

## SOCIAL SCIENCES

SEASONAL INFLUENZA VACCINATION COVERAGE: EHIS SURVEY RESULTS  
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**Abstract.** Seasonal influenza vaccination is one of the most important tools of prevention. Countries currently use many different methodologies to measure national influenza vaccine coverage in populations at higher risk. The study uses two main data sources: The European Health Interview Survey (EHIS) (collected by Eurostat) and OECD statistics, and compares both results. Findings showed that the EHIS survey results observed in this study are mainly lower than OECD data. This can mean that international sources provide overestimated data of coverage compared to outcomes from population surveys.

**Keywords:** seasonal influenza, coverage, EHIS survey, OECD.

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**Introduction**

Seasonal influenza (flu) leads to an estimated three to five million cases of severe illness, and between 250,000 to 500,000 deaths globally each year (WHO, 2014). Despite influenza's severity and the availability of safe vaccines, low influenza vaccine uptake rates within specific groups at higher risk of severe disease, remain a challenge throughout the globe and contribute to the burden of disease (WHO, 2015).

Influenza vaccination is the most effective prevention of influenza-like illnesses, with 70–90% efficacy among healthy adults (WHO, 2014). Flu vaccination can reduce the risk of flu-associated hospitalization, including among children and older adults. According to CDC, people aged 50 and older, who were vaccinated against flu, reduced their risk of being hospitalized from flu by 57%. Flu vaccination is an important preventive tool for people with chronic health conditions, such as heart disease, chronic lung disease or diabetes (CDC, 2016).

Heterogeneity in at-risk categories included in national flu vaccine recommendations still exists among European countries. In accordance with international recommendations from the European Council, vaccination providers and immunization programs should work to achieve the target of 75% vaccine coverage in populations at higher risk, with a view to reducing influenza-related morbidity and mortality (*Barberis et al., 2016*). In most of the countries, flu vaccination coverage falls far short of the 75% international target and it appears to have declined in recent years, probably reflecting the negative impact on vaccination uptake of public discussions about safety and benefits of influenza vaccination during the 2009 pandemic period (*Spruijt et al., 2016*). Moreover, several countries do not monitor annual influenza vaccine coverage in a number of target groups. As countries in the EU attempt to increase influenza vaccination coverage in populations at higher risk, developing valid and reliable methodologies to measure this in these target groups is critical.

According to OECD, the influenza vaccination rate refers to the number of people aged 65 and older who have received an annual influenza vaccination, divided by the total number of people over 65 years of age. This indicator is measured as a percentage. The data come from administrative sources or surveys, depending on the country (*OECD, 2018*).

European countries currently use many different methodologies to measure national influenza vaccine coverage in populations at higher risk (*O'Flanagan, Cotter and Mereckiene, 2013*). Data on flu vaccination coverage are needed to estimate the risk of morbidity and mortality. The estimations are usually based on routine national statistics, statistics on primary and/or secondary care performance, or population surveys. Based on a review of published literature and reports from a number of countries in the WHO European Region, as well as interviews with national focal points for influenza and influenza vaccination, five broad methodological categories that rely on different data sources for estimating influenza vaccination coverage were identified: analysis of data from national health insurance records; analysis of administrative data from well-documented national or private vaccination programmes targeting specific smaller groups such as health care professionals; evaluation of national vaccine registries; and national surveys of individuals (*WHO, 2016*). Comparison of these data sources can bring a different view on assessment of risk in population.

The European Health Interview Survey (EHIS) is an instrument which collects such information. The corresponding methodological manual aims to ensure a high level of comparability of the survey results across countries. The EHIS consists of four modules on health status, health care use, health determinants and socio-economic background variables. EHIS targets the population aged 15 and over, and living in private households. The EHIS questionnaire contains both general health questions and questions related to flu vaccination from interviews (*EUROSTAT-EHIS, 2017*). This makes it a valuable addition to standard statistical data, reflecting subjective positions of people involved.

