

Pattern of children death in Sfax, Tunisia: A 14-year autopsy study

Profil des décès d'enfants à Sfax, Tunisie : Une étude autopsique sur 14 ans

Wiem Ben Amar^{1,2} ; Mariem Grayaa^{1,2} ; Fatma Daoud^{1,2} ; Hanen Dhouib^{1,2} ; Karim Derbel² ; Ahmed Chakroun^{2,3} ; Samir Maatoug^{1,2} ; Zouhir Hammami^{1,2} ; Malek Zribi^{1,2}

1. Faculty of Medicine, University of Sfax, Sfax, 3027, Department of Forensic Medicine, Habib Bourguiba University Hospital, Sfax, 3027, Tunisia.
2. Faculty of Medicine, University of Sfax, Sfax, 3027, Tunisia
3. Faculty of Medicine, University of Sfax, Sfax, 3027, School Medical Center, Sfax, 3027, Tunisia

ABSTRACT

Introduction and aim: Child mortality is a critical indicator of public health. Identifying the causes and circumstances of death among children is the first step in preventing this tragedy. The purpose of this study was to investigate and analyse the epidemiological, social, and forensic characteristics of children deaths in Tunisia over a 14-year period and identify the leading causes of death.

Methods: We conducted a transversal descriptive study in the Department of Forensic Medicine at Habib Bourguiba University Hospital of Sfax over 14 years (January 1 st, 2008-December 31st, 2021) including all forensic autopsies carried out on children.

Results: A total of 436 cases were examined with a male predominance (Sex ratio:1.5) and a mean age of 8 ± 6 years. Accidents were the most prevalent manner of death (70%) followed by natural deaths (16%), suicides (7%) and homicides (2%). A significant association between sex, age group and the manner of death (natural/violent deaths) was observed ($p < 0.001$). The majority of accidents were due to road traffic accidents (48%), followed by drowning (20%). For suicidal deaths, hanging was the most common method (65%) followed by self-immolation (16%) and, finally, ingesting pesticides (13%). The most frequent method of homicide was sharp force.

Conclusion: This study provides valuable data regarding child mortality patterns in Tunisia, which can help to implement adequate preventive measures.

Key words: child, mortality, cause of death, autopsy, Tunisia

RÉSUMÉ

Introduction et objectif : La mortalité infantile est un indicateur essentiel de la santé publique. L'identification des causes et des circonstances de décès d'enfants est la première étape de la prévention de cette tragédie.

Cette étude avait pour objectif d'examiner et d'analyser les caractéristiques épidémiologiques, sociologiques et médico-légales des décès d'enfants en Tunisie sur une période de 14 ans, et d'identifier les principales causes de ces décès.

Méthodes : Nous avons mené une étude descriptive transversale dans le Département de Médecine Légale de l'Hôpital Universitaire Habib Bourguiba de Sfax sur une période de 14 ans (1^{er} janvier 2008-31 décembre 2021) incluant toutes les autopsies médico-légales réalisées sur des enfants.

Résultats : Au total, 436 cas ont été examinés avec une prédominance masculine (Sex ratio:1,5) et un âge moyen de 8 ± 6 ans. Les accidents étaient la forme de décès la plus fréquente (70 %), suivis par les causes naturels (16%), les suicides (7%) et les homicides (2%).

Une association significative entre le sexe, le groupe d'âge et la forme de décès (morts naturelles/violentes) a été observée ($p < 0.001$). La majorité des accidents étaient dus à des accidents de la route (48%), suivis par la noyade (20%).

En ce qui concerne les décès par suicide, la pendaison était la méthode la plus courante (65%), suivie de l'auto-immolation (16%) et enfin de l'ingestion de pesticides (13%). La méthode d'homicide la plus fréquente était l'utilisation d'arme blanche.

Conclusion : Cette étude fournit des données précieuses sur les tendances de la mortalité infantile en Tunisie, qui peuvent aider à mettre en place des mesures préventives adéquates.

Mots clés : enfant, mortalité, cause du décès, autopsie, Tunisie

Correspondance

Mariem Grayaa

Faculty of Medicine, University of Monastir, Monastir, 5000, Tunisia.

