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ORIGINAL PAPER

EPIDEMIOLOGICAL SURVEILLANCE OF INFECTIOUS DISEASES AMONG THE ELDERLY IN LOWER SILESIA

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Highlights

- Population ageing will strain healthcare due to more infections in very old patients.
- Incidence of gastrointestinal infections and outbreaks is increasing.
- Vaccine-preventable respiratory infections are relatively controlled among seniors.
- A gap in sexually transmitted infections reporting among older adults has been identified.
- Higher incidence in spa districts indicates the need for tailored local surveillance.

Abstract

Background: The elderly population in Lower Silesia, Poland, faces increased vulnerability to infectious diseases due to population ageing. A comprehensive epidemiological surveillance program among seniors is crucial for effective public health planning and intervention strategies. This study aims to characterise infectious-disease trends among individuals aged ≥65 years, emphasising the importance of tailored preventive measures. **Material and Methods:** This retrospective study analysed infection registries maintained by the State Sanitary Inspection 2020–2023 for people aged ≥65 years. Included registries encompassed notifiable infectious diseases (12 811 doctors' reports and 1499 laboratory reports), hospital-acquired infections and outbreaks, tuberculosis notifications (230 cases), influenza-like illnesses (ILI) (104 487 suspected cases), and gastrointestinal outbreaks (46 outbreaks in facilities with seniors). Spatial and temporal variations in incidence were examined in relation to demographic changes and disease types. **Results:** There was a notable increase in bacterial gastrointestinal infections and ILI among the elderly, with reporting rising markedly after lockdowns. Incidence rates shifted toward older age groups. Bacterial intestinal infections, primarily caused by *Clostridioides difficile*, increased by approx. 54%/year. Hepatitis B and C incidence was elevated, especially in long-term care facilities. Gastric outbreak numbers were stable, despite more notifications overall. Spa districts recorded higher infection rates than the rest of the region (1186.6 vs. 630.0/100 000 adults aged ≥65 years, $p = 0.014$). Notifications of sexually transmitted infections (STIs) were very rare. **Conclusions:** The findings highlight increased vulnerability of seniors, driven by diminished immunity and comorbidities, and underscore the need for targeted vaccination, systematic screening for STIs and other infections, and capacity building to meet rising demand for care among older patients. Spatial analyses point to higher risks in spa districts and call for more accurate surveillance of visitors. Improved digital integration of health surveillance systems will be critical for monitoring and responding to infectious threats in the elderly population. Med Pr Work Health Saf. 2026;77(4)

Key words: Poland, communicable diseases, aged, infections, epidemiologic methods, population surveillance

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INTRODUCTION

Aging populations face numerous challenges, and maintaining cognitive capacity, health and quality of life is essential for the well-being of seniors [1]. Older adults are particularly susceptible to infectious diseases due to physiological changes, such as weakened muscle tone and reduced saliva production, which facilitate pathogen entry [2,3]. Comorbidities increase fatality rates, as illustrated during the COVID-19 pandemic [4]. Pulmonary and urinary tract infections remain the main infectious problems for the elderly [5]. On the one hand, older people experience fewer adverse events after vaccination [6], but immune responses tend to be weaker. Pharmacokinetic changes, including those affecting antibiotics, further complicate care [7]. "Weathering" – the cumulative effect of biological and social vulnerability – is shaped by both biological susceptibility and social factors like isolation, dependence on caregivers or institutionalisation [8]. Research on sexually transmitted infections (STIs) in older adults in Poland is scarce [9–11], with most discussion occurring in non-scientific sources [12,13].

Infection registries play a key role in monitoring the epidemiological situation, identifying outbreak sources, evaluating preventive measures and planning interventions. They also enable spatial and temporal mapping of epidemic dynamics for diseases not subject to mandatory reporting. However, much of the analysis of infectious diseases among seniors in Poland relies on mortality data or health-service records [14]. The State Sanitary Inspection (Państwowa Inspekcja Sanitarna – PIS) is the public health authority responsible for infectious-disease surveillance and outbreak investigations in Poland and can enforce measures to prevent and control transmission [15]. Annual sanitary reports often provide aggregated information without access to raw data, making it difficult to isolate the elderly population from the general population.