It is well known that other sources of influenza vaccination coverage exist. The European Council Recommendation encouraged Member States to adopt and implement national, regional or local action plans or policies to improve seasonal influenza vaccination coverage, and to measure coverage in all risk groups. Countries were also encouraged to report on a voluntary basis to the European Commission on the implementation of the recommendation. ECDC-supported VENICE surveys have been identified as being an effective way of doing this. These surveys offer an established mechanism to monitor implementation, with several surveys conducted before and immediately following the Council Recommendation. A total of eight surveys were conducted by VENICE between

2008 and 2015: one pandemic influenza survey and seven seasonal influenza surveys. So, one of the sources related to influenza data is ECDC, which publishes “Technical report - Seasonal influenza vaccination in Europe“. These data come from administrative method: reported routine immunisation data, i.e. registry system of doses administered or survey method: population surveys, i.e. household, mail, face-to-face, telephone surveys (ECDC, 2017; VENICE II, 2009).

The purpose of the research is to analyze the influenza vaccination rate from EHIS survey results in selected countries and to compare them with OECD statistics.

### Methodology

The study is designed as a secondary data analysis, based on data from Eurostat, European Health Interview Survey - a cross-sectional study (EUROSTAT- EHIS, 2017). The study also compares results from EHIS with the only international data source OECD focused on flu vaccination coverage, especially in the elderly age group.

### Setting

The study assesses influenza vaccination rate in 16 selected EU countries, which took part in the EHIS survey. (Table 1): AT-Austria, BE- Belgium, BG- Bulgaria, CY- Cyprus, CZ- Czech Republic, EE – Estonia, EL- Greece, FR- France, HU- Hungary, LV- Latvia, MT- Malta, PL- Poland, RO- Romania, SI- Slovenia, SK- Slovakia, ES- Spain. We filtered data for one year for each country as we were comparing to OECD influenza vaccination rate.

Table 1

**Countries participating in EHIS survey by year and respondents**

Country	Year of survey data	Number of respondents	Population	% of population enrolled	Enrolment rare per 100 000
AT	2006	13 255	8 254 298	0,16	160.58
BE	2008	5 357	10 666 866	0,05	50.22
BG	2009	5 661	7 467 119	0,08	75.81
CY	2008	6 920	776 333	0,89	891.37
CZ	2008	1 952	10 343 422	0,02	18.87
EE	2006	1 086	1 350 700	0,08	80.40
EL	2009	6 172	11 094 745	0,06	55.63
FR	2008	24 689	64 007 193	0,04	38.57
HU	2009	5 051	10 030 975	0,05	50.35
LV	2008	6 016	2 191 810	0,27	274.48
MT	2008	3 613	407 832	0,89	885.90
PL	2009	35 100	38 135 876	0,09	92.04
RO	2008	18 172	20 635 460	0,09	88.06
SI	2007	1 937	2 010 377	0,10	96.35
SK	2009	4 972	5 382 401	0,09	92.38
ES	2009	22 188	46 239 273	0,05	47.99

Source: (EUROSTAT- EHIS, 2017; Eurostat, 2018)

Some countries were excluded from analysis because of missing data, either in EHIS responses or OECD database (for example Austria, even though this country participated in the EHIS survey).

### Sources of data

The study uses two main data sources: The European Health Interview Survey (collected by Eurostat) and OECD statistics.

The EHIS is a questionnaire-based survey (EHIS, 2010) which was conducted between 2006 – 2009. The EHIS questionnaire contained three questions related to flu vaccination via interviews. Microdata were obtained after receiving approval from Eurostat. Data were provided to us by CD database (*EUROSTAT, 2017*).

The number of respondents in EHIS were counted as a percentage of the total population (*Eurostat, 2018*) by related year, or as a rate per 100 000. An average of 0.19% of the population participated, and the highest % of respondents were recorded in Cyprus (0.89%) and Malta (0.89%). The smallest sample sizes were in the Czech Republic (0.02%) and in France (0.04%) (Table 1).

A higher proportion of women than men took part in the survey in each selected country. The average percentage of female respondents is 54%, and male respondents 46%. In Greece a larger gap was recorded between female (61%) and male (39%) respondents, and the smallest gender gap was in Slovakia. The highest percentages of respondents in the age group 65+ years were recorded in Estonia (37%), Greece (33%) and France (31%). The lowest rates of the elderly population taking part in the survey were in Slovakia (14%), Cyprus (18%) and Malta (18%). The average percentage of respondents in this age group was approximately 24%.