Email: meriemgrayaa222@gmail.com

INTRODUCTION

Child death is a tragedy that affects both families and society. According to the WHO (1), child mortality rates have shown a global decline since 1990 reflecting significant global progress. However, in some countries, especially sub-Saharan African and South Asian countries, children face alarmingly high mortality rates. In Tunisia (2), the child mortality rate decreased between 1985 and 2000. Since then, it has remained relatively stable ever since. Between 1972 and 2006, there was a six-fold decrease in child mortality rates for children under 5-years of age and a five-fold decline for infants under one year. However, disparities exist between regions based on rural/urban area, socioeconomic status and access to healthcare services. Globally, the leading causes of death for children under 5-years include preterm birth complications, birth asphyxia/trauma, infectious diseases and congenital anomalies (1). For older children, road traffic injuries and drowning are the leading causes of death (1).

The purpose of this study was to investigate and analyse the epidemiological, social, and forensic characteristics of children deaths in Tunisia over a 14-year period and identify the leading causes of death in order to guide preventive strategies and activities.

METHODS

It was a transversal descriptive study conducted in the Department of Forensic Medicine at Habib Bourguiba University Hospital of Sfax over 14 years (January 1 st, 2008-December 31st, 2021). Forensic autopsies in Tunisia, are required by law in cases of sudden, suspicious or violent deaths. Our department performs approximatively 700 medicolegal autopsies annually covering almost all the southern part of Tunisia. It is located in the district of Sfax (second city of Tunisia) and it used to cover the medicolegal activity of 7/24 districts of Tunisia (Sfax, Mednine, Sidi Bouzid, Gafsa, Tatouine, Tozeur, Kebili). Since 2016, other department of forensic medicine have been opened (Mednine, Sidi Bouzid, Gafsa). Our study included all forensic autopsies carried out on children who died during the study period. According to the Convention on the Rights of the Child and the tunisian's Child Protection Code (3,4), a child is defined as a human being under the age of 18 years. Data were collected from police investigations reports, medical records, deceased relatives' commemoratives, and autopsy reports. We excluded cases of children's deaths related to illegal immigration and infanticides due to their specific characteristics.

We analyzed socio-demographic variables (age, sex, nationality, origin), medical history, circumstances of death, the cause, and the manner of death.

The victims were divided into five age groups: <1, 1–4, 5–9, 10–14, and 15–17. The manner of death (natural, accident, suicide, homicide, undetermined) was assumed based on the context, autopsy findings and confirmed by the judicial authority. Manner of death remains

undetermined when the circumstances were unknown or insufficient, or when the cause of death was not specified. Statistical analyses were performed using statistical package SPSS for Windows, version 22.0. Descriptive statistics including numbers and percentages were calculated for qualitative variables. Quantitative variables were expressed as mean. The Student t-test was used for means comparison, the Chi-squared test to compare qualitative variables, and non- parametric tests in cases of non-applicability of the previous tests. A P value ≤ 0.05 was considered as statistically significant.

Ethical consideration

All procedures involving human participants in this study were performed in accordance with ethical standards of the Helsinki Declaration. All data were anonymized.

RESULTS

During the study period, a total of 9235 autopsies were conducted, with 436 cases concerned children aged between 0 and 17 years (4.5%). On average, 31 cases of child death per year were reported during the study period. The distribution of cases showed two peaks in 2017 (60 cases) and 2020 (58 cases).

One third of child deaths occurred during the summer. There was a male predominance with a male-female ratio of 1.5 with the mean age of 8 ± 6 for both sexes. Roughly 33% of the victims were aged between 1 and 4 years. Tunisian nationality accounted for most of the cases (96%) and most of them were from rural areas (66%).

Only 26% of the deaths occurred in hospital and merely 12% of the victims had antemortem medical histories. Table 1 shows the demographic characteristics of the study population categorized by the manner of death. Accidental deaths were the most common (70%), followed

by natural deaths (16%), suicidal cases (7%) and homicidal cases (2%). The manner of death remained undetermined in 19 cases (4%). Male predominance was observed in all manners of death except for natural deaths.

The manner of death (natural/violent) varied significantly with the victim's sex ($p < 0.0001$). Age also showed significant variations in terms of natural/violent death ($p < 0.0001$). However, there were no significant variations in the manner of death (natural versus violent) to the season, origin(urban/rural) and the place of death (hospital/elsewhere) (Table 2).

