



One of the recent attacks of smallpox in Europe: A massive vaccination campaign during the epidemic in Wrocław in 1963



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ABSTRACT

Based on archival materials, collected literature and archival articles analysing the clinical course of the disease, the article presents the medical and social course of one of the recent epidemics of smallpox in Europe, which took place in Wrocław in 1963. During the epidemic, 99 people fell ill and seven of them died. The authors describe how a mass vaccination campaign was organised in the city and the entire surrounding region. This historical study shows not only the course of the epidemic itself, but also the ways to prevent and deal with infectious diseases and the organisation of vaccinations in communist Poland. The authors also discuss the issue of the relationship between the vaccination period and the course of smallpox in patients and show the scale of post-vaccination complications in the situation of mass vaccination against smallpox. Although the article refers to historical events, it draws attention to the topicality of challenges posed by the variola virus.

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1. Introduction

Although smallpox was overcome by 1980 thanks to the efforts of the international community and massive WHO vaccination campaigns, it is still worth reminding people about this dangerous disease. It is emphasised that “this was the first, and yet only, victory of the world community over a highly dangerous infectious human disease” [1]. However, before this happened, epidemics of smallpox had occurred in the world, including in Europe, in the second half of the twentieth century. The 1963 epidemic of smallpox in Wrocław, during which 99 people fell ill and seven of them died, have never been analysed in international literature. Under the Cold War conditions, detailed information about this epidemic did not reach western countries. Therefore, this historical case allows us to take a closer look at the fight against contagious diseases and vaccination campaigns in the former communist bloc. The 1963 story may be a warning for all those who—just like in Poland—are succumbing to the slogans of contemporary anti-vaccine movements [2].

2. Materials and data

This historical study is based on archival materials of the local Wrocław press (*Gazeta Robotnicza* [Workers' Newspaper] and *łowo Polskie* [Polish Word]), archival materials of *Przegląd Epidemiologiczny* [The Epidemiological Review] and data of the local Sanitary and Epidemiological Station concerning historical studies of this epidemic (e.g. “Epidemia czarnej ospy we Wrocławiu w 1963 r.” [The Smallpox Epidemic in Wrocław in 1963] by Grażyna Trzaskowska). Medical-historical studies have also been used. There is interesting literature in the Polish language devoted to this event written by doctors who participated in the events of 1963. The most important items include the following books: “Ospa 1963. Alarm dla Wrocławia” [Smallpox 1963. Alarm for Wrocław] by Jerzy Bogdan Kos, “Ospa we Wrocławiu” [Smallpox in Wrocław] by Michał Sobków and “Variola vera” by Zbigniew Hora. There is also a book containing a fictionalised reportage of these events entitled “Zaraza” [Plague] written by Jerzy Ambroziewicz, a reporter and a journalist, in 1965.

This book also served as the basis for the screenplay of the film entitled “Zaraza” [Plague] directed by Roman Załuski in 1971 (its Polish language version is available on YouTube: <https://www.youtube.com/watch?v=w-0ts6gbXyM>). The archival footage of the Polish Film Chronicle entitled “Operacja VV” [Operation VV] (<https://www.youtube.com/watch?v=FGx3vBrB50I>) and a

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documentary dedicated to the Wrocław epidemic entitled “Variola Vera” (<https://www.youtube.com/watch?v=xbpf4LwLjvE>) have also been used. Moreover, a review of scientific literature devoted to smallpox and photos from the State Archives in Wrocław have been used.

3. Smallpox: a historical outline

Smallpox (Latin: *Variola Vera*) has been known since ancient times. Its current name comes from the sixteenth century. Before the disease was controlled in the late twentieth century, it had taken a serious deadly toll. Even the discovery of the smallpox vaccine by English physician Edward Jenner [1] in 1796 did not stop the spread of epidemics in the nineteenth and twentieth centuries. He published his work, often simply referred to as the “Inquiry,” reporting that the inoculation of cowpox protected against smallpox. Jenner called this new procedure “vaccine inoculation,” to make reference to the cow (Lat. *vacca*), the proposed origin of the preventative against smallpox [3]. Variola virus (VAR) is the causative agent of smallpox, an extinct human disease that had a mortality rate ranging from 1% (*Variola minor*) to as high as 30% (*Variola major*) [4].

Between 1900 and 1919, smallpox caused large numbers of fatalities in Europe (about 1,174,000 in Russia, about 13,000 in France, about 30,000 in Italy, and about 51,000 in Spain) [5]. The last documented outbreak of smallpox in the United States occurred in Texas in 1949 [6]. In Europe, smallpox outbreaks lasted longer, but these were no longer endemic cases.

