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The analysis of parents' understandings of and attitudes towards childhood vaccination

Analiza postaw rodziców i ich wiedzy na temat szczepień ochronnych dzieci

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Abstract

Introduction: The number of people refusing to vaccinate their children is growing in Poland every year. Anti-vaccine organisations lead very fierce disinformation campaigns. The incidence of vaccine preventable diseases is on the rise. Monitoring of parents' attitudes towards preventive vaccinations and gauging the level of their understanding of the issue may enable more effective actions of organisations responsible for public health. **Aim:** The objectives of the study included finding out about parents' opinions and views as well as evaluating their knowledge about vaccinations in Poland. The study was also to define a parents' assessment of the range of campaigns promoting vaccination and actions of anti-vaccine movements. **Material and method:** The studies were carried out with a survey conducted among 233 parents or legal guardians of the children being under the obligation of vaccinations. **Results:** Nearly 90% of respondents are proponents of vaccinations, one-third of them consider some vaccinations unnecessary, and almost 7% of the surveyed describe themselves as opponents of vaccinations. 78% among the parents surveyed encountered campaigns promoting the Childhood Immunisation Programme, and most of them regard such campaigns as useful. Anti-vaccine movements were heard of by 62.4% of all the surveyed parents or legal guardians. 60% of respondents regard their own knowledge of the issue of vaccinations as sufficient. However, only 35% of respondents provided correct answers to the control questions about preventive vaccinations. People with higher education have better knowledge on vaccinations, whereas those with primary education have the best opinion on their own knowledge. **Conclusions:** Parents' knowledge in terms of preventive vaccinations seems inadequate. The number of opponents of preventive vaccinations is systematically growing. The paediatrician being the main source of information on the issue of vaccinations for the parents. Monitoring of parents' attitudes and opinions about the issue of preventive vaccination will be useful in better directing promoting campaigns in social media, and in adjusting healthcare workers' activities to specific social groups.

Keywords: preventive vaccinations, understanding, opinion, anti-vaccine movement

Streszczenie

Wstęp: Z roku na rok w Polsce zwiększa się liczba osób odmawiających zaszczepienia swoich dzieci. Organizacje antyszczepionkowe prowadzą bardzo agresywne kampanie dezinformujące. Odnotowuje się coraz częstsze występowanie chorób, przeciwko którym można się uchronić za pomocą szczepień. Monitorowanie postaw rodziców wobec szczepień ochronnych oraz określenie ich wiedzy w tym temacie mogą pozwolić na skuteczniejsze działania instytucji odpowiadających za zdrowie publiczne. **Cel:** Cele pracy obejmowały poznanie opinii i poglądów oraz ocenę wiedzy rodziców dotyczącej szczepień ochronnych w Polsce, a także ocenę zasięgu kampanii promujących szczepienia i działań ruchów antyszczepionkowych. **Materiał i metoda:** Badania przeprowadzono metodą ankietyzacji wśród 233 rodziców lub opiekunów prawnych dzieci objętych obowiązkowymi szczepieniami. **Wyniki:** Prawie 90% respondentów jest zwolennikami szczepień ochronnych, ⅓ spośród nich uważa, że nie wszystkie szczepienia są konieczne, blisko 7% ankietowanych określa się zaś jako przeciwnicy szczepień. Spośród ankietowanych rodziców 78% miało kontakt z kampaniami promującymi Program Szczepień Ochronnych i większość uważa je za pożyteczne. O ruchach antyszczepionkowych słyszało 62,4% ogółu badanych. Swoją wiedzę z zakresu szczepień uważa za wystarczającą 60% respondentów, jednak zaledwie 35% ankietowanych udzieliło poprawnych odpowiedzi na pytania kontrolne dotyczące szczepień ochronnych. Osoby z wykształceniem wyższym prezentują lepszy stan wiedzy w kwestii szczepień, natomiast osoby z wykształceniem podstawowym najlepiej oceniają swoją wiedzę. **Wnioski:** Wiedza rodziców w zakresie szczepień ochronnych wydaje się niewystarczająca. Systematycznie rośnie liczba przeciwników szczepień ochronnych. Głównym źródłem informacji o szczepieniach dla rodziców jest lekarz. Monitorowanie postaw i opinii rodziców na temat szczepień ochronnych będzie pomocne w lepszym ukierunkowaniu kampanii promocyjnych w mediach społecznościowych oraz w dostosowaniu działań pracowników opieki zdrowotnej do określonych grup społecznych.

