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DAILY, WEEKLY, AND MONTHLY VARIABILITY OF DEATH CASES AMONG WOMEN OF REPRODUCTIVE AGE IN AZERBAIJAN

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The work uses all medical death certificates of women of reproductive age (15–49 years old) in Azerbaijan for 2023. Medical death certificates were distributed by day of the week and month of the year, based on the date of death. In 2023, the average daily number of deaths of women aged 15–49 was 5.63±0.13 (mode 5, median 5, minimum and maximum numbers 0 and 18, respectively). In Azerbaijan, the mortality rate of women of reproductive age varies by calendar days of the year (0–18 cases per day), by days of the week (5.21±0.31 on Tuesdays and 6.40±0.42 on Thursdays), by weeks (3.28±0.56 for June 5–11, 8.28±0.52 for February 13–19), by months (4.83±0.36 in November, 6.77±0.39 in January) and by season (5.28±0.23 in autumn, 6.40±0.26 in winter). The average daily number of deaths is significantly higher on Thursdays. 14 or more deaths were observed on February 2 (Thursday) and August 24 (Thursday). The structure of the causes of death on these days differed significantly from that on other days ($\chi 2$ =2.7; ϑ= 11, P= 0.01) mainly due to the relatively high proportion of diabetes mellitus (5.9 and 0.7 %) and chronic kidney disease (8.8 and 2.7 %), as well as the effects of external causes (20.6 and 15.8 %). The variability of mortality among women of reproductive age over time intervals in Azerbaijan is more likely to be related to medical and organizational problems than to climatic conditions.

Key words: day, week, month, variability, death, woman of reproductive age.

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ДОБОВА, ТИЖНЕВА І МІСЯЧНА ВАРІАБЕЛЬНІСТЬ ВИПАДКІВ СМЕРТІ СЕРЕД ЖІНОК РЕПРОДУКТИВНОГО ВІКУ В АЗЕРБАЙДЖАНІ

У роботі використано всі медичні свідоцтва про смерть жінок репродуктивного віку (15–49 років) в Азербайджані за 2023 рік. Медичні свідоцтва про смерть були розподілені за днями тижня та місяцями року на основі інформації про дату смерті. У 2023 році середньодобова кількість померлих жінок віком 15–49 років становила 5,63±0,13 (мода 5, медіана 5, мінімальна та максимальна кількість відповідно 0 та 18). В Азербайджані смертність жінок репродуктивного віку варіабельна за календарними днями року (0–18 випадків за добу), по днях тижня (5,21±0,31 по вівторках та 6,40±0,42 по четвергах), по тижнях (3,28±0,56 за 5–11 червня, 8,28±0 за 13–19 лютого) (4,83±0,36 у листопаді, 6,77±0,39 у січні) та за сезонами (5,28±0,23 восени, 6,40±0,26 взимку). Середньодобова кількість випадків смерті значно більша по четвергах. 14 і більше випадків смерті спостерігалися 2 лютого (четвер) та 24 серпня (четвер). Структура причин смертності в ці дні суттєво відрізнялася від такої в інші дні (χ^2=2,7; ϑ=11, P=0,01) в основному за рахунок відносно високої частки цукрового діабету (5,9 і 0,7 %) та хронічної хвороби нирок (8,8 і 2,7 %), а також впливу зовнішніх причин (20,6 і 15,8 %). Варіабельність смертності жінок репродуктивного віку за часовими інтервалами в Азербайджані з великою ймовірністю може бути пов'язана з медико-організаційними проблемами, а не з кліматичними умовами.

Ключові слова: доба, тиждень, місяць, варіабельність, смерть, жінка репродуктивного віку.

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The causes of mortality (diseases and external influences) occur unevenly, and the variability of mortality risk is a pattern. This is confirmed by numerous observations of scientists in many countries. Data on the seasonality of the incidence of acute kidney injury and mortality among hospitalized patients [3], stroke [7], mortality by age group [11], injury [15] and others have been published.

The winter increase in mortality from cardiovascular insufficiency is associated with the combined effects of low temperature and high concentrations of nitrogen dioxide in the air [6]. It is believed that temperature changes are especially dangerous for women and the elderly [13]. Attention is drawn to the role of seasonal changes in human behavior in increasing mortality risk [10]. Different trends in the seasonality of mortality from diseases and from external causes have been identified. Cardiovascular diseases are characterized by a winter peak in mortality in Pakistan, while injuries are characterized by a summer peak in mortality [8]. The seasonality of morbidity and mortality is more typical for interstitial lung disease [9] and cardiovascular pathology [2]. The change in the risk of mortality from injury over time in the child population has its own characteristics, with increased risk in summer and on weekends [14]. In Europe, the excess mortality rate has been established, with stable seasonal changes [8]. It is believed that environmental factors may be responsible for the seasonal pattern of cancer mortality risk. The seasonality of neonatal loss risk is described [4]. German scientists have found gender differences in seasonal mortality fluctuations in patients with myocardial infarction [9]. In the USA, for each age and sex group and cause of death, the percentage difference in mortality rates between the months with maximum and minimum mortality was calculated

[5]. We have not found information in the literature on a temporary change in the mortality risk of women of reproductive age.

