

Developing systemic solutions for typhus fever eradication in resurgent Poland between 1918 and 1924

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Farmacja Polska, ISSN 0014-8261 (print); ISSN 2544-8552 (on-line)

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Sources of financing

No sources of financing were indicated.

Conflict of interest

No conflicts of interest.

Received: 2023.07.26

Accepted: 2023.09.06

Published on-line: 2023.09.12

DOI

10.32383/farmpol/172186

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Research's subject. The research's subject includes fundamental principles and procedures for taking preventive activities against infections. Although such a holistic solution is the domain of contemporary times, the legal solutions introduced during the current Covid pandemic were created on the basis of legislature and solutions first introduced over 100 years ago as a result of the typhus epidemic. The legislators of those times already noticed the necessity to take anti-epidemic, and preventive measures in order to neutralize the sources of infections, and cut down the spread route. The study presents solutions introduced during the typhus epidemic occurring on the Polish territories (Central Europe) in the years between 1918 and 1924. Archival epidemiological data along with taken steps and measures (including the establishment of special state institutions) are presented showing how the epidemic of those times provided the fundament for preventing epidemics on the Polish territory.

Research's aim. The purpose of the research is to present, in a chronological manner, the formation of systemic solutions for combating the epidemic of typhus, which broke out in the resurgent Polish lands at the end of WWI.

Material and method. Presented data are based on documents and archival materials, which include registers of typhus patients from general hospitals between 1918 and 1924, information from the Central Military Archives, information obtained from historical sources including medical journals of that period, as well as information from the national archives and the Central Statistical Office. These data were analyzed and presented.

Results. The manuscript presents data on incidence and mortality. It also consists of a step-by-step analysis of introduced preventive measures along with the problems that were caused by their enforcement, including social distrust and resistance.

Conclusions. Enacted institutions, including the Polish Institute of Hygiene, allowed for greater monitoring of public health. The typhus experience facilitated the development of hospital networks and provided medical care to society. What is more, because of an urgent need to educate medical staff, the training of doctors, nurses, and other medical professionals was launched in 1921 as the first in Europe, School of Hygiene. Additionally, due to the typhus epidemic, the fundamentals for the State Sanitary Inspection (1954), which is functioning until this day, were laid down along with various sanitary acts.

Keywords: vaccination, typhus fever, epidemic hospitals, Sanitary Acts, national system against epidemics.

© Farm Pol, 2023, 79(4): 209–216

Introduction

Epidemic typhus is an acute infectious disease caused by *Rickettsia prowazekii* and transmitted mostly by the human body louse (*Pediculus humanus corporis*) and less often by the human head louse (*Pediculus humanus capitis*) [1]. The disease is also called jail fever, *morbus carcerum*, camp fever, or famine fever and is most prevalent in cold, crowded places; because of poor hygienic

conditions resulting from restricted access to sanitary measures (figure 1). The body louse spends all its life in human clothes. Eggs laid in the seams of clothes, hatch after about 8 days and the nymphs become adults in 2 weeks. Each louse feeds on blood about 4–6 times a day [2, 3]. Lice become infected by feeding on the blood of people with acute typhus fever and spread the disease by direct contact with another person (in rare situations with the direct contact with infested clothing or bed sheets). Typhus organisms multiply rapidly in the louse's digestive system and from infected louse's mouthparts are transferred to the human host, who by scratching, rubs louse faecal matter or crushed lice into the bite wound causing further infection. The insects can spread the disease for up to 10 days after which they die, however, the parasitic organism, *Rickettsia prowazekii* can survive in lice faeces for several months, and typhus survivors can carry a latent disease for years [2, 3]. The symptoms of the disease include headache, rapidly rising fever, chills, nausea and prostration followed by widespread rash covering the trunk and limbs. The pace of epidemic spread increases in late winter and decreases in spring [1–3].

