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Pneumococcal and seasonal influenza vaccination among elderly patients with diabetes*

Szczepienie przeciw pneumokokom i grypie sezonowej u osób starszych chorych na cukrzycę

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Authors' Contribution:
A Study Design
B Data Collection
C Statistical Analysis
D Data Interpretation
E Manuscript Preparation
F Literature Search
G Funds Collection

Summary

Introduction: Both seasonal influenza vaccination and pneumococcal vaccination are recommended for elderly diabetics. The aim of the study was to determine the rate of seasonal influenza vaccination over the previous twelve months, pneumococcal vaccination over a lifetime, and to identify predictors which affect likelihood of vaccination.

Material/Methods: 219 diabetics elders were detailed questioned 3 months after the end of 2012/2013 influenza season.

Results: 26.48% of patients have been vaccinated against influenza in the last year and only 9.13% of patients reported pneumococcal vaccination in the past. The logistic regression analysis revealed that variables which increased the likelihood of having been vaccinated against influenza were: higher number of anti-hyperglycemic medications, increased number of co-morbidities, higher patients' income, recommendation of vaccination from General Practitioners (GPs) and specialist. Significant predictors of pneumococcal vaccine uptake included increased number of co-morbidities and recommendation of vaccination received from GPs and specialist. The commonest reasons given by those unvaccinated were lack of information about immunization and low perceived benefits of vaccination. Of patients who were not treated with influenza vaccine 86.7% had never received recommendation from specialist and 71.4% had never been advised by GPs. Influenza vaccination was too expensive to 24.85% of patients.

Conclusions: The vaccination rate among elderly diabetics in Poland is low. Lack of knowledge and patients' income are the main barriers. Increased awareness of healthcare professionals to educate and encourage vaccination and propagation of free vaccinations to all people at risk may increase the rate of vaccination against influenza and pneumococcal disease.

Keywords: **diabetes • elderly • influenza and pneumococcal vaccination**

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Background

According to the International Diabetes Federation (IDF), in 2011 the prevalence of diabetes in Poland was 3.1 million (10.6% of adult population) [18]. Usually the end-stage complications of eye, neurorologic, kidney, and vascular disease are the major cause of death and suffering for people with diabetes. However, the morbidity and mortality associated with infectious diseases like influenza and pneumonia are also significant. Diabetes mellitus is an independent risk factor for developing respiratory tract infections due to some alterations in immunologic system like impaired leukocyte function, reduced phagocytic function of monocytes, poor antibody response, decreased CD4/CD8 lymphocyte ratios [19]. The increased susceptibility of diabetic patients to respiratory tract infections is connected to poor glyceamic control, longer duration of diabetes, impaired lung function, microangiopathy in the lungs, increased risk of aspiration and coexisting morbidities [25]. The immunization against influenza and pneumococcal disease is important for prevention of chronic diseases like diabetes and decrease its associated morbidity and mortality. According to the Advisory Committee on Immunization Practices (ACIP), the American Diabetes Association (ADA) and Polish Diabetes Association vaccinating individuals at high risk just before the influenza season each year and the use of the pneumococcal vaccine at least once in a lifetime are the most effective measure in reducing the impact of influenza and pneumococcal disease [1, 2, 11, 13]. These guidelines recommend also the universal vaccination of the elderly.

Despite long-standing recommendations of pneumococcal and annual influenza vaccinations of adults with chronic diseases, immunization rates in these vulnerable populations are poor suggesting the need for more awareness of this problem [8, 9, 15]. The aims of the present study were to investigate the rates of pneumococcal and influenza vaccinations in elderly patients with diabetes and to identify predictors that may influence likelihood of vaccine uptake.

