



Registered incidence of acute upper respiratory tract infections diagnosed by primary care physicians in Poland – 5-year retrospective analysis of the national health insurance database

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Abstract

Introduction and Objective. Upper respiratory tract infection (URTIs), caused by a variety of viruses and sometimes by bacteria, represents the most common acute illness in primary health care. The aim of the study was to explore the registered incidence of URTIs in Poland in the period between 2015–2019, and its burden on the health care system.

Materials and Method. A retrospective analysis was carried out of all medical encounters in Poland registered within the national billing database of public healthcare services. Medical services provided due to acute URTIs were classified according to the ICD-10 codes. Registered Incidence Rate (RIR) was calculated yearly, in a 100,000 population. A generalised additive model was used to calculate the Incidence Rate Ratio (IRR).

Results. In the analysed 5-year period, acute URTI was diagnosed in 24.3 million patients (61.7% of the whole population registered in PHC). The RIR of all acute URTIs in PHC was 50,762/100,000/year. Nearly 99% of consultations in this group of patients were provided by PHC physicians. Only 0.8% were referred to an OSC consultation and 0.4% were hospitalised. In PHC, indeterminate URTIs were most frequently diagnosed. The estimated IRR for children aged 1–4 years was 1.65 (95% CI: 1.64; 1.66, $p < 0.01$) and for men 0.79 (95% CI: 0.79; 0.79; $p < 0.01$). In the studied period, the number of patients consulted for acute URTI decreased slightly in PHC, but significantly in specialist services.

Conclusions. The registered incidence of URTIs in Poland burdens mainly PHC physicians. Women and children aged 1–4 years are more frequent users of medical services related to URTIs. It appears that strategies for increasing patient empowerment to provide efficient self-care reducing the utilisation of PHC services are needed.

Key words

Poland, epidemiology, primary health care, upper respiratory tract infections, registered incidence

INTRODUCTION

Upper respiratory tract infections (URTIs) are a common health problem that affect people of all ages. The most common symptoms of URTIs are: cough, sore throat, low-grade fever, facial pressure, nasal congestion and rhinorrhea. URTIs include the common cold, rhinitis, pharyngitis, sinusitis, and laryngitis [1, 2]. They are usually caused by viral pathogens, with the most common viruses including rhinoviruses, coronaviruses, adenoviruses, respiratory syncytial virus and influenza viruses. Bacterial pathogens such as *Streptococcus pyogenes*, *Haemophilus influenzae*, *Staphylococcus aureus*, and *Moraxella catarrhalis* can also cause URTIs, but they are less common [3, 4]. These illnesses are usually minor, of short duration and self-limiting; most people recover without

medical treatment and complications are uncommon. Only those who experience more severe, prolonged, recurrent or complicated illnesses need to visit medical professionals. Fatal consequences of URTIs occur very rarely and mostly in the elderly and children under the age of five years [5]. The management of typical URTI includes supportive care, such as rest and hydration. Treatment is usually symptomatic and involves over-the-counter medications to relieve cough or fever [6]. Antibiotics are generally not recommended.

Although URTIs are usually mild and not life-threatening, several studies show that they are among the most common diseases, significantly decreasing quality of life and representing a substantial proportion of healthcare visits. Reducing productivity and consuming health care resources, URTIs also result in a financial burden on society. Global Burden of Disease (GBD) studies estimated the occurrence of these diseases in different gender and age groups, and calculated that the estimated incident cases of URTIs amounted to more than 17 billion in 2019, with an age-

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standardised incidence rate of 225,505.7 (95% confidence interval [CI] 201,156.4 to 253,739.5) per 100,000 people. The highest incidence rate was observed in the group of children under the age of five years, and men who had a higher incidence rate than women. In the GBD study, URTIs accounted for about 43% of all causes [5].

Only a limited number of studies have estimated the attendance of patients with URTIs at primary care and other levels of the health care system. It is known that many patients prefer to consult physicians within the first few days of their illnesses, despite their self-limiting nature [7]. Respiratory tract infections are among the top ten of all reasons for patient visits to PHC [8], and are the most frequent among acute illnesses [9].

Routine data from the British primary care sentinel network database showed a high household incidence of upper respiratory infections and influenza-like illness within primary care [10]. A cohort study in The Netherlands revealed that female patients had a significantly higher incidence of respiratory symptoms as the reason for consultation (230/1000 patient-years) compared with males (186/1000 patient-years) [11]. A retrospective analysis of computerised clinical data on patients presenting to all public primary care clinics in Hong Kong showed that consultations for URTI symptoms account for almost 20% of attendances per year (around 900,000 out of five million attendances annually) [12]. The Dutch study reported a respiratory tract infection incidence rate of 144 per 1,000 person-years. The highest incidences of URTI diagnoses presented to GPs were acute rhinitis and acute sinusitis (51 and 23 per 1000 person-years, respectively). Infections were more common among children, elderly persons and patients with pulmonary, cardiac disease, and diabetes mellitus. Overall, about 15% of all consultations in Dutch general practice were related to respiratory tract infection illness [13]. URTIs are usually managed by PHC physicians, but other levels of care might also be involved, with acute URTIs accounting for up to 20% – 25% of emergency department (ED) visits [14, 15].

In Poland, only a few small-scale studies have been carried out on URTIs. In a typical PHC practice in Poland, more than half of respiratory tract infections were diagnosed as ‘unspecified’ [9]. Acute nasopharyngitis (common cold) was diagnosed in 13.6% of patients, while another study showed that URTIs were responsible for 25–40% of all PHC visits [16].

URTIs are frequent, cause a decrease in productivity and account for a significant burden on PHC in Poland; however, major epidemiological studies on them are absent.

OBJECTIVE

This study aims to answer the following research questions:

- What was the incidence of URTIs diagnosed clinically by PHC physicians in Poland in the period between 2015–2019?
- What are the seasonal differences and annual trends in the incidence of URTIs?
- What is the burden on particular levels of the health care system in Poland engendered by the care of patients with acute URTIs?
- Are there any associations between patient characteristics and place of service provision on URTI diagnosis?

MATERIALS AND METHOD

Study design. A retrospective analysis was undertaken of all medical encounters in Poland registered within the national database of public healthcare services between 1 January 2015–31 December 2019.

Source of data. The billing records of the database maintained by the National Health Fund, the only public health insurer in Poland, which covers almost the entire population of the country, were used. The database contains information on the identification of a service provider (contract number, service provider code, code of organisational units and territorial code of its location) and medical services provided (type and date of service, diagnosis code, type of personnel), retrieved from patients’ medical records. The database also contains patients’ identification numbers (PESEL – Universal Electronic System for Registration of the Population). All of these data are interconnected and reported continuously by all entities providing medical services in Poland, based on a contract with the National Health Fund. The database does not contain information on services provided outside the public health care system.

Measures. We have identified all consultations in the health care system with a diagnosis of URTI as the reason for the consultation. Diseases were classified according to ICD-10 codes assigned by the consulting physician, with the following groups distinguished:

- Indeterminate URTIs (ICD-10 code: J00 – Acute nasopharyngitis [common cold] and J06 – Acute upper respiratory infections of multiple and unspecified sites).
- Sinusitis (ICD-10 code: J01 – Acute sinusitis).
- Pharyngitis and tonsillitis (ICD-10 code: J02 – Acute pharyngitis and J03 – Acute tonsillitis).
- Laryngitis and tracheitis (ICD-10 code: J04 – Acute laryngitis and J05 – Acute obstructive laryngitis [croup] and epiglottitis).
- Influenza (ICD-10 code: J09 – Influenza due to certain identified influenza virus, J10 – Influenza due to other identified influenza virus and J11 – Influenza, virus not identified).
- Otitis media (ICD-10 code; H65 – Non-suppurative otitis media and H66 – Suppurative and unspecified otitis media).