The typhus epidemic in Central Europe started in 1812 due to Napoleon's expedition to Russia,



Figure 1. House made of barrels in Zapałów (town devastated by IWW; Austrian partition) Source: Nowości Ilustrowane. Kraków 30.10.1915: 44: 6 <https://jbc.bj.uj.edu.pl/dlibra/publication/124543/edition/116964/content> – prawo do publikacji z podaniem źródła pochodzenia zdjęcia.

which in turn caused a migration of crowds living in unsanitary conditions [2–4]. There was no cure for typhus at that time and no means to control the disease. Typhus became an international problem because of poverty and migration caused by the economic crisis in Europe. There were numerous outbreaks of typhus fever epidemic including that of the late 1830s England and another one as the aftermaths of the Great Irish Famine a decade later (so called “Irish fever”). As a result, in the second half of the 19th century typhus became a research problem in almost all European countries, contributing to the development of the so-called research institutes of infectious diseases or institutes of tropical medicine, as well as the growing importance of hygiene and development of the age of bacteriology [5]. With the expansion of migration, typhus fever also became a problem in United States [5]. In the course of time, physicians and biologists tried to find the cause of epidemic typhus. German physician Rudolf Virchow (1821–1902) observed that typhus spreads in unsanitary surroundings and claimed that education and public health measures were the answer to overcoming the epidemic spread [2–4]. In 1909, Charles Nicolle, saw a difference in epidemic spread within and outside of the hospital and determined that typhus is transmitted by the body louse and can be avoided by maintaining cleanliness. For his discovery of the causative agent, he was given the Nobel Prize in Physiology or Medicine in 1928 [6]. The following year Howard Ricketts described bacteria in the blood of typhus victims, in infected lice, and in lice mouthparts. However, he contracted typhus and died before he confirmed his observation [2–4].

Due to war chaos caused by World War I (1914–1918) the problem of epidemic typhus returned in Central Europe (7). Poor European countries could not afford preventive measures and typhus caused high mortality in Serbia and Russia (in 1915) and Poland after 1918. According to the League of Nations in the years 1917–1922, 25 million people contracted typhus fever and 3 million died [4, 8, 9]. In 1915, the Reich Health Office president convened the first conference in Berlin, which stressed the problem of the typhus epidemic and its prevention [5]. Military authorities of Germany and Austro-Hungary started to implement strict procedures of bathing and steam-treating clothing to kill lice and control typhus spread. They tried to find a better method of treatment and a vaccine against typhus [2]. Scientists who tried to achieve this goal were an Austrian physician, Stanislaus von Prowazek, who died of a laboratory acquired typhus infection, and a Brazilian microbiologist, Henrique da Rocha Lima, a physician

and a pathologist, who in 1916 found the bacteria responsible for epidemic typhus and named them *Rickettsia prowazekii* [2]. The most important researcher, who undertook the efforts to elaborate an effective anti-typhus vaccine in Austro-Hungary (and succeeded in 1920) was a bacteriologist and a parasitologist, Rudolf Weigl from University of Lviv, who by order of the Minister of War carried out research on typhus in refugee camps and in war captive camps in Czech and Moravia (Weigl also worked in a laboratory in Przemyśl, Poland) [3, 10, 11].

The paste of typhus spread and the difficulty of overcoming the disease enforced the introduction of changes on a national level. It led to the refinement and elaboration of sanitary measures and shifted the responsibility for citizen safety to state authorities. What is more, experience from the past 100 years equipped national authorities with tools to combat future pandemic, including the Covid-19 pandemic.

The main aim of this manuscript is to present the first Polish systematic sanitary solutions that were enacted in the face of the typhus epidemic outbreak. The Polish sanitary law was established and adjusted ad hoc, because of a necessity, and it was one of the first to be introduced in the Central Europe. Many of the then established rules and regulations became the basis for the introduction of currently existing solutions.

Material and methods

Presented data are based on documents and archival materials, which include registers of typhus patients from general hospitals in the years between 1918–1924, information from the Central Military Archives, information obtained from historical sources including medical journals of that period, as well as information from the national archives and the Central Statistical Office. These data were analyzed and presented.

Polish non-profit organizations during the WWI (1915–1918)

Post war demobilization of the German and the Austro-Hungarian armies, migration of refugees and repatriates from Russia, as well as military conflict between Poland and Russia (1919–1921) contributed to the spread of epidemics including the most severe of them, louse-borne typhus. [4, 7, 8]. Additionally, the Polish population was decimated by great pandemic of Spanish influenza, which occurred in Poland in September and October 1918. [4, 7, 8] At that time, apart from military authorities of the occupants, a fight against typhus was carried out by Polish



Figure 2. Sanitary Columns in Galicja (former Austrian partition); first hospital (in a tent)

Source: *Nowości Ilustrowane*. Kraków 30.10.1915: 44:4 <https://jbc.bj.uj.edu.pl/dlibra/publication/124543/edition/116964/content> – prawo do publikacji z podaniem źródła pochodzenia zdjęcia.

