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Article

Assessing the Impact: Mortality from Infectious Disease in Trnava (1911 - 1941) through a Medical Geography Lens

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ABSTRACT

This study examines mortality from infectious diseases in the Municipality of Trnava between 1911 and 1941. Conducted at the Historical Archive in Kraljevo (Serbia), the research employs historical-demographic, medical-geographic, and demographic-statistical methods. The Municipality of Trnava existed from 1839 to 1945 and encompassed six villages situated between the southeastern slopes of Golija and the Raska River valley. Analyzing the determinants of health, the population in the early decades of the 20th century faced significant challenges, including poverty, unsanitary living conditions, limited access to education, and high illiteracy rates. These adverse conditions were exacerbated by the wartime environment from 1912 to 1918, which further deteriorated living standards. The concentration of a large population in restricted areas accelerated the rapid spread of infectious diseases. The typhus epidemic in early 1915 and the Spanish flu pandemic at the end of World War I led to substantial mortality in the municipality. Local epidemics of scarlet fever, diphtheria, dysentery, and smallpox also affected mortality. This study enhances our understanding of the historical dynamics of infectious disease mortality, highlighting the interplay between environmental, geopolitical, and socio-economic determinants of health in comparable contemporary contexts.

KEYWORDS

Infectious diseases; mortality; epidemic; medical geography; Trnava.



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1. Introduction

In terms of demographic and epidemiologic transition, the first half of the 20th century in Europe is a hinge period, with infectious disease mortality still dominant early on, then falling unevenly across countries and causes. Dramatic crises and slow-moving structural changes in public health, sanitation, medical innovation, and living conditions punctuated this period.

The largest acute infectious disease outbreak in this period was the Spanish flu, which occurred in 1918-1919 and was associated with the highest mortality burden in recent history (Chowell et al., 2014). Spanish flu also known as 1918 influenza pandemic, caused between 20 and 50 million deaths (Johnson & Mueller, 2002).

The influenza pandemic of the First World War spread rapidly through military camps and trenches, infecting millions of soldiers worldwide and resulting in the deaths of approximately 100,000 troops. Its precise impact on the conflict's outcome remains uncertain. The highest morbidity was recorded among American forces in France during the Meuse-Argonne offensive on the Western Front (September

15 – November 15, 1918), when more than one million U.S. soldiers contracted the disease (Shanks, 2015; Martini et al., 2019). At the time, the overall healthcare burden of influenza was poorly understood. Several factors were thought to increase the risk of severe infection, including length of military service, ethnicity, poor hygiene (such as unclean dishes), the presence of flies and dust, overcrowding, and adverse weather conditions. In densely populated camps, the likelihood of contracting influenza and its primary complication—pneumonia—was estimated to be ten times higher. Bacterial pneumonia secondary to influenza was the predominant cause of death, driven by increased vulnerability resulting from transient immunopathological effects and dysregulated cellular immune responses to infection (Fornasin et al. 20188; Nickol & Kindrachuk, 2019; Martini et al., 2019).

In addition to influenza, other infectious diseases such as typhus, tuberculosis, diphtheria, and scarlet fever remained persistent public health threats. These diseases were associated with high morbidity and mortality rates too (Wong & Yuen, 2012; Angelakis & Bechah, 2016; Barberis et al., 2017).

In the regional context, Southeastern Europe experienced an uneven transition through the epidemic. Wars, political instability, economic underdevelopment, and weak health infrastructures delayed the decline of infectious mortality compared to Western Europe. Investigating cause-specific mortality patterns before 1950 remains challenging, as data are primarily derived from fragmented and incomplete historical sources, church records, and early vital statistics. Consequently, research on mortality due to infectious disease in the Balkans during this critical transitional period is still scarce, leaving significant gaps in the understanding of regional health inequalities and historical mortality dynamics. Therefore, the paper aims to explore demographic losses due to mortality from infectious diseases in the area of the Trnava municipality in the period from 1911 to 1941, based on previous research and primary sources - archival materials.

In Serbia, only a limited number of studies have examined mortality in the past (Radivojević & Penev, 2014; Vuletić, 2022; Todorović et al., 2023). Through historical research into the Raska region (and the municipality of Trnava), Virijević (2000 and 2013) studied the administrative-territorial organization and demographic trends of the Trnava municipality, as well as the economic, educational, hygienic, and health conditions of the towns of Raska and the Studenica District. Also, more extensive demographic research of the municipality of Trnava was conducted by Medojević and Premović (2025), focusing on the movement of the total population, the number of households, and the mortality rate.

2. Materials and Methods

2.1. Study Area

Based on the Law on the Organization of Municipalities and Municipal Authorities, which was passed in 1839, two municipalities were formed in the area between the southeastern slopes of Golijska and the Raska River: Trnava and Plesin. Both municipalities consisted of three villages each: Trnava, Vrtine, and Nosoljin made up the Trnava municipality, while Plesin, Brkuse, and Borojevici made up the Plesin municipality. This administrative-territorial organization existed until January 31, 1899, when, based on the Administrative-Territorial Organization of Districts and Counties of the Kingdom of Serbia, the municipality of Plesin was abolished and its territory was annexed to the municipality of Trnava. The newly created municipality of Trnava consisted of six villages and covered an area of 145 km². The Municipality of Trnava was abolished by the Law on the Administrative Division of Serbia, adopted on September 1, 1945 (Медојевић & Премовић, 2025). Trnava, which served as the municipal center between 1839 and 1945, is today a village located in the municipality of Raska,



Figure 1. Map of the current municipality of Raska with the villages that made up the Trnava municipality from 1899 to 1945. Source: (Медојевић & Премовић, 2025)

2.2. Data Sources and Analysis

The subject of the study, mortality from infectious diseases in the municipality of Trnava from 1911 to 1941, is based on archival research conducted at the Historical Archives of Kraljevo. For this research, archival materials from three funds were used: Fund: Trnava Municipal Court 1892-1918, box number 6; Fund: Municipality of Trnava 1918 – 1941, boxes number 7, 8, 10, 12, 13 and 14; and Fund: Religious institutions and organizations - archival books of the Church in Trnava 1911 - 1949: parish registers for the period from 1911 to 1935 and parish registers for the period from 1936 to 1949.