For all incidents, their dates (day, month and year) were recorded. Services provided less than two weeks apart to a patient with an acute URTI were considered episodes of the same illness.

Population. All publicly insured patients who had chosen a primary care provider and submitted a relevant declaration in this regard, were included. Patient gender was determined based on their PESEL number. The age variable was calculated from the date of birth and the date of the consultation and divided into the following age groups: <1; 1–4; 5–14; 15–44; 45–64; 65–74; 75+ years of age.

Settings. The data collected were analysed and conveyed by all providers of primary health care (PHC), outpatient specialist care (OSC) and hospitals contracted by the National Health Fund in Poland. The PHC includes practices providing both types of consultations – routine care (Monday – Friday, 08.00–

18.00) and out-of-hours care (nights, weekends and holidays). The place of consultation was categorised as a surgery or home visit. The size of the PHC practice was determined based on the number of declared patients, broken down into quartiles. The OSC services included otolaryngology (ENT), allergy, pulmonology and infectious disease clinics. With regard to hospitals, wards and also admission rooms and hospital emergency departments, were included. The location of the healthcare providers was determined, based on the territorial classification of the Central Statistical Office and categorised as cities (over 500,000 inhabitants), towns (below 500,000 inhabitants), mixed urban-rural areas and villages.

Statistical analysis. Analyses were performed using R software, version 4.1.3 (manufactured by R Core Team). The quantitative data were presented using raw counts, percentages and means, along with the standard deviation. The significance of within and overall time differences were tested using adjusted GAM models. Statistical significance was determined at $p < 0.01$. The Registered Incidence Rate (RIR) was calculated as the number of new URTI cases diagnosed yearly per 100,000 population. A hierarchical, generalised additive model within R's Mixed GAM Computation Vehicle (mgcv) library was used to determine the impact of patient characteristics and the place of service provision on the likelihood of presenting URTI. The choice of negative-binomial distribution was dictated by the response variable count character and its mean-variance inspection revealing a non-constant relation. The appropriateness of model diagnostics confirmed the legitimacy of the chosen distribution and the set of variables.

The following variables were included in the model equation: (a) location of the entity, (b) type of URTI, (c) patient's gender, (d) age group, (e) type of PHC consultation, (f) place of service provision and (g) size of the PHC practice. In addition, the model takes into account and corrects (a) the impact of the trend and seasonality on the relative incidence rate and differences in the shape of the trend, and seasonality of the incidence rate of individual URTIs; (b) variability in the level and dynamics of the relative incidence of diseases, as presented by individual healthcare entities; (c) differences in the number of patient declarations in each healthcare entity; (d) differences in the number of days in each month and (e) regional variability between healthcare entities. The value of the estimate is presented as an Incidence Rate Ratio (IRR) with a 95% confidence interval (95% CI) and a p-level of statistical significance.

Ethical approval. All analyses were carried out on previously anonymised data, which precluded the identification of persons or entities. The study was conducted according to the Declaration of Helsinki guidelines. The National Health Fund's source database contained patients' PESEL identification numbers. At the stage of creating the database for the study (data mart), before the research team started work, the data, including PESEL numbers, were encrypted in a way that prevented identification of the patient, and the medical event. The entire analytical process was carried out while maintaining the principle of confidentiality and minimising data availability. The Bioethical Committee of the Jagiellonian University Medical College in Kraków, approved the protocol of the study on 22 June 2022 (Approval No. 1072.6120.152.2022).

RESULTS

Patient characteristics. In Poland, during the period 2015–2019, 39.4 million citizens were registered with PHC physicians. In particular years, this number differed, ranging from a minimum of 36.7 million in 2018 to a maximum of 36.8 million in 2019. During these years, PHC doctors consulted 35.7 million persons (91% of all registered). Among them, 24.1 million (61.2% of all registered and 67.5% of those using PHC services) presented with acute URTI. Table 1 contains detailed characteristics of patients registered with PHC physicians and using their services.

In the analysed five-year period, URTI was diagnosed in 24.3 million patients at all healthcare levels (PHC, OSC and hospitals). Table 2 demonstrates the distribution of patients diagnosed with URTIs utilising health care services at different levels of the health care system.

The number of patients with URTI in particular years progressively decreased from 11.5 in 2015 to 10.7 million in 2019 (7.6% reduction; $p < 0.01$). In PHC, the decrease (7.5%; $p < 0.01$) was similar to the overall decrease of URTI patients, whereas in the OSC, the number of URTI patients decreased from 194,000 in 2015 to 126,700 in 2019 (34.7% reduction; $p < 0.0001$). In the same period, the number of URTI patients using hospital services decreased from 96.1 thousand to 78.6 thousand (18.1% reduction; $p < 0.0001$). Supplementary Materials 1 present the details.

Registered incidence of URTIs in PHC. In the years 2015–2019, PHC physicians diagnosed over 126 million cases of URTI (with a yearly average of 25.2 million; minimum 23.1 million in 2019, and maximum 26.5 million in 2015; $p < 0.001$) (Tab. 3).

Among all URTIs, the most common were: indeterminate URTI (64%) and pharyngitis and tonsillitis (21%). Less frequent were: laryngitis and tracheitis (6%), sinusitis (5%), otitis media (3%) and influenza (1%). In the analysed period, the registered incidence ratio was 50,762/100,000 /patient-year. More than half (53%) had only one episode of URTI in a year, 22% had two and 10% had three. In 2% of patients, URTI was diagnosed ≥ 9 times yearly. In the entire five-year period, the mean number of PHC consultations in all registered populations was 5.76 ± 5.08 per patient. In patients with URTIs, the mean number of PHC consultations (for all reasons) was 6.55 ± 5.44 , with 2.13 ± 1.95 being due to URTIs. At the same time, in patients without a diagnosis of a URTI, the mean number of PHC consultations for all reasons was 5.21 ± 4.74 .

The vast majority (91.1%) of URTIs were diagnosed during routine surgery consultations, while 0.7% were diagnosed during home visits. Physicians in out-of-hours services made 8.1% of URTI diagnoses in their surgeries, and 0.1% during home visits.

Only 0.8% of patients diagnosed with URTIs by PHC physicians were also in consultations in the OSC in the following fortnight, and 0.4% were consulted in a hospital setting. In this group of patients, the most common reason for OSC consultation was otitis media (61% of all URTI consultations in the studied period), and the most common URTI consulted in the hospital setting was indeterminate URTI (34% of all episodes in five years).

Of the PHC visits due to URTI during routine working hours, 0.7% were consulted in OSC in the following fortnight.

