



Respiratory Infections with Particular Emphasis on Influenza Virus Activity in Persons Over 14 Years of Age in the Epidemic Season 2016/2017 in Poland

D. Kowalczyk, K. Szymański, K. Cieślak, E. Hallmann-Szelińska, and L. B. Brydak

Abstract

Influenza viruses cause respiratory infections every epidemic season regardless of the patient's age. The aim of this study was to determine the activity of respiratory viruses in the epidemic season 2016/2017 in Poland, with particular emphasis on influenza viruses among people aged over 14. There were 2982 clinical samples taken from patients from four age groups: 15–25, 26–44, 45–64, and ≥ 65 years tested under the Sentinel and non-Sentinel surveillance programs. The presence of influenza viruses was confirmed in more than 40% of cases, the predominant type was influenza A virus unsubtype, followed by subtype A/H3N2/. The results for the four age groups indicate that the highest number of confirmed respiratory viruses was recorded in individuals ≥ 65 years of age, slightly less, in the decreasing order, in the age groups 45–64 years, 15–25 years, and 26–44 years. Influenza type B infections were

observed only in sporadic cases. Given the epidemiological data, epidemic season 2016/2017 was characterized by similar dynamics compared to the previous season in Poland and also in most of the European countries. More than 4 million cases and suspected cases of influenza and influenza-like viruses have been reported in Poland, more than 16,000 hospitalizations, and 25 deaths, of which 20 cases occurred among people ≥ 65 years of age in the epidemic season 2016/2017.

Keywords

Epidemic season · Infectious diseases · Influenza · Influenza virus activity · Molecular diagnostics

D. Kowalczyk (✉), K. Szymański, K. Cieślak, E. Hallmann-Szelińska, and L. B. Brydak
Department of Influenza Research, National Influenza Center, National Institute of Public Health – National Institute of Hygiene, Warsaw, Poland
e-mail: dorota.kowalczyk@pzh.gov.pl

1 Introduction

Infections caused by influenza A and B viruses are observed each season, and the course of illness may differ from one another (Brydak 2008). In each case, however, quick confirmation of the presence of the influenza virus is important since inappropriately treated infections can lead to sometimes deadly complications, especially among people from

the risk groups (Fiore et al. 2011). Generally, the diagnostic process is carried out using molecular biology methods (Bednarska et al. 2016b), which allows the obtaining of results promptly. The use of antiviral treatment with neuraminidase inhibitors reduces the risk of complications, also often emanating from the respiratory tract (Bednarska et al. 2015; Brydak 2015).

The epidemic season 2016/2017 in Poland was characterized by a high incidence of influenza and influenza-like illness (ILI) (4,919,110) and of the number of hospitalizations (16,890). The number of deaths due to complications amounted to 25 cases in persons over 14 years of age, out of which 20 cases were reported in persons older than 65 years (NIPH-NIH 2017). The influenza activity was rather moderate with the peak incidence of ILI at week 4 of 2017, whereas the highest number of confirmed influenza viruses was observed at week 3 of 2017. Not without significance remains the fact that the proportion of population in Poland vaccinated against influenza is declining in Poland season by season. In 2016, only 2.48% people aged over 14 and 6.87% people aged over 65 were vaccinated, the proportions comparable to those in the preceding year (EPIMELD 2016). The dismal influenza vaccination coverage rate is particularly relevant in the face of a clearly increasing incidence of respiratory infections in adult persons in recent years. The aim of the present study was to evaluate the activity of influenza and influenza viruses in individuals in the age bracket of 14–65 years in the epidemic season 2016/2017 in Poland.

2 Methods

The study was approved by an institutional ethics committee, and it was conducted in accordance with the Declaration of Helsinki for Human Research. The study material consisted of 2982 clinical specimens taken from patients from four age groups (15–25, 26–44, 45–64, and ≥ 65 years) within the Sentinel and non-Sentinel surveillance programs. The specimens were nasal and throat swabs, and bronchial alveolar lavage fluid (BALF), collected during the epidemic season

2016/2017. All laboratory investigations were performed in the Department of Influenza Research, National Influenza Centre in the National Institute of Public Health-National Institute of Hygiene (NIC NIPH-NIH) in Warsaw and in 16 Voivodeship Sanitary Epidemiological Stations (VSES) in Poland. The tests investigated in VSES were reinvestigated in the reference laboratory in the (NIC NIPH-NIH).