Lower Silesia (2.87 million residents) is facing rapid demographic ageing, particularly in sub-Sudeten areas [16]. Understanding the health challenges faced by older residents, especially with respect to epidemic risks, requires mapping their physical and social health conditions [17,18] before designing infection prevention programs. Such mapping informs prioritisation of threats, identification of high-risk settings and subgroups and selection of interventions tailored to older adults' needs. This study aims to map the epidemiological landscape of infectious diseases among the elderly in Lower Silesia, focusing on key health threats and the need for tailored interventions.

MATERIAL AND METHODS

This retrospective study analyzed internal data from PIS units in the Lower Silesian Voivodeship, Poland, covering the years 2020–2023. During this period, PIS underwent a major digital transformation [19] and integration with national platforms such as Electronic Platform for the Collection, Analysis and Sharing of Digital Medical Event Data, including PIS Information System (System Ewidencji Państwowej Inspekcji Sanitarnej – SEPIS) and interfaces with healthcare providers. Inclusion criteria were:

- individuals aged ≥65 years for registry-based analyses,
- residents of long-term care facilities (e.g., nursing homes) for outbreak analyses if age is not provided.

The study used data from the following surveillance systems and registries.

Notifiable infectious diseases registry

This registry contains information on infectious diseases that healthcare providers and diagnostic laboratories are legally required to report, including respiratory, gastrointestinal, neurological, and other infections and etiological agents [20].

In this study:

- a total of 12 811 older adults were recorded as infectious disease cases in statutory physicians' notifications submitted using the ZLK-1 form (Notification of a Suspected or Diagnosed Infection or Infectious Disease), hereafter referred to as ZLK notifications. After excluding COVID-19 (coded as U07.1 according to the International Classification of Diseases, 10th Revision – ICD-10), 3378 cases remained;
- a total of 1499 laboratory notifications were submitted using the ZLB form (Notification of a Positive Test Result for Biological Pathogenic Agents), a legally mandated form used by laboratories to report positive test results.

Physician-based (ZLK) and laboratory-based (ZLB) reporting operate in parallel. Because these sources are affected by different reporting biases, they were analysed separately.

Tuberculosis registry

This registry monitors the epidemiological situation of tuberculosis in the region, particularly in the context

of labor migration and refugees from high-incidence settings, which may affect the local elderly population [21]. A total of 230 tuberculosis notifications (ZLK-2) were analyzed.

Influenza-like illness registry

This registry enables surveillance of influenza-like illness (ILI) and other acute respiratory infections in Poland (not differentiated here), which substantially contribute to morbidity among older adults, especially during seasonal peaks in January and February [22]. Although standard surveillance uses influenza seasons (September–August), data were analyzed by calendar year. In total, 90 196 ILI registrations were included from MZ-55 reports (Report on Influenza Cases and Suspected Influenza Cases).

Outbreak registry

Gastrointestinal and foodborne outbreaks were compiled and investigated by 26 county sanitary and epidemiological stations using the Registry of Epidemic Outbreaks system [23]. The unit of analysis was both the outbreak and (where available) the individual case. Overall, 46 outbreaks involving older adults were analyzed.

Sexually transmitted infections

This dataset includes notifications of suspected or confirmed HIV infection/AIDS and other STIs (gonorrhoea, syphilis, chlamydia).

The analysis identified:

- 13 HIV registrations (ZLK-4),
- 3 laboratory notifications of syphilis (ZLB),
- 0 confirmed non-HIV STI physician reports (ZLK-3).

