



Comparing vaccination hesitancy in Polish migrant parents who accept or refuse nasal flu vaccination for their children

D.R. Gorman^{a,*}, K. Bielecki^a, H.J. Larson^b, L.J. Willocks^a, J. Craig^c, K.G. Pollock^d

^a NHS Lothian, Directorate of Public Health and Health Policy, Edinburgh, UK

^b London School of Hygiene and Tropical Medicine, London, UK

^c NHS Health Scotland, Population Health Department, Edinburgh, UK

^d School of Health and Life Sciences, Glasgow Caledonian University, Glasgow, UK

ARTICLE INFO

Article history:

Received 18 November 2019

Received in revised form 5 February 2020

Accepted 7 February 2020

Available online 20 February 2020

Keywords:

Influenza
Vaccine
Immunisation
Hesitancy
Polish
Migrants
Uptake

ABSTRACT

This study investigates the background to low uptake of nasal influenza vaccination in Polish pupils in Edinburgh, Scotland. In autumn 2018, one week after their child's nasal flu vaccination sessions, 365 Polish parents were sent a questionnaire exploring influences on their vaccination choices. The questionnaire included a series of 10 vaccine hesitancy questions recommended by the WHO SAGE Working Group on Vaccine Hesitancy.

128 questionnaires were returned representing 43.4% of vaccinated, 41.9% of refusing and 23.8% of non-consent form returning parents. Responses highlighted concerns about side effects, new vaccines and the accuracy of professional advice and information sources. There was complacency expressed about vaccination against diseases that are not common any more. Vaccine refusers were consistently more negative about all aspects vaccination and more likely to answer 'don't know'. Almost half of refusers were uncertain about the quality of health information offered to them.

Polish migrants in Scotland come with their beliefs about vaccination and modify these as they acculturate to the UK system. They also continue to be influenced by developments and opinions, norms and values from their home country, as well as diaspora media. We have highlighted issues of concern among Polish migrants as a group and gained additional insights by comparing responses of parents who have refused or accepted vaccination. These insights can inform and target messages and strategies to build confidence and encourage immunisation, which should lead to improved vaccine uptake among ethnic population groups.

© 2020 Elsevier Ltd. All rights reserved.

1. Introduction

Vaccine hesitancy, the delay in acceptance or refusal of vaccination despite availability of vaccination services, has been identified by the WHO as one of the top 10 threats to global health in 2019 [1–3]. Low vaccination uptake rates globally have resulted in several well-publicised vaccine preventable disease outbreaks, often in particular communities [4].

Economic and political migration has resulted in significant population movement across Europe and almost 100,000 Polish migrants are now established in Scotland [5]. Qualitative research demonstrates that these migrants maintain close contact with their home country, and their attitudes toward vaccination are

influenced by the Polish cultural and political narrative [6–8]. Historically, this has meant very high primary immunisation rates in Poland due to the compulsory vaccination policy under the previous communist leadership. However, there has been a gradual rise in persons refusing immunisation of their children in Poland – increasing from 4,893 in 2007, to 23,147 in 2016 [9] and accelerating since then (M Gańczak – personal communication). The drop in vaccine uptake may be partially attributed to the rise of anti-vaccination campaigners, who have had a prominent presence in the Polish media and public life [10,11]. The 'State of Vaccine Confidence in the EU 2018' report highlighted that Poland has the lowest vaccine confidence scores out of all 28 EU countries, and experienced the largest decrease in vaccine confidence between 2015 and 2018 [11]. There are also concerns about migration from adjoining countries, notably Ukraine, bringing vaccine preventable diseases into Poland. Ukraine has low vaccination rates and the highest levels of measles in Europe together with negative public

* Corresponding author at: NHS Lothian, 2–4 Waterloo Place, Edinburgh EH1 3EG, UK.

E-mail address: Dermot.Gorman@nhslothian.scot.nhs.uk (D.R. Gorman).

opinion about the benefits of vaccinations and thus the risk of measles spread to Poland is a particular concern [12]. Ukraine is implicated in their local outbreaks [13].