Materials and Methods

A survey was conducted among unselected 219 elders who attended to outpatient clinic belonged to the Department of Internal Medicine and Diabetology, University Hospital no 1 in Lodz, Poland. A detailed questionnaires and medical history were done over a period of 3 months after the influenza season of 2012/2013 had ended. The inclusion criteria were: diabetes type 2 diagnosed minimum 1 year earlier, age 65 and over and the exclusion criteria included patients with documented cognitive impairment, constant alcohol abuse. The first part of questionnaire consists of demographic and socio-economic questions included: age, gender, residence, education, marital status, smoking status, income, financial problems. The second part of questionnaire consists of detailed medical history of diabetes type 2 and include: diabetes duration, current treatment for diabetes and complications if present, family history of diabetes, co-morbid diseases of the patient (hyperlipidemia, hypertension, cardiovascular disease, lung disease, cancer, gastrointerstinal tract diseases) and their treatment. The third part comprises detailed questions about influenza and pneumococcal vaccinations including factors that could possibly influence last year influenza vaccine and ever in lifetime pneumococcal vaccine. This part of questionnaire consisted of questions on knowledge regarding influenza and pneumococcal disease, vaccine advisors and reasons for missing vaccinations. We also noted influenza-like illness over a past year and infections possibly due to Steptococcus pneumoniae over a past 5 years. All questions were based on international literature and potentially factors which can influence the rate of vaccination were included in questionnaire [3, 12, 16, 29]. We also used medical history data and available blood test results from our outpatient's clinic documents.

Statistical Analysis

The descriptive statistics for the categorical variables were tested using the Chi-square, and the continuous variables using the Student's t or the Mann Whitney-U tests whenever applicable. Two multivariate logistic regression models were generated to identify the influential factors on the uptake of influenza in last year or pneumococcal vaccines ever in lifetime. The dependent factors were set as receiving the influenza during last year or pneumococcal vaccine ever in lifetime. The univariate analysis included the variables that were found to be significant in the models. The independent variables entered in the model at step one were: gender, age, residence, education, marital status, smoking status, income, financial problems, duration of diabetes, the body mass index; waist-hip ratio (WHR), HbA1c and lipids levels, number of anti-hyperglycemic and concomitant medications, number of co-morbid conditions, number of micro and macrovascular complications, family history of DM2, General Practitioners (GPs) and specialist advice for vaccination. Odds ratios (OR) were computed and presented with the 95% interval of confidence (CI).The nonsignificant predictors ($P > 0.05$) were subsequently removed on a backward stepwise basis. A P value of less than 0.05 was considered statistically significant. Statistica 10.0 (StatSoft, Poland, Krakow) was used for analysis.

Written consent was obtained from the participants and approval was obtained from the independent local ethics committee of Medical University of Lodz.

Results

Patient demographics

The research was conducted on a group of 219 patients.

The demographic characteristics of the study group have been presented in Table 1. Patients who were vaccinated against influenza during last year and those who were not vaccinated were comparable for most sociodemographic characteristics, except for patients' residence and income as well as duration of diabetes. Patients who were vaccinated against pneumococcus had smaller WHR and greater proportion of smokers than those who were not vaccinated.

Vaccination rates

The influenza vaccination rate in patients with diabetes was only 26.48% (n=58). 81% (n=47) of patients who were vaccinated against influenza last year, received the vaccination regularly every year. However the regular vaccination against influenza was declared by 21.5% (n=47) in whole group of participants. The influenza vaccines received ever in lifetimes only 31.1% (n=68) subjects.

Reported pneumococcal vaccine uptake over patient's lifetimes was 9.13% (n=20).

Vaccine advisors

58.6% (n=34) of patients who were vaccinated against influenza last year had been advised to get the seasonal influenza vaccine by a specialist doctor, and in 46.6% (n=27) of these patients vaccination had been advised by GPs.

86.7% (n=140) of patients who weren't vaccinated against influenza last year had never been advised no vaccination by specialist doctor and 71.4% (n=115) of these patients had never been advised by GPs.

60% (n=12) of patients who had ever got the pneumococcal vaccine in their lifetime had received the recommendation to get the pneumococcal vaccine by specialist doctor, and 60% (n=12) of them received that recommendation by GPs. 98.5% (n=197) of patients who had never got the pneumococcal vaccine had never been advised by specialist doctor to get vaccination and 99.5% (n=198) of these patients had never been never advised by GPs.

Other sources of advice for whole group of participants are shown in Figure 1.