non-governmental organizations including the Central Board of Citizens and the Warsaw Sanitary Board; and under Austro-Hungarian occupation, the Episcopal Committee organized by Prince Adam Bishop Sapieha. Bishop Prince Sapieha founded many epidemic hospitals, which in the years 1915–1917 treated as many as 4,413 patients. He also called for the establishment of mobile sanitary columns [7, 11] (**figure 2**). Each column consisted of one doctor and eleven nurses and was equipped with medical instruments and tents [7, 11]. The fight against typhus was also supported by organizations of the Red Cross from England, Switzerland and America. Polish Red Cross started its work in 1917, and on 15 April 1919, Polish Government formally approved the statute of the Polish Society of Red Cross. By the end of the war, Polish government was concerned about the shortage of medical supplies and tried to make up for the loss of equipment [7, 12]. In order to overcome the epidemic, 200 delivery trucks, 400 ambulances, and soap and disinfectants were bought from France [7, 12].

Government action against Typhus (1919–1924)

In 1918, when Poland gained independence, overcoming the typhus epidemic, in what was once the Kingdom of Poland, became a priority,

and Sapieha's solutions became the basis for this undertaking [7, 12]. On the same year, Ministry of Public Health took on the responsibility for health services and the organization of activities against infectious diseases. Dr Ludwik Rajchman, the later founder of UNICEF, came up with the initiative to create an institute that would be a diagnostic laboratory and substantive base for overcoming epidemics in the country [9, 11]. Such an institute was established on 21 November 1918, under the name of the State Institute of Epidemiology renamed in 1923 to State Institute of Hygiene [13, 14]. It was the first institution of this kind in Central Europe and its aim was to carry out epidemiologic research for sanitary administration. The Institute produced and tested serums, vaccines, and biological products used in medicine. It played an important role in acting against infectious diseases, propagation of hygiene, and education. The Institute issued 100,000 educational leaflets on typhus and trained medical staff [15–17]. In 1927, the Institute was transformed into State Institute of Epidemiology and it is functioning in this form until this day. The range of its activity was defined in the Basic Sanitary Act of 19 July, 1919 and executed by the then established Ministry of Health. The Act was amended on July 25, 1919 and later on February 21, 1935. It was in effect until the early

1960s, until the smallpox epidemic outbreak in Wrocław [18–20]. Additionally, in 1922, the first in Europe, State School of Hygiene was opened to educate, train, and improve qualifications of medical staff (the school was sponsored from the Rockefeller foundation) [15].

The epidemic situation in Poland was so unfavorable that the Polish Government tried to obtain financial aid from the League of Nation [8, 9]. Thanks to Witold Chodźko, the vice-Minister of Public Health, the Sanitary Board at the League of Nations visited Poland (in August 1919) to collect information and data about the Polish public health. Resolution of the League of Nations on typhus was passed on 13 March 1920 and its aim was to protect Europe from an epidemic [7]. In 1920, an Epidemic Board at the League of Nations was established and Ludwik Rajchman (a Polish doctor and the president of the State Institute of Epidemiology) was chosen as one of its members [7, 8]. Additionally, a juridical decree, issued in 1919 by the Minister of Public Health, established a Central Board to Overcome Epidemic Typhus (Cekadur), which centralized the activities of various level governmental units [12, 21, 22]. This board was, for example, entitled to take over medical equipment bought abroad. What is more, after Poland's liberation, the equipment of sanitary columns and epidemics hospitals became a part of the national hospital network [21, 23]. In May 1919, Cekadur issued detailed regulations on sanitizing living areas and education of the public. This responsibility was trusted upon local administration, which became an executive organ, however, without the possibility of imposing sanctions. The action against consisted in carrying out sanitation of the environment and people [21–23]. Houses, streets, gutters, sewages, and toilets were cleaned, and rubbish removed. The cesspits were covered with quicklime, the wells were repaired and secured. The population was sheared and bathed, their clothes, equipment, bedding, underwear were de-lice, and baths (showers) were arranged. All of these activities were regulated in the ordinance of the Minister of Public Health of September 24, 1919. The obligation was imposed on property owners, administrators and tenants in cities, settlements, and villages. Because of the impossibility of placing sanctions, the activity of Cekadur proved ineffective and the boards was resolved in 1920. In its place a position of Chief Supreme Commissioner for Overcoming Epidemics (NNK) was appointed [22]. His administrative capacity was superior to a minister, civilian and military authorities, for example the commissioner was entitled to issue normative acts, commandeer buildings to set up