Variation in vaccine uptake by ethnic group is well recognised and the recent influx of migrants to the UK has brought new migrant communities into focus. In Scotland we have noted reduced uptake in our substantial Polish population and our previous studies have looked at HPV and nasal influenza vaccination. HPV is offered to secondary school age females and we found that uptake was 17.8% lower in Polish than UK ethnicities in 2016/17 – 89.8% vs. 72.0% [14]. In a study in three Edinburgh primary schools we showed that in 2016 Polish children had uptake of 22.2% compared with 62.6% in White British children and a strikingly high refusal rate (26.9% vs. 6.7%) [15]. The Polish community is well-established with most having lived in Scotland for 8–10 years. The majority speak Polish at home and tend to live and socialise within the Polish community and access Polish language media [16]. They also and travel between Poland and Scotland frequently. Given this travel combined with lower immunisation levels, it is not surprising that there is heightened risk of contracting vaccine preventable diseases, such as measles.

We subsequently held focus groups of Polish migrants to explore beliefs about vaccination and influences on behaviour. In 2018, focus groups were conducted in the Polish community in Edinburgh in order to understand reasons for vaccine hesitancy or refusal [17]. Together with the data on low HPV and influenza uptake, our work showed that Polish migrants as a group have attitudes shaped by Polish norms and vaccination culture which shape their vaccination uptake [15,16,18]. Based on the focus group findings, changes were made to the Polish language version of the NHS Scotland school influenza pamphlet to include additional information about why this is offered in the UK (nasal flu vaccination is not part of the Polish vaccination schedule and influenza not considered as a serious illness in Poland), potential side effects, and further references about the vaccine's constituents.

As part of the evaluation we included the WHO Sage Vaccine Hesitancy statements [2]. In this paper, we explore the different responses made to these statements by those parents who accepted the vaccination compared with those who refused the vaccination, or did not return the consent form.

2. Methods

One week following each school's influenza vaccination session in November or December 2018, a Polish language letter and questionnaire were sent home in the schoolbag to parents and/or guardians of all identified Polish pupils who had received the updated Polish influenza pamphlet. All questions were identical but the questionnaire forms were marked to identify whether the pupil had been vaccinated, had refused, or had not returned the consent form for the 2018 influenza vaccination programme.

The questionnaire included ten statements developed by the WHO SAGE Working Group on Vaccine Hesitancy [2] and respondents were asked to complete a 5-point Likert scale survey (responses were 'Strongly Agree', 'Agree', 'I Don't Know', 'Disagree' and 'Strongly Disagree').

There were also questions about the length of stay in Scotland, the language spoken at home and influences on vaccination behaviour. There was space available at the end of the questionnaire for extended written feedback. Schools were encouraged to remind parents to return the questionnaires. After two weeks, the questionnaires were collected from the schools' offices. Data was entered and analysed on SPSS, version 25.0 (IBM, USA), and comments were translated from Polish to English by a researcher (KB). Graphical representations were created using Tableau soft-

ware (version 10.3, USA). Statistical analysis using a z-test for independent proportions was performed. The proportions of parents in each group (vaccine accepters or refusers) giving the positive (from a public health perspective) response to each statement (agreeing/strongly agreeing/disagreeing) were compared.

2.1. Ethical approval

As the study was undertaken as a service evaluation, the NHS Lothian Research Ethics Scientific Coordinator deemed formal ethics application unnecessary. Approval for the use of immunisation and ethnicity data was gained from the NHS Lothian Caldicott Guardian who is responsible for data governance in the health service.

3. Results

In total, 128 out of the 365 (37.3%) questionnaires were returned. The majority of respondents had lived in the UK for between 6 and 15 years (89.8%) and these families predominantly speak Polish at home (71.9%). Forty-five of the 108 parents who had consented to vaccination (41.7%), 65 of the 165 parents who had refused vaccination (39.4%), and 18 of the 92 parents (19.6%) who had not returned a consent form returned a questionnaire. Twenty-four respondents (18.8%) made substantive written comments.

3.1. Parental opinions on vaccinations in general – vaccine hesitancy statements

When all responders are considered together and responses grouped as agree or disagree (with the 'strongly' agree/disagree and 'agree/disagree' categories aggregated as shown on Table 1), answers supporting vaccination were overwhelmingly given for four of the ten statements (important, effective, important for others in the community and good way to protect my child). While no parents accepting vaccination disagreed with these four statements, a significant proportion of refusers do (10.0%, 15.0%, 27.1% and 25.0% respectively).

Almost half the responders reported concerns about serious side effects. 68.3% of refusers vs. 15.6% of accepters state that they have concerns about these.