Data on the total number of deaths were collected and analysed, excluding neonatal mortality.

Analysis of mortality from infectious diseases is based on two phases. The first part examines earlier research on the demographic and social characteristics of Trnava to better understand the conditions and health determinants that contributed to the emergence and spread of infectious diseases. The second part concerns the analysis of mortality from infectious diseases from 1911 to 1941. After the data were grouped into statistical series, results were presented in tables and graphs, using absolute values.

3. Results and Discussion

3.1. Demographic Characteristics of the Population in the Municipality of Trnava

The natural dynamics of the population entirely determined the demographic development of the municipality of Trnava and resulted from the difference between natural growth and migration flows (Медојевић & Милосављевић, 2021, p. 106). The Trnava municipality had its highest population in 1910, with 2,925 residents, while in 1920 the number of residents was 466 fewer, representing an absolute decrease of 15.93%. The trend of population decline continued in the third decade of the 20th century, primarily due to high mortality among young people aged 19 and under. In 1927, the municipality of Trnava recorded its lowest population during the interwar period, with 2,423 people registered. Only in the early 1930s, due to a decrease in the general mortality rate, the population increased, so that in 1931, 2,668 people lived in the municipality (Медојевић & Премовић, 2025).

Hypsometric research indicates that the most significant decrease in population between 1910 and 1927 was recorded in the villages of Boroviće, Plesin, and Sebitmlje, located at altitudes above 1,000 meters. The combined decrease in population in these villages accounted for 70.92% of the total decrease in population in the Trnava municipality. The villages of Trnava, Milatkovice, and Nosoljin at lower altitudes contributed 29.08% to the overall population decline. The population decline at the village level was: Borovice 157 (26.57%), Plesin 108 (20.53%), Sebitmlje 91 (21.77%), Nosoljin 59 (15.36%), Trnava 57 (10.52%), and Milatkovice 30 (6.47%). After 1927, there are no preserved data available to monitor demographic trends at the village level of the Trnava municipality (Table 1) (Сочанац, 2006, pp. 54 - 56; Медојевић & Премовић, 2025).

Table 1. Hypsometric distribution of the population in the villages of the Trnava municipality from 1910 to 1927

Village	Altitude	1910	1920	1927
Borovice	1000 m	591	446	434
Milatkovice	550 m	464	434	434
Nosoljin	440 m	384	326	325
Plesin	1100 m	526	424	418
Sebitmlje	1020 m	418	335	327
Trnava	690 m	542	494	485
Total	/	2.925	2.459	2.423

Source: Сочанац, 2006, pp. 54 - 56; Медојевић & Премовић, 2025

The demographic losses of the Trnava municipality during the Balkan Wars and World War I had the most severe consequences for the population's biological structure (gender and age). According to the 1910 census, 1,510 men (51.62%) and 1,415 women (48.38%) lived in the Trnava municipality. In 1927, in the municipality, there were 1,172 men (48.37%) and 1,251 women (51.63%) (2; 3). A comparative analysis between 1910 and 1927 shows that the number of men decreased by 338 (22.38%) in 17 years, while the number of women decreased by 164 (11.59%). According to the last population

census in the Kingdom of Yugoslavia in 1931, there were 1,308 men and 1,360 women living in the Trnava municipality, representing an increase in the number of inhabitants in both genders compared to the 1927 data (Виријевић, 2000, p. 17). During this period, the number of men increased by 136 (11.60%), while the number of women increased by 109 (8.71%). Overall, from 1910 to 1931, the number of males decreased by 202 (13.38%), and the number of females decreased by 55 (3.89%) (Table 2).

Table 2. Total number of population by age (1910-1927) and life expectancy (1911-1941) in the municipality of Trnava

Year/Period	Total number of the population	
	Male	Female
1910	1510	1415
1921	1172	1251
1927	1308	1360
Life expectancy		
	Male	Female
1911-1920	34.62	35.45
1921-1930	32.9	36.35
1931-1941	37.47	40.66

Source: archive sources 2, 3, and 7; Виријевић, 2000, p. 17.

The data on the population killed, deceased, and missing from the municipality of Trnava during the wars from 1912 to 1918 contain the names of 135 conscripts (soldiers and civilians aged 20 to 60). According to the age structure of the victims, 35 were between 20 and 30 years old, 40 were between 31 and 40 years old, 55 were between 41 and 50 years old, and only four were between 51 and 60 years old. Of the total of 131 victims of military conscription for whom there is data on marital status, 102 were married, 28 were single, while one was a widower. The married conscripts who died in the war left behind 192 orphans (archive sources 4, 5, 6).

