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ANALYSIS OF FATALITY DUE TO CHOLERA EPIDEMICS IN TULISZKÓW PARISH IN 1852

Workplace: retirement

ABSTRACT

INTRODUCTION. Little is known about the correlation between age, gender-distribution and fatality rate during cholera epidemics.

AIM. To analyze the change in the fatality rate with regard to age and gender during cholera epidemics in 1852 in Tuliszków Parish.

MATERIAL AND METHODS. Data for the present study were retrieved from the archives. Information on fatal cases was obtained from the records of Tuliszków Parish – The Register of Deaths (1851-1879). Age, gender of the deceased and place of residence in Tuliszków Parish were analyzed. Data from the year in which the epidemic occurred (1852) and year preceding it (1851) were compared using Pearson's χ^2 test.

RESULTS. A total of 3200 persons lived in the Roman Catholic Parish of Tuliszków during cholera epidemic in 1852. Having compared to the control year (1851), fatality rate distribution changed statistically significantly in the epidemic year (1852); ($\chi^2 = 27.5665$, $p = 0.0011$). In particular, it applied to males ($\chi^2 = 28.9476$, $p = 0.0007$). Irrespective of the gender, the highest increase of the fatality rate was observed in the 10-25 age group ($\chi^2 = 5.0375$, $p = 0.0248$) while infant fatality rate decreased ($\chi^2 = 19.2789$, $p = 0.0000$).

CONCLUSIONS. Cholera epidemic resulted in a significant change of fatality rate in infants, males and the youth. Death of both parents aged up to 45 years old contributed to an increase in the number of orphans.

Key words*: cholera, epidemic, orphans, fatal cases, Tuliszków*

INTRODUCTION

Bibliographic databases do not provide papers comparing fatality rate distribution with regard to age and gender during cholera epidemic compared to the year in which no fatal cases due to cholera were reported, using Pearson's χ^2 test. Since 1836, at a command of the authorities at that time, the reports concerning cholera epidemic in the Kingdom of Poland were prepared in compliance with a specific scheme (1, 2). They included the number of persons who contracted the disease, recovered, remained sick at that time and died. Until now, publications reported on data as of the 19th century. Irrespective of the fact that cholera epidemic in 1852 resulted in a number of fatal cases, especially in Tuliszków, (3, 4) it was not described separately. Therefore, based on data available in archives and calculation methods that are currently disposed of, this paper analyzes the change in fatality rate in Tuliszków Parish in the year of cholera epidemic, i.e. 1852 compared to the year in which no cholera outbreak occurred.

MATERIAL AND METHODS

To analyze fatal cases occurred in the Roman Catholic Parish of Tuliszków during cholera epidemic in 1852, data from the records of Tuliszków Parish were employed, i.e. deaths as of 1835-1852 (5) and The Register of Deaths (1851-1879) (6). Furthermore, the records of Tuliszków city, which are accessible in the National Archive in Poznań with its Branch in Konin were examined as the territory of Tuliszków Parish at that time belonged administratively to koniński district. Polish medical bibliography, involving papers on cholera which were published in the 19th century, was also reviewed (7). Polish medical bibliography of the Central Medical Library and PubMed were searched, using the following search string: cholera, cholera epidemic, deaths, Tuliszków, 1852, Hospital of the Holy Spirit, Konin.

Having compared the number of deaths in 1844-1855, 1851 was determined as a control year. In 1851, the number of inhabitants, age and gender distribution