3.1. Smallpox in Poland in the first half of the twentieth century

After Poland regained independence (1918), the issue of preventing smallpox was regulated by the law on obligatory vaccination against smallpox of 19 July 1919. Article 1 of the law stated that “In the Polish State, all residents are subject to compulsory vaccination against smallpox” [7].

Between 1920 and 1921, smallpox spread primarily in the Eastern Borderlands and in the north-eastern part of the country, where about 30% of the population did not undergo preventive vaccination, and in Cieszyn Silesia. In 1920, 5996 cases were reported and 1003 of them ended in death [7]. In Poland, smallpox occurred endemically until 1924—on average, about 5000 cases were registered annually between 1920 and 1924. Thanks to the mass vaccination campaign, between 1925 and 1930, the number of smallpox cases dropped to several dozen annually and the disease was eradicated in Poland in 1935 [8].

It was not until 1953 that 13 cases of smallpox were reported in Gdynia and Gdańsk (including two deaths of children aged two and a half and three and a half—these children were not vaccinated). In 1962, there were also 29 cases of the disease in Gdańsk (this time there were no fatalities—the course of the disease was mild because all those who fell ill had valid vaccination certificates). Each time smallpox was brought by ship from India [9] (pp. 18–9). After the cases of smallpox in 1953 and in 1962 in Gdańsk, the local medical centre gained the reputation of an experienced centre in virological diagnostics and epidemiological practice. As it turned out, this experience was used a year later in Wrocław.

3.2. Smallpox in the eastern bloc and the situation in Europe and the world

In the 1970s, there were enormous outbreaks of the disease in Asia and Africa: between 1972 and 1976, smallpox led to the death of 45,000 people in Bangladesh [10]. In the 1970s, however, intensive activities were carried out to control the disease in the Demo-

cratic Republic of Congo (DRC) [11], in India [12] and Ethiopia [13], among other countries. The last case of natural smallpox was reported in 1977 in Somalia and the last laboratory-associated case of smallpox occurred in Great Britain in 1978 [4].

Between 1950 and 1971, smallpox was “imported” from areas where it occurred endemically to countries such as Belgium, Canada, Czechoslovakia, Denmark, France, East and West Germany, Italy, the Netherlands, Poland, Spain, Sweden, Switzerland, the United Kingdom, and Russia [14]. Typically, the virus was spread by people returning from Asian countries who then infected medical personnel. This happened in Meschede in January 1969, when a 20-year-old German “imported” smallpox from Karachi in West Pakistan. He infected nurses and patients of the Meschede hospital ward (a total of 20 people, four of whom died) [15].

Information about local epidemics in Eastern bloc countries hardly reached the public. This was the case of a mysterious epidemic of smallpox in Aralsk in the Soviet Republic of Kazakhstan in 1971, during which ten people became ill and three of them died [16]. The facts that the viral strain in Aralsk was somehow more infectious than traditional strains and that this outbreak was not reported to international institutions could confirm the supposition that the ongoing military programme was the source of the infection [16]. Another smallpox epidemic in eastern Europe at that time occurred in Yugoslavia in 1972, where 175 people fell ill and 35 of them died (23 of them were not vaccinated) [17]. Although there were probably smallpox infections in Hungary at that time [14], the one in Wrocław is known as one of the last in eastern Europe.

Despite the Cold War, the cooperation of the international community was established and massive global eradication efforts were taken, as a result of which smallpox was declared officially eradicated in 1980 [5].

4. The socio-historical-medical context of the epidemic in Wrocław

At the beginning of the 1960s, the population of Wrocław was less than 500,000 residents. Located in the south-western part of Poland, the city did not give its residents the opportunity to establish intensive international contacts in the 1960s for political reasons due to communism (guarded borders and limited international tourism). Due to such social conditions, it was difficult to suspect the emergence of smallpox from the outside. The common belief that closed borders made the “transport” of this disease virtually impossible was one of the reasons for delayed diagnosis of smallpox (see Fig. 1).

The first source of the epidemic was an employee of the intelligence services (PZ—patient zero), who stayed in Delhi from 16 to 25 May 1963. Just before leaving, PZ was vaccinated against smallpox. A few days after vaccination, there was no inflammatory reaction on his shoulder at the scarification site. It was considered that the vaccination he had undergone in childhood was a sufficient safeguard and he was given a certificate of resistance in a hurry. It was considered that the negative vaccination result could be regarded as proof of permanent immunity. PZ felt unwell on the fourth day after returning to the country—he had joint and muscle pain and an elevated temperature. Initially, he suspected a common cold he had contracted on the trip. His condition deteriorated over the next two days. PZ went to the hospital of the Ministry of Internal Affairs at Ołbińska Street in Wrocław (it later turned out that this place became the source of further infections) [18] (p. 19). Due to the appearance of skin eruptions, typhoid fever was initially suspected in PZ. After a blood test in which the presence of *Plasmodium falciparum* was found, he was diagnosed with malaria. The visit to India and the malaria parasites in the patient’s blood