Table 1. Patients registered with PHC physicians and using their health services between 2015–2019

PATIENT CHARACTERISTICS	PATIENTS CONSULTING WITH PHC		
	Main diagnosis		Total
	URTI	Other	
Patients, total N(%)	24,111,260 (100%)	35,049,772 (100%)	35,707,534 (100%)
Women, N (%)	13,328,276 (55%)	18,476,729 (53%)	18,761,729 (53%)
Men, N (%)	10,782,984(45%)	16,573,043 (47%)	16,945,805 (47%)
Age – years, mean (SD)	31.9 (23.1)	51.5 (25.5)	47.4 (26.9)
Patients in age groups – N (%)			
<1	576,766 (2%)	1,629,648 (6%)	1,649,532 (5%)
1-4	1,706,928 (7%)	1,704,351 (5%)	1,41,763 (5%)
5-14	3,135,950 (13%)	3,655,159 (10%)	3,675,723 (10%)
15-44	9,884,907 (41%)	12,744,702 (36%)	13,261,621 (37%)
45-64	5,549,632 (23%)	9,134,146 (26%)	9,195,759 (26%)
65-74	1,950,421 (8%)	3,358,895 (9%)	3,359,592 (9%)
≥75	1,306,656 (6%)	2,822,871 (8%)	2,823,544 (8%)
Patients in practices from different locations – N(%)			
Cities	2,885,648 (12%)	4,299,082 (12%)	4,422,318 (13%)
Towns	11,083,017 (46%)	15,934,303 (46%)	16,218,358 (45%)
Mixed urban-rural	5,548,847 (23%)	8,070,178 (23%)	8,211,363 (23%)
Rural	4,593,748 (19%)	6,746,209 (19%)	6,855,495 (19%)
Patients in the division to the size of PHC entity N (%)			
Q1 (≤ 2 454)	1,720,784 (7%)	2,540,215 (7%)	2,585,209 (7%)
Q2 (2 455 – 4 111)	3,324,068 (14%)	4,822,053 (14%)	4,903,463 (14%)
Q3 (4 112 – 7 027)	5,630,267 (23%)	8,074,006 (23%)	8,211,984 (23%)
Q4 (≥7 028)	13,436,141 (56%)	19,613,498 (56%)	20,006,878 (56%)

Q – quartile of the patients registered with PHC physicians (in brackets, mean yearly no. of patient's declarations); PHC – primary health care; SD – standard deviation; URTI – upper respiratory tract infection

Table 2. Patients with acute URTI, using services in PHC, OSC and hospitals in 2015–2019

Patients with URTI	No.	Ratio
All	24,324,901	100 %
Using PHC services	24,111,260	99.12 %
including:		
consulted in PHC only	23,225,244	95.48 %
consulted also in OSC*	557,452	2.29 %
consulted also in the hospital setting*	328,564	1.35 %
Not using PHC services	213,641	0.88 %
including:		
OSC consultation only	133,269	0.55 %
hospital consultation only	72,700	0.30 %
consulted in OSC and hospital setting	7,672	0.03 %

*≤2 weeks from the PHC consultation with the same medical reason for the consultation; OSC – outpatient specialist care; PHC – primary health care; URTI – upper respiratory tract infection

In the case of the patients with URTI diagnosed in out-of-hour care, this ratio was 0.9%.

The ratio of hospital consultations due to URTI was four times higher in the case of URTIs diagnosed initially in out-of-hour primary care (1.3%) when compared with cases diagnosed during routine primary care working hours (0.3%; $p < 0.0001$).

Supplementary Materials 2 present the details of URTI cases and healthcare services due to URTI, registered in the period 2015–2019.

Variables affecting the registered incidence. Diagnosis of URTI was 21% more likely in women than in men. In children 1–4-years-old, the chances of URTI diagnosis were

65% higher than in those under the age of one year. The risk of URTI was also affected by such variables as the type of infection, size of the PHC entity, and the type or place of PHC consultation (Tab. 4).

Trends and seasonal differences in URTI. During the analysed period, there was an overall increase in the total number of consultations provided in PHC for any reason, increasing from 155.0 million in 2015 to 159.8 million in 2019, representing a growth rate of 3.1%. However, with regard to patients with acute URTIs, there was a noticeable decrease in the number of visits from 26.5 million to 23.1 million, a reduction of 13.1% ($p < 0.0001$). Consequently, the proportion of consultations delivered by PHC physicians to patients with URTIs declined from 17% to 14%.

In OSC, the number of consultations due to URTIs declined significantly from 235,726 in 2015 to 144,036 in 2019, marking a substantial reduction of 38.9% ($p < 0.0001$). Moreover, the percentage of URTI cases requiring consultation by an OSC physician within 2 weeks subsequent to the PHC visit decreased from 0.9% in 2015 to 0.6% in 2019.

Similar trends were observed in hospital services, with the number of episodes declining from 109,675 in 2015 to 86,668 in 2019, signifying a reduction of 21.0% ($p < 0.0001$). However, in this particular case, the percentage of hospital visits attributed to URTIs that occurred within two weeks of a primary healthcare visit, remained relatively stable (0.41% in 2015 and 0.38% in 2019; $p < 0.0001$).

The decline in the overall number of cases consulted in PHC was primarily attributed to a 12% reduction in indeterminate URTIs, from 16.8 million in 2015 to 14.8 million in 2019 ($p < 0.0001$), as well as a 24% decrease in the incidences of throat and tonsil inflammation which decreased from 6.0 million in 2015 to 4.6 million in 2019 ($p < 0.0001$).

Table 3. Number of PHC consultations and registered incidence for acute URTI in Poland in 2015–2019

Patients	PHC consultations		Ratio of consultations with URTI (%)	No. of URTI cases*
	Total N(%)	URTI N(%)		
2015–2019	787,335,159 (100%)	126,036,728 (100%)	16	100,030,679
2015	154,956,972	26,538,904	17	21,021,460
2016	157,334,781	25,812,783	16	20,375,264
2017	158,304,434	25,546,364	16	20,273,329
2018	156,932,727	25,086,192	16	19,932,886
2019	159,806,245	23,052,485	14	18,427,740
Women	452,128,520 (57%)	69,691,846 (55%)	15	55,680,630
Men	335,06,639 (43%)	56,344,882 (45%)	17	44,350,049
Age groups				
<1	11,607,427 (2%)	1,631,604 (1%)	14	1,156,033
1–4	64,975,561 (8%)	30,088,377 (24%)	46	20,821,386
5–14	74,366,107 (9%)	29,388,442 (23%)	40	23,039,340
15–44	166,215,410 (21%)	38,770,131 (31%)	23	32,653,333
45–64	211,602,423 (27%)	17,502,152 (14%)	8	14,806,100
65–74	131,285,156 (17%)	5,565,491 (4%)	4	4,833,972
≥75	127,283,075 (16%)	3,090,531 (2%)	2	2,720,515
PHC entity location				
City	86,677,613 (11%)	16,404,515 (13%)	19	12,674,145
Town	364,330,905 (46%)	59,553,287 (47%)	16	46,876,577
Mixed urban-rural	184,684,984 (24%)	28,323,215 (23%)	15	22,759,023
Rural area	151,641,657 (19%)	21,755,711 (17%)	14	17,720,934
Size of PHC entity				
Q1 (≤ 2 454)	60,687,101 (8%)	7,823,780 (6%)	13	6,308,054
Q2 (2 455 – 4 111)	112,527,245 (14%)	16,051,827 (13%)	14	12,971,790
Q3 (4 112 – 7 027)	185,664,285 (24%)	28,442,728 (23%)	15	22,785,796
Q4 (≥ 7 028)	428,456,528 (54%)	73,718,393 (58%)	17	57,965,039

Q – quartile of the patients registered with PHC physicians (in brackets, mean yearly number of patient's declarations), PHC – primary health care, *RIR* – Registered Incidence Rate
*visits ≤2 weeks of the initial PHC consultation with the same diagnosis are excluded

Figure 1A depicts the five-year trends in the variability of specific types of URTIs, revealing a consistent, albeit slight, decrease in the registered incidence of URTI cases. This decrease was partially offset in 2017 by small increases in cases of indeterminate infections. Despite the relatively small absolute number of influenza cases in 2018, there was no corresponding increase in the frequency of registered URTI cases.

The occurrence of URTIs displayed a typical seasonal pattern during the analysed period, with peaks observed in winter and noticeable declines during summer. In February, the relative incidence of registered URTI cases was estimated to be 96.7% (95% CI: 95.8%; 97.6%) higher than the annual average, whereas in August, it was 55.9% (95% CI: 56.2%; 55.7%) lower. Figure 1B illustrates the seasonality of individual URTI infections and overall URTI cases.