epidemic hospitals, summon medical staff and in need, appoint suitable persons to help medical staff. What is more, unlike Cekadur, NNK had executive authority. Successive commissioners were appointed for main towns and on 24 July 1920, an institution of NNK was established for the whole country, with a central seat in Warsaw [21]. Each agency consisted of two to four inspectorates, depending on the density of the population in a given area [12, 13, 21, 23]. There was one doctor per two or three administrative districts. Because hospitals in eastern Poland were in majority destroyed during the war, NNK set up 113 epidemic hospital with 6550 hospital beds. All hospitals were provided with hospital clothes, portable equipment for treating infections, and disinfectants against lice. Despite regular distribution of hospitals, the number of hospital beds was insufficient for its inhabitants e.g., the Nowogród district with 1,244,047 inhabitants had 1,100 hospital beds, [9, 21, 23] which transferred to 1 bed per 1,130 inhabitants. The district covered an area of 38,190 km² and had 18 hospitals [9]. A solution for epidemic hospital shortage was portable buildings sponsored by the League of Nations [12]. During the epidemic, hospitals were set up in any suitable places including schools, railway carriages, and monastery buildings. When it was necessary, NNK allocated mobile equipment for washing, bathing, and disinfecting in epidemics hospitals, where typhus fever occurred. What is more, each hospital had a steam apparatus for disinfection. At the beginning of 1921, there were 60 disinfecting teams with light portable equipment. Each disinfecting team was equipped with the following:

1. cabinet apparatus for disinfection with hot air
2. portable spray apparatus type 'bains doche'
3. disinfectants: mainly hydrocyanic acid used for disinfection of rooms (9, 12, 21, 22).

The treatment in epidemic hospitals was based on the isolation of patient from lice - invaded places. These hospitals, apart from baths with disinfection equipment to kill lice, had a kitchen, laboratory, and outpatients, stationary and mobile vaccination stations, and provided medical care for patients treated at home. When a patient was hospitalized from an infectious disease, such a case was reported to health authorities. Those who had contact with this infectious patient were isolated and the hospital supervised carriers or potential carriers. Apart from setting up epidemic hospitals, NNK agencies organized educational actions for the public. In the areas covered by the epidemics old closed down public baths were repaired and many new baths were built thanks to the funds

from the Epidemic Board at the League of Nation [7, 12]. If there were not enough public baths in the area, people could use hospital baths; many of which had facilities for cloths' disinfection. Up until 1921, 21 baths were built in the former Polish Kingdom [12]. From 20 to 28 March, 1922, under the auspice of the League of Nations, a European Health Conference devoted to the methods of combating typhus fever was held in Warsaw, Poland. As a consequence a report counting 43 pages was drawn introducing international standards for combating typhus in view of potential war and migration crisis[24].

After achieving peace with Russia, migration of people stabilized and in the mid 1923, NNK's activities, apart from the sanitary activity, were limited [13]. Its authority and other duties were transferred to the Minister of Public Health and the authority of Chief Supreme Commissioner was transfer to district authorities [23].

Analysis

In Poland, 122,000 people contracted typhus in 1918 alone, and in the first half of 1919, the number rose to 122,984, out of which 9,865 died [12, 24-28]. In the Polish Kingdom and a part of former Galicja, 231,303 cases were registered in 1919 [12, 24-28]. Even if these data are

incomplete, they affected and impaired social and economic development. Data about infections were registered for the first time by the Central Statistical Office (GUS), which published *Statistical Annual of Poland* [25-28] The first *Annual* was published in 1921 and an incomplete register comes from 1919. An estimated number of typhus cases between 1919 and 1926 is presented in **table 1**.

1926 was chosen as the period of stabilization in Poland (boarders, migration). In fact, louse-borne typhus, tanks to preventive measures, did not occur in the form of an epidemic in the area of former Prussian occupation during World War I. There, the number of cases did not exceed 5 per 100 and in Poznań it did not exceed 2 cases per 100 people. To maintain this favorable condition, in the years 1919-1921, on the former border between Prussia and the Polish Kingdom, the Polish government created an internal sanitary border [12]. In Cracow District, in the area of former Austro-Hungarian occupation, the epidemic situation was also under control. At the peak mortality, in the years 1919-1920, only 5% of the population was infected. This was thanks to the activity of Prince Adam Bishop Sapieha, who organized epidemic hospitals, mobile sanitary teams and other preventive measures in the Austrian army and the activity of Austrian

Table 1. Aggregated case counts for louse-borne typhus by territory and year (1919-1926) (GUS).