Słowa kluczowe: szczepienia ochronne, wiedza, opinia, ruch antyszczepionkowy

INTRODUCTION

The number of people avoiding preventive vaccinations of their children has dangerously risen within the last few years[1] – in 2017 it was about 32 thousand people, in 2016 – slightly over 23 thousand[2]. It should be noted here that the numbers do not include children who had part of their vaccinations delayed or missed[3]. Anti-vaccine organisations successfully enhance the phenomenon of greater and greater reluctance towards vaccines[4,5]. Success of preventive vaccinations has proved to be a double-edged sword as a decrease in the incidence of infectious diseases has led to the fact that many people believe that vaccinations are unnecessary, while disinformation used by anti-vaccine organisations provides parents with false and unreliable information.

The number of immunised people is approaching a dangerously low level. Herd immunity, the so-called cocoon strategy, occurs when at least 80% of the population is immunised against a given disease entity[6]. Thanks to this the rest of people who cannot be vaccinated due to health reasons or are yet before the vaccination (the youngest) as well as those whose level of immunity is decreasing after a few years from the vaccination or have not achieved adequate immunity, are safe[7].

Epidemiological data indicate increasing incidence of infectious diseases which not so long ago were perceived as easy to contain from spreading with the use of vaccines. In the first half of 2018, there were noted 77 cases of measles and 283 cases of rubella; in the analogous period of 2017, the number of infected people was 27 and 268, respectively[8]. In 2008 there were reported 2,163 cases of pertussis[9], and in 2016 there were noted as many as 6,856. It is worth to note here that the actual incidence of pertussis is several dozen times higher than recorded passively[10]. Fortunately, the morbidity decreased slightly following this year[11]. The numbers indicate a simple dependency: when we forget about a disease, it comes back. The World Health Organization supports the idea of tightening up of the supervision over vaccination coverage of the population[3].

Parents' inadequate and often inappropriate knowledge about vaccinations and infectious diseases, in general, seems to be responsible for this state of affairs. In the study carried out in 2008 by Tarczoń et al.[12] as many as 41.7% of responding parents answered that pertussis had been totally eradicated through vaccinations. For comparison purposes, in the same study, 56.3% of parents admitted that smallpox belonged to the group of diseases eradicated through vaccination.

New vaccines are being developed, the vaccination schedule is being extended, parents' awareness is rising, they seek information about vaccinations, ask doctors more and more difficult and demanding questions[13,14], their opinions and decisions regarding children's immunisation are more and more influenced by the Internet. Many parents have doubts whether vaccinations are still needed, and if the risk of vaccine injuries is not higher than the benefits of their child's vaccination[14]. Activists of anti-vaccine movements make numerous allegations against the operating Childhood Immunisation Programme. These allegations are the following: too early use of vaccines, too higher number of vaccines within a short period of time, overloading the immune system, which increases the risk of developing allergies and autoimmune diseases, presence of harmful substances and many others[4,14]. Opponents of vaccinations convince others that the obligation of being vaccinated is a limitation of freedom. Alexis de Tocqueville once said that one man's freedom ends, where another man's freedom begins. Therefore, in the light of the fact that coming into contact with unvaccinated individuals may pose a life-threatening risk for people who, for various reasons, do not have immunity, it is hard to perceive mandatory vaccinations as limitation of people's freedom.

Assertions propagated by opponents of vaccinations find numerous supporters among parents and, unfortunately, also journalists or politicians. These are catchy issues based on conspiracy theories, big money, decision makers and pharmaceutical corporations[15]. Regrettably, this multitude of information obscures the voice of professionals. Consequently, parents, in majority not educated in medicine, do not have the possibility to get to reliable sources of information and to verify it.

Efforts should be made to reduce the contribution of self-appointed experts on vaccinations in shaping parents' opinions on the issue. Systematic monitoring of parents' attitudes towards vaccinations, directing actions of institutions responsible for public health, and expanding knowledge of medical community are indispensable to combat disinformation spread by communities that oppose vaccinations[14,16]. Allegations formulated by opponents of vaccinations should be answered in widely accessible media, not only at scientific conferences or in professional journals, inaccessible to an average parent[14]. Communication should not only be reliable but also understandable and generally available. What seems to be particularly important, is tailoring massive educational and promotional actions to current needs, on the basis of systematic evaluation of understandings of and opinions of parents about children's vaccinations[16].

The objectives of the study included the following: learning about parents' opinions and views as well as evaluation of their knowledge of preventive vaccinations in Poland; investigating where they find information on vaccinations, where they look for such information, how it affects their attitude towards preventive vaccinations; defining the reach of anti-vaccine movements as well as educational and promotional campaigns on preventive vaccinations.