The increase in relative incidence during winter periods was predominantly driven by indeterminate URTIs, which accounted for 65–67% of all cases. In contrast, during periods of lowest incidence, their proportion decreased to 45–48% while the proportion of throat and tonsil inflammations

Table 4. Generalised additive model for the influence of patient characteristics and place of service provision on the likelihood of URTI diagnosis

Variable	Estimated IRR	(95% CI)	P-value
	0.00	(0.00; 0.00)	<.00001
PHC entity location			
City		reference	
Town	1.00	(0.99; 1.02)	0.6
Mixed urban-rural area	1.01	(0.99; 1.03)	0.17
Rural area	1.01	(0.99; 1.03)	0.25
Patient's gender			
Women		reference	
Men	0.79	(0.79; 0.79)	<.00001
Age group			
<1		reference	
1–4	1.65	(1.64; 1.66)	<.00001
5–14	0.77	(0.76; 0.77)	<.00001
15–44	0.29	(0.29; 0.29)	<.00001
45–64	0.20	(0.20; 0.20)	<.00001
65–74	0.17	(0.17; 0.17)	<.00001
≥75	0.16	(0.16; 0.16)	<.00001
Type of URTI			
Multiple sites or unspecified URTI		reference	
Otitis media	0.05	(0.05; 0.05)	<.00001
Sinusitis	0.08	(0.08; 0.08)	<.00001
Pharyngitis and tonsillitis	0.42	(0.42; 0.43)	<.00001
Laryngitis and tracheitis	0.10	(0.10; 0.10)	<.00001
Influenza	0.01	(0.01; 0.01)	<.00001
Type of PHC consultaion			
routine		reference	
out-of-hours care	0.09	(0.09; 0.09)	<.00001
Place of service provision			
office		reference	
home visit	0.01	(0.01; 0.01)	<.00001
Size of the PHC entity*			
Q1 (≤ 2 454)		reference	
Q2 (2 455 – 4 111)	1.01	(1.01; 1.02)	<.00001
Q3 (4 112 – 7 027)	1.04	(1.04; 1.05)	<.00001
Q4 (≥ 7 028)	1.08	(1.07; 1.08)	<.00001

*No. of patients registered with PCP; IRR – Incidence Rate Ratio; CI – Confidence Interval; Q – quartile of PHC entity size; average annual number of declarations (in brackets).

increased, comprising 34–37% of all URTI cases during those periods. Detailed incidence trends from 2015–2019 and the seasonal variability of URTI cases in different years and disease groups are presented in Figures 2A and 2B, respectively.

DISCUSSION

The results of this study show that the care of patients with URTIs in Poland is provided almost entirely by PHC physicians. Only eight out of 1,000 visits with acute URTIs were referred to an outpatient specialist consultation, and four out of 1,000 were hospitalised. Between 2015–2019, two-

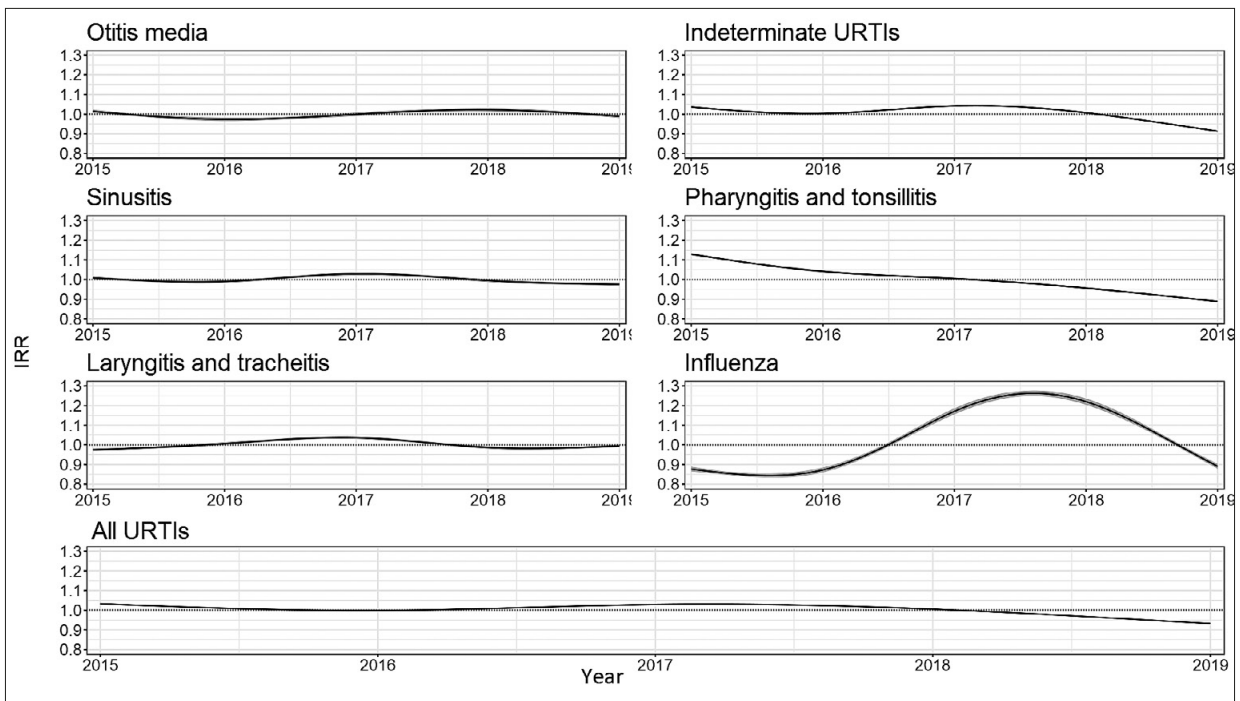


Figure 1A. Trends of incidence in particular groups of acute URTIs in 2015–2019

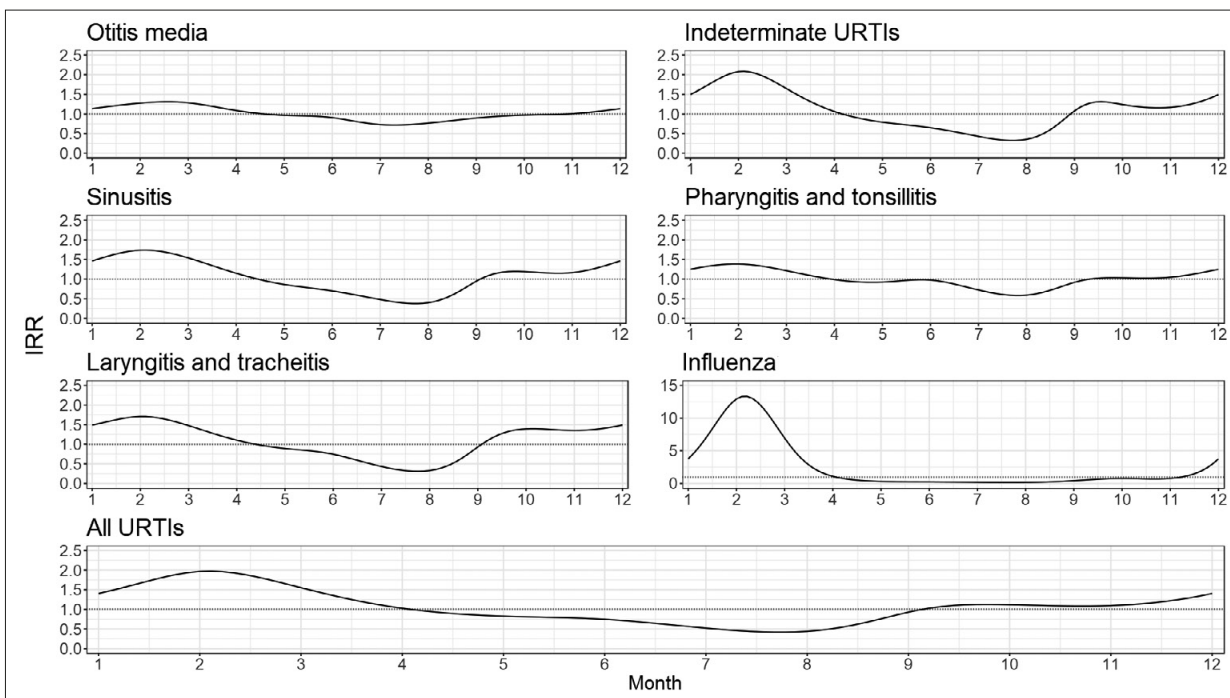


Figure 1B. Seasonal variability of incidence in particular groups of acute URTIs in 2015–2019