Reporting system and data processing

In Poland, physicians report most notifiable infectious diseases via ZLK-1, while ZLK-2 covers tuberculosis, ZLK-3 non-HIV STIs, and ZLK-4 HIV. In contrast, MZ-55 reports ILI consisted of aggregated data submitted in bulk by medical practices (this reporting system was discontinued in mid-2023 and replaced by sentinel surveillance). Laboratory notifications (ZLB) are generated whenever predefined evidence of specific pathogens is detected, typically without systematic linkage to clinical history or examination. The epidemiological verification of notified cases, including assessment against surveillance case definitions, is performed primarily at the local/poviat level by the PIS. After this verification, case numbers are transmitted from poviat sanitary-epidemiological stations to the regional level and subsequently to the national level, in aggregated reporting structures only, without demographic variables such as age. As this article focuses on older adults, the analysis had to rely on underlying individual-level raw data, cleaned for obvious duplicates (such as repeated test results from ZLB) and rejected cases, since the age criterion could not be applied to aggregated data.

Finally, spatial variation and temporal trends were examined to provide a comprehensive assessment of the regional epidemiological landscape. Exact statistical tests used for each issue is described in line in results section.

RESULTS

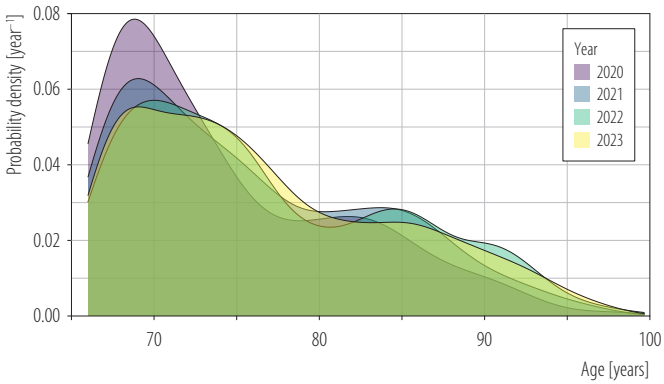
In all registries, the pandemic years 2020–2021 differed markedly from the subsequent period.

Notifiable infectious diseases registry submitted by physicians

Physicians' reports in the ZLK-1 registry reflect changes in epidemiological burden, population ageing, and reporting bias during the COVID-19 pandemic. Cases of COVID-19 are included in ZLK-1 by default; however, this is not the standard approach for estimating COVID-19 incidence. Therefore, in this paper focus is on non-COVID-19 infections. Moreover, lockdowns disrupted both routine surveillance and traditional transmission pathways, underscoring the need for robust digital integration of surveillance systems to ensure sustained healthcare access and improved epidemiological monitoring – a process that has been progressing in Poland in recent years.

One can observe a rightward shift in the age distribution, partly driven by ageing of the older-adult population (Figure 1). The Kruskal-Wallis test indicated overall differences in age distributions across years ($p = 6.98 \times 10^{-8}$). Dunn's *post hoc* comparisons showed that all year pairs were significant or borderline ($p \leq \sim 0.05$), except 2022 vs. 2023, which was not different ($p = 0.71$). Overall, this pattern suggests a shift toward older ages over time, with the distribution stabilizing 2022–2023.

The ICD-10 codes are standardized medical classification codes used to identify diseases, health conditions, symptoms, injuries, causes of death, and other health-related problems [24]. To summarize disease frequencies, 2-digit ICD-10 codes is used: A04 – other bacterial intestinal infections, A69 – other spirochaetal infections, B34 – viral infection of unspecified site, J10 – influenza due to other identified influenza virus, Z20 – contact with and exposure to communicable diseases,



ZLK-1 – physician notification form for reporting suspected or confirmed cases of infectious diseases in Poland.