Viral RNA was isolated using the Maxwell 16 Viral Total Nucleic Acid Purification Kit (Promega Corp; Madison, WI) according to the manufacturer's instructions. The isolates were eluted in 50 μ L of RNase-free water. To determine the presence of influenza viruses, real-time RT-PCR (qRT-PCR) was performed in capillary tubes using a Roche LightCycler 2.0 System (Roche Diagnostics; Rotkreuz, Switzerland) and SuperScript[®] III/Platinum[®] Taq Mix (Invitrogen by Life Technologies-Thermo Fisher Scientific; Carlsbad, CA). Primers and probes for the analysis were obtained through the International Reagent Resources (IRR), part of the Centers for Disease Prevention and Control in the USA. Positive controls consisted of the RNA isolated from the reference viruses A/California/7/2009 (H1N1) pdm09, A/Hong Kong/4801/2014 (H3N2), and B/Brisbane / 60/2008 as recommended by the WHO for the epidemic season 2016/2017. The RNase-free water was used as a negative control.

A conventional multiplex RT-PCR was performed to confirm the presence of influenza-like viruses, using a RV15 OneStep ACE Detection Kit (Seegene; Seoul, South Korea). Specimens were tested for the following respiratory viruses: influenza A and B; adenoviruses (ADV); respiratory syncytial viruses (RSV) A and B; human metapneumovirus (HMPV); human coronavirus (HCoV); human parainfluenza viruses 1, 2, 3, and 4; human bocavirus (HBoV); and enteroviruses.

3 Results

In total 2882 clinical specimens were tested in people aged over 14. The presence of influenza viruses and influenza-like infections (ILI) was

confirmed in 46.5% of cases. The percentages of respiratory viruses stratified by age groups and virus types are shown in Figs. 1 and 2, respectively. The highest percentage of infections was

noticed in the age group ≥ 65 years (49.4%), slightly less in 45–64 years of age (44.9%), while in the 15–25 and 26–44 years of age, the percentage was at a comparable level of about

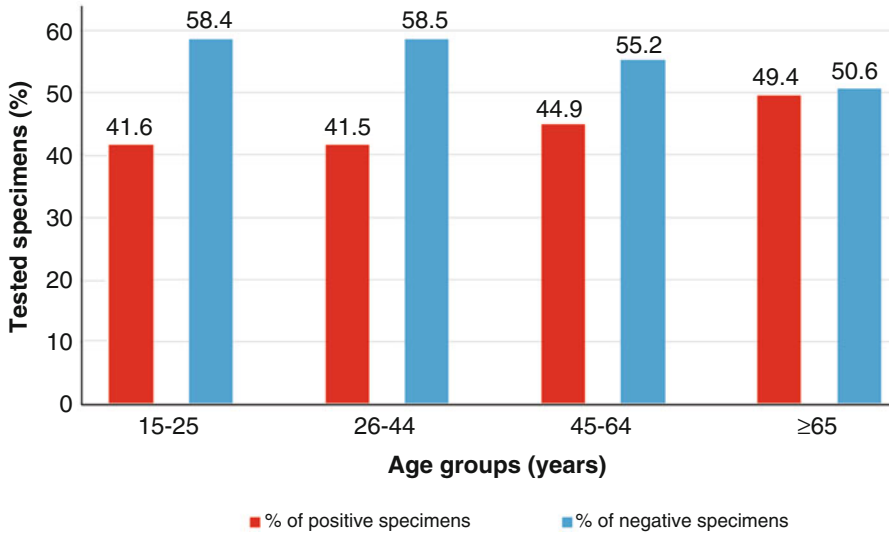


Fig. 1 Percentage of confirmed cases of influenza and influenza-like viruses in people over the 14 years of age in the epidemic season 2016/2017 in Poland