thirds of Polish patients reported to a doctor at least once because of acute URTI. About one-sixth of all consultations provided by PHC physicians during the period concerned this problem. In PHC, indeterminate URTIs were most often diagnosed, but referrals to specialists occurred mainly due to otitis media. In the period investigated, there was a decrease in the number of patients diagnosed with acute URTI. This was relatively small in PHC, but significant in specialist services. There was a clear seasonality of registered cases, with the peak intensity of all analysed diseases in the winter period, the highest in the case of influenza. A decline

occurred in the summer, with the lowest number of registered cases in August.

Strengths and limitations of the study. The strength of this study is the inclusion of all medical events during which assistance was provided within the public health care system. Data was based on information from the National Health Fund which did not allow the identification of private health care sector visits. Some patients, especially those with higher incomes, use visits in this sector, also in the case of URTI. In Poland, there is no system for collecting complete data on

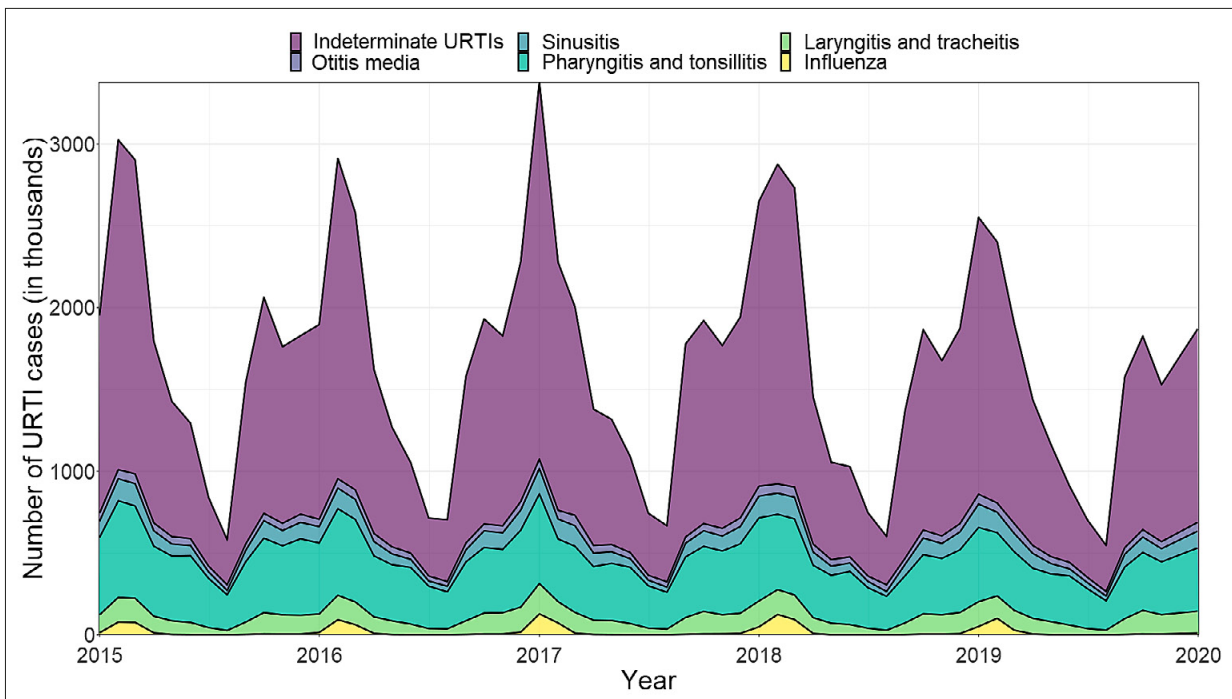


Figure 2A. Number of cases due to acute URTIs in 2015–2019, classified according to ICD-10 codes

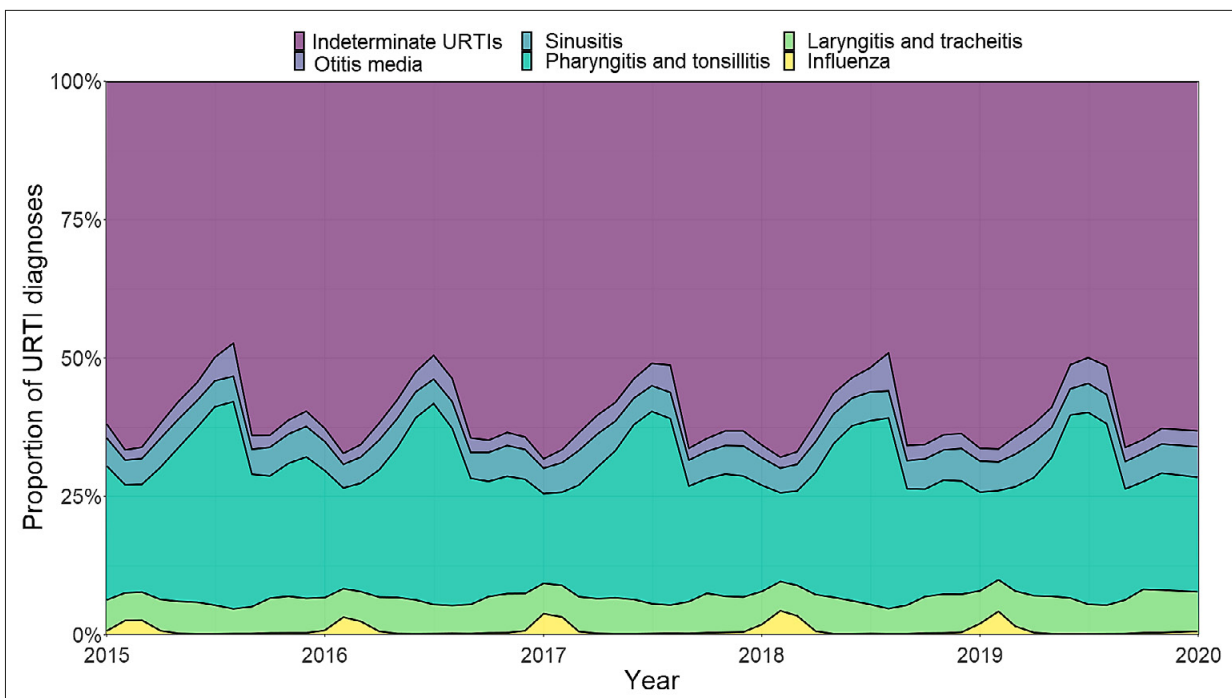


Figure 2B. Proportion of particular diagnoses in the total number of cases due to acute URTIs in 2015–2019

visits in the private sector. Another limitation may be the imprecise coding system based on the ICD-10 classification, in which a significant number of events related to URTIs were coded with the use of symbols corresponding to indeterminate infections. It cannot be ruled out that for patients with several problems, physicians may have omitted the URTI code when reporting the visit. However, it can be assumed that such a risk was relatively small, as acute problems tend to attract more direct attention than chronic diseases. Moreover, in the period before the COVID-19 pandemic, family doctors in Poland did not have the diagnostic tools to make a more

precise diagnosis. Also, complicated and time-consuming influenza reporting procedures to health authorities may have significantly contributed to the underestimation of this diagnosis.