The Organization for Economic Co-operation and Development (OECD) monitors country indicators and shares statistics by topic, through direct access to a real-time data warehouse. It provided data about the vaccination rate for influenza in selected countries, available only for the population aged 65+ years (*OECD Health Data, 2018*). OECD uses Guidelines for Completing the OECD/Eurostat/WHO-Europe Joint Questionnaire on Non-Monetary Health Care Statistics. The overall objective of this joint questionnaire is to provide internationally comparable data on key aspects of health care systems as they relate to health care resources and activities. The joint questionnaire on non-monetary health care statistics is divided into four main parts: 1) Health employment and education; 2) Health workforce migration (added in 2015); 3) Physical and technical resources; and 4) Health care activities, which contains immunization data. The objective is to record the percentage of elderly people who have been vaccinated against seasonal influenza during the past twelve months. National focal points should complete/update the respondent information in countries (*OECD-EUROSTAT- WHO. 2017*). These data were used to compare with influenza vaccination rate results from the EHIS survey.

### Data analysis

The study focused on answers to questions related to influenza vaccination from EHIS; three questions were available for our research concerns: 1: Have you ever been vaccinated against flu? 2: When was the last time you were vaccinated against flu? 3: What month was that?

We were interested in vaccination coverage in the population aged 65+ years and those with chronic diseases. Therefore, data relating to chronic diagnoses in respondents from the survey were also used. Respondents could mark only diseases confirmed by their healthcare providers. Respondents were divided into groups without chronic disease, and those with at least one chronic disease. Vaccination rate was investigated only for the population aged 65+ years and with chronic disease.

Personal identifiers, such as age of person, sex, country, and date of interviews were also provided by the EHIS database. Data cleaning and missing data decisions were made subsequently by the research team, and initial grouping by country, sex, age group, etc., was performed.

The following indicators were assessed by country: percentage of respondents who have never been vaccinated against flu, percentage of respondents who were vaccinated against flu in the current year (year of filling questionnaire), percentage of respondents who were vaccinated against flu in suitable month (Flu vaccination should begin soon after vaccine becomes available, by the end of October, if possible.) (CDC, 2016). The response rates for the three EHIS questions were calculated for each country as a percentage. The first question, asking whether respondent has ever been vaccinated against flu, was filled in by an average of 98.5% of all respondents (min: Bulgaria (91.2%), max Cyprus: (99.9%). These questions were not answered at all by respondents from Austria, meaning that results will not be shown for this country. The second question regarding the time of last vaccination was filled in at a lower rate, with an approximate average of 27% for each country (min: 11% - Bulgaria, max: 59% - Malta). The third question, about the month of vaccination, had the lowest response rate, on average 13.5%. Austria, Belgium and Spain did not provide any results for the second and the third question, so results will not be reported for these countries.

OECD provided data about vaccination rate for influenza in selected countries (Czech Republic, Estonia, Greece, France, Hungary, Latvia, Poland, Slovenia, Slovakia). These were available only for the population aged 65+ and data were recorded by percentage from risk group (OECD Health Data, 2018). These data were compared to those from the EHIS, according to year questionnaire completed.

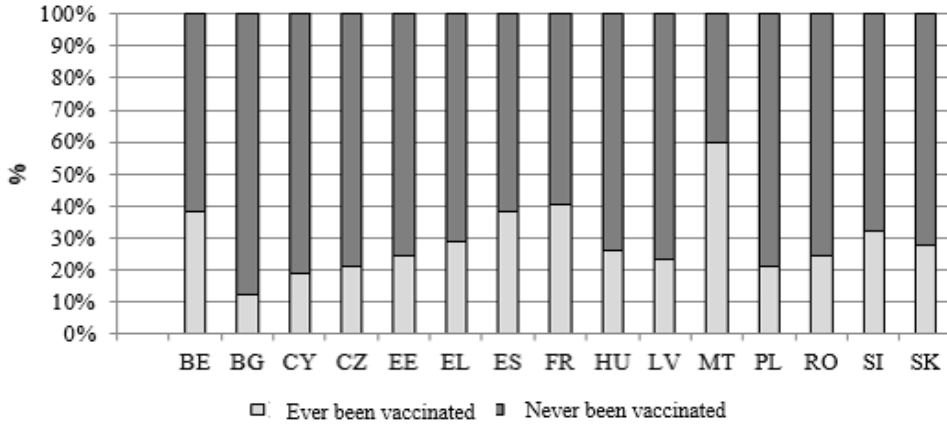
## Results

Main outcomes related to EHIS survey results relating to influenza vaccination according to questionnaire are shown.

