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Child drowning mortality in Israel: Trends and measures for prevention

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ABSTRACT

Introduction: In this study, we use the media-based database of *Beterem-Safe Kids Israel*, to provide a 15-year review of unintentional fatal childhood drowning in Israel, between 2008 and 2022. *Method:* It total, we identified 257 cases of child mortality due to drowning during this period. *Results:* Our results demonstrate a gradual rise in childhood mortality due to drowning, from 72 cases in 2008–2012, to 85 cases in 2013–2017, and to 100 cases in 2018–2022. Especially worth noting is the increase in childhood drowning in domestic swimming pools. We point to a link between low socioeconomic status and cases of drowning, showing that the risk of drowning extends beyond a mere matter of caregiver inattention. We recommend a series of regulatory and legislative steps to reduce fatal childhood drowning, including fencing built around domestic swimming pools, extending lifeguard activity hours, adding declared beaches, forming programs of safe behavior in water environments for adolescents, and establishing swimming lessons during the 2nd grade, for all populations. We further recommend that a special focus will be put in municipalities situated at the bottom of the socioeconomic index.

1. Introduction

Drowning is the second leading cause of unintentional mortality in children under the age of 18 in Israel, after traffic accidents (Beterem, 2022). Drowning can occur in natural water sources, public and domestic pools, and in the home environment, in buckets, bathtubs and tubs (Falk et al., 2021).

In this paper we provide a 15-year review, showing the scope of childhood drowning in Israel, as well as its fluctuations as a function of place of injury, age, gender, ethnicity, and socioeconomic level. The data are gleaned from a media-based database managed by *Beterem-Safe Kids Israel*, which constitutes the most up-to-date and comprehensive source available on unintentional childhood mortality in Israel. Our data show that the frequency of childhood mortality due to drowning has climbed in recent years, with a clear link between low socioeconomic status and cases of drowning. As we believe that childhood drowning is preventable, using proper guidance, supporting infrastructure, regulation, legislation and enforcement (Taylor et al., 2020), we provide recommendations for actions that may assist in curbing the trends reviewed herein.

1.1. Background: The state of Israel

Israel is a high-income country with over 9.6 million residents on the eve of 2023 (December 2022) (CBS, 2022a). As of September 2022, there were 3.08 million children (0–17 years) residing in Israel, comprising 32.2% of the Israeli population (CBS, 2022b). The population in Israel consists of two major groups: Jews and Arabs. Arab citizens of Israel comprise about 21.1% of the Israeli population, about 82% of which are Muslims (CBS, 2022a). Whereas the Arab population as a whole is typified by lower socio-economic status compared to the Jewish population, its living conditions and lifestyles somewhat vary. Earlier research has demonstrated that while the Arab population in Israel's northern district shares many demographic characteristics among itself (including the Muslim Arab and Bedouin subgroups), it differs markedly from the Arab population in the south (Beterem, 2019). The Arab population in the South district of Israel (the Negev) is mostly composed of Bedouin tribes who live in permanent towns or villages or in localities that have not been officially recognized by the state of Israel and therefore not given access to facilities such as electricity, sanitation, and water supply. In general, Bedouin towns and villages rank significantly low in terms of socio-economic status and are characterized by inadequate infrastructure, and low levels of law enforcement (Falk & Orr, 2023).

1.2. Children and adolescents drowning

Drowning is one of the main risks leading to child and adolescent

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mortality. In high-income countries, drowning is one of the five most significant causes of death among children, adolescents, and young adults under the age of 24. Similarly to other causes of injury, mortality due to drowning is more frequent in low-income countries than in high-income countries (WHO, 2014). Furthermore, even in developed countries, rates of mortality due to drowning are higher among children and adolescents with lower levels of income and education, as well as among populations of immigrants, ethnic minorities, and rural and peripheral regions. In rural regions, in many cases the increased risk is the result of higher proximity to water sources, and greater distance from essential medical services (Willcox-Pidgeon et al., 2020).

Among infants, insufficient supervision and unsupervised access to water sources are mentioned as main causes for drowning (Denny et al., 2019; Hamilton et al., 2018). It has been shown that the majority of infant drownings occur swiftly and silently, as a result of lack of attention of caregivers (Denny et al., 2019). A survey conducted in the United States in 2016 showed that a third of the asked parents believe that they can leave their children unattended for two minutes at the pool, and that in the presence of a lifeguard, the responsibility for their children's safety is on the lifeguard (Mackay et al., 2016).

Among teenagers, the risk of drowning is high probably due to a decrease in caregivers' supervision (Lawes et al., 2021; Peden et al., 2022). Gender differences are especially accentuated among adolescents, with males being at a much higher risk than females (Koon et al., 2021; Lawes et al., 2021). Most drownings at these ages take place in open water sources, such as seas and lakes (Janson, 2021), especially during holidays (Hamilton et al., 2018). It is of note that while many intervention programs address drowning among younger children, there is a shortage in interventions aimed at drowning risk reduction among adolescents (see Peden et al., 2023).

This study aims to evaluate the scope and nature of child and adolescents' mortality due to drowning over time, and provide recommendations to policy makers concerning means of coping with the issue at hand. This is conducted through the analysis of the media-based database of *Beterem-Safe Kids Israel*.

2. Materials and methods

We extracted the data on fatal childhood drowning from the media-based database of unintentional pediatric mortality, founded by *Beterem-Safe Kids Israel* in 2008. Children are defined in this study as ages birth to 17. The media-derived database is a real-time, up-to-date database, which includes data collected from Israeli news websites in four different languages: Hebrew, Arabic, Russian, and English. As these sources represent different sectors in Israeli society, and include local news sources as well, we view this as a reliable and comprehensive source of information, with extremely low chances of missing cases of child mortality (Beterem, 2020). In part, Israel's highly concentrated, geographically-localized, hectic and scoop-oriented media system (Reich & Godler, 2014), likely accounts for the comprehensiveness of the media database. Whereas an analogous comparison in Australia has yielded a somewhat mixed picture regarding the comprehensiveness of documenting drowning incidents via media coverage (Peden et al., 2020), Israel's dramatically smaller population size and media landscape make for a rather comprehensive proxy of childhood mortality.