Accepters are more likely than refusers to agree that vaccines for uncommon diseases are not important (21.7% vs. 2.2%) and that vaccinating their child is important for the health of others in the community (86.7% vs. 58.3%). They are also more likely to accept their GP/healthcare provider's vaccine / recommendations (86.7% vs. 59.3%).

For all 10 statements a mean 14.1% of accepters' and 25.3% of refusers' responses were 'don't know'. Three questions had a particularly large proportion of 'don't know' responses – 'all vaccines being beneficial' (34.7%), new vaccines 'carrying more risks' (52.5%) and 'NHS information being reliable and trustworthy' (38.3%). Responses to these three statements were unevenly distributed between groups with refusers more likely to reply 'don't know' (35.6%, 61.7% and 48.3% respectively).

4. Discussion

To our knowledge, this is the first study to survey a migrant parent group with the WHO SAGE recommended vaccine hesitancy questions and their responses linked to actual vaccination behaviour. The work reveals the aspects of vaccination practice and policy where the Polish migrant group has most concerns. Chronologically, the top three responses discordant with the bene-

Table 1
Comparison of likert-scale vaccine hesitancy statements of consented and refused respondents.

	Childhood vaccines are important for my child's health			Childhood vaccines are effective			Having my child vaccinated is important for the health of others in my community			All childhood vaccines offered by the NHS in my community are beneficial			New vaccines carry more risks than older vaccines			The information I receive about vaccines from the NHS is reliable and trustworthy			Getting vaccines is a good way to protect my child from disease			Generally I do what my GP/healthcare provider recommends about vaccines for my child			I am concerned about serious adverse effects of vaccines			My child does not need vaccines for diseases that are not common anymore		
	Consented	Refused	All	Consented	Refused	All	Consented	Refused	All	Consented	Refused	All	Consented	Refused	All	Consented	Refused	All	Consented	Refused	All	Consented	Refused	All	Consented	Refused	All	Consented	Refused	All
Base (n)	45	60	121	45	60	120	45	60	120	45	60	120	45	60	120	45	60	120	45	60	120	45	60	120	45	60	120	45	60	120
Strongly Agree (%)	73.3	20.0	44.6	64.4	13.3	35.8	62.2	15.0	36.7	47.7	10.2	26.3	4.4	8.3	19.2	60.0	8.3	30.8	46.7	6.8	25.2	2.2	16.7	11.7	0.0	3.3	1.7	0.0	3.3	1.7
Agree (%)	20.0	60.0	41.3	26.7	41.7	33.3	24.4	43.3	34.2	22.7	27.1	22.9	8.9	18.3	35.0	31.1	38.3	35.0	35.6	46.7	41.7	40.0	52.5	44.5	13.3	51.7	35.0	2.2	18.3	14.2
Disagree (%)	6.7	5.0	6.7	5.0	13.3	13.3	9.2	13.3	9.2	13.3	22.0	13.6	42.2	11.7	22.5	2.2	6.7	18.3	11.7	8.9	25.4	18.5	55.6	15.0	30.8	44.4	36.7	40.0	36.7	40.0
Strongly Disagree (%)	3.3	3.3	1.7	1.7	1.7	0.8	8.3	8.3	4.2	5.1	5.1	2.5	8.9	7.5	0.8	6.7	1.7	3.3	3.3	3.4	1.7	22.2	1.7	10.0	46.7	13.3	26.7	13.3	26.7	26.7
I Don't know (%)	6.7	10.0	7.4	8.9	30.0	20.8	11.1	20.0	15.8	29.5	35.6	34.7	35.6	61.7	52.5	26.7	48.3	38.3	4.4	20.0	12.5	4.4	11.9	10.1	6.7	15.0	12.5	6.7	28.3	17.5
Agree (%)	93.3	80.0	86.0	91.1	55.0	69.2	86.7	58.3	70.8	70.5	37.3	49.2	13.3	26.7	21.7	71.1	43.3	54.2	95.6	55.0	72.5	86.7	59.3	69.7	15.6	68.3	46.7	2.2	21.7	15.8
Disagree (%)	NS	10.0	6.6	8.9	15.0	10.0	2.2	21.7	13.3	13.3	27.1	16.1	51.1	11.7	25.8	2.2	8.3	7.5	25.0	28.8	20.2	77.8	16.7	40.8	91.1	50.0	66.7	66.7	66.7	66.7
Significance																														

fits of vaccination are concern about side effects, introduction of new vaccines, and a belief that vaccinations for rare diseases are not needed. Further analysis of responses of vaccine accepters and refusers as separate groups confirms that refusers hold more negative views about every statement compared with accepters. Every vaccine accepting parent agreed with three statements about vaccination being important for child health, vaccine effectiveness and all vaccines being beneficial.