Interpretation of the results in relation to other publications. URTIs are mostly self-limiting conditions that do not require medical consultation. For years, experts have been pointing-out the need to disseminate knowledge on this subject in society, and the role that PHC doctors might play in this respect [17, 6, 18]. Patients requiring professional

medical assistance due to an URTI episode turn mainly to general practitioners, seeking mostly further examination, reassurance or symptomatic medication, with only a minority expecting an antibiotic prescription [19, 20]. An Italian study showed that about 95% of patients with URTIs were consulted and treated by GPs, a finding similar to that in the presented study [21]. Another Italian study based on a telephone survey showed that 3% of patients sought help at Emergency Departments, and 1% were admitted to hospital. In that study, 93% of patients seeking professional medical help were consulted by GPs, which is slightly lower than in the current study [22]. NHS figures for 2012–2013, show that, in Scotland, patients were most likely to consult a doctor or nurse for URTI symptoms such as coughing, wheezing or shortness of breath, with 70% of them seeking advice from a GP [23]. Other British data indicate that approximately 25% of patients visit their GP each year because of URTIs alone [24]. In this study, the percentage is slightly higher (30%). In Poland, over 99% of URTIs were diagnosed by PHC physicians during surgery consultations, and only less than 1% during home visits. In a study conducted in Italy, as many as 30% of medical consultations related to URTI took place during home visits [21]. This difference highlights significant dissimilarities in the culture and organisation of the PHC systems in these countries.

In the analysed period, a systematic decrease was observed in the number of patients consulted in PHC due to URTIs. A similar downward trend was noted in a British study conducted in 1997–2006 [24]. The results of the current study indicate a 21% greater chance of being diagnosed with URTI in women than in men. In a similar study conducted by de Lusignan et al. in 2013–2018, a five-year retrospective analyses of respiratory tract infections also showed a higher percentage of cases in women [10]. Similar results were obtained in a study conducted in Norway and The Netherlands [11,13]. This is also consistent with a large review of 84 studies which also concluded that URTIs are more common in women [25].

In the presented study, the highest percentage of GP consultations related to URTI was recorded in the group aged 1–4 years, where they accounted for nearly half of all consultations. The estimated IRR for children in that age group was 1.65 (95% CI 1.64–1.66, $p < 0.05$). These results are consistent with the results of a British study in which the estimated IRR for influenza-like illnesses in children under 5 years of age was 1.62 (95% CI 1.38–1.89, $p < 0.0001$) [10]. Numerous studies confirm the importance of attending daycare centres due to the increased URTI morbidity in this age group, at the same time indicating the need to search for effective preventive strategies in this regard [26, 27].

In the presented study, in two-thirds of cases, GPs diagnosed indeterminate URTIs and influenza accounted for only 1% of diagnoses. Also, in the Dutch research, the most common reason for patients with acute URTIs to visit a PHC physician was a common cold, which is consistent with our results [13]. A study by Chow et al. and colleagues showed that in Singapore, as in Poland, otitis media is the most common cause of referrals to specialist care [15].

The results of the current study once again confirmed the seasonality of URTIs. Influenza tends to occur in late autumn and winter, while other URTIs have a much more diffuse occurrence throughout the year. Similar results were also reported by the authors of other studies [21, 22]. The

influenza-related burden varies by age and season [28, 29, 30]. Its prevention may include various interventions [31], particularly vaccinations which showed effectiveness in all age groups, especially among the elderly [32, 33, 34].

Implications for clinical practice and further research.

The results of the study indicate the need to seek solutions that would relieve PHC practices and improve the care of patients with URTIs. A positive step in this direction was the introduction in Poland in 2022 of rapid tests detecting streptococcal infections and viruses responsible for respiratory tract infections; these are also at the disposal of nurses. It is also necessary to intensify efforts to popularise vaccinations against influenza, COVID-19, RSV and pneumococci, as well as to promote self-care. Overall, the burden of URTIs on health care systems can be reduced by the promotion of self-care and patient empowerment [35], including the dissemination of information concerning various preventive and treatment options [36, 37]. Currently, there is no convincing evidence for prophylactic vaccination against colds and other undifferentiated URTIs in healthy individuals [38].

Research is needed to show how the COVID-19 pandemic has affected the epidemiology and distribution of systemic burdens related to the care of patients with URTIs. Another direction of research may be qualitative studies to help better understand the attitudes, beliefs and behaviour of patients with these diseases.

CONCLUSIONS

The incidence of URTIs diagnosed clinically is high and creates a heavy burden on the health care system in Poland, particularly to PHC physicians who provide 99% of related health services. Advice for URTI patients is provided by physicians mainly in their offices during routine working hours. URTIs are characterised by a typical seasonal distribution, most strongly expressed in the case of influenza. Children between 1–4 years old and women are consulted more often than other age groups and men. Physicians and health care organisers should consider these differences and seek measures to reduce the burden of URTIs.

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Supplementary materials 1. Patients in PHC, OSC and hospitals**Supp. Table A.** Patients with acute URTI using primary care, OSC, and hospital services in Poland in 2015–2019

Patients with URTI	Cohort	2015	2016	2017	2018	2019	Difference (%) 2019 vs 2015
Patients, total		11 539 365	11 245 099	11 373 378	11 457 704	10 661 381	-7,6%
	All	11 475 655	11 190 785	11 323 591	11 411 024	10 616 821	-7,5%
Using PHC services	consulted in PHC only	11 251 004	10 982 269	11 128 313	11 231 125	10 457 211	-7,1%
	consulted also in OSC*	149 167	133 392	125 242	112 597	97 074	-34,9%
	consulted also in the hospital setting*	75 484	75 124	70 036	67 302	62 536	-17,2%
	All	63 710	54 314	49 787	46 680	44 560	-30,1%
Not using PHC services	OSC consultation only	43 150	36 459	33 348	30 389	28 478	-34,0%
	hospital consultation only	18 906	16 473	15 184	15 130	14 943	-21,0%
	consulted in OSC and hospital setting	1 654	1 382	1 255	1 161	1 139	-31,1%
OSC consultations – total		193 971	171 233	159 845	144 147	126 691	-34,7%
Hospital consultations – total		96 044	92 979	86 475	83 593	78 618	-18,1%

*≤2 weeks from the PHC consultation, with the same medical reason for the consultation
 OSC – outpatient specialist care; PHC – primary health care; URTI – upper respiratory tract infection

**Supplementary materials 2
Part A: PHC consultations****Supp. Table B.** Number of PHC consultations in the years 2015–2019 in Poland

Year	PHC consultations of URTI		Total PHC consultations		The ratio of consultations with URTI (%)
	Number	%	Number	%	
2015	26 538 904	21.1	154 956 972	19.7	17
2016	25 812 783	20.5	157 334 781	20.0	16
2017	25 546 364	20.3	158 304 434	20.1	16
2018	25 086 192	19.9	156 932 727	19.9	16
2019	23 052 485	18.3	159 806 245	20.3	14
2015–2019	126 036 728	100.0	787 335 159	100.0	16

PHC – primary health care; URTI – upper respiratory tract infection

Supp. Table C. Number of PHC consultations between 2015 and 2019 in Poland, by patient's gender