For respondents who answered the question “Have you ever been vaccinated against influenza?”, the majority have never been vaccinated (Figure 1). This result was found for almost every country, except Malta, where the percentage of vaccinated population (60%) exceeds that of those who never been vaccinated against flu (40%). The percentage of the population never vaccinated ranged from 40% - 88%. The highest percentages of never vaccinated population were recorded in Bulgaria (88%), Cyprus (81%) and Czech Republic (79%), according to EHIS survey results. The proportion of those, who were at least once vaccinated, varied from 12% - 60%, with the highest proportions observed in Malta (60%), France (41%) and Spain (39%).

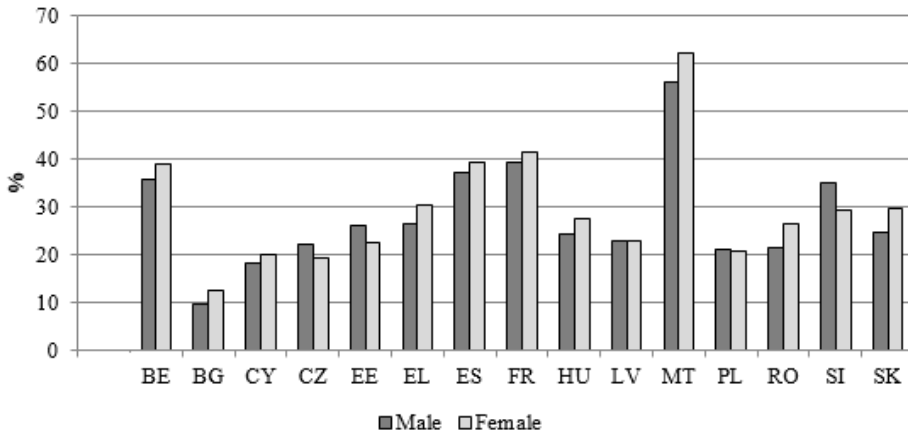
Figure 2 provides a view of ever vaccinated persons from total survey population, by sex. We can see that in 10 of 15 countries (excluding Austria) there is a higher percentage of ever vaccinated women compared to men. A higher male proportion was captured only in the Czech Republic (22% vs. 19%), Estonia (26% vs. 22%) and Slovenia (35% vs. 29%). Latvia

and Poland results are similar for both sexes. The most remarkable gap between women and men is observed in Malta (62% vs. 56%) and Slovenia (29% vs. 35%) respectively.



**Fig. 1. Survey results about respondent's experience with influenza vaccination before/ever**

Source: (EUROSTAT-EHIS, 2017)

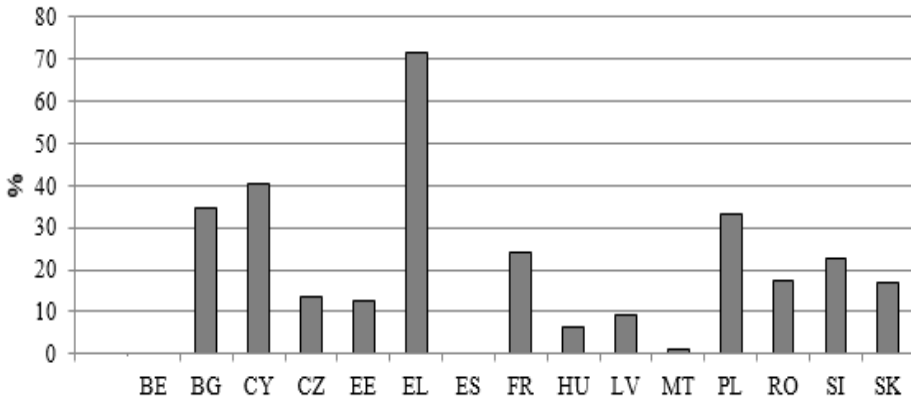


**Fig. 2. Population ever vaccinated against flu by sex in selected countries**

Source: (EUROSTAT-EHIS, 2017)