Table 1. Demographic characteristics of cases

	Natural	Accident	Suicide	Homicide	Undetermined	Total
Number of cases	68	307	32	10	19	436
Sex :						
Male	23	200	20	8	12	263
Female	45	107	12	2	7	173
Age group :						
<1	19	12	0	0	6	37
1-4	24	109	0	1	8	142
5-9	9	56	2	1	1	69
10-14	8	67	14	1	3	93
15-17	8	63	16	7	1	95
Nationality :						
Tunisian	63	298	32	9	19	421
Other	5	9	0	1	0	15
Origin :						
Urban	25	93	5	4	10	137
Rural	38	205	27	6	9	285
Season:						
Winter	17	68	11	0	6	102
Spring	16	72	6	2	3	99
Summer	18	102	9	5	6	140
Autumn	15	62	6	3	1	87
Place of death:						
Hospital						
Elsewhere	26	80	4	1	4	115
	42	227	28	9	15	321
Medical history	27	13	4	0	7	51

Table 2. Comparison of demographic characteristics of victims according to the manner of death (natural versus violent)

	Natural death	Violent death	p values
Sex:			
Male	23	228	p<0.0001
Female	45	121	
Age group:			
<1	19	12	p<0.0001
1-4	24	110	
5-9	9	59	
10-14	8	82	
15-17	8	86	
Origin:			
Urban	25	102	p=0.95
Rural	38	239	
Season:			
Winter	17	79	p=0.7
Spring	16	80	
Summer	18	116	
Autumn	15	71	
Place of death:			
Hospital	26	85	0.015
Elsewhere	42	264	

For accidental deaths, there was a male predominance (sex ratio of 1.9). Only 13 cases had antemortem medical histories. The majority of these deaths were attributed to traffic accidents (48%), followed by drowning (20%), poisoning (17%), falls (7%), and burns (6%). Traffic

accidents were the leading cause of death for children over one year while two thirds of the victims being boys. Most of cases involved pedestrians (50%), who were hit by vehicles in 80% of cases, or motorbikes in 20% of cases. We noted motorbike victims (drivers or passengers) in 20% of cases. The remaining cases involved car passengers. Most drowning victims were aged between 1 and 4 years (n=35/61) with wells being the most common site of drowning. Toxicological analysis of accidental deaths due to substance inhalation showed that 9 cases were due to CO poisoning, 3 cases were attributed to pesticides, 2 cases resulted from the inhalation of caustic agents, and 3 cases resulted from exposure to other toxic products (Table 3).

For suicidal deaths, no history of diagnosed psychiatric disorders was reported in any case. The male to female ratio of suicide victims was 1.5. Most of victims were lived in rural areas (n=27/32). The most common methods were hanging (65%), self-immolation (16%), and ingesting pesticides (13%) (Table 4). Hanging and self-immolation were more frequent in males, whereas ingesting pesticides and drugs were more common in females.

The majority of homicide victims were male aged between 15 and 17 years. Sharp force, reported in four cases, was the most frequent method of homicide. Other observed causes included burns in two cases, firearms two cases, blunt trauma in one case, and strangulation in one case (Table 5).

Table 3. Distribution of accidental deaths by mechanism and age group

	<1 year	1-4 years	5-9 years	10-14 years	15-17 years	Total
Traffic accident	2	37	33	39	35	146
Fall	1	11	3	4	3	22
Firearm	0	0	0	1	0	1
Caustic poisoning	1	1	0	0	0	2
Pesticide poisoning	0	3	0	0	0	3
CO poisoning	0	5	1	2	1	9
Other product poisoning	1	0	0	0	2	3
Hanging	0	2	1	2	0	5
Ligature strangulation	0	2	0	0	0	2
Positional asphyxia and constriction	2	4	0	1	0	7
Drowning in the sea	0	1	5	4	4	14
Drowning in canals	0	3	2	3	0	8
Drowning in wells	0	12	2	2	0	16
Bath drowning	1	2	0	1	0	4
Other drowning type	0	17	1	0	1	19
Electrocution	0	0	2	0	9	11
Thermal burns	3	6	3	5	3	20
Other type of accident	0	3	2	3	4	12