Almost half of parents expressed concern about potential vaccine side effects. This increased to 77.8% in vaccine refusers and was 16.7% in vaccine accepters. While we lack a Scottish comparison group with respect to attitudes, we compared our results with the views of the Poland and United Kingdom samples in the 'State of Vaccine Confidence in EU' report [11]. This shows more concern in Poland about vaccine safety with only 72.4% in Poland agreeing that "Vaccines are safe", compared with 89.9% in the UK [11]. Similarly, 69.2% of our Polish respondents agreed that vaccines were effective - a figure well below the UK's 92%, and closer to the 74.9% reported from Poland (9). This gives further support to the view that the Polish population in Scotland retain Polish norms and perspectives on vaccination.

While concern about new vaccines feature prominently, 15.8% of our respondents agreed that children do not need vaccines for uncommon or apparently rare diseases. While public health professionals would know that diseases such as diphtheria are rare precisely due to the successful vaccine programmes implemented globally, it should not be assumed that the general public understand this. Furthermore, previously rare diseases such as diphtheria can rapidly re-emerge when vaccine uptake rates become sub-optimal [19]. The Polish vaccination schedule is significantly different from the UK programme with, for instance, nasal influenza vaccine not offered to healthy children nor influenza and pertussis offered to pregnant women. One respondent wrote that if vaccination were provided during pregnancy, there would be 'surprise and debate amongst many people' in Poland.

The fact that respondents were answering about 'all childhood vaccinations being beneficial' makes us think they may interpret the statement about new vaccines as being 'new to me' rather than the latest and suggests that the community understand that vaccination schedules vary between Poland and the UK. This variation between countries can, by suggesting that health authorities are unsure about vaccination policy, be exploited by anti-vaccination campaigners to spread doubt and disinformation [20]. The suggestion by McKee et al. that there should be international standardisation of vaccination schedules could help reduce confusion amongst families living transnationally [21]. However, given that public health infrastructure and priorities even about the importance of vaccination differ widely throughout the EU, the likelihood of this being implemented is debatable.

The North American measles outbreaks show the risk of disease transmission across countries, spread by individuals within ethnic or religious communities living and travelling to visit relatives and friends [1,22]. An analogous situation is likely to exist in Poland, where there are now approximately two million economic migrants originating from Ukraine [13,23]. This country has experienced a tenfold increase in measles cases in 2018, and people are migrating to a country with decreasing vaccine confidence, reducing MMR immunization rates and complacency about 'diseases that are not common anymore' [12].

In the three statements about side effects, new vaccines and uncommon diseases the 'incorrect' view was held more strongly by the vaccination refusers. Indeed, as demonstrated in Fig. 1, those accepting vaccination were much more likely to give the pro-vaccination view. That so many Polish migrants, especially vaccine refusers, answer 'don't know' to questions suggests that refusers are less certain and potentially amenable to change. We



Fig. 1. Graphical comparison of likert-scale vaccine hesitancy statements of accepted ($n = 45$) and refused ($n = 60$) respondents. This illustration of responses by parents who accepted and refused vaccination has each bar centred on the middle of the 'don't know' answer for each statement. It shows that accepters are more likely to choose a response that supports vaccination (in three responses the desirable answer, from a vaccination promotion perspective, is 'disagree'). The fact that refusers are more likely to choose the 'don't know' response is clearly shown.

know that Polish migrants are unfamiliar and at times suspicious of the UK primary care system, as reflected in the findings that only 54% of parents agreed with the statement “the information I receive about vaccines from the NHS is reliable and trustworthy” and over 20% reported they did not generally accept their GP/healthcare provider’s recommendations about vaccinations.

4.1. Limitations

While we expected parents, who refused vaccination, to be less likely than those who had their children immunised to return questionnaires, the response rates were similar (39.4% and 41.7%, respectively). This study was held in three primary schools in Edinburgh with the largest cohorts of Polish pupils. Polish is usually the language spoken at home and, anecdotally from our observations on field visits to schools, Polish was prominent in the playgrounds and classrooms. As Polish children in Scotland almost universally attend state primary schools which have geographically-based catchments, we believe this is a representative sample. However, a larger national study would be informative to both confirm our findings and include sufficient numbers of respondents from Scottish and other ethnic groups e.g. Roma or Romanian communities to allow other comparisons. It is within the latter groups that sporadic cases of measles occur within Scotland.

