning in Poland are registered interventions of the police from Police Headquarters routine statistics. It is worth mentioning that the police do not apply medical criteria in cases of interventions due to

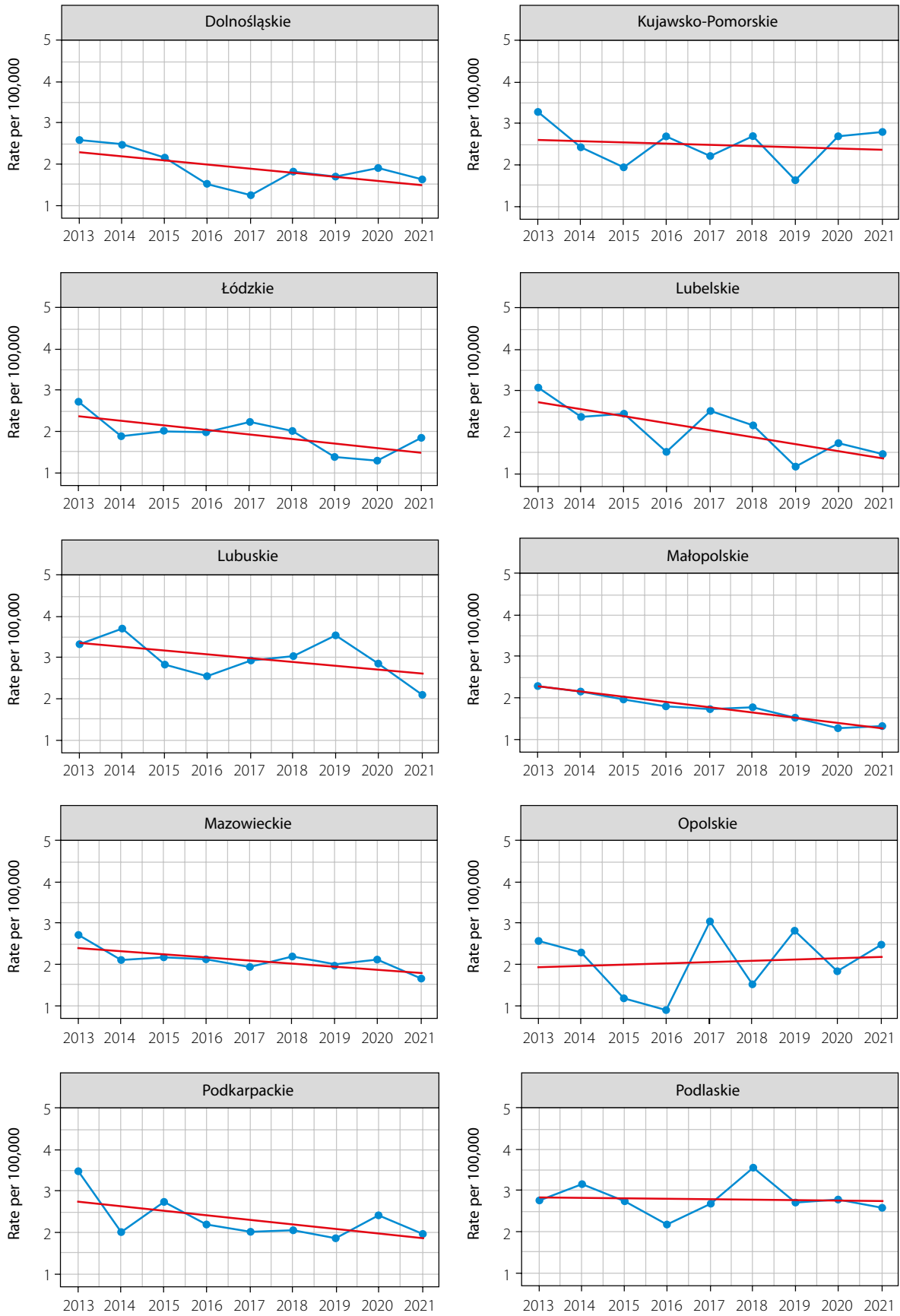


FIGURE 3. Death rates due to drowning (W65-W74, V90, V92, X37-X39, X71, Y21) per 100,000 population by voivodships. Red line indicates observed linear trend for the years 2013-2021