This database includes detailed information of all external-cause instances of childhood mortality in this age range in Israel. The said database is updated regularly, on a weekly basis. It contains information concerning childhood injury drawn from the Israeli printed and web-based media, in Hebrew, Arabic, English and Russian. The data are classified in accordance with the Minimum Data Set (MDS) standard recommended by the World Health Organization for documenting the circumstances of injury and mortality (WHO, 2015). It should be pointed out that the data in this study are devoid of information about living individuals, and is compiled in such a way that the identifying details of the documented mortality cases are wholly anonymized, despite their having been obtained from media coverage. For this reason, human research ethics approvals did not apply.

For the sake of this study, all cases of childhood mortality due to unintentional drowning, by all objects involved, with no exclusions, based on water body type, were filtered, starting from the beginning of 2008, and until the end of December 2022. The extracted data were collated and processed using Excel software. In total, 257 cases were extracted for the sake of this study.

The studied data include all instances of fatal childhood drowning in Israel, including cases of non-residents, as well as cases of Israeli children drowning abroad. We include these cases because we view the risk of drowning not merely as a reflection of geographic characteristics, but also as a reflection of children's and parents' awareness. The analysis was performed by gender, age, ethnicity (as indicated by place of residence, name of victim, and pictures of the victim as appears in the media), and socioeconomic clusters. The results are presented in batches of five years: 2008–2012, 2013–2017, and 2018–2022. In addition, standardized mortality rates that cut across the said 5-year batches are provided to test the significance of differences as a function of some explanatory variables.

All cases were individually examined, including reading the complete scenarios of each case, to form as comprehensive a picture as the data could afford regarding the circumstances surrounding the fatal injury. The following parameters were documented for each case: date of incident, day of incident, time of day, place of injury, age and gender of victim, ethnicity, object involved, place of residence, and socioeconomic cluster of place of residence (later divided into three groupings). All of these details are extracted from the media documentation. In addition, we had access to a description of the circumstances of injury (technically dubbed 'scenario') as appears in Israeli media. Mortality rates per 100,000 and 95% Confidence Intervals (CIs) were computed in order to test the statistical significance of differences along socioeconomic, age-related, and ethnic parameters. Note that whenever calculating rates, mortality cases of non-residents and tourists have been removed from the numerator, as they are also excluded from the denominator.

Child population data were gathered from the website of the Israel Central Bureau of Statistics (CBS, 2023a). This dataset was used to calculate the growth in child population. The socioeconomic rankings of municipalities were also taken from the databases of CBS (CBS, 2023b). Municipalities were divided by socioeconomic level into three groupings: 1–3 (municipalities of low socioeconomic level), 4–6 (municipalities of an intermediate socioeconomic level), and 7–10 (municipalities of high socioeconomic level). Municipalities were assigned to each case by the reports in the media. In 23 out of the 257 cases discussed here, the place of residence of the victim was not mentioned. These 23 cases are excluded from the analysis by socioeconomic level.

The parameter 'Objects involved' includes the material item or product that played a role in the injury (e.g., built swimming pools, buckets, lakes, etc.). Zimmers, which are mentioned as a locus of drowning incidents, are a unique form of accommodation in Israel. They resemble, to some extent, Bed & Breakfasts. However, they tend to be rural, smaller than B&Bs, and often, more luxurious. Accordingly, the often include pools, Jacuzzis, or both. Note that in Israel, Sundays to Thursdays are considered weekdays, while the weekend lasts from Friday to Saturday.

3. Results

Since January 2008 and until the end of December 2022, 257 Israeli children have died by drowning, of which 180 are male (70%), and 77 are female (30%). There is a gradual growth in the number of cases over time (Fig. 1). The linear trendline indicates the fluctuation in the data, as well as the general increase in the incidence of cases. The peak of 37 cases in 2018 includes the casualties of the Tzafit Wadi disaster, which occurred on April 26th, 2018. In this event, 25 high school graduates

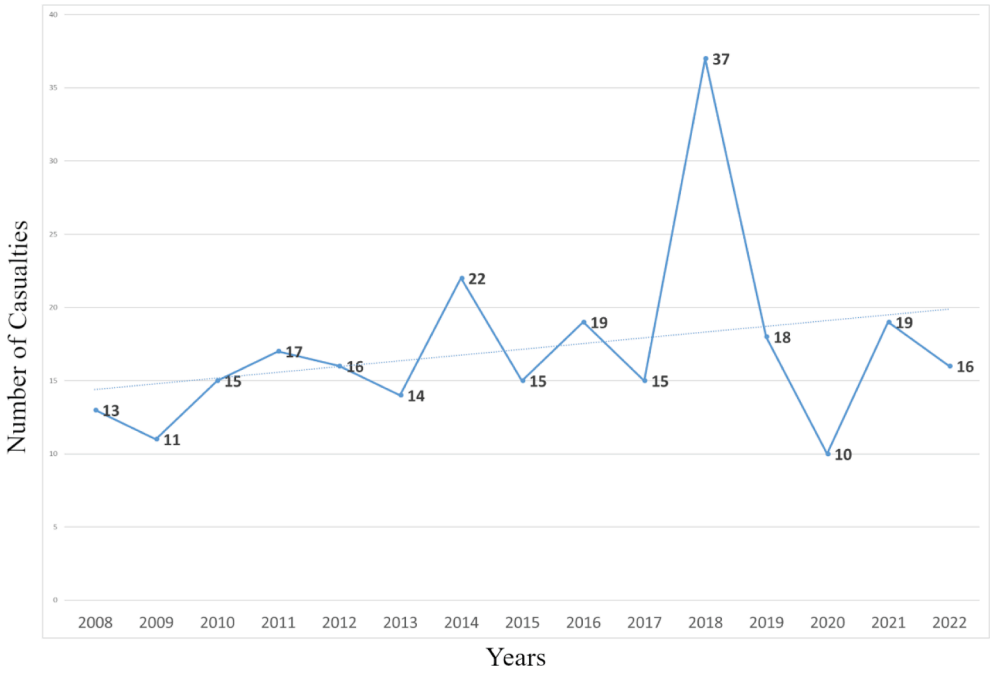

Fig. 1. Trend of drowning of children and teenagers over time.