Reasons for the lack of immunization

The participants were also asked about the reasons why they were not vaccinated. For both influenza and pneumococcal vaccinations the commonest reasons given were lack of information about immunization and low perceived benefits of vaccination. Influenza vaccination was too expensive to 24.85% (n=40) of patients. Almost

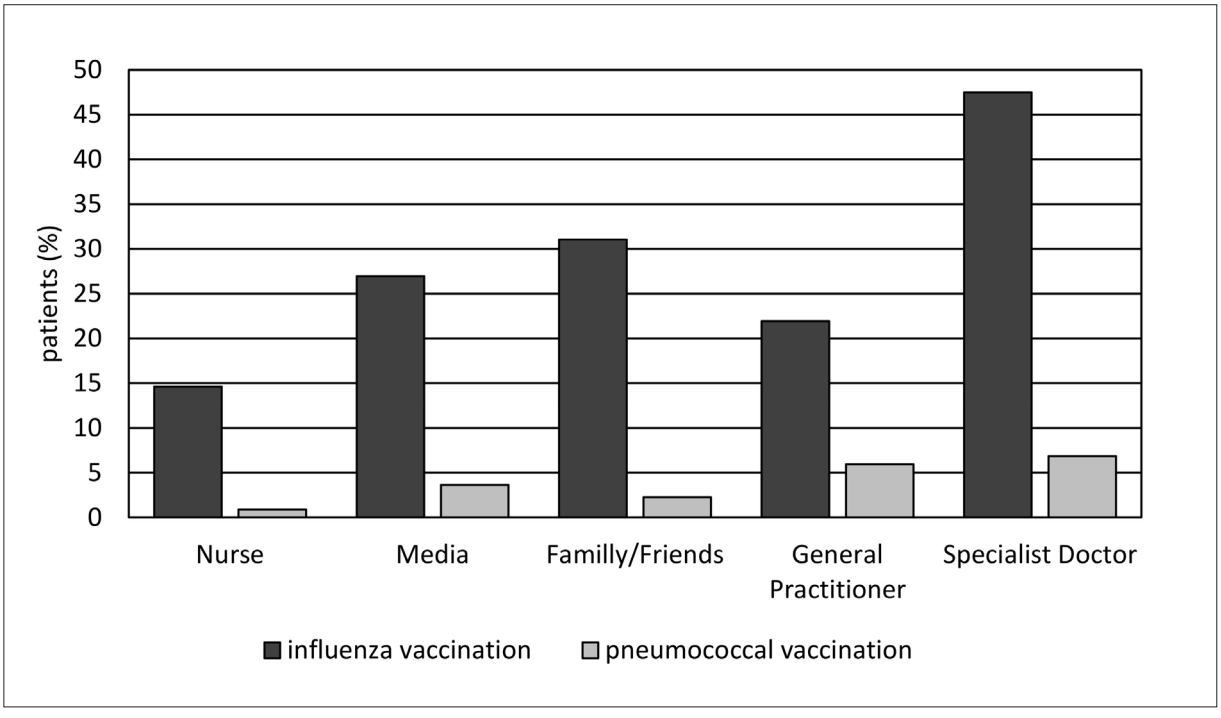

Fig. 1: Percentage of patients in receipt of advice regarding seasonal influenza and pneumococcal vaccines from various sources