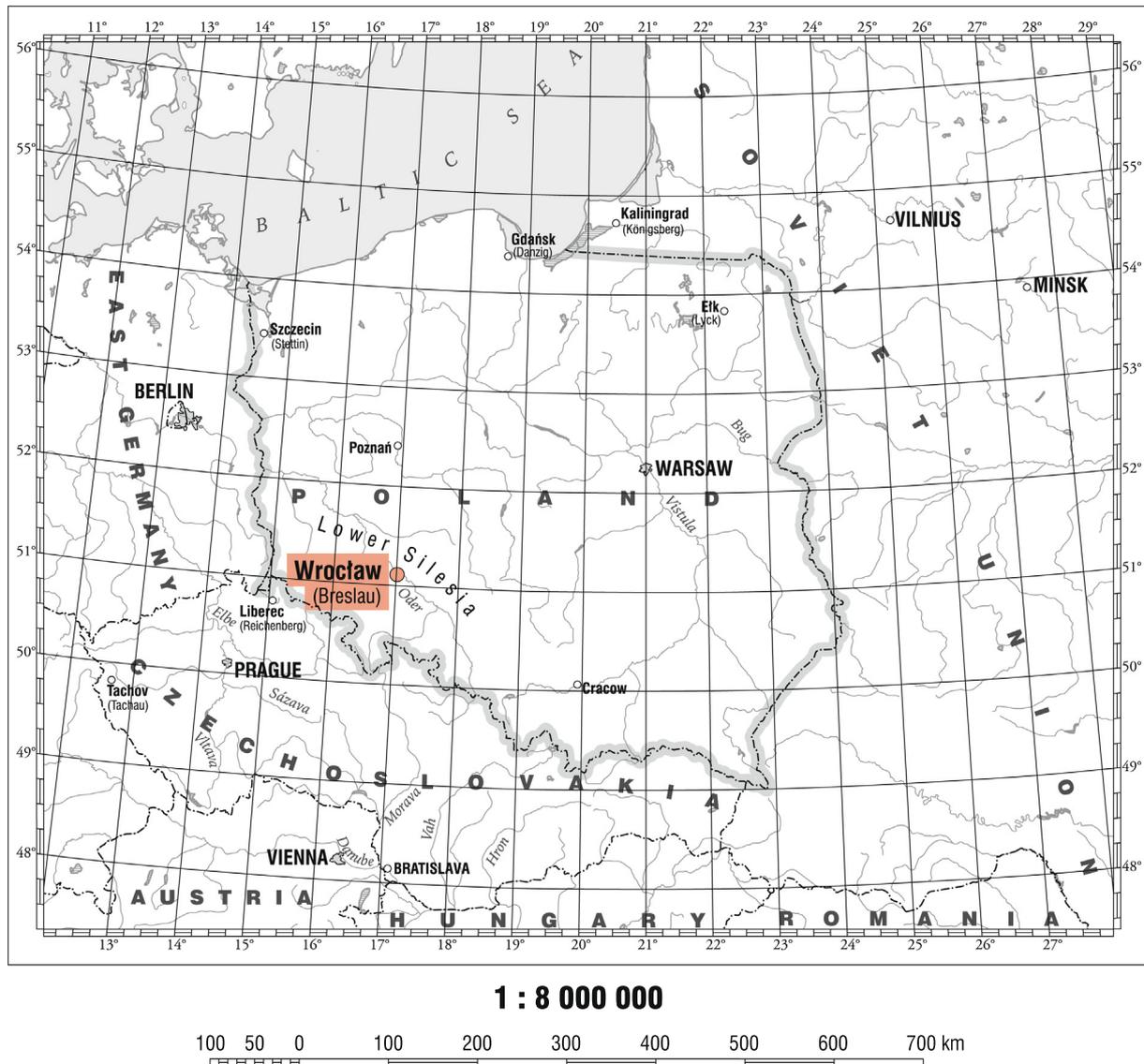


Fig. 1. Map of region in 1963.

were indicative of malaria. After administering anti-malaria drugs, PZ felt better and was discharged from hospital. His treatment ended there. Although PZ coped with the virus that he had brought from India and recovered, he became a source of infection for more people [18].