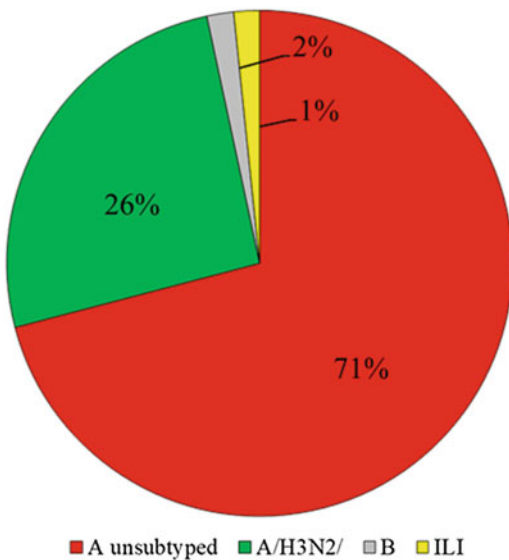


Fig. 2 Percentage of influenza and influenza-like virus infections in persons over 14 years of age in Poland in the epidemic season 2016/2017

41.5%. Taking all age groups combined, 71% of confirmed infections were caused by influenza A unsubtype, 26% by A/H3N2/ subtype, and 2% by influenza B virus. Other respiratory viruses were confirmed in 1% of cases (Fig. 2).

In the season 2016/2017, infections caused by influenza A virus remained prevalent (Fig. 3), with the highest number of confirmed cases noted in the age group ≥ 65 ($n = 356$). In age groups 45–64 and 26–44 years, infections caused by influenza A unsubtype amounted to 279 and 230 cases, respectively. The lowest number of confirmed influenza A unsubtype cases was observed in the age group 15–25 years ($n = 86$). The presence of influenza virus subtype A/H3N2/ was observed across all age ranges. The highest number of confirmed cases of A/H3N2/ subtype was observed in the age groups 26–44 and 45–64 years, 105 and 104, respectively, slightly lower in the age group ≥ 65 years ($n = 91$), and the lowest in 15–25-year-old subjects ($n = 45$). There were single cases of influenza B virus, but

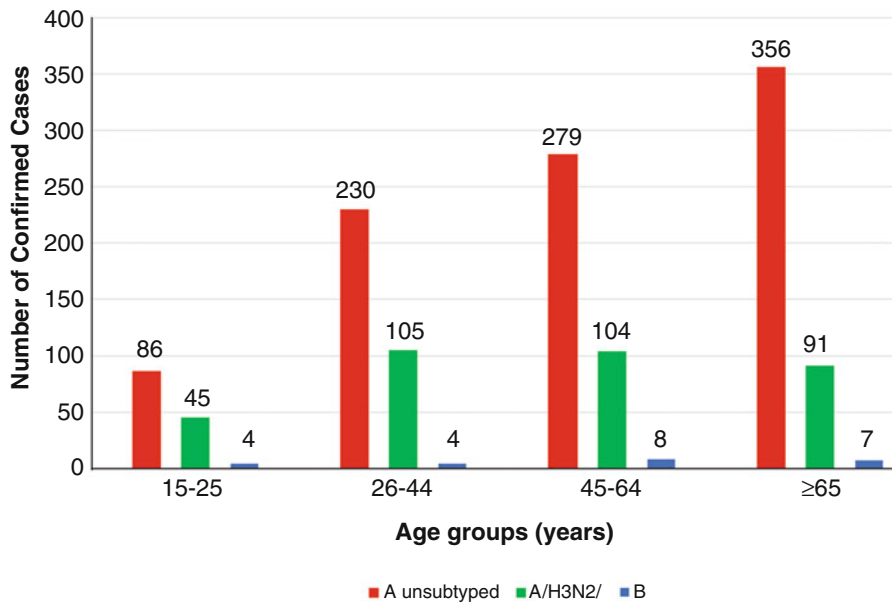


Fig. 3 The number of confirmed cases of influenza virus infection in people over 14 years of age in Poland in the epidemic season 2016/2017 in age groups

no A/H1N1/pdm09 (Fig. 3). During the epidemic season 2016/2017, there were only 22 cases of ILI caused by other influenza respiratory viruses reported in people aged over 14, with the predominance of RSV ($n = 11$).