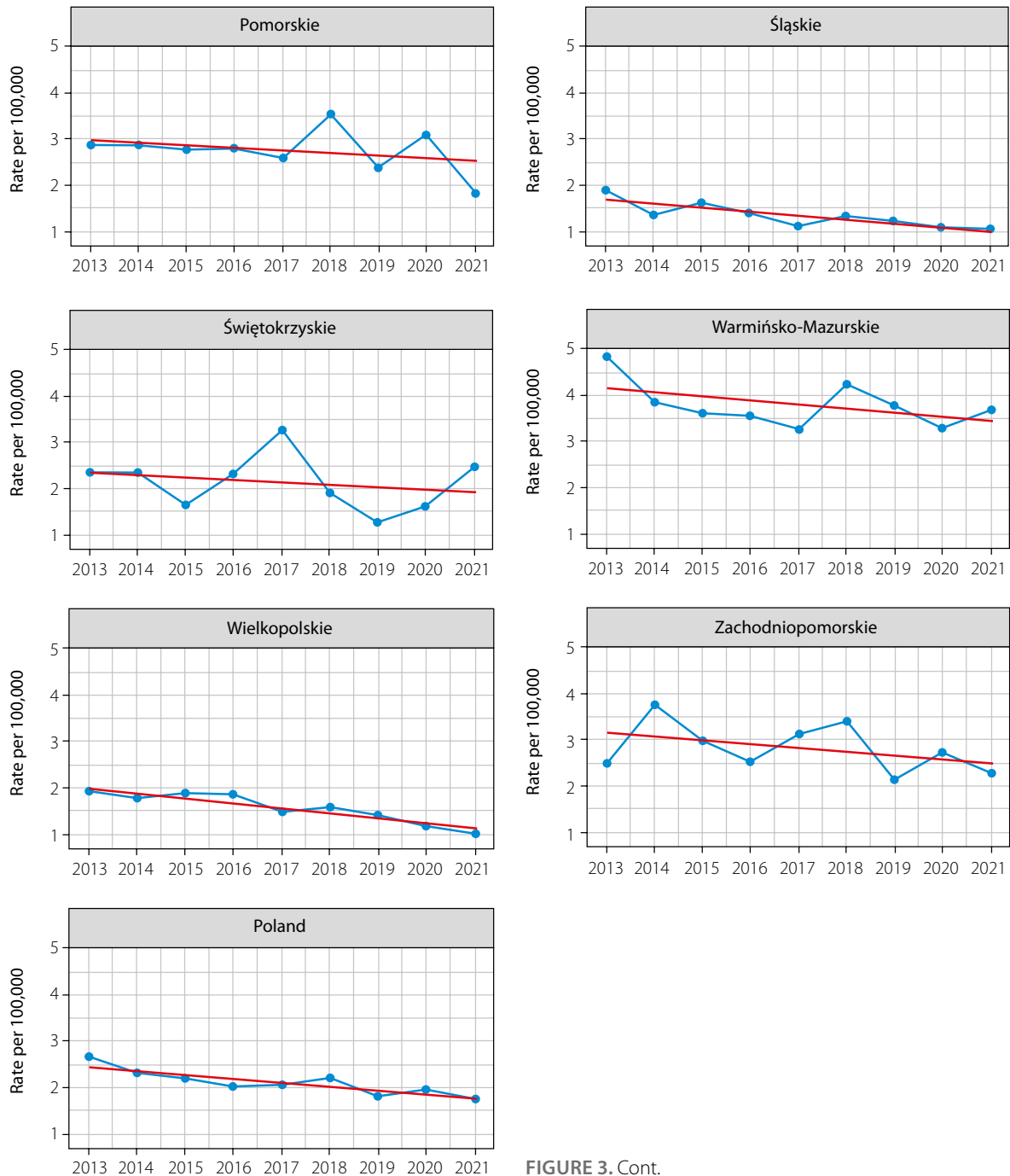


FIGURE 3. Cont.