The average life expectancy of the population in Trnava municipality is influenced by high mortality rates among young people under 19, significant deaths from infectious diseases, and wartime hardships among males. Those who survived childhood could expect to live over 60 years. However, wars and epidemics like typhus and the Spanish flu caused frequent spikes in mortality across the entire population. Of the 1,612 residents of Trnava who died between 1911 and 1941, records show the length of life for 1,581 individuals. During the second decade of the 20th century, due to wars and epidemics, the lowest average life expectancy was observed—35.45 years for women and 34.62 years for men. Between 1921 and 1930, the gap in average life expectancy between women and men widened from 0.83 years in the previous decade to 3.45 years. A major factor contributing to this increased gap was the high mortality among the under-19 age group in both populations. Among females, there were 83 deaths in this age group, representing 37.22%, while among males, 97 deaths occurred, accounting for 48.99%. From 1931 to 1941, declining mortality from infectious diseases increased life expectancy for both sexes. Overall, from 1911 to 1941, women's life expectancy rose by 5.21 years, and men's increased by 2.85 years (Table 2) (archive source 7).

The lack of more precise information about the social structure of the Trnava municipality's population is one of the biggest problems in understanding the circumstances that influenced the emergence and spread of infectious diseases in the interwar period. In the population census conducted in 1931, data related to social structure were not provided at the municipal level, but at the district level, which from today's perspective makes it difficult to view the overall living conditions of that

time and understand the cause-and-effect relationships between health determinants on the one hand and mortality from infectious diseases on the other (Виријевић, 2013, p. 94).

The largest share of residents in the Trnava municipality was engaged in agriculture. Their situation was especially difficult during the three-year occupation during the First World War, when the enemy carried out ruthless looting of livestock, fodder, agricultural tools, and other inventory. Out of a total of 504 households in the municipality at the beginning of 1919, 400 were without cattle, while 60 families did not have food for their basic diet. In such circumstances, the restoration of livestock and the acquisition of agricultural tools proceeded very slowly, leaving many farmers too impoverished to afford grain seeds for sowing (Виријевић, 2000, pp. 18, 24, 25). In addition, natural disasters such as hail and drought, as well as the appearance of livestock diseases, further slowed down the recovery (archive sources 8, 9).

The primary task of agricultural production was to provide food for the local population, which, due to livestock devastation, relied on crops. Of the plant crops, cereals were the most widely grown. In the villages of Trnava, Milatkovice, and Nosoljin, which were located at lower altitudes, corn and wheat were mainly grown. In contrast, in the villages of Plesin and Borovice, at higher altitudes, where the vegetation cycle was shorter, oats were mostly sown. Villages that achieved higher per capita wheat and corn production had lower mortality, and vice versa.

According to the data in 1927, wheat production in kilograms per capita at the village level of the Trnava municipality was: Milatkovice 27.65, Nosoljin 24.62, Trnava 16.49, Plesin 7.18, Sebimlje 6.12, and Borovice 4.61, while corn production in kilograms per capita was: Milatkovice 80.65, Nosoljin 36.92, Trnava 30.93, Sebimlje 6.12, Borovice 4.61, and Plesin 2.39 (3). There were 51 watermills in the municipality (Медојевић & Премовић, 2025).

Farmers who, in addition to their primary occupation, also earned income through additional work in other activities were in a somewhat more favorable economic position. In 1928, there were eight such persons in the municipality, who owned: two taverns, two woodturners, a carpentry shop, a blacksmith shop, and two watermills (archive source 10). Among the residents of the Trnava municipality who did not earn their income through agricultural work, but whose primary occupations were related to other economic activities, there were five merchants and one innkeeper (archive source 11). An analysis of mortality among the population that earned its income entirely or partially from non-agricultural activities showed no deaths from infectious diseases, indicating a possible correlation between the population's socio-economic status and mortality from infectious diseases (archive source 12).

When it came to food supply, state officials were in a far better position than farmers. In addition to teachers and priests, the following employees in the public administration also had the status of state officials: the president of the municipal court, six village serfs, the clerk of the municipal court, the treasurer of the municipal court, the keeper of the municipal forests, the postal horseman, the office clerk, six village clerks, the municipal postman, and the manager for the animal food (Медојевић & Премовић, 2025). Apart from the municipal postman and the manager for the animal food, who were paid on a part-time basis for the work they performed, other employees in the administrative department received regular salaries. An analysis of the average prices of wheat and corn led to the conclusion that the highest annual salary in the administrative department could buy 2,526 kilograms of wheat, or 2,909 kilograms of corn, while the annual salary of the lowest-paid civil servants could buy 316 kilograms of wheat, or 364 kilograms of corn (Виријевић, 2000, p. 53; archive source 13).

In the Trnava municipality, the number of literate people in 1919 was 1,168, which represented 40.36% of the population registered in 1910 (Виријевић, 2000, p. 168). After the end of World War I, conditions were created for schools to resume their work. The school in Trnava began operating in 1919 (archive source 14). However, due to labor shortages in the fields, limited education, and cultural prejudices, a large number of parents during the interwar period were reluctant to send their children to school (archive source 15).

There were no health institutions in the Trnava municipality, so its residents were treated at the district hospital in Raska. The director of the district hospital also served as the district doctor for the

Trnava municipality from 1924 (Медојевић & Премовић, 2025). The cost of one day of inpatient treatment at the district hospital in Raska was three dinars (archive source 16).

Hygiene conditions varied across households and were largely determined by socioeconomic status, education, and cultural habits. Accordingly, awareness of the importance of hygiene was far greater among the literate population than among the illiterate, among people who served in the military than among those who did not, and among the small population for whom agriculture was not their primary occupation. Personal hygiene, such as washing and bathing, was not maintained regularly. In many cases, people did not wash for a week, and in the winter months, due to the cold water, even for a month. Bathing was done in the river in the summer months, while in the winter months, bathing was mainly limited to standing up to the waist, with the rare use of soap. Changing clothes was done once a week, usually on Sundays. The hygiene of the cutlery was also low. All household members most often ate from the same bowl, which was rarely washed with hot water and soap (Вирџевић, 2000, pp. 194, 195, 196). According to the 1927 data sources, 477 households were registered in the municipality's territory, with an average of 5.08 household members. In the six villages of the Trnava municipality, there were a total of 170 wells, cisterns, fountains, and sources of drinking water (Медојевић & Премовић, 2025). The water hygiene test was conducted at the Public Health Center in Novi Pazar (archive source 17).