participated in a three-day hike in the Negev Desert, as part of their participation in a pre-military preparatory program. While hiking through a steep-sloped wadi, a sudden flash flood occurred, killing 10 people, nine of which were under the age of 18. Still, even when excluding this disaster, the number of casualties during 2018 is relatively high (n = 28). The low number of cases in 2020 (n = 10) can be associated with the general reduction in childhood injury during the Covid-19 pandemic lockdowns (Hamill & Sawyer, 2020; Palmer & Teague, 2021).

Childhood mortality by drowning has climbed from 72 cases in 2008–2012, to 85 cases in 2013–2017, and to 100 cases in 2018–2022 (Fig. 2). As Fig. 2 shows, the scope of growth in drowning is higher than the rate of growth in children population, implying that the rise in drowning cannot be exclusively explained by the rise in the population of children.

Over the years, there has been a drop in the median and average ages of children comprising instances of childhood drowning. In 2008–2012, median age was 10.5 (average: 9.7); in 2013–2017 it was 7 (average: 8.4), and in 2018–2022 it was 5 (average: 7.4). The drastic drop in the ages of drowning victims reflects the steep rise in number of casualties in ages 0–4, from 19 cases in 2008–2012, to 35 cases in 2013–2017 (a rise of 45.7%), and to 50 cases in 2018–2022 (a rise of 30.0%) (Fig. 3; Table 1). Moreover, when analyzed in terms of mortality rates per 100,000 throughout the period under examination, the standardized drowning incidences among age groups 0–4 and 15–17 (95% CI [0.64, 0.95] and 95% CI [0.93, 1.49], respectively) significantly exceed those of age groups 5–9 and 10–14 (95% CI [0.25, 0.47] and 95% CI [0.21, 0.43], respectively (Fig. 4).

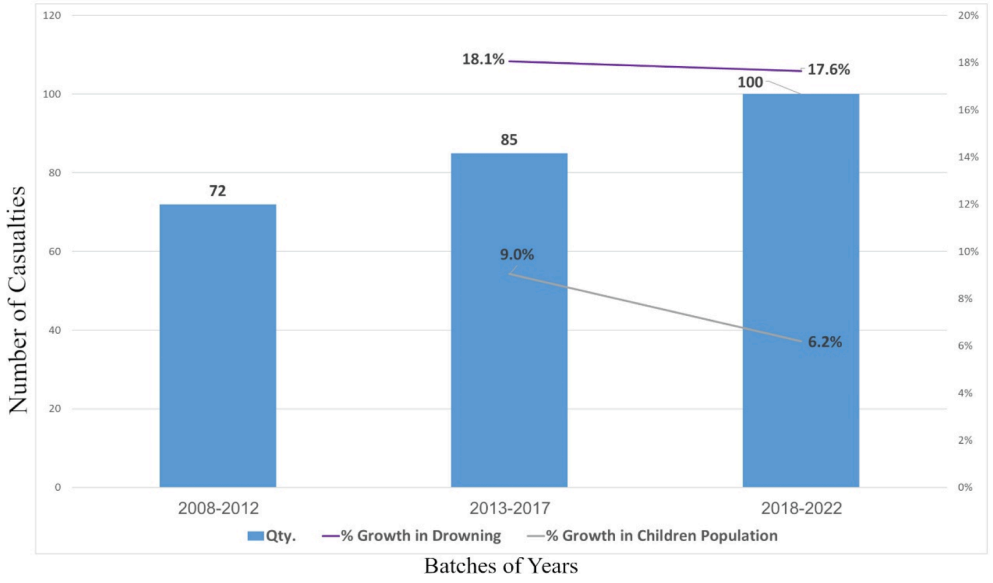

Fig. 2. Trend in drowning by batches of years, and growth in children (0–17) population. Information concerning children population is taken from publications of Central Bureau of Statistics (CBS, 2023a).

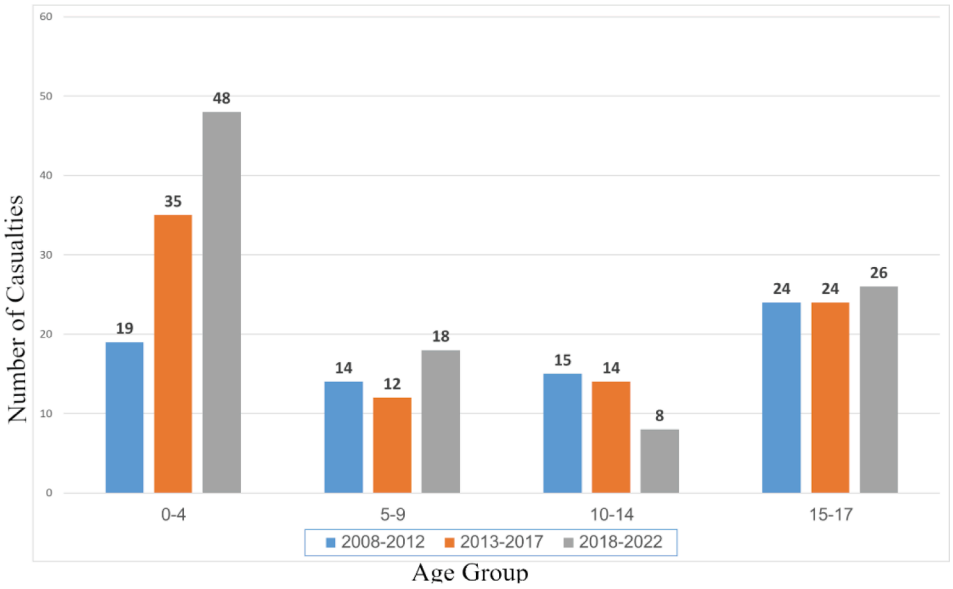

Fig. 3. Child mortality by drowning by groups of years and ranges of age.