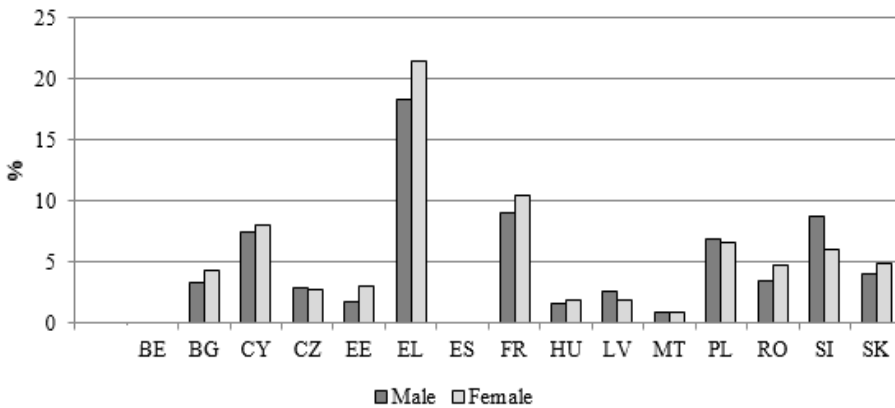
Results showing the percentage of population vaccinated by assessed year can be seen in Figure 3. According to the survey data, we can see that vaccination coverage in random sample sizes ranges from 1% (Malta in 2008) to 71% (Greece in 2009), with the average coverage estimated at 23% of total population in all countries. Malta (2009), Hungary (2008) and Latvia (2008) did not achieve 10% of coverage. Data related to this question were not available for Austria, Belgium and Spain. These survey data related to influenza vaccination rate in the total population are difficult to compare with any international data statistics,

because of missing databases, difference in seasonal counting/assessing of rate and incidence by ECDC (from annual reports), or because of national data focused mainly on risk groups.



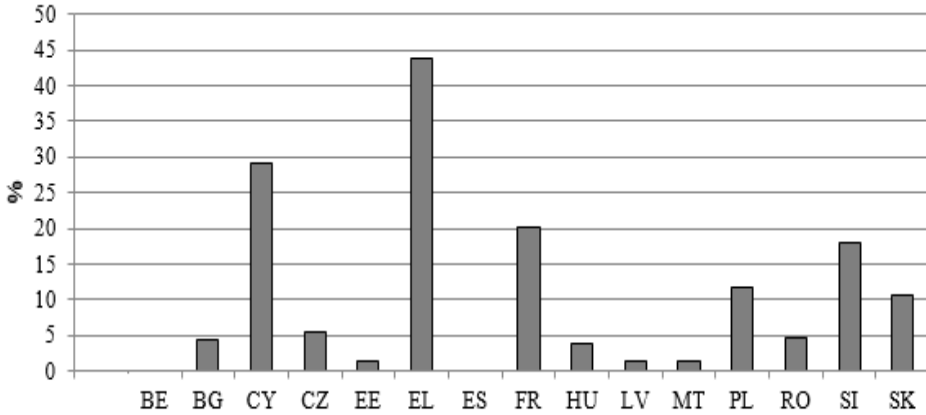
**Fig. 3. Proportion of respondents vaccinated since the beginning of (survey) year**  
 Source: (EUROSTAT-EHIS, 2017)

A higher proportion of women were vaccinated in the selected year compared to men (Figure 4). The highest coverage in women was detected in Greece (22%, 2009) and France (10%, 2008), and for men, Greece (18%, 2009), France (9%, 2008) and Slovenia (9%, 2007).



**Fig. 4. Proportion of respondents vaccinated since the beginning of (survey) year by sex**  
 Source: (EUROSTAT-EHIS, 2017)