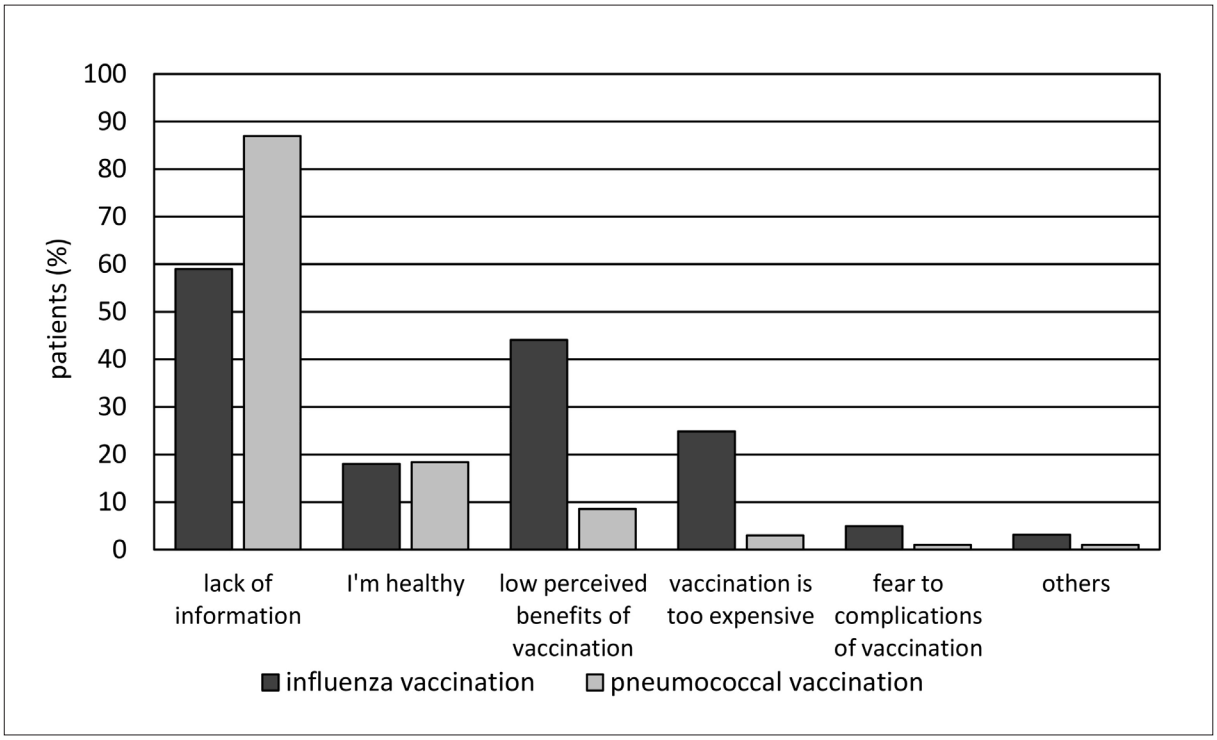

Fig. 2: Reasons in percentage reasons of not being vaccinated against seasonal influenza and pneumococcus

18% (n=29) of subjects had claimed that vaccination is not necessary because they are healthy. 5.02% (n=11) of patients reported an adverse experience with the seasonal influenza vaccine. Reasons for missing vaccinations are presented in Figure 2.

Knowledge and attitudes

28.8% (n=63) of all participants claimed that they knew the difference between influenza and the common cold. 49.8% (n=109) of patients claimed that knew complications due to influenza and only 5.02% (n=11) of patients claimed that knew pneumoccocus-related diseases and complications. In addition, 4.1% (n=9) participants reported having had an influenza-like illness over twelve months and 2.3% (n=5) had pneumonia and 3.65% (n=8) had sinusitis in last 5 years, which are most common pneumoccocus-related diseases.

Only 31.5% (n=69) of diabetics are going to get the influenza vaccination next year, however this number of patients increase to 42% (n=92) if the vaccination would be for free.

Predictors of vaccine uptake

The univariate logistic regression models revealed many factors which are associated with last year influenza vaccination and ever in lifetime pneumococcal vaccination (table 2).

The multivariate logistic regression model showed that variables which increased the likelihood of having been vaccinated against influenza were: higher number of anti-hyperglycemic medications, increased number of co-morbidities, higher patients' income, recommendation of vaccination from GPs and specialist. Significant predictors of ever in lifetime pneumococcal vaccine uptake included increased number of co-morbidities and recommendation of vaccination received from GPs and specialist (table 3).

Discussion

Immunization is one of the most effective public health interventions which significantly reduces the burden of many infectious diseases. Adult vaccination coverage, however, remains low for most routinely recommended vaccines. The purpose of the World Health Assembly is the implementation of the programs that allow to increase the rate of immunization in all risk groups, including elderly to 75% [24]. Uptake rates of the seasonal influenza vaccine and pneumococcal vaccine among patients range vary widely in different countries. In the US in adults aged ≥65 years, influenza vaccination coverage was 66.2 % [5] and pneumococcal vaccination coverage was 59.9% in 2012 [7]. In Poland the influenza vaccination coverage in 2012/2013 for whole population was only 3.7%, and it was lower comparing to previous years (in 2011/2012-4.5%, in 2010/2011 – 5.2%) [27]. In Poland the influenza vaccination coverage in 2011/2012 in adults aged ≥65 years was 14.2% [28]. Working Group of Influenza based on the best world standards had set goals for influenza vaccination coverage for all people: 5-6% in short term (2 next years), 14-15% in long period (15 years), for adults aged ≥65 years: 14-15% and 50%,

Table 1. Demographic characteristics of elderly patients with T2DM by vaccination status