Table 1
Drowning child mortality by period and age group, number of cases and proportion of age group out of total per period.

Age group	2008–2012	2013–2017	2018–2022	2008–2012	2013–2017	2018–2022
0–4	19	35	48	26.40%	41.20%	48.00%
05-Sep	14	12	18	19.40%	14.10%	18.00%
Oct-14	15	14	8	20.80%	16.50%	8.00%
15–17	24	24	26	33.30%	28.20%	26.00%
Total	72	85	100	100.00%	100.00%	100.00%

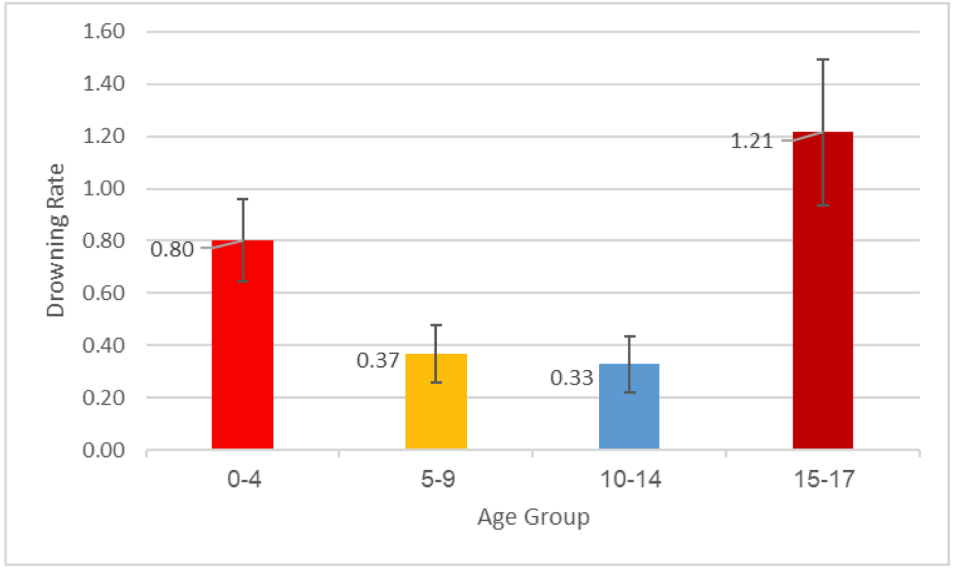

Fig. 4. Drowning rate according to age group per 100000.

Jewish children form the majority of drowning mortalities between 2008 and 2022 (n = 150; 58.4%) (Fig. 5). These proportions, however, are markedly lower than the general proportions of the Jewish population in Israel (73.6%). Arab children constitute 35.8% of child mortality due to drowning (n = 93), while Arab children form only 24% of Israel's children population. There was a rise in the proportion of Jewish casualties due to drowning in 2018–2022 (n = 63; 63.0%). The scale of growth in Jewish children drowning in 2018–2022 is 26.0%, compared to a growth of 13.8% among Arab children. When converted into mortality rates per 100,000, the standardized drowning incidence among Arab children (95% CI [0.69, 1.05]) significantly exceeds that of Jewish children (95% CI [0.41, 0.57]) for the entire period (2008–2022) (Fig. 6).

There is a drop of 32.1% in drowning at the sea between 2013 and 2017 and 2018–2022 (Fig. 7). There is, however, a steep rise in drowning of children in private pools, from one case in 2008–2012 to 16

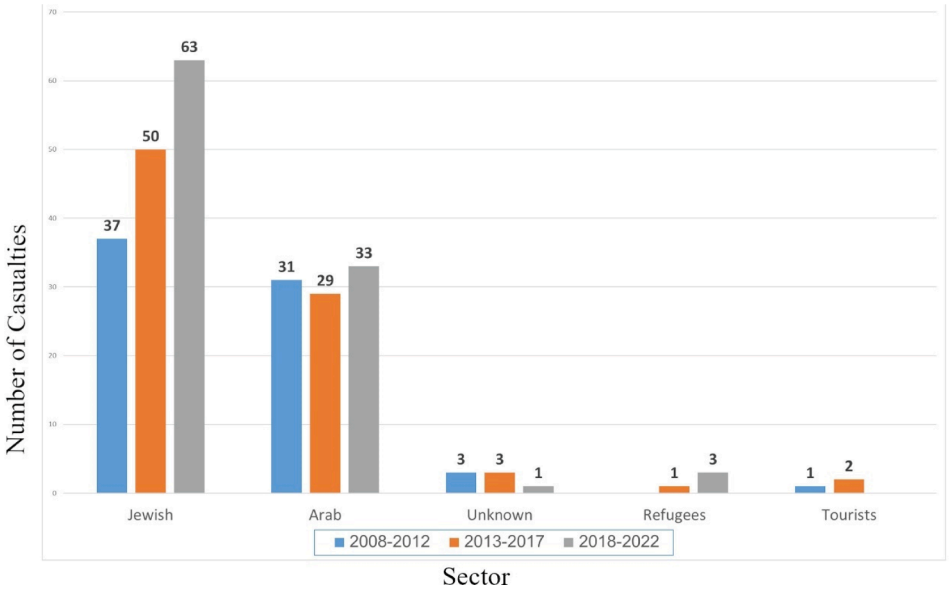

Fig. 5. Trends of childhood mortality due to drowning by sector.