drowning, so many casualties could be caused by injuries or other sudden health problems while being in the water. Also, the number of fatal drownings reported by the police is much lower than the real reported mortality in Poland. In the years 2013-2021 the police reported a total of 4760 drownings – 67% of the actual number of drownings shown by death certificate. An unfavourable circumstance is that the scope of information about causes of drowning officially published by the police was limited in the years 2013-2021 compared to previous years. According to police data, most of drownings occurred in rivers (26.4%) and lakes

(22.9%), and only 4.8% of drowning incidents occurred in the sea (Table 3). The most frequent causes of drowning were swimming in an unsupervised but not forbidden place (15.4% of cases) and lack of caution while being close to the water (8% of cases). The third cause of reported drowning incidents was swimming in forbidden places (7.7% of cases). Intoxication by alcohol or other psychoactive substances is one of the serious risk factors of drowning worldwide. It is estimated that alcohol is involved in 30–40% of drowning incidents [14]. In the years 2013-2021 it was observed that from 19.1% to 25.4% of drowning casualties were unsober

TABLE 2. Jointpoint regression estimations of crude mortality trends due to drowning (W65-W74, V90, V92, X37-X39, X71, Y21)

Parameter	AAPC	95% CI	Death rate per 100,000 in 2013	Death rate per 100,000 in 2021
Poland	-4.0%*	(-5.9; -2.1)	2.7	1.8
Males	-4.4%*	(-6.0; -2.7)	4.5	3.0
Females	-2.6%	(-6.8; 1.7)	1	0.6
Rural areas	-3.7%*	(-5.9; -1.5)	3.3	2.3
Cities	-4.5%*	(-6.6; -2.3)	2.3	1.5
Age group				
0-14	-7.9%*	(-13.4; -2.1)	0.5	0.3
15-29	-6.5%*	(-9.7; -3.2)	2.5	1.4
30-44	-4.5%*	(-7.1; -1.8)	2.2	1.3
45-64	-4.3%*	(-5.5; -3.1)	4.2	2.7
65+	-1.0%	(-5.2; 3.3)	3.3	2.8
Region				
Warmińsko-Mazurskie	-2.3%	(-5.7; 1.2)	4.8	3.7
Kujawsko-Pomorskie	-1.1%	(-6.9; 5.0)	3.3	2.8
Podlaskie	-0.4%	(-4.7; 4.1)	2.8	2.6
Opolskie	1.0%	(-10.3; 13.7)	2.6	2.5
Świętokrzyskie	-1.8%	(-10; 7.1)	2.4	2.5
Zachodniopomorskie	-2.9%	(-8.4; 2.8)	2.5	2.3
Lubuskie	-2.9%	(-7.4; 1.9)	3.3	2.1
Podkarpackie	-4.9%	(-9.8; 0.4)	3.5	2.0
Łódzkie	-5.4%*	(-10; -0.5)	2.7	1.9
Pomorskie	-1.6%	(-6.9; 4.0)	2.9	1.8
Mazowieckie	-3.5%*	(-6.2; -0.8)	2.7	1.7
Dolnośląskie	-5.1%	(-9.9; 0.1)	2.6	1.7
Lubelskie	-7.8%*	(-13.4; -1.9)	3.1	1.5
Małopolskie	-6.9%*	(-8.2; -5.6)	2.3	1.3
Śląskie	-6.2%*	(-9.0; -3.3)	1.9	1.1
Wielkopolskie	-6.8%*	(-9.4; -4.1)	1.9	1.0

APC – annual percentage change of mortality

*Statistical significance $p < 0.05$.

in Poland. However, before year 2013 the police also informed that not all drowning casualties are tested for a presence of alcohol in the blood, and thus this number could be higher. The higher rate of unsober persons who drowned in 2020 was 25.4% of casualties.