The nurse who cleaned PZ's hospital room fell ill on 15 June 1963. Like PZ, she suspected a common cold. However, when a rash appeared, she was referred to the municipal infectious hospital at Piwna Street with suspected chickenpox. The disease primarily affects children, but this suspicion may have been justified in the case of a nurse working in the hospital. She recovered but, in the meantime, she infected her son and daughter (Lonia Kowalow), who worked as a nurse in another hospital. Her son's health improved, but Lonja was hospitalised on 3 July 1963 because she had felt very weak for a few days. She died in the hospital on 8 July 1963 and was not properly diagnosed with the disease until the end. The rapid deterioration of her health and death was a shock. At the same time, it was a mystery to medical personnel. Initially, a type of malignant leukaemia was suspected [18]. As it turned out later, the deceased nurse was vaccinated for smallpox in 1946 [9] (p. 12), but when she encountered the virus again in June 1963, her body was unable to defend itself.

A breakthrough in the diagnosis occurred on 9 July 1963, when a fever occurred in a four-year-old boy who had previously had contact with the ward nurse and had become ill on 15 June. Chickenpox was diagnosed in the child during his stay in hospital. When he was recovering and waiting for discharge from the hospital, the sudden fever changed these plans. What forced doctors to verify their diagnosis of the boy's disease was the reappearance of rash on the child's skin. The fact that chickenpox occurs once in a lifetime forced doctors to look for another disease. Scrapes from the skin and a throat swab were collected and sent to a laboratory. The test result was confirmed a few days later—the Institute of Immunology and Experimental Therapy of the Polish Academy of Sciences in Wrocław confirmed the isolation of the variola virus from the material sent. The boy who had recovered from chickenpox was infected with smallpox in the hospital. The diagnosis was confirmed on 16 July 1963 [18] (p. 22).

5. The scale of the smallpox epidemic in Wrocław

Table 1 shows the total number of cases by sex. The development of the disease in Wrocław is demonstrated in Table 2. It

Table 1
Incidence of smallpox in Poland in 1963.

Age	Female	Male
0	1	0
1–4	4	2
5–9	3	5
10–14	1	4
15–19	2	6
20–29	13	4
30–39	17	8
40–49	3	6
50–59	12	5
60	3	0
Total	59	40

Source: Kostrzewski J, Magdzik W. *Epidemie Ospy w Polsce w latach 1953–1963*. Przegląd Epidemiologiczny 1964;18(2).

Table 2
Course of the smallpox epidemics in Wrocław in 1963.

Stage of the epidemics	Duration of the epidemic	Number of cases	Number of deaths
Stage I, initial	19.05–14.06.1963	1	0
Stage II	15.06–8.07.1963	4	1
Stage III	9.07–20.07.1963	21	1
Stage IV (disease peak)	21.07–28.07.1963	44	3
Stage V	29.07–6.08.1963	20	1
Stage VI	After 7 August 1963	4	0

Source: Data of the Sanitary and Epidemiological Station in Wrocław (Trzaskowska G. *Epidemia czarnej ospy we Wrocławiu w 1963 roku*).

should be noted that the number of patients and deaths in Wrocław (94 fell ill and six of them died) showed in Table 2 does not coincide with the sum of all 99 patients and seven deaths during the entire epidemic. This is because one death occurred in Wieruszów and a few cases of smallpox were reported outside of Wrocław [8]. However, all these diseases had their origin in Wrocław. Although it was one of the largest recent epidemics in Europe, it was controlled in about a month due to the actions taken. Nevertheless, the state of endemic emergence in Wrocław lasted longer: from 16 July to 19 September 1963 [18] (p. 192). WHO was not involved in the vaccination campaign during the epidemic in Wrocław.

6. The medical and social dimension of the smallpox vaccination campaign

The case of vaccination against smallpox in Poland after World War II was regulated in 1951 by the Ministry of Health, which ordered primary vaccinations of children aged 2–6 months and repeated vaccinations at the age of seven and of all other people aged up to 60 years, five years after the primary vaccination [9] (p. 21).

After the aforementioned outbreak of smallpox in Gdańsk in 1962, the Ministry of Health introduced some supplements to the law, imposing an additional obligation to vaccinate healthcare workers every three years. The regulation also concerned students of medical universities. As Zbigniew Hora emphasises, failure to comply with these provisions was one of the reasons for the epidemic in 1963 and brought tragic consequences for the people who fell ill in the first place [9]. Like in many epidemics—when a disease most often hits healthcare workers—in 1963, smallpox first attacked hospital staff in Wrocław. Four of the seven deaths affected medical staff: one doctor, one nurse and two ward nurses. Of the 99 people infected, 25 healthcare professionals fell ill: five

doctors, one medical student, eight nurses, five ward nurses and six other employees of the medical department [9] (p. 22).

On 17 July 1963, one day after the diagnosis of smallpox in Wrocław, a state of emergency was announced to city residents in a brief message in the local press. Though they tried not to evoke panic, the message also said: “All people who have not been vaccinated against smallpox and also those who were vaccinated earlier than three years ago are recommended to immediately undergo vaccination” [19].