MATERIAL AND METHOD

The studies were carried out with a survey conducted among 233 parents and legal guardians of children being

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	Women	Men	Total
Respondents	179 (76.8%)	54 (23.2%)	233 (100%)
Age (years)	33.7 ± 6.68, range 20–49	35.2 ± 6,20, range 22–48	34.1 ± 6.57, range 20–49
Family model:			
• 2 + 1	60 (33.5%)	18 (33.3%)	78 (33.5%)
• 2 + 2	83 (46.4%)	28 (51.9%)	111 (47.7%)
• 2 + 3	23 (12.8%)	6 (11.1%)	29 (12.4%)
• 2 + >3	13 (7.3%)	2 (3.7%)	15 (6.4%)
Place of residence:			
• Cities/towns	102 (57.0%)	34 (63.0%)	136 (58.4%)
• Rural areas	77 (43.0%)	20 (37.0%)	97 (41.6%)
Education*:			
• Primary	7 (4.0%)	2 (3.9%)	9 (4%)
• Vocational	33 (18.6%)	6 (11.8%)	39 (17.1%)
• Secondary	79 (44.6%)	23 (45.1%)	102 (44.7%)
• Higher	58 (32.8%)	20 (39.2%)	78 (34.2%)
* Five respondents did not provide information about their education.			

Tab. 1. Demographic profile of respondents

	Proponents	Proponents of selected vaccinations	Opponents	No opinion
Respondents*	141 (60.8%)	66 (28.4%)	16 (6.9%)	9 (3.9%)
Women	109 (61.2%)	48 (27.0%)	14 (7.9%)	7 (3.9%)
Men	32 (59.3%)	18 (33.3%)	2 (3.7%)	2 (3.7%)
* All the answers provided were analysed. Therefore, the number of analysed answers differs from the number of respondents.				

Tab. 2. Parents/guardians' gender vs. opinion about preventive vaccinations

under the obligation of vaccinations. A total of 500 questionnaires were distributed, out of which 239 were collected. Consequently, after the procedure of correctness and completeness check (≤2 unanswered questions), 233 questionnaires were used in the studies. The questionnaire was completed by 179 women and 54 men. The study was conducted in the Silesia and Małopolskie province at the turn of 2016 and 2017. Respondents were recruited at workplaces, health-care institutions, and schools and nursery schools. The inclusive criterion was being a parent/legal guardian of a child/children between 1 and 18 years of age. Exclusion criteria were lack of consent and/or being unable to self-complete the questionnaire.

The study tool was an original questionnaire comprised of 24 questions including demographic data, i.e. age, gender, education, place of residence, number of children, self-evaluation of knowledge regarding vaccinations, defining the attitude towards mandatory vaccinations, sources of information about vaccinations, familiarity with social campaigns promoting vaccinations, the range of anti-vaccination movements. Respondents self-completed the questionnaire, participation in the study was voluntary and anonymous. Following the check of their completeness, the data from the questionnaire were entered into the databases and analysed in terms of their dependence with the use of the STATISTICA package. Intergroup comparisons were made using *t*-test, and, if assumptions were not met, the Mann–Whitney *U* test was applied. In the case of qualitative variables, the Pearson's chi-square tests were used as well as those of highest reliability. Statistical significance was defined as a p value <0.05 in all analyses.

RESULTS

239 people participated in the survey study, 233 correctly completed questionnaires were included in the analysis, 76.7% of them were completed by women, and 23.3% by men. The average age of the people under study was 34.1 ± 6.57 years. The dominant model of a family was a family with two children (47.6% of respondents). Urban dwellers constituted 58.4%, whereas rural ones – 41.6%. The most numerous group among respondents had secondary education (Tab. 1). 89.2% of responding parents describe themselves as supporters of preventive vaccination. One-third of them, however, think that some vaccinations are unnecessary. Nearly 7% of the total number of respondents is against vaccinations. Younger mothers significantly more frequently (p = 0.02) were opponents of vaccinations. The average