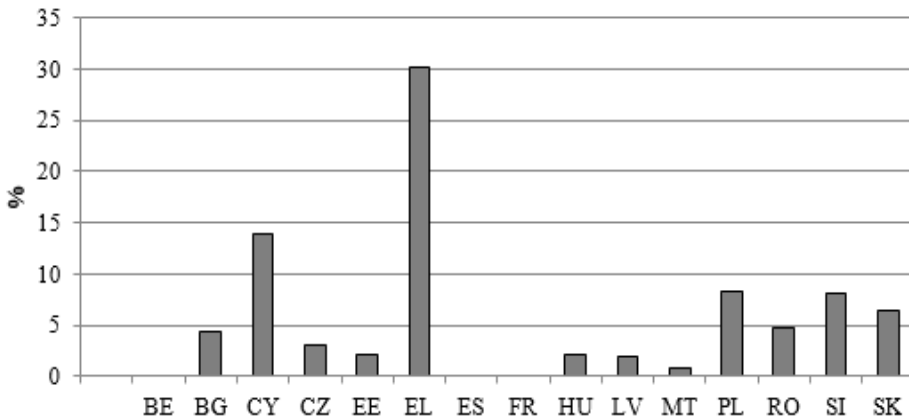
Influenza vaccination coverage in the older population, 65+ years, can be estimated for 13 countries (Figure 5), with the average at 12% for assessed countries. The highest vaccination coverage is recorded in Greece (44%, 2009), Cyprus (29%, 2008) and France (20%, 2008). The lowest value of vaccination rate is found in Estonia (1,3%, 2006), Malta (1,4%, 2008) and Latvia (1,5%, 2008). None of the countries achieved recommended influenza vaccination coverage (75%) for risk group 65+, according survey response results.



**Fig. 5. Proportion of respondents vaccinated since the beginning of (survey) year in age group 65+**

Source: (EUROSTAT-EHIS, 2017)

Respondents, who recorded one or more diagnosed chronic diseases, were investigated according to vaccination status against influenza (since the beginning of (survey) year). It was found that the highest percentage of those vaccinated with at least one diagnosis was detected in Greece (30%) (Figure 6). The lowest value was in Malta (0,9%). None of the countries achieved recommended influenza vaccination coverage for this risk group with chronic diseases, according survey response results. In Austria, Belgium, Estonia and France data were missing.

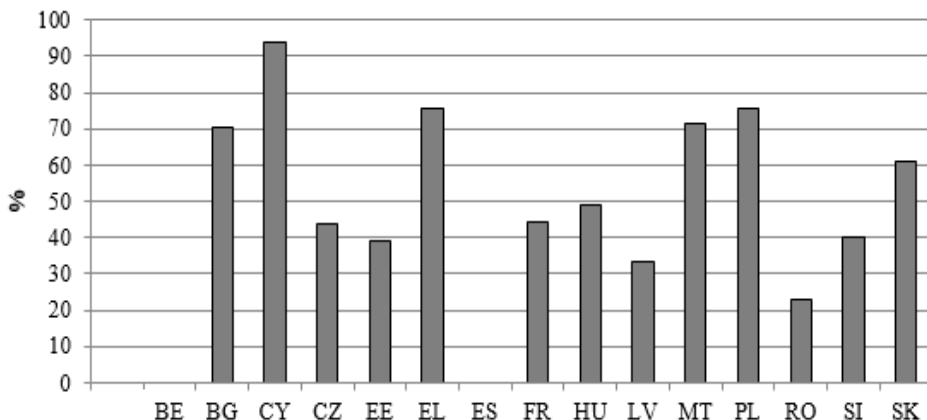


**Fig. 6. Proportion of vaccinated respondents with diagnosis of at least one chronic disease since the beginning of (survey) year**

Source: (EUROSTAT-EHIS, 2017)

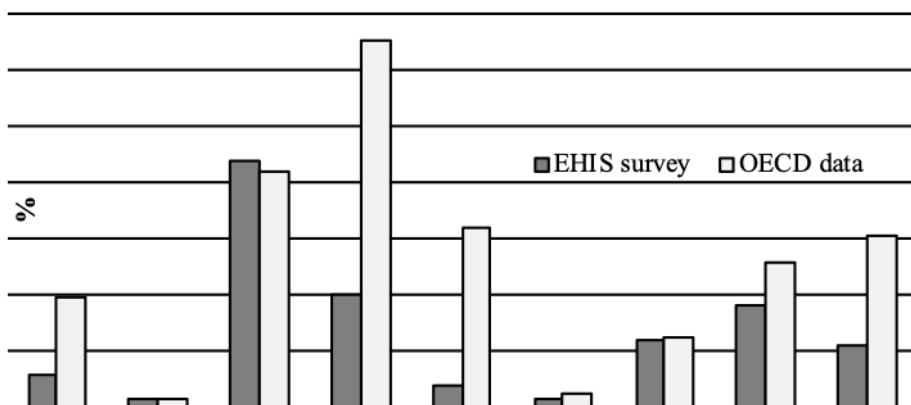
The proportion of respondents vaccinated against influenza (in suitable month) by the end of October is described in Figure 7. Among countries with the highest percentage of respondents vaccinated by the recommended time are Cyprus (94%), Greece (76%) and Poland (75%).