were the closest to 1852. Simultaneously, it was the year in which no cholera cases occurred in Tuliszków Parish. Furthermore, the number of fatal cases in 1851 was only slightly lower (77 deaths) compared to the average number of fatal cases (81 deaths) as of 1844-1855, excluding 1852, in which cholera epidemic was reported. All the data from death records for the control group (1851) were readable while in the study group (1852) one fatal case was entered into records twofold (during transcribing it into another register). Furthermore, not all of the data from 406 death records were readable. It was not always possible to determine the gender or age of the deceased. For one case, neither gender nor the age could be established. Therefore, a total of 10 death certificates were excluded from the analysis. As many as 396 death certificates were subject to analysis, including 207 and 189 females and males, respectively. Data from the death certificates expressed in days, weeks or months were calculated into year fractions, adopting 365 days in a year. Having sorted the data as of 1852 by the age at the time of death from the lowest to the highest values, age groups were determined. The bases of division were: subdivision of newborns and infants, age of the deceased, where double-digit turned into single number of deaths (considerable change in the number of deaths), retaining 5-year-intervals. The same age groups for the deceased were adopted in the control year.

Statistical analysis. "0" and "1" were attributed to females and males, respectively. Analysis was performed, using Pearson's χ^2 test in Statistica. Differences were considered to be statistically significant if the value was - $p \leq 0.05$.

RESULTS

An average annual number of deaths in Tuliszków Parish within 11 years, from 1844 to 1855, excluding 1852 (epidemic year) was 81 deaths (Fig. 1). In the Parish, a total of 406 persons died in the epidemic year, including 240 persons from Tuliszków per se. For the Parish, it is 325 and 329 persons more compared to the annual average and the year preceding the epidemic, respectively. In the control year (1851), 77 persons died, including 39 females and 38 males.

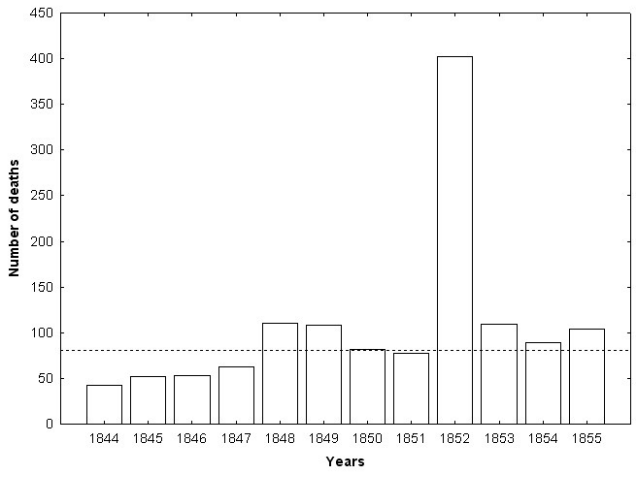

Fig. 1. Annual average number of deaths in Tuliszków Parish within 11 years, 1844- 1855, excluding 1852 (epidemic year)

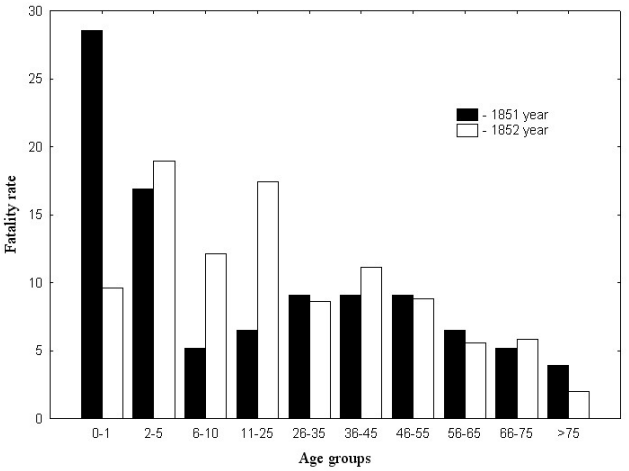

Fig. 2. Fatality rate by age groups in 1851 and 1852 (epidemic year)

Table I. Fatality rate distribution by gender in the epidemic year (1852) and year preceding it (1851) in Tuliszków Parish, Pearson's χ^2 test

Years	X^2	Df	P
1852-1851	27.5665	9	0.0011
1852-1851 (females)	9.1020	9	0.4279
1852-1851 (males)	28.9476	9	0.0007