6.1. The system of vaccination organisation and control over the course of vaccination

Vaccination points were organised in all health centres in the city. Children in kindergartens and nurseries were vaccinated. Moreover, vaccination points were opened at railway stations and at all main roads entering the city [18] (p. 30). During the communist period, a workplace was an important institution in social life—it was not only a place of work, but also an important centre of social integration. Therefore, employees were also vaccinated in workplaces that had outpatient clinics. Vaccination control was introduced for all those entering and leaving the city. Without a vaccination certificate, it was not possible to buy a train or airline ticket, nor was it possible to check into a hotel. Although it was the middle of summer and holidays in the city, all swimming pools were closed and residents were encouraged not to leave for holidays and breaks [20]. Those Wrocław residents who left the city for the mountains or the sea before the outbreak of the epidemic anxiously read the news in the press and wondered whether to come back home. Vaccinations were also organised for them at local sanitary and epidemiological stations, including in the seaside resort of Kołobrzeg [21] (p. 179). In the recreation areas of the Lower Silesia region (of which Wrocław is the capital), mobile vaccination points were also organised—teams of doctors and nurses travelled to villages in the mountain and foothill areas of the Karkonosze Mountains [21] (p. 32) (see Figs. 2 and 3).

However, at the beginning of the epidemic in Wrocław, there were only 6000 doses of vaccine in the local Sanitary and Epidemiological Station. Not being able to immediately vaccinate the entire population, the following order was established: (1) vaccinate health workers who had not been vaccinated in the last two years; (2) in the event of new cases, immediately vaccinate all persons who had been in contact with the sick; (3) along with the inflow of new vaccines, organise general vaccination in districts around



Fig. 2. At all roads entering Wrocław, there were boards with the following inscription: “All persons who have not been vaccinated for smallpox are prohibited from entering the city” (Source: State Archives in Wrocław).



Fig. 3. At the vaccination point at the Wrocław Główny railway station (Source: State Archives in Wrocław).

Wrocław; (4) organise vaccinations for those people coming from Wrocław for holidays in districts and those returning to Wrocław from these districts [22].

The vaccines that were delivered to Wrocław were Polish and Hungarian (both were in the form of suspensions) and Soviet (this vaccine was freeze-dried and gave quite strong general and local post-vaccination reactions) [22]. Vaccinations were carried out using a multiple-pressure method: a needle or a scarifier was pressed into the disinfected epidermis 30–40 times. Each patient was checked after five days and, if there was no positive effect, the check was repeated after ten days. Individuals vaccinated with a positive result received a certificate. If the result was negative, re-vaccination was performed. Only after three vaccinations with negative results would the patient receive a certificate with the annotation: “vaccinated three times with negative results” [23] (pp. 18–9).

Although the whole action required the involvement of doctors and nurses in non-standard working time, it generally proceeded smoothly without panic. However, there were also pathological events in this mass campaign. For example, in one of the villages near Wrocław, scammers swindled fees from local residents for supplying an “oral vaccine that does not cause complications.” In a city of half a million people, there were also those who can be considered the counterparts of today’s “anti-vaccinists”—they considered vaccination as “an invention of guys in white aprons” and avoided vaccination points, did not respond to calls or had “fake” vaccination certificates [18]. Despite these incidents, from 16 to 31 July, 1,433,478 people were vaccinated in the anti-epidemic action in the Wrocław province; 692,607 people were vaccinated between 1 and 15 August, and 50,862 people underwent vaccination between 16 and 31 August. In total, 2,176,947 people were

vaccinated in the Wrocław province and positive results were found in 86% of those vaccinated [22]. In the city of Wrocław, 426,000 people were vaccinated at that time, about 1,200,000 people in the neighbouring Opolskie province and about 4,500,000 people in other parts of Poland [8].

6.2. The clinical course of the epidemic and the patient vaccination rate

Based on the course of smallpox in diagnosed patients, four categories were classified: (a) patients with the most severe cases of the disease that led to death within a few days; (b) patients with severe and medium-severe cases of the disease with a typical course; (c) patients with a mild course of the disease; (d) patients with an abortive course of the disease [24] (p. 167) (see Figs. 4 and 5).

In all the categories mentioned, there was a direct correlation between the course of the disease and the date or the absence of vaccination. In the first category, there were four cases of haemorrhagic smallpox, ending in death, which was very rapid and took the form of haemorrhagic purpura. These patients had been either vaccinated a long time before or had not been vaccinated at all [24].

The second category of patients with severe cases of smallpox included 27 people, all of whom had been vaccinated against the disease in childhood. In this category, 14 people were re-vaccinated two to 17 days before the disease and 13 patients were not re-vaccinated. In total, of all 27 patients in this category, the variola virus was found in 20 cases. In the case of people whose smallpox infections did not raise any doubts, the material for diagnostic tests was taken from scabs or vesicle swabs; in the case of people suspected of smallpox, diagnostic methods were combined (sometimes electron microscopy was also used). Throat swabs were collected from convalescents and people leaving hospitals and isolation wards [25].