	Vaccinated against influenza last year	Not vaccinated against influenza last year	Vaccinated against pneumoccocus ever in lifetimes	Not vaccinated against pneumococcus ever in lifetimes
Number of patients	58	161	20	191
Male/female	28/30	64/97	7/13	85/114
Age (years)	72.15 ± 5.96	71.09 ± 5.05	70.65 ± 4.47	71.44 ± 5.39
Residence: urban/rural	52/6	108/53*	17/3	143/56
Education (%)				
primary school	4/58 (6.89%)	18/161 (11.18%)	2/20 (10%)	20/191 (10.05%)
secondary school	28/58 (48.27%)	82/161 (50.34%)	11/20 (55%)	99/191 (49.74%)
Technical school	14/58 (24.13%)	44 /161(27.32%)	6/20 (30%)	52/191 (26.13%)
University	12/58 (20.68%)	17/161 (10.56%)	1/20 (5%)	28/191 (14.07%)
Marital status: single/married	20/38	56/105	8/12	68/131
Current smoking (%)	14/58 (24.14%)	26/161 (16.15%)	8/20 (40%)	32/199 (16.08%)#
Had ever smoked (%)	21/58 (36.2%)	49/161 (30.43%)	9/20 (45%)	66/199 (33.17%)
Income (%)				
Low (<1000 pln/person)	1/58 (1.72%)	40/161 (24.84%)	3/20 (15%)	38/191 (19.09%)
Medium (1000-2000 pln/person)	26/58 (44.83%)	85/161 (52.79%)	10/20 (50%)	101/191 (50.75%)
Higher (>2000 pln/person)	31/58 (53.44%)	36/161 (22.36%)*	7/20 (35%)	60/191 (30.15%)
Duration of T2DM (years)	16.47 ± 11.89	11.97 ± 10.07$	16.95± 12.12	12.77 ± 10.55
BMI (kg/m2)	29.94 ± 5.11	30.62 ± 4.09	29.62 ± 4.45	30.52 ± 4.34
Waist/Hip Ratio (WHR)	± 0.14	± 0.12	0.93 ± 0.08	1.02± 0.12*
HbA1C (%)	8.44 ± 2.09	8,27 ± 1.88	8.96± 2.15	8.25 ± 1.91
TC (mmol/l)	4.95± 0.94	4.7 ± 1.04	4.77± 1.15	4.77 ± 1.0
LDL (mmol/l)	3.06 ± 0.78	2.82 ± 0.98	2.84 ± 0.96	2.89 ± 0.94
TG (mmol/l)	1.71 ± 0.83	1.78 ± 0.98	1.46 ± 0.61	1.79 ± 0.96
HDL (mmol/l)	1.31± 0.27	1.27± 0.26	1.38 ± 0.27	1.28 ± 0.27
Treatment of T2DM				
OAD	34/58 (58.62%)	87/161 (54.04%)	13/20 (65%)	108/199 (54.27%)
Insulin	43/58 (74.14%)	107/161 (66.46%)	13/20 (65%)	106/199 (46.73%)
OAD + Insulin	32/58 (55.17%)	87/161 (54.04%)	16/20 (80%)	108/199 (54.27%)
Complications (%)				
Previous CVD	28/58 (48.28%)	72/161 (44.72%)	13/20 (65%)	87/199 (43.72%)
Stroke	3/58 (5.17%)	20/161 (12.42%)	2/20 (10%)	21/199 (10.56%)
Previous HA or use of HA drugs	51/58 (87.93%)	136/161 (84.47%)	19/20 (95%)	168/199 (84.42%)
Hyperlipidemia	44/58 (75.86%)	111/161 (68.94%)	17/20 (85%)	138/199 (69.34%)
Microvascular complication (%)				
Retinopathy	14/58 (24.14%)	45/161 (27.95%)	7/20 (35%)	52/199 (26.13%)
Nefropathy	6/58 (10.34%)	21/161 (13.04%)	3/20 (15%)	24/199 (12.06%)
Neuropathy	12/58 (20.68%)	28/161 (17.39%)	5/20 (25%)	35/199 (17.58%)
Family history of T2DM	33/58 (56.89%)	99/161 (61.49%)	14/20 (70%)	118/199 (59.29%)