DISCUSSION

According to the WHO, the main tools for drowning prevention are: supervision of waters, control of access to water hazards, teaching school-age children basic swimming, water safety, and safe rescue, and enforcing and executing safety procedures and regulations in the area of water sports and water transport (for example using a life-jacket). From the view of public health, it should be examined by observational studies of whether the exist-

ing implemented regulations in the area of water safety are effective in lowering number of the drownings, and which elements of these safety regulations should be changed or improved in Poland [15, 16].

The observed changes in drowning epidemiology in the years 2013-2021 in Poland redefine some of the conclusions regarding drowning prevention in Poland. A growing problem of drownings in elderly people is observed. The latest evidence from observational studies shows that elderly people and people suffering from chronic health problems have a higher risk of drowning [17, 18]. Thus, prevention of NCDs can lead also to a reduced number of drowning casualties [19]. Considering that alcohol and psychoactive substances also increase the risk of drowning, activities in the area

TABLE 3. Place of occurrence, sobriety, and circumstances of drownings reported by the National Police Headquarters cumulatively in the years 2013-2021

Category of incident	Cumulative number of cases in the years 2013-2021 and percentage
Place of occurrence	
River	1255 (26.4)
Lake	1088 (22.9)
Pond	809 (17.0)
Reservoir	455 (9.6)
Sea	228 (4.8)
Circumstances and causes of drowning	
Swimming in an unsupervised but not forbidden place	732 (15.4)
Lack of caution while being close to the water	380 (8.0)
Swimming in a forbidden place	366 (7.7)
Lack of caution while fishing	309 (6.5)
Alcohol involvement	1076 (22.6)

of prevention of mental health problems could be also beneficial in this context. According to the EZOPII study conducted in Poland concerning the prevalence of mental health problems, heavy alcohol use is more frequent among males from groups with lower socio-economic status, who also have a substantially high risk of drowning in Poland [20].

The successful reduction of mortality due to drowning seen in young age groups in Poland could be caused by swimming lessons in schools, which also teach water safety skills to children and adolescents. These lessons were introduced several decades ago in Poland. It shows also the necessity to continue these efforts and to evaluate and improve curricula in the area of swimming lessons for children and adolescents.

In the context of Poland and the observed regional differences, it could be useful to coordinate policies of regional development and to cooperate and coordinate actions with local stakeholders like local self-government, regional governmental administration, and services and NGOs to allocate more resources for the supervision of waters, building safe infrastructure protecting people from water hazards, and teaching inhabitants skills on how to avoid and how to manage risky situations while being close to water.

CONCLUSIONS

Despite favourable downward trends of mortality due to drownings, there are still characteristic high inequalities of drowning risk between males and females

in Poland. The most favourable change was the dynamic decrease of mortality among young age groups; however, among elderly people the mortality did not change much. Another negative phenomenon observed in Poland is the especially high mortality due to drowning among less educated people.

There is a need to address drowning prevention tailored to groups with risk factors in Poland, like males, elderly people, and people with low socio-economic status. Taking into consideration the disparities of drowning death rates and differences in drowning mortality trends in Polish voivodships, interventions should also be tailored to the regional context. The areas of special concern include Opolskie voivodship and voivodships with a higher share of waters and with a higher percentage of rural population in Poland like Kujawsko-Pomorskie, Warmińsko-Mazurskie, Świętokrzyskie, and Podlaskie.

Data quality regarding drowning surveillance in Poland should be improved. The introduction of medical criteria in Police statistics in cases of drowning should be considered.

DISCLOSURE

The author reports no conflict of interest.