The purpose of the study was to study the daily, weekly, and monthly variability in mortality among women of reproductive age in Azerbaijan.

Materials and methods. The work uses 2055 medical death certificates of women of reproductive age (15–49 years old) in Azerbaijan for 2023. Medical death certificates were distributed by day of the week and month of the year, based on the date of death. Statistical processing was carried out using descriptive statistical methods, and information was obtained on the average weekly death rate, standard error, standard deviation, mode, median, kurtosis, skewness, minimum, and maximum. The following parameters were calculated: the average daily number of deaths by the end of the year; the average daily number of deaths by day of the week; the average daily number of deaths from the first to the last week of the year; the average daily number of deaths by season (winter, spring, summer, and autumn).

The indicators were compared by day of the week, week, month, and season using a one-factor analysis of variance. When comparing the indicators by day of the week and month of the year in pairs, a two-sample t-test with different variances was used. The calculations were performed using the Excel data analysis package. The descriptive statistics method was used to calculate averages, standard deviations, errors, intervals, variances, kurtosis, skewness, t-criterion, and statistical significance (p). The critical value for statistical significance was assumed to be $p<0.05$.

Results of the study and their discussion. In 2023, the average daily number of deaths of women aged 15–49 was 5.63±0.13 (mode 5, median 5, minimum and maximum numbers 0 and 18, respectively). At the same time, the three-sigma interval (standard deviation=2.45) of daily deaths was 0–13, 14 or more deaths were observed on February 2 (Thursday) and August 24 (Thursday). The structure of the causes of death on these days differed significantly from that on other days (χ^2=2.7; ϑ=11, P=0.01), mainly due to the relatively high proportion of diabetes mellitus (5.9 and 0.7 %) and chronic kidney disease (8.8 and 2.7 %), as well as the effects of external causes (20.6 and 15.8 %). The weather conditions were similar to those in the coming days of February and August. On days of the week, this indicator varied between 5.21±0.31 and 6.40±0.42 (P=0.05).

On Tuesdays and Saturdays, the average daily number of deaths was minimal (5.21 and 5.23), on Sundays and Mondays, it was almost the same (5.71 and 5.73). The average daily number of deaths of women of reproductive age for full weeks of the year (52 full weeks) is shown in Table 1.

Table 1

Average daily number of deaths of women of reproductive age by week

Date	M±m	Date	M±m	Date	M±m
January 2–8	6.14±0.63	May 8–14	6.14±0.91	**S**eptember 4–10	5.57±1.28
January 9–15	6.86±0.98	May15–21	4.71±0.64	September 11–17	4.14±0.59
January 16–22	7.57±1.10	May 22–28	7.42±0.78	September 18–24	5.71±0.74
January 23–29	6.71±0.52	May 29–June 4	6.28±0.56	September 25 to October 1	5.71±0.80
January30–February 5	6.42±1.41	June 5–11	3.28±0.56	October 2–8	5.57±0.64
February 6–12	7.42±0.42	June 12–18	4.85±0.79	October 9–15	5.42±1.08
February 13–19	8.28±0.52	June 19–25	5.57±0.52	October 16–22	4.28±0.80
February 20–26	4.42±0.64	June 26–July 2	5.00±0.57	October 23–29	6.0±0.61
February 27–March 5	5.71±1.06	July 3–9	5.71±0.77	October 30– November 5	5.28±0.71
March6–12	5.14±0.50	July 10–16	6.00±1.19	November 6–12	4.71±0.74
March13–19	7.57±0.89	July 17–23	6.42±1.13	November 13–19	4.28±0.60
March20–26	4.14±0.50	July 24–30	5.42±0.57	November 20–26	4.42±0.89
March 27–April 2	5.57±0.81	July 31–August 6	5.28±0.99	November 27–December 3	4.71±0.86
April 3–9	5.42±0.64	August 7–13	4.71±0.96	December 4–10	6.57±0.92
April 10–16	4.85±0.63	August 14–20	5.71±0.68	December 11–17	5.57±0.10
April 17–23	5.85±1.05	August 21–27	6.71±2.15	December 18–24	6.14±0.129
April 24–30	5.14±1.07	August 28–September 3	5.85±0.98	December 25–31	5.0±0.127
May 1–7	5.71±1.24				

The lowest average daily number of deaths was 3.28±0.56, observed in June (June 5–11). The maximum average daily number of deaths occurred in February (February 13–19) and amounted to 8.28±0.52.