Figure 1. Annual age density of reported infections submitted by physicians (ZLK-1) without COVID-19 among adults aged ≥65 years in Lower Silesia, 2020–2023, Poland

B96 – other specified bacterial agents as the cause of diseases classified elsewhere, A09 – diarrhoea and gastroenteritis of presumed infectious origin, J00 – acute nasopharyngitis (common cold), A02 – other salmonella infections, A46 – erysipelas, A40 – streptococcal sepsis, W54 – bitten or struck by dog, B02 – zoster (herpes zoster), B18 – chronic viral hepatitis, J13 – pneumonia due to *Streptococcus pneumoniae*. Among physicians' reports, bacterial intestinal infections dominated (Figure 2).

A marked year-on-year increase was observed in bacterial intestinal infections (Figure 2), with incidence in 2022–2023 generally higher than in 2020–2021. Among spirochaetal infections, the increase was driven mainly by *Borrelia* infections (tick-borne disease).

Demographic data indicate that the Sudeten counties are among the fastest-ageing areas in Poland. The highest numbers of post-working-age individuals per 100 working-age persons were observed in spa municipalities, notably Polanica-Zdrój (62) and Duszniki-Zdrój (61), as well as in Jelenia Góra and Szczawno-Zdrój (58 each), which are among the highest values in the Lower Silesian Voivodeship [16]. In these Sudeten counties – many of which are also spa districts with a high concentration of sanatoria – reported infection incidence is higher (Figure 3) than in the rest of the region (1186.6 vs. 630.0/100 000 adults aged ≥65 years, p = 0.014 according to t-test). These localities function as national "mixing hubs," where patients from across Poland spend prolonged periods in shared accommodation, dining, rehabilitation, and social settings, increasing opportunities for exposure and onward transmission. This context may also be relevant for STIs, as visitors may form short-term partnerships during stays and prevention behaviours may be inconsistent [25]. However, routine surveillance data are administratively attributed to the patient's place of residence. As a result, infections diagnosed in visitors are typically reported to their home districts rather than recorded in spa-district statistics. Consequently, local surveillance in spa districts primarily reflects infections among permanent residents, and the true burden associated with visiting patients is likely underestimated.

Notifiable infectious diseases registry submitted by laboratories

A total of 1499 laboratory confirmations reported using ZLB forms were analyzed (Figure 4). *Clostridioides difficile* was the most frequently reported agent, likely reflecting ongoing hospital outbreaks and the high representation of healthcare-associated infections in this registry. Seniors are particularly susceptible to urinary tract infections due to pelvic anatomical changes and chronic comorbidities, which increases vulnerability in this age group [26].

Reported hepatitis B (HBV) and C (HCV) cases may be overrepresented due to screening procedures and the (re)identification of chronic infections (Figure 4).

Gastrointestinal outbreak registry

Outbreaks involving older adults were identified using either recorded age, when available, or the outbreak setting as a proxy (e.g., nursing homes). Although the total number of outbreaks increased over time, the number of outbreaks involving older adults remained numerically stable (Figure 5). Overall, 46 foodborne outbreaks included older adults.