A proportion of parents (19.6%) who had not returned an influenza consent form did complete and return a feedback questionnaire. This indicates a willingness to become engaged, but raises questions as to why the original consent form was not returned. This may have been due to the consent form being in English, and the consent form guidance translations available online being inaccessible or unfit for purpose, or that this cohort of parents are “passive refusers”, where by not returning a form, their child is simply not vaccinated.

While the SAGE statements are about vaccination generally, the fact that our questionnaire was issued alongside the influenza programme could potentially influence answers. Influenza is less feared in Poland than many countries, and vaccination is not offered to healthy Polish children and is generally poorly taken up in those with pre-existing conditions where it is indicated [24,25]. The fact that the EU report answers to the statement

“The seasonal influenza vaccine is important” was agreed to by 59.7% in Poland and 80.7% in UK, confirms the different views about its benefit held in each country.

5. Conclusion

Our respondents show that vaccination is a controversial and a highly emotive topic. Responses to the questionnaires contained words such as ‘scared’ to describe their concern about side effects and said ‘cannot sleep before and after every vaccination’ and expressed fear about vaccination ‘bringing out the illness in children’. This shows high levels of anxiety. Naturally, within such a large community, people will hold a wide range of opinions and comments. One mother reported being described as being ‘ignorant’ because of her pro-vaccination views and commented that ‘after discussion with other parents, it seems that views on vaccination are strongly polarised... those who say no to vaccination seem to be very categorical in their own beliefs’. Another mother was indignant that her vaccinated child was being potentially put at risk by anti-vaccination activity within the Polish community. This shows that, while there are outspoken anti-vaccinators, there are other Polish parents who could be recruited to spread positive messages about vaccination within the Polish migrant community and more efforts could be made to energise these parents to influence through social media and other fora. Despite greater volumes of pro-vaccination discourse in recent years, and the anti-vaccination content user base being smaller, the anti-vaccine community continues to grow in size. This finding coupled with the minimal inter-communication between communities suggests developing ideological isolation [26]. The vaccination programme in Scotland is changing in response to a new general practitioner contract and NHS Health Scotland intends to embrace social media and recruit Polish health practitioners and social media influencers to promote vaccination on social media.

CRediT authorship contribution statement

D.R. Gorman: Conceptualization, Funding acquisition, Investigation, Methodology, Project administration, Supervision, Writing

- original draft, Writing - review & editing. **K. Bielecki:** Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Validation, Visualization, Writing - original draft, Writing - review & editing. **H.J. Larson:** Conceptualization, Methodology, Writing - review & editing. **L.J. Willocks:** Conceptualization, Funding acquisition, Investigation, Methodology, Writing - review & editing. **J. Craig:** Conceptualization, Funding acquisition, Writing - review & editing. **K. G. Pollock:** Conceptualization, Formal analysis, Methodology, Writing - review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

Thank you to Nuala Healy and Heather Williams at NHS Health Scotland. Thank you to Ruth Burns, Sarah Macleod, Lyndsey Devine, and the Childhood Vaccination and Health teams for their help in this project. Thank you to the Polish interpretation team in assisting in the editing of pamphlet.

Funding

This project was commissioned by NHS Health Scotland and funded by the Vaccination Transformation Programme.