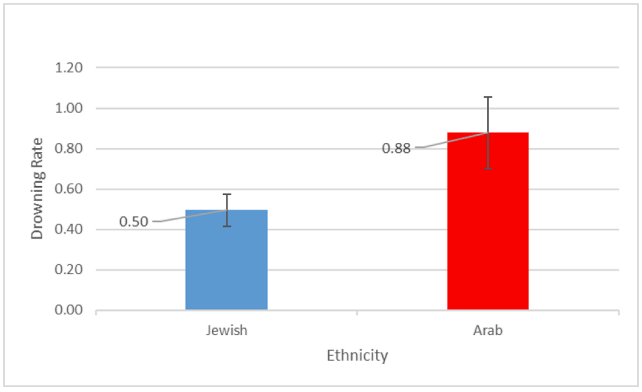

Fig. 6. Children's drowning rate per 100,000 (2008–2022) by ethnicity.

cases in 2013–2017 (a rise of 1500%), and 19 cases in 2018–2022 (a rise of additional 18.8%). We wish to stress here the rise in drownings in zimmers, in both pools and Jacuzzis, from no cases in 2008–2012, to five cases in 2013–2017, all of which are in swimming pools, and eight cases in 2018–2022 (a rise of additional 60.0%), six of which in swimming pools, and two in Jacuzzis.

Results point to a rise in casualties in private swimming pools (Fig. 7). In total, in the last 15 years, 12.8% of child mortality due to drowning have occurred in built swimming pools (n = 33). Out of these 33 cases, 29 cases were of children aged 0–4 (87.9%). Also of note is the rise in drownings in bathtubs and buckets in the last five years (n = 7 and n = 5, respectively).

There is a rise in childhood drowning in ages 0–4 (n = 50 in 2018–2022, a rise of 30%), and 5–9 (n = 18, a rise of 33.3%). The majority of deaths in ages 0–4 occur in private houses, with 31 cases in 2018–2022, a growth of 40.9% from 2013 to 2017 (Table 2). Also of note is the rise in drowning cases among children aged 0–4 in zimmers,

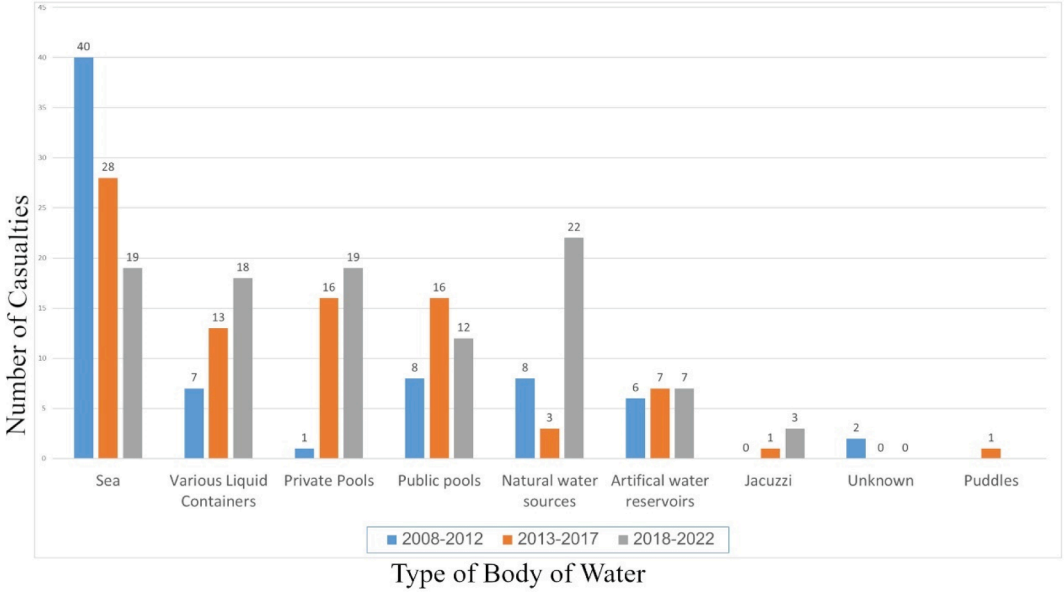

Fig. 7. Child mortality due to drowning by period and type of body of water.

Table 2
Drowning in ages 0–4 by place of accident.

Place of Incident	2008–2012	2013–2017	2018–2022	Total
Private houses	6	22	31	59
Zimmers	-	4	6	10
Sea	4	2	3	9
Public pools	3	3	2	8
Natural water sources	3	-	3	6
Artificial water reservoirs	-	3	2	5
Unknown	2	-	-	2
Hotels	1	-	1	2
Puddles	-	1	-	1
Total	**19**	**35**	**48**	**102**

all of which occurred in swimming pools.

The majority of children drowning involves children from municipalities of a low socioeconomic level (Fig. 8). Moreover, the differences between the lowest socioeconomic grouping and the rest are dramatic. Indeed, when examined in terms of mortality rates per 100,000 and taking into account the population of children in each socioeconomic grouping over the years, municipalities of socioeconomic grouping 1–3 (95% CI [0.65–0.93]) significantly exceed groupings 4–6 (95% CI [0.34, 0.59]) and 7–10 (95% CI [0.22–0.41]) in the standardized incidence of childhood drowning throughout the entire period (2008–2022) (Fig. 9). Still, it is of note that there is also a rise in the raw incidence of childhood drowning among the intermediate socioeconomic groupings and among children from municipalities of a high socio-economic level. The preponderance of mortality cases in socioeconomic grouping 7–10 occurred in private houses, although there is also a clear rise in drowning in natural water sources in this grouping.

Summer months (June-August) are typified by an elevated frequency of drowning incidents (Supplementary Fig. 1). The Tzafit Wadi disaster creates another peak in April of 2018–2022. Excluding this disaster, the April numbers are 50% lower. As for weekdays, most cases take place during the weekends (Friday-Saturday; Supplementary Fig. 2).