**Fig. 7. Proportion of respondents vaccinated against influenza by the end of October**  
 Source: (EUROSTAT-EHIS, 2017)

Figure 8 shows comparison of EHIS survey results and data from the OECD international database for influenza vaccination coverage in age group 65+ years. Comparison is possible for only nine countries, because of incomplete data. Survey results observed in this study are mainly lower than OECD data, except Estonia and Greece. Data related to France elicited the highest difference between coverage sources, where according to EHIS it is 20% and the value from OECD is 65% (for the same year). Coverage in Hungary was also different (EHIS 4% vs. OECD 32%). Vaccination coverage in the Czech Republic was recorded as 5,4% according to EHIS and 19% described by OECD. Differences in Slovenia (18% vs. 26%) and Slovakia (11% vs. 31%) are remarkable, too. Coverage in Estonia is similar to data from the survey (EHIS 1,3% vs. OECD 1,1%). Data in Latvia and Poland are relatively similar (Latvia:1,5% vs. 2,2%, Poland: 11,8% vs. 12,1%). In Greece, EHIS results were higher, 44% vaccination rate, compared to data from OECD, 42%.



**Fig. 8. Comparison of vaccination coverage in 65+ age group according EHIS results and OECD data**  
 Source: (EUROSTAT-EHIS, 2017; OECD, 2018)

## Discussion

Annual influenza vaccination is the primary means of preventing influenza and its complications. A recent modelling study estimated that seasonal influenza vaccination in Europe may avert between 1.6 and 2.1 million cases of influenza, and prevent between 25 200 and 37 200 deaths each year (*Preaud et al., 2014*). WHO recommends that Member States target a number of high-risk groups for influenza vaccination, including elderly people, children aged between five months to five years, pregnant women, people with underlying chronic diseases and health care personnel (*WHO, 2012a; WHO, 2012b*). While vaccination coverage rates vary by country, most countries in the WHO European Region do not achieve the WHO and European Union's target rate of 75% for influenza vaccination for elderly people and those with underlying illnesses (*ECDC, 2015a*).

Our results show that according to EHIS and OECD statistics, this target rate was not achieved in selected countries. The highest vaccination coverage was recorded in Greece (44%, 2009), Cyprus (29%, 2008) and France (20%, 2008) in age group 65+, as EHIS survey outcomes. Only eight European countries currently have a general recommendation for the vaccination of children and/or adolescents: Austria, Finland, Latvia, Malta, Poland, Slovakia, Slovenia and the United Kingdom. Of these, only Finland, Latvia and the United Kingdom provide the vaccine free of charge. Although Estonia and Lithuania also recommend that those aged  $\geq 65$  are vaccinated, they do not provide public funding for the programme (*ECDC, 2015c; VENICE, 2015*). Health systems and vaccination policy features for a sample of European countries differ. In countries like Germany, France and Belgium, vaccinations are primarily paid for by social health insurance schemes, funded through employee and employer payroll contributions, and largely administered by private physicians. Among Southern European countries, only Malta has a positive recommendation for childhood influenza vaccination ( $\geq 6$  months to  $< 3$  years), but this is not part of the routine schedule. Cyprus has no general age group recommendations, but Greece has a publicly funded seasonal programme for those aged  $\geq 60$  (*McGuire, Drummond and Keeping, 2015*).