3.2. General Characteristics Of Mortality From Infectious Diseases

Between 1911 and 1941, infectious diseases were a major cause of mortality in the municipality of Trnava, as 684 deaths (42.43% of the total) were attributed to infectious diseases. The highest number of deaths from infectious diseases was recorded in 1915 at 149, while the lowest was recorded in 1930 at 2 (Table 3) (archive source 7).

In the deadliest year of 1915, with 79 deaths, typhus was the leading cause of mortality, especially among the population aged between 20 and 50. Of the other infectious diseases, diphtheria left a fatal mark with 47 deaths, scarlet fever caused the death of 10 people, eight died of smallpox, two each from tuberculosis and dysentery, and one resident of the Trnava municipality died of influenza (archive source 18).

During World War I, a total of 263 inhabitants of Trnava died from infectious diseases, i.e., the cause of 38.45% of all deaths was one of the infectious diseases in the period between 1911 and 1941 (archive source 19).

Table 3. All-cause mortality and mortality from infectious diseases in the municipality of Trnava, 1911-1941

	1911	1915	1918	1923	1929	1935	1941
All-cause mortality	60	191	88	62	43	42	61
Mortality from infectious diseases	20	149	71	31	15	20	17

Source: archive source 7.

Registration of deceased persons was the responsibility of parish priests, and the causes of death should have been determined by the municipal doctor, or, in the case of the Trnava municipality, the county doctor, based on the application of relatives (Кривошејев, 2022). An inspection of the two death registers shows that tuberculosis, i.e., consumption, and pulmonary tuberculosis were the most common causes of death in years when there was no high mortality due to the effects of an epidemic. Common causes of death were cough and whooping cough, followed by dysentery, i.e., heart disease, scarlet fever, and diphtheria in children. Other causes of death include flu or influenza, smallpox/measles, jaundice, malaria, scrofula, ectopic pregnancy, tuberculosis of the bones, canker sores, intestinal tuberculosis, black pimples, and syphilis. In addition, in several cases where

the cause of death could not be determined most precisely, there are two diagnoses, such as scarlet fever and sore throat, flu and jaundice, and flu with inflammation (Figure 2) (archive source 7). The typhus epidemic in the first half of 1915 and the Spanish flu pandemic in the last two months of 1918 caused mass deaths (archive source 20).

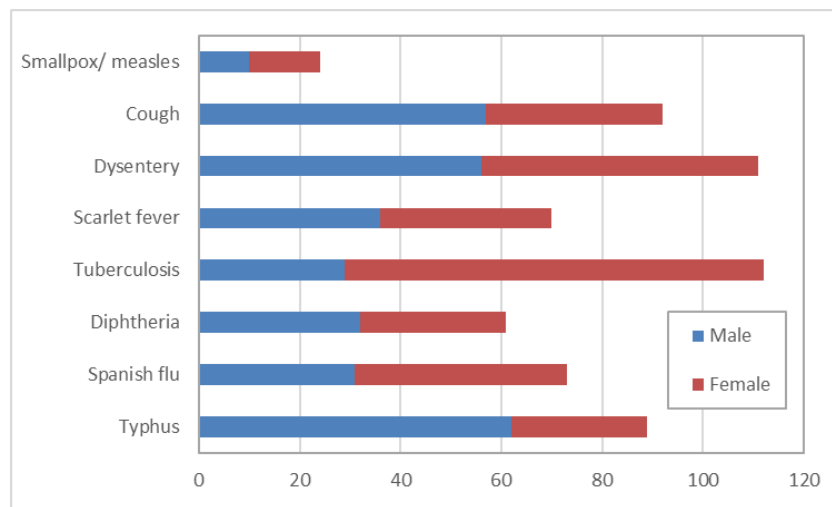


Figure 2. Mortality from infectious diseases by gender in the municipality of Trnava, 1911-1941 (Source: archive source 7)

In the total number of deaths from infectious diseases in the period from 1911 to 1941, slightly higher mortality was recorded in the female population, with a total of 346 deaths, while the number of dead men in the same period amounted to 388. Observed in the villages of the municipality of Trnava, higher mortality among the female population was recorded in Plesin, Boroviće, and Sebimilje. In comparison, higher mortality was recorded with the male population in the villages of Trnava, Nosoljin, and Milatkovice. In total, the highest mortality from infectious diseases was recorded in Plesin, where a total of 186 people died, while the lowest mortality rate was recorded in the village of Milatkovice, where the total number of people who died of infectious diseases during this period was 55 (Figure 3) (archive source 7). In addition to the primary patterns of mortality from infectious diseases, differences in mortality between Plesin and Milatkovice can also be found in the correlation between the quantity of deaths and the distance of the village from the district hospital in Raska. The distance between Plesin and Raska was a four-hour walk, while the distance between Milatkovice and Raska was half that, at two hours' walk (Медојевић & Премовић, 2025).