As for the time of day during which drownings occur, out of 200 cases for which a timeframe is available, there is an almost even distribution between early afternoons (13:01–16:00; 27% of the cases), late afternoons to early evenings (16:01–19:00; 28%), and evenings (19:01–23:00; 25%). Only seven cases took place during nighttime to early mornings (4%). There is a decline in the proportion of drowning cases during the late afternoon to early evening, and a rise in the proportions of drownings during the early afternoons (Fig. 10).

When analyzing drowning mortality cases by timeframes and ages (Supplementary Fig. 4), we can see a dominance in cases during the late afternoon to early evenings in ages 10 to 14, while cases of ages 15 to 17 occur mainly during the early afternoon (13:01–16:00). Cases of drowning of children in ages 9 and below occur mainly during morning to noon (07:01–13:00). The proportions of drowning cases during the night hours is slightly more pronounced among ages 15–17 (7% of the cases).

4. Discussion

This study presents a pattern of a pronounced rise in childhood drowning in Israel over the last 15 years. In Israel there are laws and regulations aimed at the prevention of injuries in water environments, most of which are anchored in the regulations of public swimming facilities and are part and parcel of planning and construction regulations. However, these do not include private swimming pools. Moreover, in our view, these regulations do not fully address the relevant needs, and their enforcement is lacking. Here we point to measures that may help in reducing childhood mortality and morbidity due to drowning.

Certainly, close supervision may prevent childhood drowning. Previous studies have demonstrated the crucial role of supervision in child injury prevention (e.g., Chang & Ozanne-Smith, 2020; Morrongiello & Schell, 2010; Peden, Franklin & Willcox-Pidgeon, 2020; Petrass et al., 2011; Saluja et al., 2004; Schwebel et al., 2023). As Chang and Ozanne-Smith (2020) rightly state, attention, proximity and continuity of caregivers may prevent the drowning of a child.

Yet, policymakers should avoid laying the full burden of responsibility for the prevention of childhood drowning (and for any other unintentional childhood injury, for that matter) on the shoulders of caregivers. For example, in order to raise caregivers' awareness to the importance of close supervision over children when in contact with water, it is imperative for the state to promote public campaigns dealing with water safety (Chang & Ozanne-Smith, 2020).

Moreover, our study points to a strong link between the socioeconomic level of the locality and ethnicity, on the one hand, and the risk of drowning, on the other. Previous studies have repeatedly demonstrated a link between childhood injury in general and socioeconomic variables (e.g., Birken & MacArthur, 2004; Fang et al., 2014; Faelker et al., 2000; Hong et al., 2010; Williams et al., 1997), further stressing the

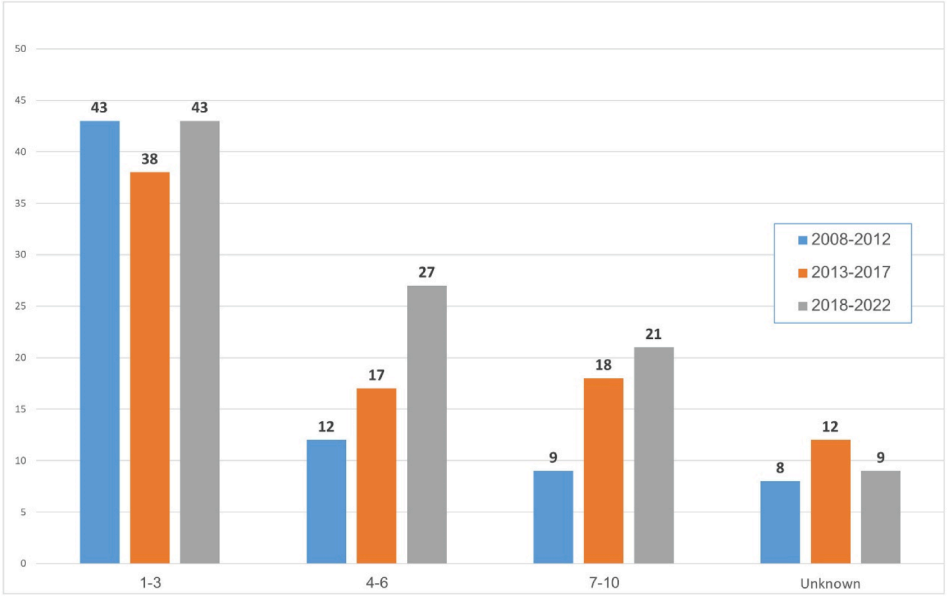

Fig. 8. Trends in child mortality due to drowning by socio-economic status.

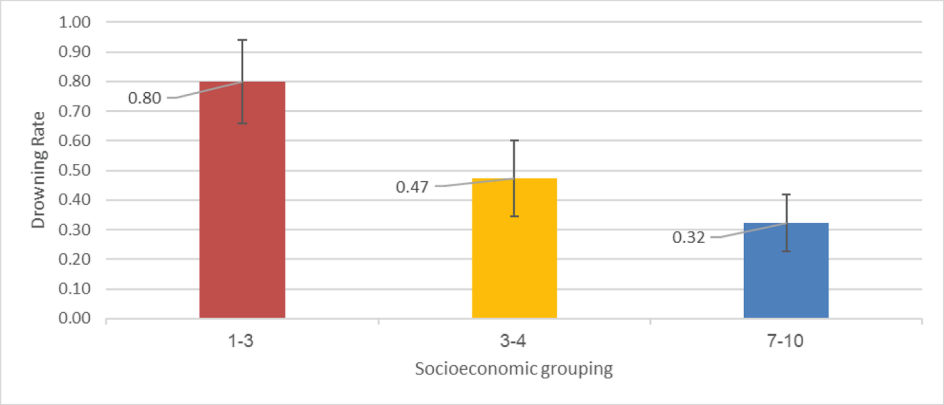

Fig. 9. Children's Drowning rate across socioeconomic groupings per 100000.