Influenza-like illness notifications

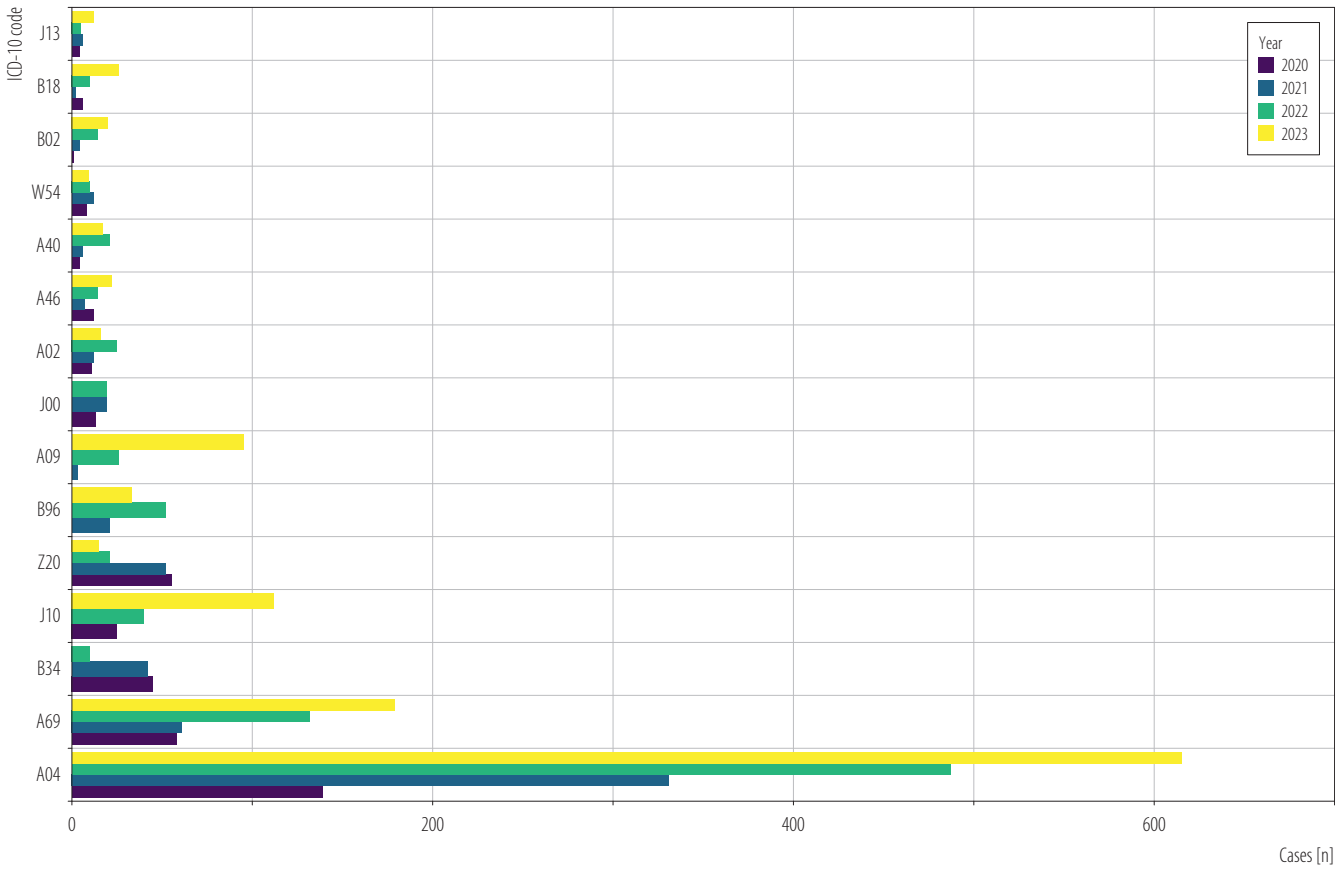
A total of 104 487 ILI notifications (MZ-55) among older adults were analyzed (after extrapolation), using baseline comparisons.

An increase in ILI notifications among older adults was observed (the 2022/2023 season was particularly severe, likely due to immunity gaps and the relaxation of COVID-19 restrictions); however, the increase was even more pronounced in younger age groups (Table 1).

Tuberculosis

The tuberculosis (TB) situation was broadly stable across the study period, except for 2022 (Table 1).

The impact of the war in Ukraine is evident (Table 1), reflected in the inflow of a younger, TB-affected migrant population [21]. In contrast, TB in the local population shows a declining trend, and the increase in 2022 was driven predominantly by cases recorded among migrants.