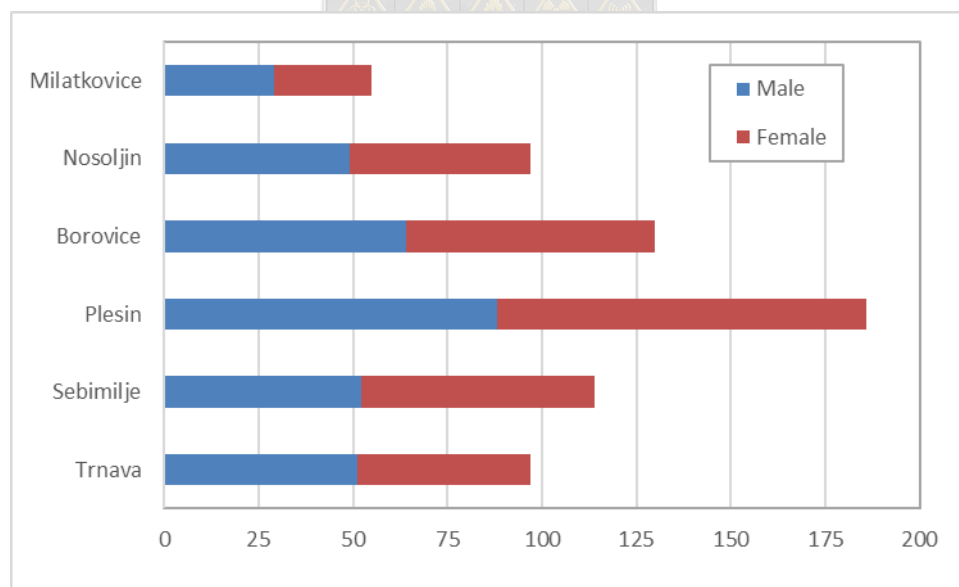


Figure 3. Mortality from infectious diseases by gender and villages in the municipality of Trnava, 1911-1941 (Source: archive source 7)

High mortality among young people under the age of 19 was an important demographic feature of the municipality of Trnava during the second, third, and fourth decades of the 20th century. Within this age group, the highest number of deaths was recorded among children under the age of one and amounted to 186, followed by children aged 2 to 6 with a total of 122 deaths, which is the lowest mortality within this age category. However, it was also extremely high, recorded in the population aged 7 to 19 years, in which the number of deaths was 114. The highest number of deaths from infectious diseases among the population aged up to 19 years was recorded in 1915, 1918, 1922, and 1923. In these four years, due to mortality caused mostly by diphtheria, Spanish flu, and scarlet fever, a total of 150 people, i.e. 35.55% of all deaths caused by infectious diseases, of this age category of the population in the period between 1911 and 1941 (archive source 7).

In the age group between 20 and 59 years, the total number of deaths from infectious diseases was 216. The highest number of fatal cases was recorded in 1915 and was mostly caused by the typhus epidemic. In this year, from infectious diseases, a total of 76 people died, i.e. 35.19% of all deaths in this age group that are correlated with infectious diseases in the thirty-year period. In the population aged 60 and over, the number of deaths related to infectious diseases was the smallest, and was only 40. The deadliest year for this age group was in 1918, when it was to the greatest extent due to the pandemic of the Spanish flu. In this year, 14 people died from infectious diseases, which is 35% of all deaths that were the result of contracting infectious diseases in the period between 1911 and 1941 (archive source 7).

3.3. Mortality from Infectious Diseases among Soldiers in the Municipality of Trnava

The war period from 1912 to 1918 favored the appearance and spread of various diseases. The high mortality of soldiers, in addition to the poor hygienic conditions caused by the state of war, was also influenced by the belated modernization of healthcare, given that Serbian doctors were educated in the countries of Western Europe, while the Faculty of Medicine in Belgrade was founded in 1919. In such conditions, at the beginning of World War I, 534 doctors were recruited by the army, of whom 132 (24.9%) died by the end of the war (Антић, 2021). The number of doctors was too small for effective health care, considering that in Serbia in 1914, there were 30,000 regular army soldiers and over 400,000 mobilized soldiers in the war (Станојевић, 1958). Already in the fall of 1914, the Serbian military medical service found itself in a difficult situation when mass sickness and death from typhus began, which lasted until the end of May 1915, in which, according to Russian testimonies, between 30,000 and 35,000 Serbian soldiers died (Радивојевић, 2021). In such a situation, the Government and the Red Cross of the Kingdom of Serbia sent an appeal for help, which was responded to by medical missions from Russia, Great Britain, Canada, Greece, Australia, New Zealand, Switzerland, the USA, the Netherlands, and Denmark (Лопичић Јанчић & Васић, 2019).

A total of 89 soldiers from the Trnava municipality territory died in the wars from 1912 to 1918, which was 3.08% of the population enumerated in 1910. The largest number of deceased soldiers, 60.67% of them died from various infectious diseases, while 22.47% soldiers died on the front in direct conflict with the enemy (Table 4) (archive source 1).

Table 4. Mortality by cause of death among soldiers in the municipality of Trnava, 1912-1918

	Died in the war	Died from infectious diseases	Died from non-infectious diseases	Unknown cause of death
Total number of deaths	20	54	7	8

Source: archive source 1

The typhus epidemic caused the highest mortality among soldiers in the Trnava municipality (Figure 4). At the beginning of the epidemic in December 1914, most of the deaths among the soldiers were from relapsing fever, while louse-borne typhus was the leading cause of death in the deadliest

period of the epidemic from February to April 1915, in which 33 soldiers died. After May 1915, mortality from typhus was sporadic, with one death each in June and July 1915 and January 1916. Trnava soldiers died from other infectious diseases: diphtheria, pox, dysentery, tuberculosis, and influenza (archive source 18).