4 Discussion

Comparing epidemiological data, the epidemic season 2016/2017 was characterized by similar intensity to the preceding 2015/2016 season. The number of cases and suspected cases of influenza and influenza-like viruses and the number of hospitalizations were akin to each other in both seasons, exceeding 4 million cases (NIPH-NIH 2017). However, there was almost sixfold fewer deaths due to postinfection complications in the season 2016/2017 (Table 1).

During the epidemic season 2016/2017, the number of specimens analyzed to confirm influenza infections was lower than that in the previous seasons. However, the percentage of confirmations among people aged over 14 was higher (45.0%) compared with the seasons 2015/2016 (40.2%) and 2014/2015 (21.2%)

(Kowalczyk et al. 2017a; Bednarska et al. 2016b). Akin to the season 2014/2015, the influenza A unsubtype (71%) virus prevailed in 2016/2017, followed by the A/H3N2/ subtype (26%) (Hallmann-Szelińska et al. 2016). While in the season 2015/2016 influenza A/H1N1/pdm09 was the prevailing subtype, there were no confirmed cases of this subtype among people aged over 14 years in the season 2016/2017 (Kowalczyk et al. 2017a).

Concerning the age-dependent differences in the type of influenza virus causing infections (Fig. 1), the highest number of confirmations in 2016/2017 was observed in persons over 65 years of age (49.4%), which was different from 2015/2016 when the highest number was in those in the age brackets of 45–64 and 26–44 (Kowalczyk et al. 2017a). The results are consistent with the data from other EU countries concerning influenza virus infections; the prevalence of A/H3N2/ subtype was noted in the season 2016/2017, especially in persons aged over 65, who were most vulnerable to infection, according to the ECDC risk assessment (Flu News Europe 2017; ECDC 2016). An additional factor that differentiates the epidemic seasons 2014/2015 and 2015/2016 from

Table 1 Epidemiological indicators for influenza and influenza-like virus infections in the 2015/2016 and 2016/2017 epidemic seasons in Poland (according to NIPH-NIH)

Epidemic season	ILI cases (n)	Morbidity (n)	Hospitalizations (n)	Deaths (n)	Specimens (n)
2015/2016	4,107,077	10,685.2	15,969	140	8542
2016/2017	4,811,501	12,519.2	16,602	25	4078

NIPH-NIH National Influenza Center of the National Institute of Public Health-National Institute of Hygiene in Warsaw, Poland

2016/2017 is a pronounced decrease in the number of influenza B virus infections in the latter season. In 2014/2015, the presence of influenza B virus was reported in 34.1% of cases (Bednarska et al. 2016b). In 2015/2016, B virus was the dominant type in the 15–25 and 26–44 age groups; its presence was confirmed in 201 cases in the latter group. In contrast, in the season 2016/2017 there were only single confirmed cases of influenza B virus (Fig. 3).

Comparing confirmed ILI infections among individuals aged over 14 in the epidemic seasons 2015/2016 and 2016/2017, the number of confirmations was at a comparable level ($n = 16$ and $n = 22$, respectively). In both seasons, also in 2014/2015, RSV infections were predominant (Kowalczyk et al. 2017b; Bednarska et al. 2016a).

Given the increase in the number of infections among the elderly over 65 years of age in the analyzed season 2016/2017, a low percentage of people vaccinated against influenza in Poland appears to be an important factor. Although in many voivodships vaccination for this age group is paid by the marshal's offices, 6.87% of them have been vaccinated (NIC 2017). There also was an alarming increase in the number of deaths due to complications among the elderly, 20 out of the 25 cases in 2016/2017, compared with the 56 out of the 140 influenza-related deaths in the preceding season. This dramatic increase in the proportion of influenza-related deaths in the elderly should signal an urgent need for intensified attempts to increase the vaccination coverage in Poland. According to the recommendations issued by WHO, 15 academic medical societies, and 143 national influenza centers, vaccination is the only and most effective method of preventing influenza complications and deaths (NIC 2017; Grohskopf et al. 2016; Brydak et al. 2012; Brydak 2008).

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Conflicts of Interest The authors declare no conflicts of interest in relation to this article.

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