Figure 2 presents fatality rates in 1851 and 1852 by age groups. Having compared to the control year (1851) ($\chi^2 = 27.5665$, $p = 0.0011$), the distribution of fatality rate changed statistically significantly in the epidemic year (Tab. I). In particular, it applied to males ($\chi^2 = 28.9476$, $p = 0.0007$) (Fig. 3). During the epidemic, the number of deaths in all age groups increased. Increase in

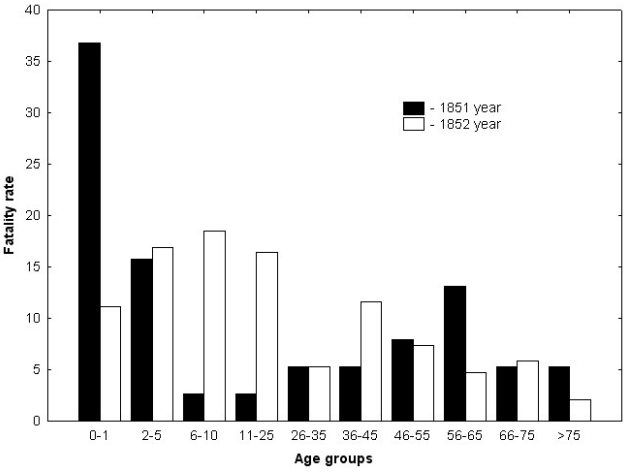

Fig. 3. Fatality rate distribution in males by age groups in 1851 and 1852 (epidemic year)

the fatality rate in the 1-5 age group was lower compared to those aged 6-10 years (Fig. 2). The highest increase of the fatality rate was observed in the 10-25 age group ($\chi^2 = 5.0375$, $p = 0.0248$). Fatality rate in newborns and infants (aged up to 1 year old) considerably decreased ($\chi^2 = 19.2789$, $p = 0.0000$), regardless of the increase in the number of deaths in this group (Tab. II).

Table II. Fatality rate distribution by age group in the epidemic year (1852) and year preceding it (1851) in Tuliszków Parish, Pearson's χ^2 test

Age group (years)	Epidemic year 1852	Control year 1851	X^2	Df	P
0-1	0.0960	0.2857	19.2789	1	0.0000
2-5	0.1894	0.1688	0.0698	1	0.7916
6-10	0.1212	0.0519	2.4924	1	0.1144
11-25	0.1742	0.0649	5.0375	1	0.0248
26-35	0.0859	0.0909	0.0000	1	1.0000
36-45	0.1111	0.0909	0.1038	1	0.7473
46-55	0.0884	0.0909	0.0000	1	1.0000
56-65	0.0556	0.0649	0.0032	1	0.9552
66-75	0.0581	0.0519	0.0000	1	1.0000
>75	0.0202	0.0390	0.3436	1	0.5578

Figure 4 presents the number of deaths in particular months of 1852 and first quarter of 1853. Figure shows that the number of deaths in the year succeeding the epidemic year did not immediately return to the level preceding the epidemic. Figure 5 shows the numbers of deaths in particular weeks of June, July and August of 1852 in Tuliszków Parish, Tuliszków per se and the remaining territory of the Parish. From the figure transpires that beginning from the week 2 of August, the number of deaths increased in villages close to Tuliszków.

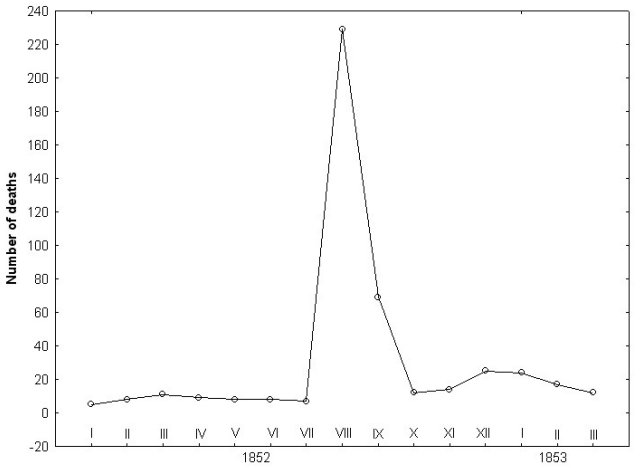

Fig. 4. Number of deaths by months in 1852 (epidemic year) and first quater of 1853 in Tuliszków Parish