References

1. World Health Organization. Fact sheets – Drowning. Available from: <https://www.who.int/news-room/fact-sheets/detail/drowning> (accessed: 24 April 2023).
2. Global report on drowning: preventing a leading killer WHO, 2014. Available from: <https://www.who.int/publications/i/item/global-report-on-drowning-preventing-a-leading-killer> (accessed: 24 April 2023).
3. Rahman A, Peden AE, Ashraf L, et al. Drowning: global burden, risk factors, and prevention strategies. Oxford Research Encyclopedia of Global Public Health. Available from: <https://doi.org/10.1093/acrefore/9780190632366.013.307> (accessed: 24 April 2023).
4. Halik R, Seroka W. Accidents and their health consequences – potential impact of lifestyle changes during a pandemic in Poland. In: Health status of Polish population and its determinants. Wojtyniak B, Goryński P (eds.). National Institute of Public Health NIH – National Research Institute, Warsaw 2022; 391-411.
5. Halik R, Poznańska A, Seroka W, Wojtyniak B. Accidental drownings in Poland in 2000-2012. *Przegl Epidemiol* 2014; 68(3): 493-499, 591-594.
6. Szpilman D, Palacios Aguilar J, Barcala-Furelos R, et al. Drowning and aquatic injuries dictionary. *Resusc Plus* 2021; 5: 100072.
7. Peden AE, Passmore J, Queiroga AC, et al. Closing the gap for drowning prevention across Europe. *Lancet Public Health* 2022; 7(9): e728-e729.
8. Kim HJ, Fay MP, Feuer EJ, Midthune DN. Permutation tests for joinpoint regression with applications to cancer rates. *Stat Med* 2000; 19(3): 335-351.

9. Poznańska A, Goryński P, Seroka W, et al. Nationwide general hospital morbidity study as a source of data about Polish population health. *Przegl Epidemiol* 2019; 73(1): 69-80.
10. Beerman S, Bierens J, Clemens T, et al. Clarification and categorization of non-fatal drowning: a draft position statement for review and input by the global drowning community. WHO, Toronto 2018. Available from: <https://www.who.int/publications/m/item/clarification-and-categorization-of-non-fatal-drowning> (accessed: 24 April 2023).
11. Neal JM. Near-drowning. *J Emerg Med* 1985; 3(1): 41-52.
12. Peden AE, Mahony AJ, Barnsley PD, et al. Understanding the full burden of drowning: a retrospective, cross-sectional analysis of fatal and non-fatal drowning in Australia. *BMJ Open* 2018; 8(11): e024868.
13. Peden AE, Franklin RC, Mahony AJ, et al. Using a retrospective cross-sectional study to analyse unintentional fatal drowning in Australia: ICD-10 coding-based methodologies verses actual deaths. *BMJ Open* 2017; 7(12): e019407.
14. Hamilton K, Keech JJ, Peden AE, Hagger MS. Alcohol use, aquatic injury, and unintentional drowning: a systematic literature review. *Drug Alcohol Rev* 2018; 37(6): 752-773.
15. Pearn JH, Nixon JW, Franklin RC, Wallis B. Safety legislation, public health policy and drowning prevention. *Int J Inj Contr Saf Promot* 2008; 15(2): 122-123.
16. Leavy JE, Gray C, Della Bona M, et al. A review of interventions for drowning prevention among adults. *J Community Health* 2023; 48(3): 539-556.
17. Peden AE, Franklin RC, Queiroga AC. Epidemiology, risk factors and strategies for the prevention of global unintentional fatal drowning in people aged 50 years and older: a systematic review. *Inj Prev* 2018; 24(3): 240-247.
18. Clemens T, Peden AE, Franklin RC. Exploring a hidden epidemic: drowning among adults aged 65 years and older. *J Aging Health* 2021; 33(10): 828-837.
19. Dunne CL, Sweet J, Clemens T. The link between medical conditions and fatal drownings in Canada: a 10-year cross-sectional analysis. *CMAJ* 2022; 194(18): E637-E644.
20. Moskalewicz J, Wciórka J. Kondycja psychiczna mieszkańców Polski: raport z badań „Kompleksowe badanie stanu zdrowia psychicznego społeczeństwa i jego uwarunkowań – EZOP II”. [Mental condition of the inhabitants of Poland: research report “Comprehensive study of the mental health of the society and its determinants – EZOP II”]. Instytut Psychiatrii i Neurologii, Warszawa 2021.