ICD-10: A02 – other salmonella infections, A04 – other bacterial intestinal infections, A09 – diarrhoea and gastroenteritis of presumed infectious origin, A40 – streptococcal sepsis, A46 – erysipelas, A69 – other spirochaetal infections, B02 – herpes zoster, B18 – chronic viral hepatitis, B34 – viral infection of unspecified site, B96 – other specified bacterial agents as the cause of diseases classified elsewhere, J00 – acute nasopharyngitis (common cold), J10 – influenza due to other identified influenza virus, J13 – pneumonia due to *Streptococcus pneumoniae*, W54 – bitten or struck by dog, Z20 – contact with and exposure to communicable diseases.

Figure 2. Frequency of physicians' notifications by year and two-digit International Statistical Classification of Diseases and Related Health Problems, 10th Revision (ICD-10) code without COVID-19 among adults aged ≥65 years in Lower Silesia, 2020–2023, Poland

Sexually transmitted infections

Until 2022, all registered HIV cases were reported exclusively from Wrocław, the regional capital. Among HIV patients residing outside Wrocław, 40% were originally from Ukraine, compared with one-eighth among those currently living in Wrocław. For HCV, no evidence of high-risk sexual behaviours was identified as a likely route of transmission. No non-HIV STI physician reports (ZLK-3) were recorded in Lower Silesia. For the 3 laboratory-confirmed syphilis cases, detailed epidemiological investigations were not available.

DISCUSSION

Aging-related physiological and social changes, including immunosenescence and chronic comorbidities, increase older adults' susceptibility to severe infections and may also heighten vulnerability to climate-related health threats [27]. Key findings indicate a marked increase in bacterial gastrointestinal infections over the study period (Figures 2, 4 and 5). Underreporting was likely substantial during the 2020–2021 lockdowns [20]. Influenza-like illness notifications among seniors increased (Table 1), although the rise was less pronounced than in younger age groups. This may partly reflect higher vaccine uptake among older adults, suggesting that maintaining high vaccination coverage in this group is beneficial [28]. While the overall number of reported outbreaks increased, the number of gastrointestinal outbreaks involving older adults remained numerically stable (Figure 5). In addition, laboratory data indicated a high burden of HBV and HCV among seniors (Figure 4).

Spatially, higher infection rates were observed in areas with sanatoria and long-term care facilities (Figure 3). Tuberculosis notifications were predominantly concentrated among migrant populations (Table 1).

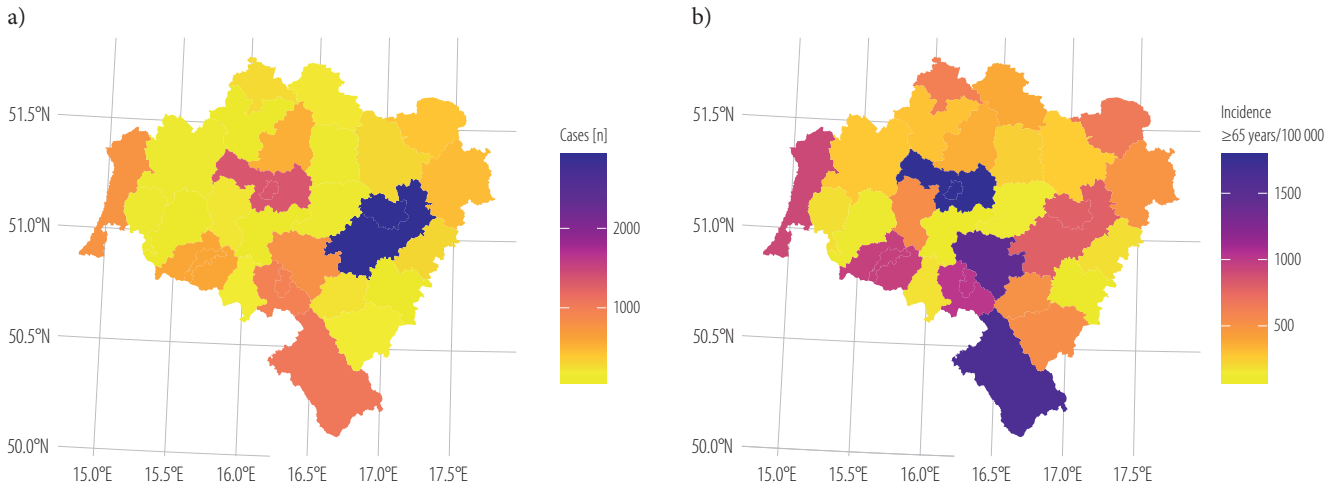


Figure 3. Spatial distribution by poviat of a) the number of notified cases and b) incidence per 100 000 population among adults aged ≥65 years in Lower Silesia, 2020–2023, Poland