*p<0,001,# P=0.016, $ p=0.006, comparing participants who had been previously vaccinated with those who had never been vaccinated.
T2DM – type 2 diabetes, BMI – body mass index, TC – serum total cholesterol, LDL – low density lipoprotein cholesterol, TG – triglyceride, HDL – high-density lipoprotein cholesterol, OAD- oral anti-diabetic drug, CVD - cardiovascular disease, HA- hypertension,
The Student t test, Mann-Whitney U test, or chi2 test was used to test for significant differences

Table 2. Factors associated with influenza vaccination during last year and pneumococcal vaccination ever in lifetime (univariate logistic regression model)

Associated parameters with influenza vaccination	p value	OR (95% CI)
Duration of type 2 diabetes (years)	0.009	1.037 (1.009-1.006)
OAD oral anti-diabetic drug (n)	0.036	1.538 (1.029-2.301)
Anti-hyperglycemic medication (n)	0.001	2.304 (1.392-3.814)
Co-morbidity (n)	0.004	1.351 (1.1-1.658)
Concomitant medication (n)	0.017	1.297 (1.048-1.604)
Residence – urban	0.002	2.062 (1.311-3.245)
Higher income (>2000 pln/person)	0.000	4.594 (2.172- 9.718)
No financial problems	0.000	1.915 (1.356-2.704)
GPs recommendation	0.000	2.410 (1.706-3.403)
Specialist recommendation	0.049	1.357 (1.001-1.840)
Associated parameters with pneumococcal vaccination		
Co-morbidity (n)	0.000	2.778 (1.875-4.116)
Concomitant medication (n)	0.033	1.502 (1.034-2.181)
Current smoking (n)	0.012	1.865 (1.148-3.031)
GPs recommendation	0.000	17.234 (5.855-50.723)
Specialist recommendation	0.000	9.899 (4.796-20.433)

GP - General Practitioner, OAD - oral anti-diabetic drug

Table 3. Factors associated with influenza vaccination during last year and pneumococcal vaccination ever in lifetime (multivariate logistic regression model)

Associated parameters with influenza vaccination	p value	OR (95% CI)
Anti-hyperglycemic medication (n)	0.018	2.159 (1.143-4.078)
Co-morbidity (n)	0.002	1.165 (1.1-1.986)
Higher income (>2000 pln/person)	0.000	5.344 (2.376- 12.015)
GPs recommendation	0.000	2.706 (1.791-4.088)
Specialist recommendation	0.024	1.563 (1.061-2.304)
Associated parameters with pneumococcal vaccination		
Co-morbidity (n)	0.006	4.084 (1.497-11.146)
GPs recommendation	0.000	35.23 (6.43-193.015)
Specialist recommendation	0.000	12.531 (3.6-43.616)

GP - General Practitioner

respectively [12]. Apart from one study [14] until recently there have been no significant data regarding the rates of immunization against influenza in patients with diabetes in Poland. Our study is the first which shows the influenza vaccine and pneumococcal uptake rate in elderly patients with diabetes. We had found that the influenza vaccine rate in previous year was only 26.48% for adults who had at least two serious indications for vaccination – old age and presence of diabetes. The results was similar to data presented in 2011, were the coverage in diabetic (in all ages) patients was 24% [14]. The rate of pneumococcal vaccination in our study was extremely low. Only 9.13% of elderly patients with diabetes had ever taken this vaccine in their lifetime. Then we have tried to find reason for the low coverage rate. One of this it could be low income and some financial barriers to buy a vaccine. Multivariate analyses showed that income was an important factor that influenced influenza vaccination uptake in Poland. Individuals with higher incomes were more likely to have been vaccinated as compared to those with lower incomes. In Poland usually elderly people are retired with very low monthly pension. The cost of influenza and pneumococcal vaccine is much above financial possibilities of most of elderly people in Poland [20]. This barrier could disappeared if the National Health Insurance (NHI) finance the vaccination. Hoverer, in some regions, the influenza vaccination is for free for elderly, but number of participants is limited by the government. The researchers published analysis that implementing a vaccination pro-

gramme in Poland in which influenza vaccination would be fully reimbursed by the NHI for people aged ≥ 65 years would be a very cost-effective strategy [4].