	Płeć	PHC consultations of URTI		Total PHC consultations		The ratio of consultations with URTI (%)
		Number	%	Number	%	
2015	Women	14 744 117	55.6	89 431 306	57.7	16
	Men	11 794 787	44.4	65 525 666	42.3	18
2016	Women	14 218 738	55.1	90 565 552	57.6	16
	Men	11 594 045	44.9	66 769 229	42.4	17
2017	Women	14 116 048	55.3	90 884 471	57.4	16
	Men	11 430 316	44.7	67 419 963	42.6	17
2018	Women	13 855 033	55.2	89 831 036	57.2	15
	Men	11 231 159	44.8	67 101 691	42.8	17
2019	Women	12 757 910	55.3	91 416 155	57.2	14
	Men	10 294 575	44.7	68 390 090	42.8	15
2015–2019	Women	69 691 846	55.3	452 128 520	57.4	15
	Men	56 344 882	44.7	335 206 639	42.6	17

PHC – primary health care; URTI – upper respiratory tract infection

Supp. Table D. Number of PHC consultations between 2015 and 2019 in Poland, by location of the PHC entity

Year	Location of the PHC entity	PHC consultations of URTI		Total PHC consultations		The ratio of consultations with URTI (%)
		Number	%	Number	%	
2015	City	3 524 917	13.3	17 177 309	11.1	21
	Town	12 609 731	47.5	71 735 467	46.3	18
	Mixed urban-rural	5 916 460	22.3	36 268 898	23.4	16
	Rural	4 487 796	16.9	29 775 298	19.2	15
2016	City	3 483 442	13.5	17 370 332	11.0	20
	Town	12 243 427	47.4	72 824 934	46.3	17
	Mixed urban-rural	5 725 959	22.2	36 866 996	23.4	16
	Rural	4 359 955	16.9	30 272 519	19.2	14
2017	City	3 287 397	12.9	17 359 995	11.0	19
	Town	12 090 925	47.3	73 374 903	46.4	16
	Mixed urban-rural	5 750 853	22.5	37 108 600	23.4	15
	Rural	4 417 189	17.3	30 460 936	19.2	15
2018	City	3 202 095	12.8	17 381 405	11.1	18
	Town	11 786 654	47.0	72 533 627	46.2	16
	Mixed urban-rural	5 692 015	22.7	36 830 189	23.5	15
	Rural	4 405 428	17.6	30 187 506	19.2	15
2019	City	2 906 664	12.6	17 388 572	10.9	17
	Town	10 822 550	46.9	73 861 974	46.2	15
	Mixed urban-rural	5 237 928	22.7	37 610 301	23.5	14
	Rural	4 085 343	17.7	30 945 398	19.4	13
2015–2019	City	16 404 515	13.0	86 677 613	11.0	19
	Town	59 553 287	47.3	364 330 905	46.3	16
	Mixed urban-rural	28 323 215	22.5	184 684 984	23.5	15
	Rural	21 755 711	17.3	151 641 657	19.3	14

PHC – primary health care; URTI – upper respiratory tract infection

Supp. Table E. Number of PHC consultations between 2015 and 2019 in Poland, by size of the PHC entity

Year	Size of PHC entity (quartile of the number of patients' declarations)	PHC consultations of URTI		Total PHC consultations		Ratio of consultations with URTI (%)
		Number	%	Number	%	
2015	1	1 606 415	6.1	11 777 165	7.6	14
	2	3 337 718	12.6	21 986 771	14.2	15
	3	5 940 901	22.4	36 444 389	23.5	16
	4	15 653 870	59.0	84 748 647	54.7	18
2016	1	1 571 937	6.1	12 054 570	7.7	13
	2	3 194 224	12.4	22 247 772	14.1	14
	3	5 726 987	22.2	36 983 378	23.5	15
	4	15 319 635	59.3	86 049 061	54.7	18
2017	1	1 594 425	6.2	12 110 841	7.7	13
	2	3 254 674	12.7	22 586 172	14.3	14
	3	5 786 344	22.7	37 417 767	23.6	15
	4	14 910 921	58.4	86 189 654	54.4	17
2018	1	1 594 960	6.4	12 166 654	7.8	13
	2	3 233 774	12.9	22 499 331	14.3	14
	3	5 696 597	22.7	36 967 562	23.6	15
	4	14 560 861	58.0	85 299 180	54.4	17
2019	1	1 456 043	6.3	12 577 871	7.9	12
	2	3 031 437	13.2	23 207 199	14.5	13
	3	5 291 899	23.0	37 851 189	23.7	14
	4	13 273 106	57.6	86 169 986	53.9	15
2015–2019	1	7 823 780	6.2	60 687 101	7.7	13
	2	16 051 827	12.7	112 527 245	14.3	14
	3	28 442 728	22.6	185 664 285	23.6	15
	4	73 718 393	58.5	428 456 528	54.4	17

PHC – primary health care; URTI – upper respiratory tract infection

Supp. Table F. Number of PHC consultations of URTI between 2015 and 2019 in Poland, by type of URTI

Year	Type of URTI	PHC consultations of URTI	
		Number	%
2015	Indeterminate URTI	16 849 146	63.5
	Pharyngitis and tonsillitis	6 042 471	22.8
	Laryngitis and tracheitis	1 433 296	5.4
	Sinusitis	1 240 964	4.7
	Otitis media	730 750	2.8
	Influenza	242 277	0.9
2016	Indeterminate URTI	16 636 964	64.5
	Pharyngitis and tonsillitis	5 503 532	21.3
	Laryngitis and tracheitis	1 489 982	5.8
	Sinusitis	1 214 215	4.7
	Otitis media	712 113	2.8
	Influenza	255 977	1.0
2017	Indeterminate URTI	16 528 791	64.7
	Pharyngitis and tonsillitis	5 234 089	20.5
	Laryngitis and tracheitis	1 504 677	5.9
	Sinusitis	1 254 123	4.9
	Otitis media	736 809	2.9
	Influenza	287 875	1.1
2018	Indeterminate URTI	16 347 711	65.2
	Pharyngitis and tonsillitis	4 964 771	19.8
	Laryngitis and tracheitis	1 447 963	5.8
	Sinusitis	1 216 539	4.8
	Otitis media	755 095	3.0
	Influenza	354 113	1.4
2019	Indeterminate URTI	14 835 624	64.4
	Pharyngitis and tonsillitis	4 594 563	19.9
	Laryngitis and tracheitis	1 449 846	6.3
	Sinusitis	1 180 878	5.1
	Otitis media	734 608	3.2
	Influenza	256 966	1.1
2015 - 2019	Indeterminate URTI	81 198 236	64.4
	Pharyngitis and tonsillitis	26 339 426	20.9
	Laryngitis and tracheitis	7 325 764	5.8
	Sinusitis	6 106 719	4.8
	Otitis media	3 669 375	2.9
	Influenza	1 397 208	1.1

PHC – primary health care; URTI – upper respiratory tract infection

Supp. Table G. Number of PHC consultations of URTI between 2015 and 2019 in Poland, by the type of PHC consultation

Year	type consultation of URTI	PHC consultations of URTI	
		Number	Ratio of PHC consultations (%)
2015	All consultations	26 538 904	100
	PHC surgery consultation	26 312 584	99.1
	routine care	24 067 051	90.6
	out-of-hours care	2 245 533	8.5
	Home visit	226 320	0.9
	routine care	203 409	0.8
out-of-hours care	22 911	0.1	
2016	All consultations	25 812 783	100
	PHC surgery consultation	25 608 244	99.2
	routine care	23 364 172	90.5
	out-of-hours care	2 244 072	8.7
	Home visit	204 539	0.8
	routine care	186 059	0.7
out-of-hours care	18 480	0.1	
2017	All consultations	25 546 364	100
	PHC surgery consultation	25 332 193	99.2
	routine care	23 254 844	91.1
	out-of-hours care	2 077 349	8.1
	Home visit	214 171	0.8
	routine care	196 998	0.7
out-of-hours care	17 173	0.1	
2018	All consultations	25 086 192	100
	PHC surgery consultation	24 890 302	99.2
	routine care	22 948 153	91.5
	out-of-hours care	1 942 149	7.7
	Home visit	195 890	0.8
	routine care	181 610	0.7
out-of-hours care	14 280	0.1	
2019	All consultations	23 052 485	100
	PHC surgery consultation	22 893 026	99.3
	routine care	21 147 551	91.7
	out-of-hours care	1 745 475	7.6
	Home visit	159 459	0.7
	routine care	149 525	0.6
out-of-hours care	9 934	0.1	
2015–2019	All consultations	126 036 728	100
	PHC surgery consultation	125 036 349	99.2
	routine care	114 781 771	91.1
	out-of-hours care	10 254 578	8.1
	Home visit	1 000 379	0.8
	PHC consultation	917 601	0.7
out-of-hours care	82 778	0.1	