The difference between the minimum and maximum values is significant (p=0.01). The confidence interval (95 %) of the minimum average daily number of deaths is 2.16–4.40, and the maximum average daily number of deaths is 7.24–9.32. The average daily number of deaths above 4.40 (the upper limit of the confidence interval of the minimum average daily number of deaths) and below 7.24 (the lower limit of the confidence interval of the

maximum average daily number of deaths) was observed during most weeks of the year. Above the lower limit of the confidence interval (7.24) of the maximum average daily number of deaths, the indicators were observed in only five weeks (January 16–22, February 16–12 and 13–19, March 13–19, May 22–28). Obviously, there is a higher risk of mortality during these periods of the year.

Based on these data, the variability of the average daily number of deaths by week over the year is significant, and the indicator's change is chaotic. The average daily number of deaths by aggregated intervals (months and seasons of the year) is shown in Table 2.

Table 2

Average daily number of deaths of women of reproductive age by month and season

Months and seasons	Average value	Average error	Median	Minimum	Maximum
January	6.77●	0.39	7	2	11
February	6.60	0.48	6.5	1	14
March	5.83	0.40	5	2	11
April	5.20●	0.40	5	2	10
May	6.12	0.43	6	2	12
June	4.86●	0.31	5	1	8
July	5.64●	0.43	6	0	11
August	5.87	0.60	6	1	18
September	4.96●	0.41	5	0	10
October	5.19●	0.37	5	1	9
November	4.83●	0.36	5	1	8
December	5.64●	0.51	6	1	10
Winter	6.40●	0.26	6.5	1	14
Spring	5.36●	0.23	5	1	12
Summer	5.47●	0.27	5	0	18
Autumn	5.28●	0.23	5	1	10

● $P \leq 0.05$ when comparing the average values of each month and season with the maximum value of the indicator, respectively, by month and season.

Monthly indicators range from 4.86±0.31 to 6.77±0.39 (the minimum and maximum average daily number of deaths, respectively, occur in June and January). Compared with January, the number of deaths was statistically significantly lower in April, June, July, September, October, and November. A comparison of the average daily number of deaths by season reveals a clear trend, as the indicators are similar in spring (5.36±0.23), summer (5.47±0.27), and autumn. The risk of mortality increases significantly only in winter (6.40±0.26).

Thus, the quantitative characterization of deaths of women of reproductive age is manifested by its volatility by days (0–18 cases) of the year. The average daily number of deaths is significantly higher on Thursdays. The weekly trend in the average daily number of deaths is chaotic, with one week in January, two weeks in February, and one week each in March and May characterized by an increased risk of death. In January, February, and May, the average daily number of deaths is relatively higher. Of the seasons of the year, only winter is associated with an increased risk of mortality in women of reproductive age.

Changes in mortality risk over time intervals are most often studied by month [3, 4, 7, 8]. The observation shows that January and March have the highest mortality risk. The lowest all-cause mortality was observed in July – September. According to our data, the mortality of women of reproductive age from all causes was highest in January, February, and May, and the lowest in July, September, and November. It is shown that mortality is higher in January and lower in July. For the first time, our work presents daily deaths of women of reproductive age. Weather conditions on days with a sharp increase in the number of deaths (14 cases on February 2; 18 cases on August 24), with an average daily number of cases per year of 5.6±0.13 (standard deviation of 2.45), did not differ from those on the rest of the days in the corresponding periods. The only difference we found was the different structure of the causes of death. Diabetes mellitus, chronic kidney disease, and injuries dominated the structure of causes of death on these critical days. The sharp increase in deaths on February 2 and August 24 was probably due to inadequate emergency care. The monthly and seasonal variability in mortality among women of reproductive age cannot be attributed to a random increase in deaths during one day in February and August. Moreover, according to our data, the seasonal variability in female mortality (with increased risk in winter, especially in January–February) is not exceptional, as many studies confirm this pattern in other populations. [3, 7, 11, 15].

Limitations: The study's limitation is the relatively short follow-up period (1 year). Monitoring for at least 3 years will be appropriate to exclude bias.

Conclusions

1. In Azerbaijan, the mortality rate of women of reproductive age varies by calendar days of the year (0–18 cases per day), by days of the week (5.21±0.31 on Tuesdays and 6.40±0.42 on Thursdays), by weeks (3.28±0.56 for June 5–11, 8.28±0.52 for February 13–19), by months (4.83±0.36 in November, 6.77±0.39 in January) and by season (5.28±0.23 in autumn, 6.40±0.26 in winter).

2. The average daily number of deaths is significantly higher on Thursdays. 14 or more deaths were observed on February 2 (Thursday) and August 24 (Thursday). The structure of the causes of death on these days differed significantly from that on other days (χ^2=2.7; ϑ=11, P= 0.01), mainly due to the relatively high proportion of diabetes mellitus (5.9 and 0.7 %) and chronic kidney disease (8.8 and 2.7 %), as well as the effects of external causes (20.6 and 15.8 %).

3. The variability of mortality among women of reproductive age over time intervals in Azerbaijan is more likely to be related to medical and organizational problems than to climatic conditions.

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