The data have also suggested that various factors carry a positive impact on the uptake of influenza and pneumococcal vaccinations in Poland. It is believed that more complicated or older diabetes patients have more contact with their doctors and other specialist who could advice the vaccination. Therefore, these patients may have an increased chance of vaccination. Our results revealed that those who had more co-morbidities had a higher chance of being vaccinated against influenza or pneumoccocus. We also have founded that previous GPs and specialist doctor recommendation is the positive predictor of influenza vaccine uptake and the strongest predictor of pneumococcal vaccine uptake. This is reflected by the finding that 58.6% of patients received the advice from specialist and 46.6 % from GPs, regarding the seasonal influenza vaccine. The stronger association was revealed when it comes to pneumococcal vaccine – 60% of patients were advised by GPs and specialist. The explanation for that could be that group of patients who were ever vaccinated against pneumoccus had more often respiratory co-morbidities like asthma and COPD. Thus the specialist recommended more strongly the pneumococcal vaccination. In addition group of patients who smoke cigarettes had more chance to be vaccinated. Perhaps they got more advice from health professionals. Other studies in different countries had also shown the association between rate of influenza and pneumococcal vaccination and GPs and hospital doctors advice [10, 22, 23]. Healthcare professionals are therefore a good source of patient information, and should be the focus of prevention efforts. This may include providing healthcare professionals with training and materials to encourage those at risk of influenza complications to be vaccinated. Poor awareness played an important part in vaccine non-uptake in our study. The participants asked about the reasons why they got not vaccinated complained about lack of information about recommended vaccination and low perceived benefits of vaccination. However other studies revealed some additional predictors of high influenza vaccine uptake like: previous vaccination of a family member, awareness of influenza and influenza vaccination, awareness drives through the media, and accessibility of the vaccine [17, 12, 26]. The Centers for Disease Control and Prevention (CDC) considers that new strategies are required to improve influenza vaccine coverage in all age groups and high--risk groups [6]. In European countries the researchers had proposed that future interventions could be directed towards: an information campaign with special attention to the high-risk groups due to disease; promotion of personal invitations; and, for Poland, solving financial barriers to vaccination [20].

Conclusions

In conclusion, the uptake of influenza and pneumococcal vaccination among elderly diabetics in Poland are low. The main barriers to vaccination are lack of knowledge and low perceived benefits of vaccination. The strong predictors of influenza uptake were higher income, and for both vaccine uptake are GPs and specialist doctor advice. Healthcare professionals, as the main initiators of healthcare education for patients, should increasingly educate and encourage influenza and pneumococcal vaccination among diabetics. There should be also a global solution to increase the rate of vaccination like the implementation a national vaccination programme.

References

[1] ACIP Prevention and Control of Influenza. Recommendations of the Advisory Committee on Immunization Practices 2008. MMWR, 2008; 57: 1–60

[2] American Diabetes Association. Standards of Medical Care in Diabetes 2012. Diabetes Care, 2012; 35(suppl 1): S28-30

[3] Armstrong K., Berlin M., Schwartz S., Propert K., Ubel P.A.: Barriers to influenza immunization in a low-income urban population. Am. J. Prev. Med., 2001; 20: 21-25

[4] Brydak L., Roiz J., Faivre P., Reygrobellet C.: Implementing an influenza vaccination programme for adults aged ≥65 years in Poland: a cost-effectiveness analysis. Clin. Drug Investig., 2012; 32: 73-85

[5] Centers for Disease Control and Prevention (CDC). Flu vaccination coverage, United States, 2012–13 influenza season. Atlanta, GA: US Department of Health and Human Services, CDC; 2013. http://www.cdc.gov/flu/fluvaxview/coverage-1213estimates.htm (15.09.2014)

[6] Centers for Disease Control and Prevention (CDC). Influenza vaccination coverage levels, 2009-10 influenza prevention & control recommendations. www.cdc.gov/flu/professionals/acip/coverage-levels.htm (28.09.2014)

[7] Centers for Disease Control and Prevention (CDC). Noninfluenza Vaccination Coverage Among Adults — United States, 2012. MMWR 2014; 63; 95-102

[8] Ciebiada M., Barylski M., Ciebiada-Adamiec A., Kmiecik T., Górska-Ciebiada M.: Vaccination in elderly patients. Geriatria, 2010, 4: 26-32