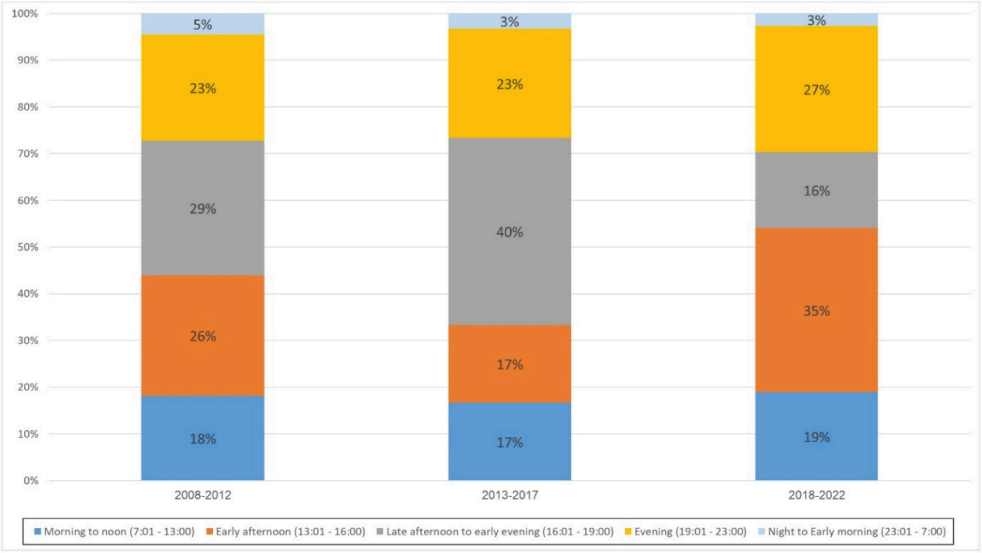

Fig. 10. Child mortality due to drowning by periods and by proportions of timeframes.

responsibility of policymakers in the promotion of equity, in the form of novel policies and regulations, as well as well-planned allocation of resources, for the prevention of childhood injury as a whole.

4.1. Recommendations and call for action

We provide several recommendations concerning possible trajectories of coping with childhood drowning in Israel. These recommendations are based on regulations known from other countries, as well as literature on the subject. We divide this section into sub-sections by topics.

4.1.1. Domestic swimming pools

As demonstrated above, a large portion of childhood drowning cases occurs in private swimming pools. Given the prevalence of children aged 0–4 among these cases, we urge policymakers to promote regulation and legislation concerning the use of fences as barriers around built swimming pools both in private houses and zimmers. Fencing is considered the most important means for the prevention of infant drowning, and a link between the existence of a fence around the entire perimeter of a pool and the reduction of chances of infant drowning has been established (Burford et al., 2005; Denny et al., 2019; Thompson et al., 1996). Franklin and Peden (2017) have further demonstrated that the rates of drowning mortality in private pools have dropped following the expansion of private pools fencing regulations and enforcement in Australia.

Currently, public swimming pools in Israel must be fenced. Fencing regulations require that the fence be stable, and at least 1.1 m. We recommend applying these regulations to domestic built pools as well. The fence must enclose the entire perimeter of the pool. Also, it has to be high enough to stop children from jumping or climbing over it, and the gap between the bottom of the fence and the ground must be lower than 10 cm, preventing children from crawling underneath it (Rubio et al., 2015). Bars must be vertical rather than horizontal, in order to prevent children from using them as a ladder. Most importantly, the gate of the fence must close automatically, and must be self-latching. The latch must be out of children's reach.

We further recommend imposing fencing requirements and a gate lock on swimming pools of all kinds, including paddling pools, in zimmers. Finally, we recommend updating the regulations of bathing places (Safety in swimming pools, subsection 12b, 2004) so that it includes a prohibition of leaving a child under the age of 9 unattended.

4.1.2. Open water sources

According to the Ministry of Interior's website (2023), the shoreline of Israel is 306 km long. It is divided into three types of shores: officially declared beaches, in which swimming is permitted at times when lifeguard services are provided (21 km, ~7% of the shoreline); prohibited

beaches, in which swimming is forbidden at all times (170 km; ~56%); and undefined shores, in which no clear rule concerning swimming is provided (115 km; ~38%). While in officially declared beaches rescue services are under the responsibility of local municipal authorities, and under the inspection of the Ministry of Interior, undeclared shorelines' rescue services are under the responsibility of local marine police services.

Currently there are 155 declared beaches in Israel: 104 on the shores of the Mediterranean Sea, 31 on the shores of the Sea of Galilee, 16 on the shores of the Dead Sea, and 4 on the shores of the Red Sea. While efforts have been made in recent years to increase the number of active beaches, the shores permitted for swimming still do not meet the need.

In most declared beaches, rescue services are provided during swimming season, starting around the beginning of April, and until around mid-October. Starting from 2018, the timing of season opening has been extended to include the Passover vacation, and in 2019 this change has been made into a law.

The ordinance regulating bathing places defines a minimal standard of eight hours a day for rescue stations activity, while local municipal authorities can expand this during swimming season, or in parts of it. This leads to a lack of uniformity between different authorities. The ordinance regulating bathing places permits local authorities imposing fines in cases of swimming against regulations, and bylaws of some local authorities indeed mention this option. Yet, some local authorities do not have such bylaws, and in general, the enforcement of these bylaws is not common. Moreover, the obligation of monitoring applies only to declared beaches, leaving out undeclared shores.