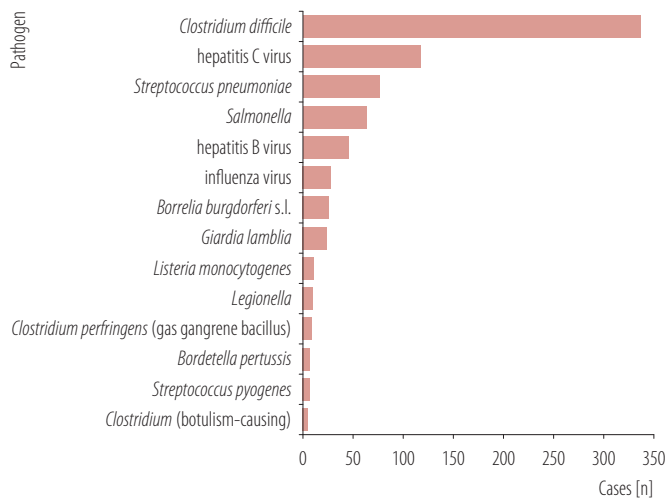


Figure 4. Most frequently reported pathogenic biological agents among adults aged ≥65 years in Lower Silesia, 2020–2023, Poland

Limitations

This analysis used internal data from PIS units in the Lower Silesian Voivodeship and therefore covered only infections and pathogens subject to mandatory notification. Several conditions common in older adults, such as candidiasis (e.g., Candida albicans infections of athe genital organs or skin), are not included among notifiable diseases or listed biological agents. Consequently, the statistics may underestimate the true burden: some infections are oligosymptomatic and remain undiagnosed, while others are managed in private practices where reporting may be incomplete, particularly for STIs. Moreover, COVID-19 lockdowns disrupted transmission patterns and reduced routine healthcare access, creating additional data gaps.

The analysis used primary ZLK and ZLB because official verified epidemiological reports are aggregated and