DISCUSSION

Having examined the records from the epidemic and period succeeding it, neither information on the onset nor termination of the epidemic in Tuliszków was found. Significant increase in the number of deaths occurred following the week 3 of July (Fig. 5). The maximal number of deaths was reported in August. Increase in the number of deaths in all age groups is in compliance with the observation of *Koellner* (8). He noted that during cholera epidemic in 1866 in Koło "neither age nor character prevented from epidemic; the disease affected both the youth and elderly, the weakest and the strongest individuals, the youngest children and the eldest persons". *Clemens* also confirms the occurrence of infections in all age groups (9).

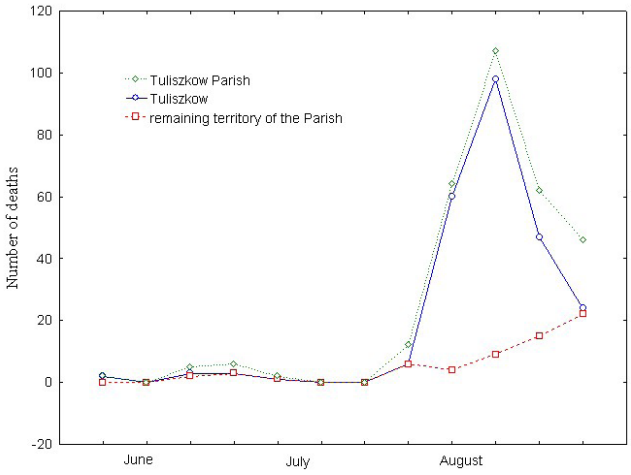

Fig. 5. Number of deaths in the weeks of June, July and August in 1852 (epidemic year)

Despite the fact that there was an increase in the number of deaths in the age group up to 1 year old, fatality rate compared to its value in the remaining age groups considerably decreased ($\chi^2 = 19.2789$, $p = 0.0000$). According to *Borkowski,* no infections are reported in infants in endemic areas (10). In Poland, however, Asian cholera does not occur endemically. It was first reported in the Kingdom of Poland on the 26th November in 1830 in Hrubieszów and was introduced by the Russian Kremenczucki Regiment (11). Beyond the territory of the Kingdom of Poland, it occurred in Gdańsk on the 27th May 1831, when the ship from Riga entered the port (12). In countries, where cholera is endemic or epidemic, it was observed that newborns and infants who are breastfed contract the disease relatively rarely or the disease is of mild course (13). *Qureshi* et al., who observed children aged less than 3 years old during cholera epidemic demonstrated that breastfeeding does not prevent from infection with *V. cholerae,* however, it protects against disease progression (14). Sialyllactose, which is present in the mother's milk, play a significant role in the neutralization of cholera toxin (15). In non-endemic areas, a small percentage of persons have natural antibodies against *V. cholerae* (14). Furthermore, IgG antibodies, which are of im-

portance in neutralizing the cholera toxin (16), begin to appear on the day 21 following the infection (17). In the 1-5 age group, only younger children are breastfed. Consequently, the remaining children are not protected sufficiently against the infection. Therefore, no statistically significant decrease in the number of deaths was reported in this age group and its increase was lower compared to the 6-10 age group.