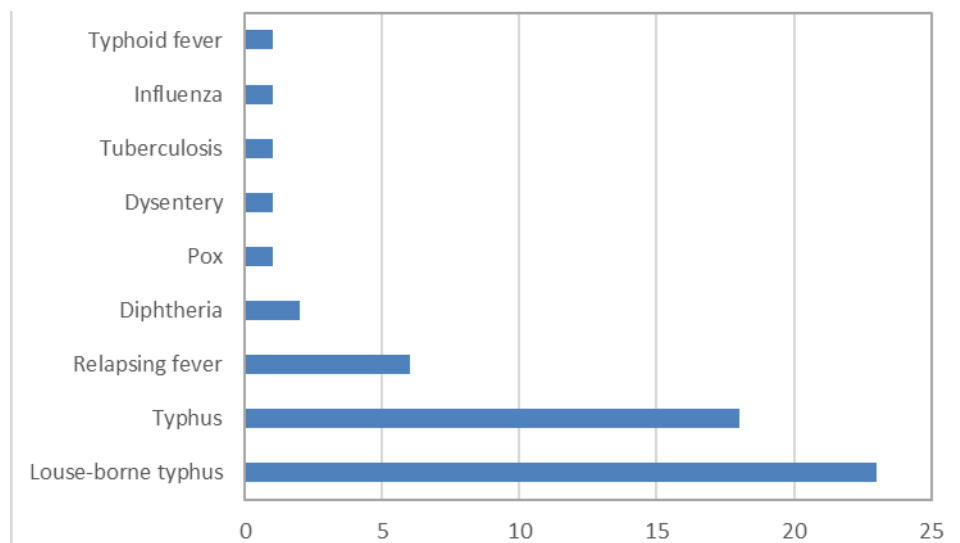


Figure 4. Mortality from infectious diseases among soldiers in the municipality of Trnava, 1912-1918 (Source: 18)

The largest number of soldiers whose deaths were the result of infectious diseases, 14 of them died in their homes while they were receiving home treatment. In contrast, the rest of the soldiers died in military hospitals, divisional, camp hospitals, temporary and district hospitals located in: Prizren, Belgrade, Kosovska Mitrovica, Uzice, Krusevac, Kragujevac, Kraljevo, Bitola, Varadiste, Vele, Dolac, Novi Pazar, Grocka, Beli Potok, Skopje, Ripanj, Kladovo, Raska, and Kavaja (Albania) (archive source 21).

3.4. Typhus Epidemic in 1915

The typhus epidemic that appeared in Serbia during World War I lasted from December 1914 to the end of May 1915 and was most likely caused by the capture of Austro-Hungarian soldiers, who brought typhus on lice. Basic characteristic of the epidemic was the mass occurrence of three different diseases that had similar symptoms and names: typhoid fever, which occurs sporadically both before and after the epidemic appeared among the population, relapsing typhus or relapsing fever, and louse-borne typhus, which was also the most deadly, so the epidemic was mostly attributed to this. Appearance of louse-borne typhus was first observed in southern Serbia in the fall of 1914, and after the Battle of Kolubara, it led to mass illness and death in the Valjevo hospital. By sending Serbian soldiers to home treatment, the typhus epidemic spread throughout the country of Serbia (Кривошејев, 2023).

In the period between January and May 1915, 14 soldiers, who were receiving home treatment due to typhus, died in the villages of the municipality of Trnava. The largest number of soldiers died is in the villages of Plesin, Borovice, and Trnava, four each, then in the village of Sebimilje, two. At the same time, in the villages of Milatkovice and Nosoljin, there were no deceased soldiers receiving home treatment. The first death due to a typhus epidemic in the Trnava municipality was recorded in the village of Plesin in January 1915. The epidemic soon spread to other villages where soldiers who were treated for typhus died, first Sebimilje, and then Borovice and Trnava. High mortality due to the typhus epidemic lasted until the beginning of June 1915, when the last victim of the epidemic died in the village of Plesin (archive source 18).

The typhus epidemic in the territory of the Trnava municipality claimed 46 lives without counting mobilized soldiers who died of typhus in other places. According to the causes of origin and the directions of the

spread of the typhus epidemic, the highest mortality among the villages of the municipality of Trnava was recorded in Plesin. At the same time, the fewest deaths occurred in Milatkovice (Figure 5) (archive source 18).

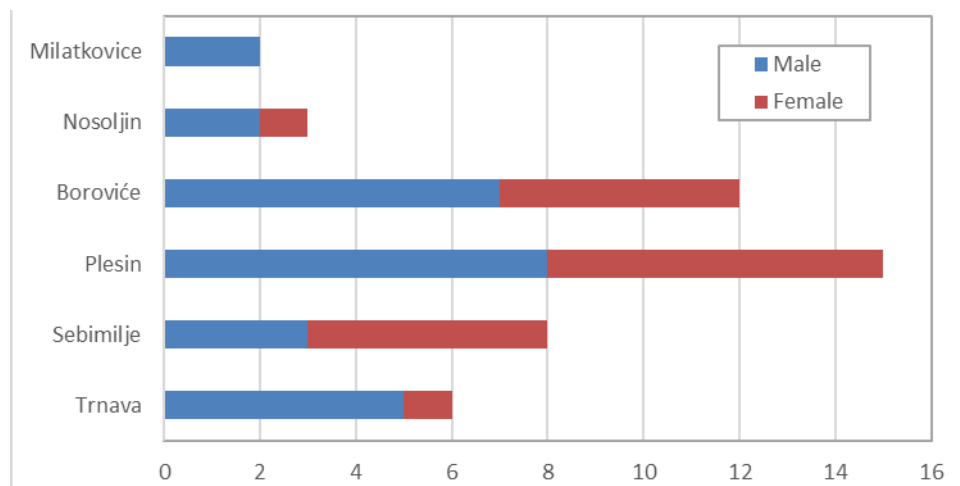


Figure 5. Mortality caused by typhus, by villages and gender in the municipality of Trnava in 1915 (Source: archive source 18)

In the total number of deaths due to the typhus epidemic, higher mortality was recorded in men population, with a total of 27 deaths, while the number of female deaths was 19. Observed by the villages of the municipality of Trnava, the higher mortality among the female population was found only in the village of Sebimilje. In comparison, in all other villages, the mortality among the male population was higher (archive source 18).