The highest percentage of ever vaccinated population was recorded in Malta (60%). Vaccination of the elderly population in Malta was 40% for 2008/2009. Only 70,000 individuals are vaccinated in the Maltese Islands, giving an overall population vaccination rate of approximately 16%. In addition, this shortfall in vaccination uptake has in the past resulted in a perennial wastage of more than 8,000 vaccinations per year. In order to address these lacunae, an influenza vaccination initiative was spearheaded by Mater Dei Hospital's Patient Safety and Quality Improvement Team (PaSQIT), focusing on high risk patients attending the hospital environs for outpatient or other appointments. The vaccination station was sited in a strategic position close to the Outpatients' Department to increase vaccination uptake. The total number of vaccinations given through this initiative exceeded 7,500 (*Baron, 2017*).

In Bulgaria, the EHIS showed the highest proportion of never vaccinated population against influenza, at 88%. The main barriers to vaccination as described by the ECDC include a low perception of risk, particularly in healthcare settings, fear of possible or perceived side effects from vaccination, questions about the effectiveness of the vaccine, issues of cost, availability and convenience, misleading reports in the mainstream media, and a general lack of accurate information about influenza and vaccination (*ECDC, 2015b*).

For influenza coverage data, the relevant source is the VENICE project in Europe. Data on influenza vaccine uptake in the elderly are available for 19 countries out of the 29

members of VENICE. For seven of these countries, Bulgaria, Cyprus, Estonia, Greece, Iceland, Latvia and Malta, no other sources of data are available (*Mereckiene et al., 2008*). Other studies use different methods of data collecting, for example, telephone surveys conducted by the University of Zurich collecting data from Austria and the Czech Republic (*Blank, Schwenkglenks and Szucs, 2008*). An international study (*Jorgensen et al., 2017*), based on data from ECDC and VENICE, confirmed that influenza coverage of target groups in European countries was generally low, but with large variations between countries. Vaccination coverage was not monitored for several groups. Furthermore, implementation of vaccination coverage monitoring is critical for assessing performance and impact of the programs. Jorgensen et al.'s (*2017*) study showed that information on coverage was provided by 33 (72%) of the countries recommending influenza vaccination for older people in 2014/2015. The Netherlands was the only country in the region that had met the goal by 2010, reporting coverage rates above 75% between the seasons 2008/2009 and 2011/2012, after which uptake dropped. The Netherlands were not included in the EHIS, so we cannot compare these data with survey results.

We found that data from ECDC-supported VENICE surveys (*ECDC, 2017; VENICE II, 2009*) and OECD (*OECD Health Data, 2018*) were almost the same, so for this reason we used only one of these sources for comparison. In this study, observed survey results are mainly lower than OECD data, except Estonia and Greece. Data related to France generated the highest difference between coverage sources, where according to EHIS, it was 20%, and the value from OECD was 65%. Coverage in Hungary also differed by sources (EHIS 4% vs. OECD 32%). On comparison, coverage in Estonia, Latvia, Poland and Greece was similar by data sources. The OECD obtains a large quantity of statistical information from national agencies and other international organisations that are fed into the extensive range of policy recommendations and analytical reports produced each year. OECD statistics are also made available to external users in a number of specialised paper and electronic statistical publications. One of the recurring issues raised during discussions with national statistical institutes, and other national data providers over the last five years, is their perception of the need for international organisations, including the OECD, to develop clear statements of direction for data collection, particularly from the perspective of minimising their reporting burden. Data providers at national level are: national statistical offices; departments of national governments (including ministries of finance, agriculture, education, health, science and technology, etc.) and national central banks; and private institutes, companies or associations. As a prelude to the development of a data capture policy for the OECD, it might also be useful to articulate a number of broad principles for discussion and endorsement by the High Level Group for Statistics, that would provide a wide-ranging context for the collection of data and metadata from national source agencies (*OECD, 2002*).

We are aware of the limitations in this study. Comparison was performed only with one international database (OECD) and comparing coverage data was assessed for a year period, not for a seasonal period, as influenza is usually measured. Data from EHIS survey were incomplete for many countries. Survey results can be biased by sample size and the process of randomization of individuals.

## Conclusions

The study demonstrated that international sources can provide overestimated data of coverage compared to outcomes from population survey and countries evidenced very low

uptake of the vaccination according to the EHIS. Monitoring of influenza vaccination coverage plays a key role for the detection of risk groups in the population. In addition, results highlight low levels of health policy implementation, in terms of vaccination and overall prevention strategies. It is necessary to unify and standardize the recording process of influenza coverage data across countries and support activities leading to increasing uptake and reducing barriers.

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