Irrespective of the gender, a considerable increase of the deaths ($\chi^2 = 5.0375$, $p = 0.0248$) was reported in the 11-25 age group (Fig. 2). It could result from several factors. In many articles, water and food contaminated with *V. cholerae* are considered to be the main source of infection (18-22). Data published by *Dzierżawski,* however, raise interest (23). From the data transpires that during the cholera epidemic in 1867 in Warsaw (Tab. III), the highest percentage of infections (19.6%) and fatality rate (42.7%.) were noted in prostitutes. In PubMed, only one article was found (24), in which there is only a reference that during cholera epidemic in Paris in 1832 an increased number of infections was reported in prostitutes. High percentage of infections and deaths in prostitutes suggest a correlation between sexual behaviours and deaths due to cholera. Such behaviours in the 10-25 age group are manifested by the youth and young adults. It could result in the increase in the number of infections, and consequently increased percentage of deaths. Mild or severe course of disease (frequently leading to death) is associated, i.a. with immunity status of individuals. *Gałązka* et al. demonstrated that persons vaccinated with a suspension of *V. cholerae* inactivated with formaldehyde (*Vaccinum cholericum*) display different activity of IgG and IgM antibodies in the elderly and younger individuals. Contrary to the elderly, younger individuals reacted with an increased IgM activity (25). Studies on purified human IgM demonstrated that it does not neutralize cholera toxin (16). Thus, young individuals are more prone to the action of *V. cholerae* enterotoxin which underlies the pathogenesis of the disease.

Table III. Infections and deaths in selected professional groups during cholera epidemic in Warsaw in 1867 based on Dzierżawski's data [23]

Profession	Total	Number of infections	Infections (%)	Fatal cases (%)
Prostitutes	598	117	19.6	42.7
Labourers	14554	1165	8	38.9
Feldshers	497	25	5	20
Housekeepers	20783	899	4.3	27.2
Merchants	8782	366	4.2	22.9
Tailors	2489	83	3.3	26.5

A significant change in the distribution of fatality rate was observed in males ($\chi^2 = 28.9476$, $p = 0.0007$). Cholera epidemic in 1852 in Tuliszków and its surroundings occurred in summer months in which there are high temperatures and field works. Working in a high temperature enhances the thirst and desire to drink frequently. To a larger extent, more hard field work was done by males, thus, it increased the probability of drinking a beverage contaminated with *V. cholerae*. It had an impact on the increase in the number of infections and ,consequently, the number of deaths in males. Such finding remains in compliance with the data published by *Dzierżawski* (23), which confirm a high percentage of infections (8%) and deaths (38.9%) in labourers (Tab. III).

Figure 2 shows that high fatality rate was reported in individuals aged up to 45 years old. It is associated with a risk of death of both parents and children bereave-

Photograph 1. Anna Bilińska – Bohdanowicz. Children wakening up their deceased mother (around 1880). Oil, canvas 68 × 95 [cm]. Private collection. In the deposit of the National Museum in Kraków.

ment (3, 26). Such conclusion is confirmed in a letter, in which the Commissioner of Koniński Oblast recommended village heads and mayors to assign wandering boys aged 7-16 years old to "canton schools" (27). A document remained in Konin city records in which it is stated that in case of 15 families both parents died, leaving their children without means securing the life (28). Out of 583 individuals who died due to cholera in Konin in 1852, it constituted 2.6% (29). Occurrence of a number of orphans following cholera epidemic was reflected in Polish painting of the 19th century (Photograph 1).

A lack of entries on the cause of death in death certificates and data on the onset and termination of cholera epidemic in Tuliszków Parish made impossible to compare the deaths due to cholera with deaths due to different causes in the comparative year (1851). Thus, the data on deaths in 1852 and 1851 were compared. Having considered the number of parish's inhabitants (3200 persons) and statistical error in calculations, however, the results should be considered as reliable. The results, collected on a basis of data from the death certificates, are to a large extent compatible with the data which could be obtained from other records present in archives. They enable to reproduce the course of cholera epidemic in Tuliszków Parish (Fig.4 and 5).

SUMMARY

This paper is the first to compare the number of deaths during cholera epidemic and the year in which epidemic was not present. Compared to the control year, fatality rate distribution changed considerably in infants, males and young persons. The death of both parents aged up to 45 years old resulted in an increased number of orphans.

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Author of the present article declares that he has no competing interests.

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