The main particularity of the typhus epidemic that distinguishes it from other epidemics was high mortality among the population aged 20 to 59, while mortality in the population up to 19 years and the population over 60 was relatively low. Across all three age categories, higher mortality was recorded in the male population (Table 5) (archive source 18).

Over 60 was relatively low. Across all three age categories, higher mortality was recorded in the male population (Table 5) (archive source 18).

Table 5. Mortality caused by typhus, by age and gender in the municipality of Trnava in 1915

Gender	Age		
	0-19	20-59	60 and over
Male	2	19	5
Female	1	16	2

Source: archive source 18

According to the cause of death recorded in the death register, 22 people died of typhus, 21 of them of louse-borne typhus, while three people died from typhoid fever. On the territory of the municipality, during the typhus epidemic in Trnava, no deaths from relapsing fever were recorded (archive source 18). In total, during the period from 1912 to 1918, 85 inhabitants of the municipality of Trnava (civilians and soldiers) died of typhus, which was 2.94% of the population recorded in 1910 (archive source 1).

3.5. The Spanish Influenza Pandemic from 1918 to 1920

The Spanish influenza pandemic (also known as Spanish flu) that swept the world in 1918 did not escape Serbia either. The arrival of massively ill Serbian soldiers to their homes after the breakthrough of the Salonika front, as well as the release of infected soldiers from Hungarian camps,

caused the spread of Spanish flu throughout Serbia (Hutinec, 2006). The first death due to the Spanish influenza pandemic in the municipality of Trnava occurred in the village of Plesin in October 1918. The pandemic soon spread to other villages, causing as many as 63 deaths by the end of 1918. During the Spanish influenza pandemic from 1918 to 1920 in the municipality of Trnava, a total of 73 people died, which was 2.52% of the enumerated population in 1910. The last victim of the pandemic in the municipality of Trnava was also in the village of Plesin, in April 1920 (archive source 22). Among the villages of the Trnava municipality, the highest mortality was recorded in Plesin, while the lowest of deaths occurred in Borovice (Figure 6) (archive source 22).

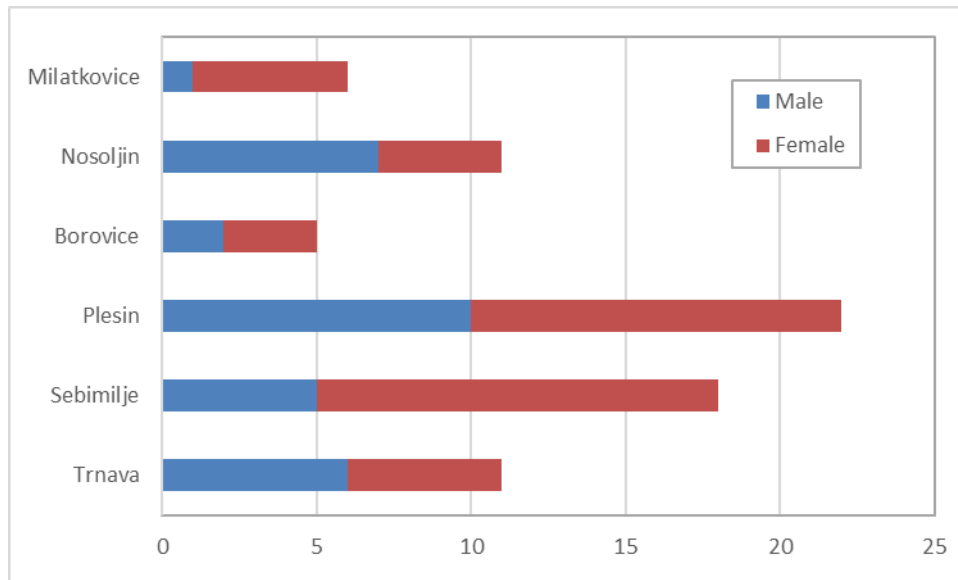


Figure 6. Mortality caused by the Spanish influenza pandemic, by villages and gender in the municipality of Trnava, 1918-1920 (Source: archive source 22)

Unlike the typhus epidemic, in which higher mortality was recorded in the male population, the Spanish influenza pandemic was more deadly for females. In the course of a two-year period, the pandemic caused the death of 42 women and 31 men. Observed in the villages of the Trnava municipality, higher mortality among males was in the villages of Trnava and Nosoljin, while in all other villages, higher death rates were among females (archive source 22).

The age distribution of mortality during the Spanish influenza pandemic was also significantly different from that caused by the typhus epidemic. The pandemic was particularly deadly for the population aged up to 19 years, with 45.20% share in the total number of deaths due to the Spanish flu. A slightly lower mortality was recorded in the population aged 20-59 years, with a share in total mortality of 36.99%. The population aged 60 and over accounted for 17.81% of deaths from the Spanish fever. In all three age categories, higher mortality was among females (Table 6) (archive source 22).

Table 6. Mortality caused by the Spanish influenza pandemic, by age and gender in the municipality of Trnava, 1918-1920

Gender	Age		
	0-19	20-59	60 and over
Male	16	10	5
Female	17	17	8

Source: archive source 22

3.6. Local Epidemics

Local epidemics of infectious diseases caused relatively high mortality among the population both during the war period and in times when there was no war. Poor and irregular nutrition, which led to weakened immunity, as well as unfavorable hygienic living conditions and a lack of hygiene and health culture, had the greatest impact on the emergence and spread of local epidemics of infectious diseases. In addition, the way of life in rural areas, which mainly took place in family cooperatives characterized by a large number of household members and a kind of semi-collective housing, favored the spread of infection (Кривошејев, 2023). The failure to implement preventive health measures also contributed to the population's increased mortality. In the period between the two world wars, the mandatory immunization program was implemented only twice. In both cases, only children were vaccinated, the first time on June 24th, 1921, and the second on October 9th, 1926 (archive sources 23 and 24).