Table 4. Distribution of suicide cases by sex and method

	Male	Female	Total
Drug poisoning	0	2	2
Pesticide poisoning	1	3	4
Self-immolation	5	0	5
Hanging	13	8	21
Total	19	13	32

Table 5. Distribution of homicidal deaths by method and sex

	Sex	
	Male	Female
Sharp force	4	0
Firearm	2	0
Blunt trauma	1	0
Burn	0	2
Strangulation	1	0
Total	8	2

Natural deaths accounted for 12% of our study population. Thirty percent (30%) of these cases occurred in children under 1 year of age and 38% occurred in children aged 1 to 4 years. The majority of natural diseases victims were female. The leading causes of death were respiratory, neurological and cardiovascular diseases (Table 6).

Table 6. Distribution of natural deaths by causes and sex

	Sex	
	Male	Female
Cardiovascular	2	7
Respiratory	5	6
Neurological	3	7
Infectious	1	5
Digestive	3	0
Other	9	20
Total	23	45

DISCUSSION

Our study provides significant insight into child mortality in Tunisia offering valuable data for planning preventive strategies. We conducted autopsies on 436 cases of child death, with an average of 31 cases per year. Consistent with previous studies, our findings showed that the majority of victims were male (5–7). This sex disparity was also noticed in the northern of Tunisia, South Africa, and Kuala Lumpur (8–10). This can be attributed to the impulsive behaviour, curiosity, and outdoor activities of boys. Nevertheless, in a separate study carried out in New Delhi, the sex distribution of child fatalities showed variations across years. In 2019, a higher number of deaths were documented among males, whereas in 2020 and 2021, deaths were more recorded in female paediatric autopsies (11).

In our series, the most affected age group was children aged 1 to 4 years, which is in conformity with studies from Nigeria (12) and northern Tunisia (8). However, a Turkish study and a Finnish study reported higher incidences

among 15 to 18-years-olds and 10 to 14-year-olds, respectively (13,14). The majority of deaths occurred out of hospital. This could be explained by the fact that most of them occurred in rural areas where there was limited access to healthcare services and lack of medical transport.

In our study, accidents were the most common manner of child death. This is consistent with previous studies, which have shown rates of 40% to 54% for accidental death (7,10,11). In 2004, according to the WHO, global child violent deaths were distributed as follows: accidental deaths accounted for 84.3%, homicidal deaths accounted for 5.8%, and suicidal deaths for 4.4% (15).

The percentage of violent deaths was higher in Tunisian boys compared to girls ($p < 0.001$). These findings are in line with those reported in other countries (7,10). A significant association between age groups and manner of death was found ($p < 0.001$). As the children grew older, the percentage of natural deaths decreased, while the percentage of violent deaths increased.

As reported in the literature, the majority of accidental deaths were attributed to road traffic accidents (7,10,11,16). According to the WHO, road traffic accidents are the leading cause of death for children and young adult aged 5-29 years. The rates of traffic-related mortality among children vary between regions and countries depending on the enforcement of strict regulations and the income levels of countries (17).

Approximately, one quarter of the deaths in road traffic crashes in Sindh, Pakistan involved children between 2 and 14 years of age (18). This reinforces the view that children are very vulnerable to deaths in road traffic crashes. In line with previous studies, the majority of child deaths resulting from road traffic injuries were among pedestrians (8,13,18).

In our study, 61 child deaths were attributed to accidents involving water, which is in accordance with findings in the United States, where water-related accidents were the leading type of nontraffic accidental deaths (19).

As noted by other authors (8,10), water deaths occurred mainly in the group 1-4 years. These particular ages reflect the inability of young children to understand and/or deal with potentially hazardous surroundings. The location of child drowning varies between countries. In our study, as reported in Northern Tunisia, Daman and Poland, most of the drowning incidents occurred in natural bodies of water (62%) (5,8,20). Meanwhile, swimming pools were the primary site of drowning in the United States (26–37%), and Australia (19,21). In Japan, drowning in the bathtub was common (28–39%) (22). This variation depends on the geographical area and natural landscape. In this study, suicidal deaths accounted for 7% of all child deaths. It affected adolescents aged between 10 and 17 years. Several behavioral, psychological, family and social factors influence suicidal ideation during adolescence. At this age, adolescents often feel insulted or attacked by family members or friends which can lead to depression and other psychiatric disorders. They may also experience anxiety related to their academic performances (23). In our study, no antemortem psychiatric disorders were diagnosed in any case. This can be explained by the fact