References

- [1] WHO. Ten threats to global health in 2019. Geneva WHO; 2019. p. <https://www.who.int/emergencies/ten-threats-to-global-health-in-2019>.
- [2] Larson HJ, Jarrett C, Schulz WS, Chaudhuri M, Zhou Y, Dube E, et al. Measuring vaccine hesitancy: The development of a survey tool. *Vaccine* 2015;33(34):4165–75.
- [3] MacDonald NE. Vaccine hesitancy: Definition, scope and determinants. *Vaccine* 2015;33(34):4161–4.
- [4] Hopkins Tanne J. Measles: two US outbreaks are blamed on low vaccination rates. *BMJ* 2019;364:l312.
- [5] National Records of Scotland. Population by country of birth and nationality 2017. Edinburgh: Scottish Government; 2018.
- [6] Gorman DR, Porteous LA. Influences on Polish migrants' breast screening uptake in Lothian, Scotland. *Public Health* 2018;158:86–92.
- [7] Sim JA, Ulanika AA, Katikireddi SV, Gorman D. 'Out of two bad choices, I took the slightly better one': vaccination dilemmas for Scottish and Polish migrant women during the H1N1 influenza pandemic. *Public Health* 2011;125(8):505–11.
- [8] Bell S, Edelstein M, Zatonski M, Ramsay M, Mounier-Jack S. 'I don't think anybody explained to me how it works': qualitative study exploring vaccination and primary health service access and uptake amongst Polish and Romanian communities in England. *BMJ Open* 2019;9(7):e028228.
- [9] Increasing problem with vaccine hesitancy among Polish parents [Internet]. Polish National Institute of Public Health- National Institute of Hygiene; 2018 [cited 17/11/19]. Available from: <http://szczepienia.pzh.gov.pl/en/stories/increasing-vaccine-hesitancy/>.
- [10] Zarobkiewicz MK, Zimecka A, Zuzak T, Cieślak D, Roliński J, Grywalska E. Vaccination among Polish university students. Knowledge, beliefs and anti-vaccination attitudes. *Hum Vaccines Immunotherapeutics* 2017;13(11):2654–8.
- [11] Larson H, de Figueiredo A, Karafillakis E, Rawal M. State of vaccine confidence in the EU 2018. Luxembourg: Publications Office of the European Union; 2018.
- [12] Trust Wellcome. Wellcome global monitor 2019 how does the world feel about science and health? London: Wellcome Trust; 2019.
- [13] Poland T. Unvaccinated foreigners will not be able to enter Poland. Minister Warsaw: Telewisia Poland; 2018.
- [14] Pollock KG, Tait B, Tait J, Bielecki K, Kirolos A, Willocks L, et al. Evidence of decreased HPV vaccine acceptance in Polish communities within Scotland. *Vaccine* 2019;37:690–2.
- [15] Bielecki K, Kirolos A, Willocks LJ, Pollock KG, Gorman DR. Low uptake of nasal influenza vaccine in Polish and other ethnic minority children in Edinburgh, Scotland. *Vaccine* 2018;37(5):693–7.
- [16] Bielecki KCJ, Willocks LJ, et al. Impact of an influenza information pamphlet on vaccination uptake in Polish pupils in Edinburgh, Scotland. Submitted to *Vaccine*; 2019.
- [17] Gorman DR, Bielecki K, Willocks LJ, Pollock KG. A qualitative study of vaccination behaviour amongst female Polish migrants in Edinburgh, Scotland. *Vaccine* 2019;37(20):2741–7.
- [18] Pollock KG, Tait B, Tait J, Bielecki K, Kirolos A, Willocks L, et al. Evidence of decreased HPV vaccine acceptance in Polish communities within Scotland. *Vaccine* 2018;37(5):690–2.
- [19] Paniz-Mondolfi AE, Tami A, Grillet ME, Marquez M, Hernandez-Villena J, Escalona-Rodriguez MA, et al. Resurgence of vaccine-preventable diseases in Venezuela as a regional public health threat in the Americas. *Emerg Infect Dis* 2019;25(4):625–32.
- [20] McKee M, Middleton J. Information wars: tackling the threat from disinformation on vaccines. *BMJ* 2019;365:l2144.
- [21] McKee MRW, Siciliani L, et al. Increasing vaccine uptake: confronting misinformation and disinformation. *Eurohealth* 2018;24(3):35–8.
- [22] Nelson R. US measles outbreak concentrated among unvaccinated children. *Lancet Infect Dis* 2019;19(3):248.
- [23] Walker S. 'A whole generation has gone': Ukrainians seek a better life in Poland: The Guardian; 2019 [Available from: <https://www.theguardian.com/world/2019/apr/18/whole-generation-has-gone-ukrainian-seek-better-life-poland-elect-president>].
- [24] Zatoński W. Importance of health literacy for the improvement of paediatric and adult vaccination coverage in Poland. 2018;4(2):73–4.
- [25] Nitsch-Osuch A, Golebiak I, Wyszowska D, Rosinska R, Kargul L, Szuba B, et al. Influenza vaccination coverage among Polish patients with chronic diseases. *Adv Exp Med Biol* 2017;968:19–34.
- [26] Gunaratne K, Coomes EA, Haghighyan H. Temporal trends in anti-vaccine discourse on twitter. *Vaccine* 2019;37(35):4867–71.