Former territory:	Voivodeship (after year 2018)	1919	1920	1921	1922*	1923	1924	1925*	1926
Habsburg Austria	Stanisławowskie	-	-	40,053	6,805	1,156	650	470	290
	Lwowskie	-	28,690	7,346	3,388	1,563	993	756	519
	Krakowskie	-	9,560	2,110	987	462	150	140,5	131
	Tarnopolskie	-	-	5,477	1,965	705	672	472	272
Kingdom of Poland	Kieleckie	67,301	11,185	2,883	1,627	918	610	388,5	167
	Lubelskie	47,120	14,561	5,484	2,573	1,207	843	579	315
	Warszawskie	12,679	4,050	2,889	1,297	582	477	264	51
	Łódzkie	12,326	3,476	1,861	781	328	176	115	54
	m. Warszawa	5,050	2,048	1,030	384	143	138	94,5	51
Kingdom of Prussia	Śląskie	-	40,619	5,951	172	5	2	1	0
	Poznańskie	-	488	259	48	9	8	5	2
	Pomorskie	-	-	161	58	21	99	50	1
Russian Empire	Białostockie	12,022	4,172	2,981	1,472	727	55	97,5	140
	Nowogródzkie	-	-	5,440	2,180	874	385	443,5	502
	Poleskie	-	-	2,510	1,164	540	325	272,5	220
	Wołyńskie	-	-	3,117	1,075	371	547	370	193
	Okr. Adm. Wilno	-	-	-	-	1,573	1,071	865,5	660

*) estimated

- no data

Red Cross. In the area of former Polish Kingdom mortality rate was higher, it affected from 7% to 10% of the inhabitants. According to GUS's statistics, the situation was worst in the following districts: Śląskie 32%, Lubelskie 22%, Kieleckie 26% (epidemic's peak observed in 1919–1920) and Stanisławowskie 29% (peak in 1921). Similarly, an unfavorable situation was observed in the Eastern part of Poland (these areas were invaded by Soviets in 1920 and during repatriation of Poles from Russia in 1919 and 1920). The highest incidence, and at the same time the most intense measures against typhus, were taken in the years between 1919, and 1923, and after 1924 the countries stabilization was observed (table 1) [25–29].

Conclusion

All these activities, carried out under a certain compulsion brought results and success was achieved for overcoming the louse transmitted typhus, from nearly 220,000 cases in 1919 to 11,185 in 1923. In the thirties of the 20th century, the number of typhus cases was so low that it no longer posed an epidemic threat. However, after the II WW, epidemics hit the Polish territory once more. Nevertheless, learning from the experience of previous years, sanitary columns were reenacted and in 1944, NNK reestablished. Although louse-borne typhus does not pose a threat currently (the last Typhus case in Europe was noted in 1960's), the typhus epidemic forced the development of specific strategies for protecting the public. As a consequence of the typhus epidemic, Poland accelerated the process of creating an efficiently functioning research, diagnostic and educational institutions of state rank along with legal solutions with penalties for non-compliance.

Enacted institutions, including the Polish Institute of Hygiene, allowed for greater monitoring of public health. The typhus experience facilitated the development of hospital networks, and provided medical care to the society. What is more, because of an urgent need to educate medical staff, the training of doctors, nurses and other medical professionals was launched in 1921 at the first in Europe, School of Hygiene. Additionally, due to the typhus epidemic, the fundamentals for the State Sanitary Inspection (1954), which is functioning until this day, were laid down.

Controlling the development of infections has been rooted in the legislature so as to discipline the population and enforce anti-epidemic activities. Legally introduced measures allowed for the legal system to become equipped with a range of

sanctions that facilitate obedience. The Ministry of Public Health, which was the first in Poland to control anti-epidemic activities, strictly subordinated the activities of territory administration. In the field of public health, the typhus experience allowed for enforcing obligatory reporting of typhus incidence or deaths.

Although in the following years new acts and regulations on preventing infectious diseases emerged, the program that was enforced to stop typhus spread, became the fundament for overcoming epidemic spread and it is possible to see its continuation in further, more contemporary proceedings.

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