that many families concealing psychiatric illness, which is considered a negative label and a societal taboo. In accordance with previous Tunisian studies, most of suicide victims were from rural areas (8,24). Our study showed that suicide occurred more frequently in males with a male to female ratio of 1.5. According to the literature, male teenagers are more likely to commit suicide than females. However, females are generally more likely to experience suicidal ideation and make suicide attempts (25). Worldwide, the suicide rate for males aged between 10 and 19 years was found to be more than twice that of females (26). This higher rate of completed suicide among males, especially in many European and American countries, may be linked to their greater (27–30). In contrast, a higher suicide rate among teenage females was recorded in some governorates of Tunisia, China, and some Middle East countries (24,29,31). According to Petroni et al. (32), the increased number of suicides among adolescent girls is attributed to gender discrimination, sexual abuse, exclusion from education, unemployment, and unequal family responsibilities.

Consistent with the literature (10,23,33), the majority of suicide incidents were due to hanging (34 cases, 69%). This can be explained by the easy availability and accessibility of materials for hanging (33). However, there were geographic variations. For example, firearm suicides and jumping from high places were the most common methods of suicide in the USA and Hong Kong, respectively (27,31,34). Gender analysis showed that hanging was the most commonly used method for both boys and girls. Poisoning using pesticide was more common among girls, while self-immolation was committed only by boys. Overall, it has been shown that males are more likely to employ more violent methods of suicide like firearms or hanging, whereas females tend to resort to less violent methods such as pesticide poisoning (23). This distribution of violent and non-violent suicide methods varies between countries. In accordance with our findings, a Turkish study showed that hanging was the most common suicide method among females (23).

Comparatively, homicide, the least common manner of death (2.2%), was more predominant among males aged between 15 and 17 years (7 out of 10 cases). A possible explanation for this result is that boys at this age are more exposed to quarrels and other forms of violence due to spending more time outside their homes. In the age group of 15 to 17 years, sharp force injuries were common, as highlighted by other studies of child homicide conducted in Tunisia and other countries (35–37). In contrast with other reports (35,37), shooting was rare as a method of child homicide. This can be explained by the Tunisian regulations that ban the possession of such weapons.

Natural deaths accounted for 12% of all children deaths autopsied in our series, with 30% of them occurring in children under 1 year and 38% occurring in the 1-5-year age group. Van den Ordel (10) has reported natural diseases in 7% of children who were admitted to the medico legal laboratory, with 50% of them occurring in the age of 1-5 years. As indicated by some studies including infants (5,7,38), the majority of this age group

die from natural diseases. Respiratory diseases were the major cause of natural death in our study. According to the WHO (39), the leading causes of death among children include respiratory infections, diarrheal diseases, measles, malaria, malnutrition and new-born conditions. However, patterns of child natural deaths varied between regions.

In 19 cases, the cause of death could not be established. After the exclusion the intervention of an external factor, this could be explained that some natural deaths could not be identified and not be scientifically ascertained (cardiac arrhythmia, genetic disease...).

To the best of our knowledge, our study was the first exhaustive chronological report including all cases of child death conducted in southern Tunisia. Although this study was specific to a region, the implications can be generalized to other Tunisian governorates. It allowed us to compare our results with national and international data. However, our study had some limitations as it was retrospective study, which meant that some information was unavailable.

CONCLUSION

In conclusion, our study provides essential data regarding violent and unexpected child deaths in southern Tunisia. The most common manner of death were accidents followed by natural diseases, suicides and homicides. Violent deaths were more prevalent among males and concerned traffic accidents. Many of these fatalities can be prevented through strategic interventions. Recognizing these violent deaths as a substantial factor in mortality and implementing a targeted and preventive plan are crucial at this time.

Key points

- Accidents were the most prevalent manner of death followed by natural deaths, suicides and homicides.
- A significant association between sex, age group and the manner of death (natural/violent deaths) was observed ($p < 0.001$).
- The majority of accidents were due to road traffic accidents, followed by drowning.
- Hanging was the most common method of suicide followed by self-immolation and, finally, ingesting pesticides.