[9] Ciebiada M., Barylski M., Górska-Ciebiada M.: Incidence of influenza in the elderly on the basis of recent epidemiological data and treatment recommendations. Geriatria, 2010, 4: 191-198

[10] Clancy U., Moran I., Tuthill A.: Prevalence and predictors of influenza and pneumococcal vaccine uptake in patients with diabetes. Ir Med J., 2012; 105: 298-300

[11] Clinical recommendation of Polish Diabetes Association for the management of patients with diabetes, 2012. Diabetol. Klin., 2012, 1: A47-48

[12] Evans M.R., Watson P.A.: Why do older people not get immunized against influenza? A community survey. Vaccine, 2003; 21: 2421–2427

[13] Górska-Ciebiada M., Ciebiada M., Barylski M., Loba J.: Diabetes mellitus in elderly according to new recommendations of Polish Diabetes Association. Geriatria, 2009; 3: 147-150

[14] Grabia J., Kałek N., Lewandowski N., Zozulińska-Ziółkiewicz D.: Vaccination against seasonal influenza in diabetic patients. Diabetol. Prakt., 2011; 12: 65-70

[15] Grypa i jej koszty. Raport Ernst & Young. 2013, 6: 30-44. http://adst.mp.pl/s/www/opzg/Raport_I_EY_Grypa_i_jej_koszty.pdf (14.09.2014)

[16] Hoeck S., Van der Heyden J., Geerts J., Van Hal G.: Preventive Care Use among the Belgian Elderly Population: Does Socio-Economic Status Matter? Int. J. Environ. Res. Public Health, 2014; 11: 355-372

[17] Horby P.W., Williams A., Burgess M.A., Wang H.: Prevalence and determinants of influenza vaccination in Australians aged 40 years and over – a national survey. Aust. NZJ Public. Health, 2005; 29: 35-37

[18] International Diabetes Federation Diabetes Atlas, 5th ed. Brussels, 2011. http://www.idf.org/diabetesatlas (12.09.2014)

[19] Kornum J.B., Thomsen R.W., Riis A., Lervang H.H., Schønheyder H.C., Sørensen H.T.: Type 2 diabetes and pneumonia outcomes: A population-based cohort study. Diabetes Care, 2007; 30: 2251-2257

[20] Kroneman M., van Essen G.A., Paget J.: Influenza vaccination coverage and reasons to refrain among high-risk persons in four European countries. Vaccine, 2006; 24: 622-628

[21] Ma K.K., Schaffner W., Colmenares C., Howser J., Jones J, Poehling K.A.: Influenza vaccinations of young children increased with media coverage in 2003. Pediatrics, 2006; 117: 157-163

[22] Mangtani P., Breeze E., Stirling S., Hanciles S., Kovats S., Fletcher A.: Cross-sectional survey of older peoples' views related to influenza vaccine uptake. BMC Public. Health, 2006; 6: 249-250

[23] Müller D., Szucs T.D.: Influenza vaccination coverage rates in 5 European countries: a population-based cross-sectional analysis of the seasons 02/03, 03/04 and 04/05. Infection, 2007 ;35: 308-319

[24] Ogólnopolski Program Zwalczania Grypy. Raport Ernst & Young, 2013, 6: 11-41. http://adst.mp.pl/s/www/opzg/Raport_II_Ogolnopolski_Program_Zwalczania_Grypy.pdf (19.09.2014)

[25] Smith S.A., Poland G.A.: Use of influenza and pneumococcal vaccines in people with diabetes. Diabetes Care, 2000; 23: 95-108

[26] Takahashi O., Noguchi Y., Rahman M., Shimbo T., Goto M., Matsui K., Asai A., Onishi M., Koyama H., Sawada I., Yoshinaka T., Fukui T.: Influence of family on acceptance of influenza vaccination among Japanese patients. Fam. Prac., 2003; 20: 162-166

[27] Vaccination in Poland in 2011. Annual report of National Institute of Public Health, 2012: 91-92

[28] Vaccination in Poland in 2012. Annual report of National Institute of Public Health, 2013: 83-85

[29] Zimmerman R.K., Santibanez T.A., Janosky J.E., Fine M.J.: What affects influenza vaccination rates among older patients? An analysis from inner-city, suburban, rural, and veterans affairs practices. Am. J. Med., 2003; 114: 31– 38

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