The third category of patients with a mild course of the disease included 40 people—seven people from this group had been vaccinated one year before the outbreak of the epidemic and one two years earlier. The others had been vaccinated only in childhood. During the epidemic, 29 people from this category were re-vaccinated from 0 to 18 days before the onset of the disease and three patients were vaccinated after becoming ill. The clinical picture in this group consisted of weak general symptoms and scant skin lesions [24].



Fig. 4. Staff of the smallpox hospital in Prąsznik wearing protective clothing (Source: State Archives in Wrocław).



Fig. 5. A small patient in the isolation room at the smallpox hospital in Prząśnik (Source: State Archives in Wrocław).

The fourth group included 17 cases with an abortive course of the disease. In this category, there were no typical clinical or initial symptoms. Of these patients, eight had been vaccinated within two to 20 years and seven within 21–51 years from the outbreak of the epidemic, while two had not been vaccinated at all. During the epidemic, all of them had been vaccinated 1–15 days before the disease and two after the outbreak of the disease [24].

Fig. 6 shows the number of smallpox cases depending on the time that elapsed since the last vaccination. Deaths during the Wrocław epidemic were observed only in patients who had not been vaccinated at all or had been vaccinated more than ten years before. There were no deaths among patients with smallpox who had been successfully vaccinated within a few up to 12 days before the disease. The disease was observed in 47 patients who had been vaccinated with positive results (with a visible take) one to nine days before the first symptoms of the disease, in 14 patients vaccinated 10–20 days before the disease and in four patients vaccinated one year before the outbreak of smallpox [8]. This testified to the fact that vaccination with a positive result did not provide full protection against smallpox but the course of the disease in these people was mild or very mild.

6.3. Post-vaccination complications: the scale of the phenomenon

As vaccinations were performed on a large scale and with significantly limited medical contraindications, cases of post-vaccination complications occurred. Although the vaccination campaign was voluntary at first, obligatory vaccinations were introduced in Wrocław on 1 August. There was a fine or detention penalty of up to three months for evading vaccination [23] (pp. 20–1). Although in the initial phase of vaccination it was considered that pregnant women could be vaccinated only up to the fifth month of pregnancy, the local press later reported that pregnancy, regardless of the period, did not constitute a contraindication to vaccination [23] (p. 18).

Complications observed in Wrocław and the province included *vaccinia generalisata*, which often led to diagnostic difficulties and caused the suspicion of smallpox, *vaccinia inoculata*, i.e. extensive and deep necrosis at the place of vaccination, and *encephalitis post-vaccinalis*, which resulted in the deaths of two children [22]. Other post-vaccination complications included a general breakdown, high temperature and large local reactions. In general, the number of people with post-vaccination complications in the Wrocław province was around 2400 people—on average, one in 1000 of those vaccinated [22]. The ratio of neurological complications was estimated at 1.51 per 100,000 vaccinated people [9] (p. 24). About 1000 were admitted to consultation clinics for patients with post-vaccination complications and 80 of them were referred to hospitals [18] (p. 35).

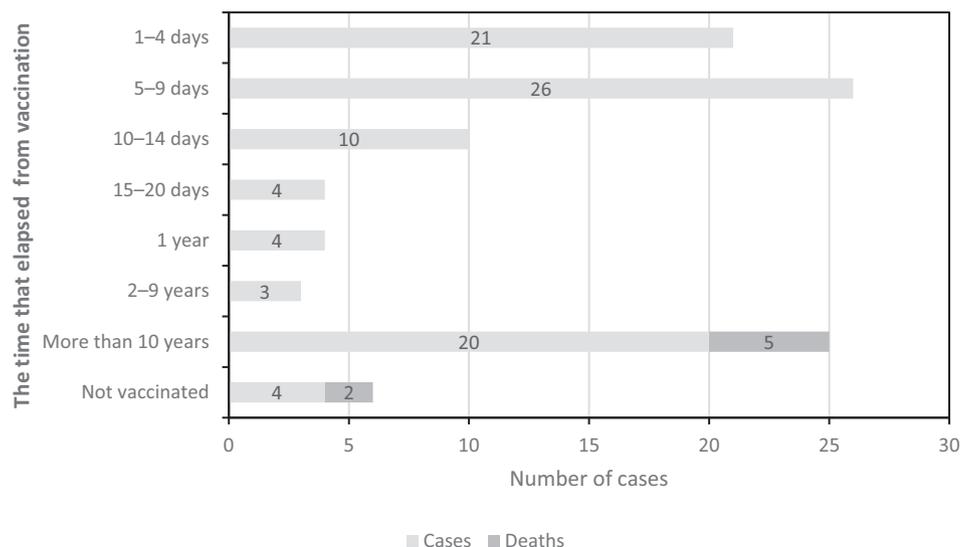


Fig. 6. Cases of and deaths from smallpox in Poland in 1963 depending on vaccination. The time that elapsed from the last vaccination with a positive result to the outbreak of the disease.