Given this, we recommend providing an explicit definition of undeclared beaches, and of beaches without lifeguard services, as prohibited for swimming. This should include undefined beaches. Additionally, we propose the institution of robust enforcement mechanisms that draw on the law for the prohibition of swimming in undeclared beaches, including the definition of the authority responsible for enforcement and sanction. We also recommend the uniform and inclusive expansion of lifeguard services hours during the summer, from sunrise to dark. Moreover, we recommend increasing the quantity of declared beaches.

The Tzafit Wadi disaster was an extreme and rare event. Nevertheless, important lessons were drawn from it. Following the disaster, the Ministry of Education has formed a special committee to regulate the operation of trips and outdoor activities in Pre-Military preparatories. Following this committee, the Ministry of Education has recommended that all Pre-Military preparatories voluntarily abide by the Ministry of Education circular, committing in return to provide them services of coordination, monitoring, and regulation (Aharonishki, 2018). This has been accepted by all Pre-Military preparatories. In addition, it has been decided that a special team, with representatives from the Ministry of Defense, the Ministry of Education and the Pre-Military preparatories, will be formed, to consolidate future protocols concerning outdoor activities in Pre-Military preparatories.

4.1.3. Water containers around and inside the house

Cases of drowning inside and around the house, in bathtubs, portable pools, and transferable objects, are harder to cope with. Indeed, such cases cannot be resolved through regulations and enforcement. Yet, Peden, Franklin and Pearn (2020) point to a link between social determinants and child drowning in portable pools. They further suggest that regulations may act as an effective means for drowning prevention.

We therefore recommend passing into law an obligation for marketers of portable swimming pools, requiring them to provide warnings concerning the danger of infant and childhood drowning as part of their advertising, in addition to offering safety recommendations within the costumer leaflet. We wish to stress that air-filled flotation aids pose a risk of drowning by themselves (Rubio et al., 2015), and therefore must not be used under any circumstances.

In addition, it is our view that public campaigns approaching parents should be used, raising the awareness concerning the safety rules in water environments, including lingual and cultural adaptations to match different populations.

4.1.4. Skills of coping with water environments

By virtue of the circular of the general director of the Ministry of Education of Israel (1998), swimming lessons are provided to pupils of the 5th grade, as part of school activity, and under the responsibility of the Ministry of Education. These lessons are mandatory in all places of residence wherein swimming pools that correspond to safety requirements are available. Approximately 70,000 pupils participate in this program annually (Falk et al., 2021). Yet, the program does not cover all pupils in Israel. It is our recommendation that the age of swimming classes is pushed back, to the 2nd grade.

Children and adolescents of low socioeconomic status are less likely to participate in swimming lessons, and so their swimming capabilities are often lower, as well as their levels of knowledge of water safety (Lawes et al., 2021; Sakamoto et al., 2020). We therefore stress the urgent need to expand swimming lessons to all ethnicities and municipalities within the Israeli system of education, with an emphasis on populations in risk and municipalities of low socioeconomic status. Indeed, previous studies show that swimming lessons reduce the frequency of child drowning cases, while also developing required water skills (e.g., Willcox-Pidgeon et al., 2021). For this, we recommend that public pools be constructed in municipalities of low socioeconomic level, and especially in Arab municipalities.

Additionally, in recent years, there is a special focus on developing sets of skills for coping with the challenges posed by water environments. This stems from the understanding that swimming by itself is not enough for the prevention of drowning. Rather, there is a need, in addition to physical skills, for a profound body of knowledge concerning water safety, and the ability to evaluate and anticipate risks (Stallman et al., 2017). According to Stallman et al. (2017), crucial water-related skills are not emphasized during swimming lessons, which usually take place in pools, without exposure to changing conditions. Swimming lessons provide people, and especially adolescents, with an exaggerated evaluation of their capability to cope with dangers, and without the proper objective criteria to assess natural conditions, such as underwater currents, changing terrains, fatigue, and stress. Among the relevant skills, one can mention physical aspects, such as transition to a floating state, underwater swimming, and the capability to get out of the water; principles of safe access to water, while avoiding jumping off wharfs and bays, entering water of unknown depth, and avoiding swimming under the influence of alcohol; the identification of specific dangers, and how to avoid them; a proper evaluation of personal capabilities of long-term swimming, and the principles of safe rescue, avoiding physical contact with the person drowning and entering the zone of danger.

As acquiring water survival skills may reduce rates of drowning (Rubio et al., 2015), it is our view that such skills should be acquired and established already in schools. We therefore recommend performing courses of water safety and water survival skills in natural environments (including shores, lakes, streams and springs), as early as during Junior High years. We recommend putting an emphasis on municipalities located by the beach, and among populations in risk. These recommendations are in accordance with the WHO recommendations for drowning prevention (WHO, 2014).

The main limitations of this study have to do with the identification of the ethnicity of the mortality cases. As media coverage did not always contain information from which ethnicity could be inferred, our ability to ascribe ethnicity was somewhat limited. In these cases, and in the absence of geographic clues, we classified it as missing data. Despite this, sound bases for such inferences were present in the overwhelming majority of the relevant news items, thereby enabling the analyses reported herein. Additionally, the media documentations often lack a description of the full dynamic that led to the death of the child, including the presence or absence of a caregiver, the activity performed during the time of death, and more.

5. Conclusions

In this paper we present a 15-year review of child drowning in Israel. We show patterns and trends, and point to issues demanding urgent intervention. Among other issues, we point to a rise in child drowning in general, and child drowning in domestic swimming pools specifically. We further demonstrate a decline in median age of child drowning cases, and a strong link between socioeconomic level and the chances of drowning.

Following this, we provide a list of recommendations important, in our view, for coping with the danger of drowning among children. Indeed, some of the mentioned measures involve financial costs, and would require state budgeting. Yet, we believe that adopting our recommendations may reduce the incidence of childhood drowning in Israel.

Ethics

All medical data used by Beterem Safe Kids Israel are approved by a Helsinki protocol. In the case of data collected from the media, as it is fully anonymized and publicly available, no ethical protocol is required.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jsr.2024.02.002.

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