REFERENCES

1. World Health Organization. Children: improving survival and well-being [Internet]. 2020 [cited 2025 Jan 2]. Available from: <https://www.who.int/news-room/fact-sheets/detail/children-reducing-mortality>
2. United Nations International Children's Emergency Fund. Santé [Internet]. [cited 2025 Jan 2]. Available from: <https://www.unicef.org/tunisia/sante>
3. Law n° 95-92 of 9 november 1995 related to Child Protection Code. [cited 2025 Jan 2]. Available from: <https://legislation-securite.tn/latest-laws/loi-n-95-92-du-9-novembre-1995-relative-a-la-publication-du-code-de-la-protection-de-lenfant-titre-ii-protection-de-lenfant-delinquant-arts-68-a-123/>
4. United Nations International Children's Emergency Fund. The Convention on the Rights of the Child: The children's version [Internet]. [cited 2025 Jan 2]. Available from: <https://www.unicef.org/child-rights-convention/convention-text-childrens-version>
5. Alsaif DM, Almadani OM, Ali Almoghannam S, Hamdi D, Al-Farayedhi MA, Kharosha MA. Child Fatalities in Dammam: A Call for Child Fatality Reviews in Arab Countries. *J Forensic Sci*. 2018 Jul;63(4):1171–5.
6. Maloney D, Keller SJ, Fierro MF. Child deaths in Virginia, 1996: a review of investigations of sudden, unexpected, or unnatural deaths of children less than age 13. *Am J Forensic Med Pathol*. 2000 Jun;21(2):189–94.
7. Okoye CN, Okoye MI. Forensic epidemiology of childhood deaths in Nebraska, USA. *J Forensic Leg Med*. 2011 Nov;18(8):366–74.
8. Ben Abderrahim S, Belhaj A, Bellali M, Hmandi O, Gharbaoui M, Harzallah H, et al. Patterns of Unnatural Deaths Among Children and Adolescents: Autopsy Study (2011-2018). *Pediatr Dev Pathol*. 2022;25(6):635–44.
9. Kumar V, Jumali IB. Paediatric deaths in Kuala Lumpur. *Med Sci Law*. 2006 Oct;46(4):301–9.
10. Ordel G van den, Toit-Prinsloo L du, Saayman G. Childhood and adolescent fatalities at the Pretoria Medico-Legal Laboratory: 2005 - 2009. *South African Journal of Child Health*. 2016;10(1):52–6.
11. Duchania SK, Singh S, Sunil null. Pattern of deaths in paediatric population- An autopsy based study done at a tertiary care hospital in New Delhi. *J Forensic Leg Med*. 2023 Apr;95:102489.
12. Ekanem EE, Asindi AA, Okoi OU. Community-based surveillance of paediatric deaths in Cross River State, Nigeria. *Trop Geogr Med*. 1994;46(5):305–8.
13. Athani P, Hugar BS, Harish S, Girishchandra YP. Pattern of unnatural deaths among children: An autopsy study. *Med Leg J*. 2017 Jun;85(2):90–2.
14. Parkkari J, Kannus P, Niemi S, Koskinen S, Palvanen M, Vuori I, et al. Childhood deaths and injuries in Finland in 1971-1995. *Int J Epidemiol*. 2000 Jun;29(3):516–23.
15. World Health Organization. World report on child injury prevention [Internet]. [cited 2025 Jan 2]. Available from: <https://www.who.int/publications/i/item/9789241563574>
16. Almuneef M, Saleheen H, AlBuhairan F, Al-Eissa M, Al Muntaser M, Al Alem H, et al. Child mortality in Saudi Arabia: Time for action at all levels. *Int J Pediatr Adolesc Med*. 2021 Sep;8(3):165–71.
17. World Health Organization. Global status report on road safety 2018 [Internet]. [cited 2025 Jan 2]. Available from: <https://www.who.int/publications/i/item/9789241565684>
18. Shah SGS, Khoubati K, Soomro B. The pattern of deaths in road traffic crashes in Sindh, Pakistan. *Int J Inj Contr Saf Promot*. 2007 Dec;14(4):231–9.
19. Centers for Disease Control and Prevention. Drowning — United States, 2005–2009 [Internet]. [cited 2025 Jan 2]. Available from: <https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6119a4.htm>
20. Grajda A, Kułaga Z, Gurzkowska B, Góźdz M, Wojtyło M, Litwin M. Trends in external causes of child and adolescent mortality in Poland, 1999-2012. *Int J Public Health*. 2017 Jan;62(1):117–26.
21. Wallis BA, Watt K, Franklin RC, Nixon JW, Kimble RM. Where children and adolescents drown in Queensland: a population-based study. *BMJ Open*. 2015 Nov 26;5(11):e008959.
22. Mizuta R, Fujita H, Osamura T, Kidowaki T, Kiyosawa N. Childhood drownings and near-drownings in Japan. *Acta Paediatr Jpn*. 1993 Jun;35(3):186–92.
23. Uzun I, Karayel FA, Akyildiz EU, Turan AA, Toprak S, Arpak BB. Suicide among children and adolescents in a province of Turkey. *J Forensic Sci*. 2009 Sep;54(5):1097–100.
24. Majdoub W, Mosbahi A, Naouar M, Beji M, Mannai J, Turki E. Suicide in children and adolescents: a Tunisian perspective from 2009 to 2015. *Forensic Sci Med Pathol*. 2017 Dec;13(4):417–25.
25. McLoughlin AB, Gould MS, Malone KM. Global trends in teenage suicide: 2003-2014. *QJM*. 2015 Oct;108(10):765–80.
26. Kölves K, de Leo D. Suicide methods in children and adolescents. *Eur Child Adolesc Psychiatry*. 2017 Feb;26(2):155–64.
27. Singh VD, Lathrop SL. Youth suicide in New Mexico: a 26-year retrospective review. *J Forensic Sci*. 2008 May;53(3):703–8.
28. Vandevoorde J. Le geste suicidaire chez l'enfant : mesure du phénomène, caractéristiques épidémiologiques et recommandations de base. *Journal de Pédiatrie et de Puériculture*.