PHC – primary health care; URTI – upper respiratory tract infection

Part B: OSC and hospital consultations**Supp. Table H.** Number of URTI consultations in outpatient specialist care (OSC) and hospital providers in ≤ 2 weeks from the PHC consultation in the years 2015–2019 in Poland

Year	Number of PHC consultations of URTI	Number of OSC consultations of URTI	Number of hospital consultations of URTI	OSC consultations of URTI as the ratio of PHC consultations of URTI (%)	Hospital consultations of URTI as the ratio of PHC consultations of URTI (%)
2015	26 538 904	235 726	109 675	0.9	0.41
2016	25 812 783	208 383	107 831	0.8	0.42
2017	25 546 364	190 473	98 348	0.7	0.38
2018	25 086 192	171 226	93 259	0.7	0.37
2019	23 052 485	144 036	86 668	0.6	0.38
2015 - 2019	126 036 728	949 844	495 781	0.8	0.39

OSC – outpatient specialist care; PHC – primary health care; URTI – upper respiratory tract infection

Supp. Table I. Number of URTI consultations in OSC and hospitals in ≤ 2 weeks from the PHC consultation in the years 2015 – 2019 in Poland by type of URTI

Year	Type of URTI	Number of PHC consultations of URTI	OSC consultations of URTI		OSC consultations of URTI as the ratio of PHC consultations of URTI (%)	Hospital consultations of URTI		Hospital consultations of URTI as the ratio of PHC consultations of URTI (%)
			Number	%		Number	%	
2015	Indeterminate URTI	16 849 146	27 188	11.53	0.16	36 677	33.44	0.22
	Pharyngitis and tonsillitis	6 042 471	22 476	9.53	0.37	25 869	23.59	0.43
	Laryngitis and tracheitis	1 433 296	16 812	7.13	1.17	16 071	14.65	1.12
	Sinusitis	1 240 964	28 573	12.12	2.30	4 193	3.82	0.34
	Otitis media	730 750	140 644	59.66	19.25	26 129	23.82	3.58
	Influenza	242 277	33	0.01	0.01	736	0.67	0.30
2016	Indeterminate URTI	16 636 964	23 958	11.50	0.14	37 683	34.95	0.23
	Pharyngitis and tonsillitis	5 503 532	20 213	9.70	0.37	23 827	22.10	0.43
	Laryngitis and tracheitis	1 489 982	15 022	7.21	1.01	15 804	14.66	1.06
	Sinusitis	1 214 215	24 539	11.78	2.02	3 748	3.48	0.31
	Otitis media	712 113	124 607	59.80	17.50	24 383	22.61	3.42
	Influenza	255 977	44	0.02	0.02	2 386	2.21	0.93
2017	Indeterminate URTI	16 528 791	22 084	11.59	0.13	33 320	33.88	0.20
	Pharyngitis and tonsillitis	5 234 089	16 900	8.87	0.32	22 314	22.69	0.43
	Laryngitis and tracheitis	1 504 677	12 847	6.74	0.85	14 375	14.62	0.96
	Sinusitis	1 254 123	22 852	12.00	1.82	3 673	3.73	0.29
	Otitis media	736 809	115 761	60.78	15.71	23 506	23.90	3.19
	Influenza	287 875	29	0.02	0.01	1 160	1.18	0.40
2018	Indeterminate URTI	16 347 711	19 226	11.23	0.12	32 266	34.60	0.20
	Pharyngitis and tonsillitis	4 964 771	14 908	8.71	0.30	19 726	21.15	0.40
	Laryngitis and tracheitis	1 447 963	11 261	6.58	0.78	12 246	13.13	0.85
	Sinusitis	1 216 539	19 176	11.20	1.58	3 648	3.91	0.30
	Otitis media	755 095	106 621	62.27	14.12	22 426	24.05	2.97
	Influenza	354 113	34	0.02	0.01	2 947	3.16	0.83
2019	Indeterminate URTI	14 835 624	16 296	11.31	0.11	28 144	32.47	0.19
	Pharyngitis and tonsillitis	4 594 563	12 763	8.86	0.28	18 251	21.06	0.40
	Laryngitis and tracheitis	1 449 846	9 336	6.48	0.64	14 313	16.51	0.99
	Sinusitis	1 180 878	15 914	11.05	1.35	2 909	3.36	0.25
	Pharyngitis and tonsillitis	734 608	89 685	62.27	12.21	19 346	22.32	2.63
	Influenza	256 966	42	0.03	0.02	3 705	4.27	1.44
2015–2019	Indeterminate URTI	81 198 236	108 752	11.45	0.13	168 090	33.90	0.21
	Pharyngitis and tonsillitis	26 339 426	87 260	9.19	0.33	109 987	22.18	0.42
	Laryngitis and tracheitis	7 325 764	65 278	6.87	0.89	72 809	14.69	0.99
	Sinusitis	6 106 719	111 054	11.69	1.82	18 171	3.67	0.30
	Otitis media	3 669 375	577 318	60.78	15.73	115 790	23.36	3.16
	Influenza	1 397 208	182	0.02	0.01	10 934	2.21	0.78

OSC – outpatient specialist care; PHC – primary health care; URTI – upper respiratory tract infection

Supp. Table J. Number of URTI consultations in OSC and hospitals in ≤2 weeks from the initial PHC consultation of URTI in the years 2015–2019 in Poland, by the type of PHC consultation

Year	Type of PHC consultation of URTI	Number of PHC consultations of URTI	OSC consultations of URTI		OSC consultations of URTI as the ratio of PHC consultations of URTI (%)	Hospital consultations of URTI		Hospital consultations of URTI as the ratio of PHC consultations of URTI (%)
			Number	%		Number	%	
2015	routine care	24 270 460	211 774	89.8	0.9	78 803	71.9	0.32
	out-of-hours care	2 268 444	23 952	10.2	1.1	30 872	28.1	1.36
2016	routine care	23 550 231	186 898	89.7	0.8	78 639	72.9	0.33
	out-of-hours care	2 262 552	21 485	10.3	0.9	29 192	27.1	1.29
2017	routine care	23 451 842	171 505	90	0.7	71 757	73	0.31
	out-of-hours care	2 094 522	18 968	10	0.9	26 591	27	1.27
2018	routine care	23 129 763	154 499	90.2	0.7	67 632	72.5	0.29
	out-of-hours care	1 956 429	16 727	9.8	0.9	25 627	27.5	1.31
2019	routine care	21 297 076	130 184	90.4	0.6	62 318	71.9	0.29
	out-of-hours care	1 755 409	13 852	9.6	0.8	24 350	28.1	1.39
2015–2019	routine care	115 699 372	854 860	90	0.7	359 149	72.4	0.31
	out-of-hours care	10 337 356	94 984	10	0.9	136 632	27.6	1.32

OSC – outpatient specialist care; PHC – primary health care; URTI – upper respiratory tract infection