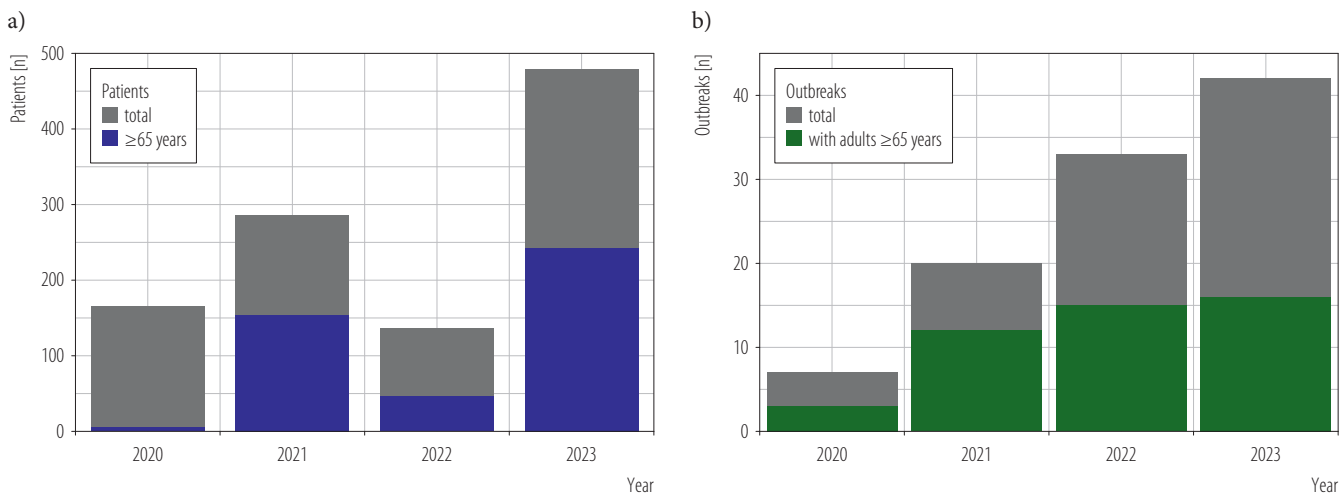


Figure 5. Gastrointestinal outbreaks in Lower Silesia, 2020–2023, Poland: a) proportion of older adults among outbreak cases, b) proportion of outbreaks that involved older adults

Table 1. Annual notifications of influenza-like illness and tuberculosis among adults aged ≥65 years in Lower Silesia, 2020–2023, Poland

Year	Persons ≥65 years	
	n	%[a]
Influenza-like illness		
2020	23 032	12.6
2021	19 281	12.7
2022	27 875	12.0
2023	34 299.4[b] (20 008 up to June 30, 2023)	10.2
Tuberculosis		
2020	42	15.8
2021	59	21.1
2022	70	16.7
2023	59	23.7

[a] Among all age categories.
[b] Extrapolated to the end of the calendar year based on partial data following closure of the MZ-55 registry (Polish national infectious diseases surveillance registry; data available up to June 30, 2023).

lack demographic variables, which made it impossible to identify the cohort of patients aged ≥65 years. Obtaining harmonised individual-level data from the county level was not feasible due to legal and administrative barriers, including the requirement to obtain separate approval from each county sanitary inspector. Therefore, the presented findings are exploratory and based on epidemiological surveillance data. They should not be interpreted as definitive absolute estimates of the true disease burden in the older population. Moreover, the absence or scarcity of reports, particularly physician-based STI notifications among older adults, should not be treated solely as missing information, but also as an epidemiological signal requiring cautious interpretation. Given the very limited scientific literature on infections among older adults in Poland, especially in the context of STIs, this study should be understood as exploratory and data-driven, with the primary aim of identifying surveillance gaps and generating hypotheses rather than providing definitive causal explanations. Thus, improved digital integration of surveillance systems could strengthen monitoring and response capacity.

CONCLUSIONS

Ageing is associated with a weakened immune response and a higher risk of infection and severe outcomes on the demand side [29], as well as increased needs for prevention (e.g., vaccination) and adapted clinical management (e.g., diagnostics and modified interventions) on the supply side [30]. Reported infectious diseases (excluding COVID-19) declined during the 2020–2021 lockdowns, likely due to both reduced transmission and constrained access to healthcare. Lower Silesia is ageing more rapidly than many other regions in Poland and Europe [31], underscoring the need for targeted local epidemiological interventions. Key trends in respiratory and gastrointestinal infections were identified, and the importance of vaccination and enhanced epidemiological surveillance was highlighted. Recommended interventions include:

- capacity building to meet the growing demand for care among older infectious patients [32],
- training for primary care physicians to better recognise and reporting STIs in older patients [33],
- vaccination programs (e.g., influenza [34]) and screening strategies (e.g., combined antigen/antibody respiratory and STI testing), which should be evaluated using cost-effectiveness analyses.

Targeted interventions, ongoing surveillance, and tailored public health strategies are essential for effective infectious disease control among seniors [35]. Without timely, detailed data, planning and evaluation of such measures is limited; newer registries (e.g., respiratory syncytial virus and herpes zoster) could support more comprehensive future analyses.

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AI USE

ChatGPT 5.2 was used for language editing and proofreading of the manuscript.

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