- 2015 Sep 1;28(4):197–204.
29. Värnik P. Suicide in the world. *Int J Environ Res Public Health*. 2012 Mar;9(3):760–71.
 30. Weinberger LE, Sreenivasan S, Sathyavagiswaran L, Markowitz E. Child and adolescent suicide in a large, urban area: psychological, demographic, and situational factors. *J Forensic Sci*. 2001 Jul;46(4):902–7.
 31. Shek DT, Tang V. Adolescent suicide in Hong Kong during 1980–2000. *Int J Adolesc Med Health*. 2003;15(3):245–65.
 32. Petroni S, Patel V, Patton G. Why is suicide the leading killer of older adolescent girls? *Lancet*. 2015 Nov 21;386(10008):2031–2.
 33. Arslan M, Akçan R, Hilal A, Batuk H, Cekin N. Suicide among children and adolescents: data from Cukurova, Turkey. *Child Psychiatry Hum Dev*. 2007 Dec;38(4):271–7.
 34. Bridge JA, Goldstein TR, Brent DA. Adolescent suicide and suicidal behavior. *J Child Psychol Psychiatry*. 2006;47(3–4):372–94.
 35. Batalis NI, Collins KA. Adolescent death: a 15-year retrospective review. *J Forensic Sci*. 2005 Nov;50(6):1444–9.
 36. Grayaa M, Kort I, Naceur Y, Gharbaoui M, Kouada R, Bekir O, et al. Child homicide in northern Tunisia: a retrospective study of forensic autopsy cases. *Egypt J Forensic Sci*. 2021 Nov 9;11(1):32.
 37. Sauvageau A, Racette S. Child and adolescent victims in forensic autopsy: a 5-year retrospective study. *J Forensic Sci*. 2008 May;53(3):699–702.
 38. Nwafor CC, Ugiagbe EE, Akhiwu WO. A retrospective study of paediatric medicolegal autopsies at the University of Benin Teaching Hospital, Benin City, Nigeria. *Journal of Medicine and Biomedical Research*. 2013 Aug 6;12(1):76–80.
 39. World Health Organization Child mortality and causes of death [Internet]. [cited 2025 Jan 2]. Available from: <https://www.who.int/data/gho/data/themes/topics/topic-details/GHO/child-mortality-and-causes-of-death>