During the entire third decade of the 20th century, increased child mortality was recorded due to scarlet fever. However, the most tragic consequences were left by a local epidemic that took place in 1922 and 1923, in which 22 children died. The first fatality caused by scarlet fever was recorded in the village of Plesin, in November 1922, and the last in the village of Nosoljin, in April 1923. The highest number of dead children was recorded in the village of Plesin, with 14, while there were no deceased children in the village of Borovice. In the last two months of 1922, in which 12 children died, 50% of them were between the ages of 7 and 14 years. While in the period from January to April 1923, the highest child mortality was recorded in the age group between 2 and 6 years, with a share of 80% in mortality caused by scarlet fever (archive source 25).

The typhus epidemic in 1915 masked the high mortality of the population, above all children, caused by diphtheria. Bearing in mind that children were mostly spared from illness and death from typhus, the occurrence and spread of diphtheria in the territory of Trnava municipalities has neutralized any advantage they have in relation to older age groups. A large number of families disappeared biologically due to the simultaneous death of the middle-aged population from typhus and children and youth from diphtheria (archive source 26).

In 1915, 47 inhabitants of the Trnava municipality died of diphtheria. The first cases of death were recorded in the villages of Plesin and Milatkovice in February, while the last death recorded was in December in the village of Nosoljin. The highest number of deaths recorded is in the village of Plesin, a

total of 24, while the lowest number of deaths was recorded in the village of Nosoljin, in which only one person died of diphtheria. The highest mortality was recorded among children between the ages of 2 and 6, which accounted for 44.68% of the total mortality from diphtheria. In comparison, the mortality of the population aged 20 and over was only 6.38% (archive source 18).

Until the beginning of the fourth decade of the 20th century, mortality from dysentery was mostly sporadic in the municipality of Trnava. An exception was in 1912, 1919, and 1923, when seven people died due to this disease. Since 1930, mortality from dysentery has a continuity of recurrence from year to year, with a culmination in 1941, when 10 people died of this disease within three months. Between the first death that occurred in the village of Trnava in August 1941 and the last one recorded in November 1941, a total of five people died in the village of Trnava, three from the village of Plesin, and two from the village of Sebimilje. Seven of them were between the ages of 2 and 6 years, the two who died were in the age group from 7 to 19 years, while one deceased person was over 60 years old (archive source 27).

An increase in measles mortality in the municipality of Trnava was recorded in 1911. The local epidemic first appeared in the village of Sebimilje, where the first death was recorded in January. Then, in January and February, the infection spread to the villages of Trnava, Plesin, and Borovice. In a local epidemic in which the last death was recorded at the end of February, a total of 10 people died in the village of Plesin. Five people died of measles in the village of Trnava. Two in the villages of Sebimilje and two in Plesin, while one person died in the village of Borovice. Children under the age of 2 accounted for 60% of those who died from smallpox (archive source 28). From February

24th to April 25th, 1915, smallpox caused the death of eight people in the village of Trnava (archive source 29).

Mortality from respiratory infectious diseases such as cough, whooping cough, tuberculosis (euctics, ectics, tuberculosis in the lungs), and flu (influenza) was a significant factor in total infectious disease mortality. Mortality from these diseases was continuously repeated from year to year, but never led to any more significant epidemics that would result in massive population deaths. However, in causing deaths from respiratory infectious diseases, a certain level of regularity existed. The highest mortality from cough and whooping cough was recorded in

the period from March to May. About half of the mortality (50.56%) in the period March-April-May was due to these two causes. Children aged up to one year, with a participation of 86.52% in the total number of deaths, had the highest mortality from cough and whooping cough. A similar pattern of mortality was observed in those who died from the flu. The highest mortality among age categories was recorded in the population under 20 years, which accounted for 75.92% of the total number of deaths. Mortality from tuberculosis in terms of seasonal distribution does not differ much from other mortality patterns caused by respiratory infectious diseases (archive source 7).

4. Conclusion

The demographic and epidemiological transition of the municipality of Trnava between 1910 and 1941 reveals a population profoundly shaped by war, epidemics, and harsh socio-economic conditions. Mortality crises during the Balkan Wars, World War I, and interwar epidemics further disrupted the biological and social structure of the population, particularly through disproportionately high losses among males who participated in the military and children and young people under 19 years old.

Infectious diseases, especially the Spanish influenza pandemic, typhus, diphtheria, scarlet fever, and tuberculosis, accounted for more than 40% of all deaths in the study time frame. The typhus epidemic of 1915 and the Spanish flu pandemic of 1918–1920 stand out as the deadliest events, highlighting the weakness of public health in a setting with no local medical infrastructure and weak preventive measures. Local epidemics such as scarlet fever and dysentery also contributed to persistently high child mortality.

The analysis of mortality due to infectious diseases in the Trnava municipality illustrates how demographic and health outcomes in small rural areas were not only determined by natural growth and migration but also deeply impacted by wars, epidemic outbreaks, socio-economic inequality, as well as cultural practices. The experience of Trnava reflects broader patterns of demographic instability in early 20th-century Serbia and highlights the critical role of healthcare modernization, nutrition, and hygiene in shaping public health resilience.

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5. SOURCES from Historical Archive

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