7. Is smallpox a thing of the past? Epidemics and vaccinations: history lessons

The last case of smallpox during the epidemic in Wrocław was recorded on 10 August 1963. From 11 August, there were no more new cases but the isolation wards, smallpox hospitals and vaccination points were still working. On 1 September 1963, as no new cases were confirmed by virological tests, the Anti-Epidemic Council decided to close some smallpox hospitals and isolation wards. However, it was only on 9 September 1963 that the city and the region were considered to be free of smallpox and the state of anti-epidemic emergency was cancelled [9] (pp. 135–6). The main reasons for the development of the epidemic in Wrocław were late diagnosis of the first four people with smallpox, too late an introduction of complete isolation of smallpox patients and the failure in 1962 to vaccinate the staff of the hospital in which the first infections occurred [26] (p. 157). These conclusions may have been useful in later years in other parts of the world.

However, as vaccination against smallpox caused adverse side effects in some cases, the WHO recommended the cessation of vaccination after 1980. As a result of this decision, mankind has lost collective resistance not only to smallpox, but also to other zoonotic orthopoxvirus infections. The literature emphasises the possible occurrence of new zoonotic smallpox mutations resulting from the natural evolution of these viruses [27]. Therefore, “taking into account that the classical live vaccine against smallpox can induce severe side effects, it is necessary to continue the development of modern new generation safe smallpox vaccines as well as the search for new anti-smallpox chemical preparations” [28].

Moreover, due to the rapid spread of the variola virus and the possibility of a massive epidemic, it can play the role of biological weapon and also be used as a means of attack in the case of bioterrorism. There is also the risk that the variola virus will be taken out of military laboratories not controlled by democratic communities. Therefore, work on a new generation of smallpox vaccines requires political, social, ethical and economic decisions [29]. Under the current conditions, when many national healthcare systems are in crisis and globalisation has brought new challenges to healthcare (both in the context of the greater movement of people who may transfer the virus as well as the migration of doctors [30]), looking at the forgotten smallpox epidemic is taking on a new perspective. Moreover, when political populism also influences medical decisions [31] and creates a friendly climate for the development of anti-vaccine movements, such decisions encounter more obstacles and, therefore, require special social reflection.

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Both authors have no financial disclosure.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

- [1] Shchelkunova GA, Shchelkunov SN. 40 Years without smallpox. *Acta Naturae* 2017;9(4):4–12.

- [2] Żuk P, Żuk P, Lisiewicz-Jakubaszko J. The anti-vaccine movement in Poland: the socio-cultural conditions of the opposition to vaccination and threats to public health. *Vaccine* 2019;37(11):1491–4. <https://doi.org/10.1016/j.vaccine.2019.01.073>.
- [3] Esparza J, Schrick L, Damaso CR, Nitsche A. Equination (inoculation of horsepox): an early alternative to vaccination (inoculation of cowpox) and the potential role of horsepox virus in the origin of the smallpox vaccine. *Vaccine* 2017;35(52):7222–30. <https://doi.org/10.1016/j.vaccine.2017.11.003>.
- [4] Hammarlund E, Lewis MW, Hanifin JM, Mori M, Koudelka CW, Slifka MK. Antiviral immunity following smallpox virus infection: a case-control study. *J Virol* 2010;84(24):12754–60. <https://doi.org/10.1128/JVI.01763-10>.
- [5] Fenner F, Henderson DA, Arita I, Jezek Z, Ladnyi ID. Smallpox and its eradication, the pathogenesis, immunology, and pathology of smallpox and vaccinia. Geneva: World Health Organization; 1988.
- [6] Irons JV, Sullivan TD, Cook EBM, Cox GW, Hale RA. Outbreak of smallpox in the lower Rio Grande valley of Texas in 1949. *Am J Public Health* 1953;43(1):25–9. <https://doi.org/10.2105/AJPH.43.1.25>.
- [7] Więckowska E. Szczepienia ochronne w zapobieganiu zachorowaniom na ostre choroby zakaźne w Polsce w latach 1918–1923. *Przegląd Epidemiologiczny* 1999;53(3–4):395–401.
- [8] Kostrzewski J, Magdził W. Epidemie Ospy w Polsce w latach 1953–1963. *Przegląd Epidemiologiczny* 1964;18(2):141–52.
- [9] Hora Z. *Variola vera*. Wrocław: Zakład Narodowy im. Ossolińskich; 1982.
- [10] Foster SO, Hughes K, Tarantola D, Glasser JW. Smallpox eradication in Bangladesh, 1972–1976. *Vaccine* 2011;29(Supplement 4):D22–9. <https://doi.org/10.1016/j.vaccine.2011.06.081>.
- [11] Muyembe-Tamfum J-J, Mulembakani P, Botee Lekie R, Szczeniowski M, Jeżek Z, Doshi R, et al. Smallpox and its eradication in the Democratic Republic of Congo: lessons learned. *Vaccine* 2011;29(Supplement 4):D13–8. <https://doi.org/10.1016/j.vaccine.2011.10.049>.
- [12] Dutta M, Basu RN. Lessons from smallpox eradication campaign in Bihar state and in India. *Vaccine* 2011;29(Supplement 4):D19–21. <https://doi.org/10.1016/j.vaccine.2011.12.001>.
- [13] de Quadros CA. Experiences with smallpox eradication in Ethiopia. *Vaccine* 2011;29(Supplement 4):D30–5. <https://doi.org/10.1016/j.vaccine.2011.10.001>.
- [14] Mack TM. Smallpox in Europe, 1950–1971. *J Infect Dis* 1972;125(2):161–9.
- [15] Wehrle PF, Posch J, Richter KH, Henderson DA. An airborne outbreak of smallpox in a German hospital and its significance with respect to other recent outbreaks in Europe. *Bull World Health Organ* 1970;43(5):669–79.
- [16] Zelicoff AP. An epidemiological analysis of the 1971 smallpox outbreak in Aralsk, Kazakhstan. *Crit Rev Microbiol* 2003;29(2):97–108. <https://doi.org/10.1080/713610418>.
- [17] Litvinjenko S, Arsić B, Borjanović S. Epidemiologic aspects of smallpox in Yugoslavia in 1972. Geneva, Switzerland: World Health Organization; 1973.
- [18] Kos JB. Ospa 1963. Alarm dla Wrocławia. Wrocław: Warstwy; 2017.
- [19] Komunikat Wydziału Zdrowia. Słowo Polskie; 17 July 1963.
- [20] Kienzler I. Epidemia ospy we Wrocławiu. In: Kronika PRL 1945–1989. vol. 3. Afery i skandale. Warszawa: Edipresse-Kolekcje and Bellona; 2015.
- [21] Ambroziewicz J. Zaraza. Warszawa: Dowody na istnienie; 2016.
- [22] Penar S, Przyłęcki S, Żołnierkowska D. Ospa prawdziwa w województwie wrocławskim w roku 1963. *Przegląd Epidemiologiczny* 1964;18(2):189–96.
- [23] Trzaskowska G. Epidemia czarnej ospy we Wrocławiu w 1963 roku. Wrocław: Stowarzyszenie na Rzecz Promocji Dolnego Śląska; 2008.
- [24] Surowcowa-Świdzińska A, Tarkowska-Gawron B, Hawling T, Oleksin D. Przebieg kliniczny ospy w epidemii wrocławskiej w 1963 r. *Przegląd Epidemiologiczny* 1964;18(2).
- [25] Skurska Z. Laboratoryjna diagnostyka ospy i trudności z nią związane. *Przegląd Epidemiologiczny* 1964;18(2):173–8.
- [26] Arendzikowski B, Kocielska W, Przesalska H. Epidemia ospy we Wrocławiu w roku 1963. *Przegląd Epidemiologiczny* 1964;18(2).
- [27] Shchelkunov SN. An increasing danger of zoonotic orthopoxvirus infections. *PLoS Pathog* 2013;9(12):. <https://doi.org/10.1371/journal.ppat.1003756>.
- [28] Shchelkunov SN. Emergence and re-emergence of smallpox: the need for development of a new generation smallpox vaccine. *Vaccine* 2011;29(Supplement 4):D49–53. <https://doi.org/10.1016/j.vaccine.2011.05.037>.
- [29] Poland GA, Jacobson RM, Tilburt J, Nichol K. The social, political, ethical, and economic aspects of biodefense vaccines. *Vaccine* 2009;27(Supplement 4):D23–7. <https://doi.org/10.1016/j.vaccine.2009.08.054>.
- [30] Żuk P, Żuk P, Lisiewicz-Jakubaszko J. Labour migration of doctors and nurses and the impact on the quality of health care in Eastern European countries: the case of Poland. *Econ Labour Relat Rev* 2019;30(2):307–20. <https://doi.org/10.1177/1035304619847335>.
- [31] Lasco G, Curato N. Medical populism. *Soc Sci Med* 2019;221:1–8. <https://doi.org/10.1016/j.socscimed.2018.12.006>.