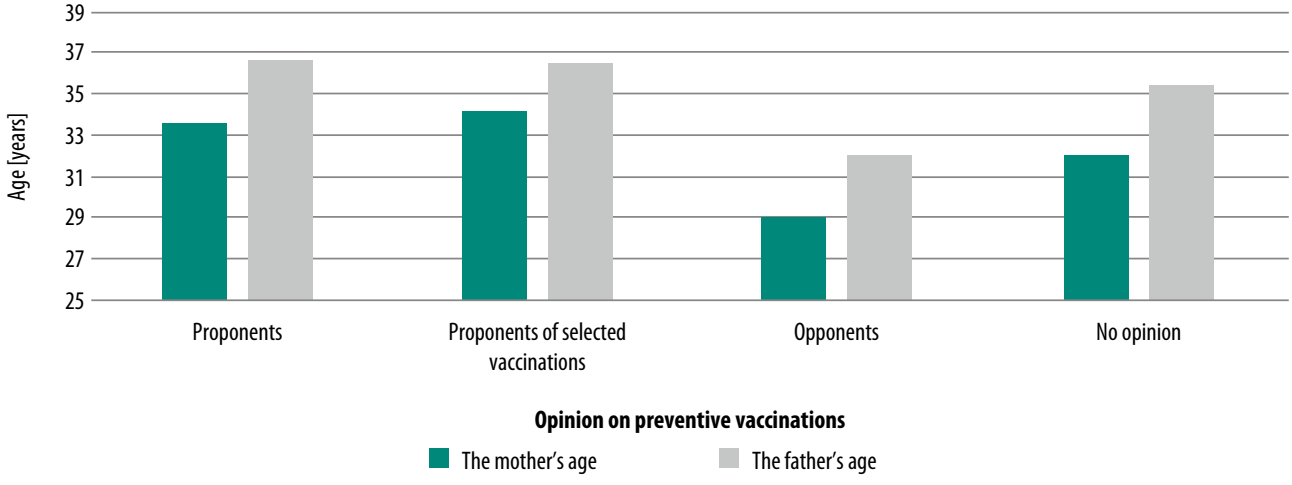

Fig. 1. Opinions about vaccinations vs. the age of the surveyed parents

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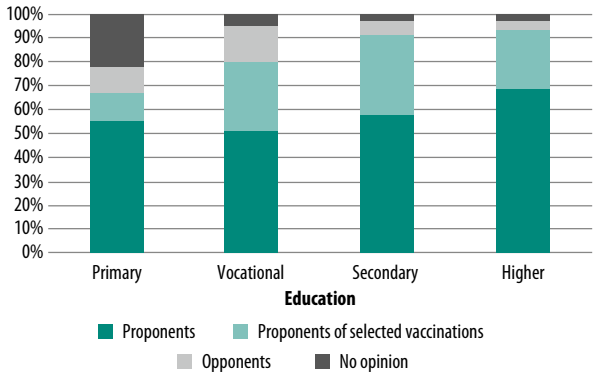

Fig. 2. Opinions on vaccinations vs. respondents' education

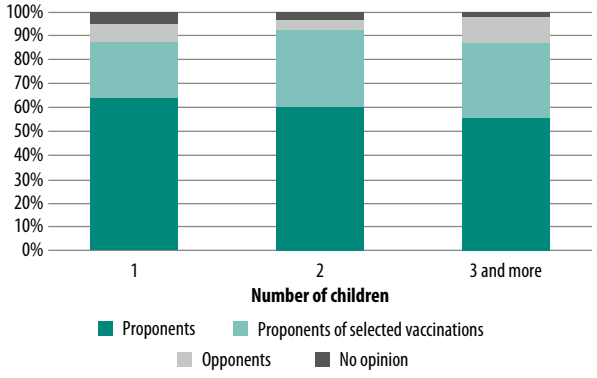

Fig. 3. Opinion about vaccinations vs. number of children

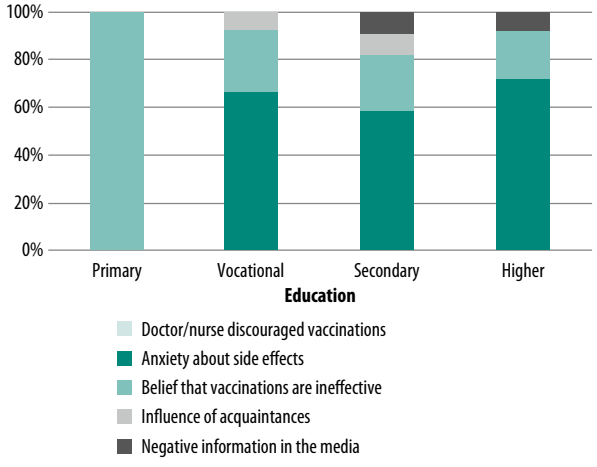

Fig. 4. Education of respondents vs. reasons for being an opponent of vaccinations

age of mothers who responded negatively to the question: "Do you support childhood preventive vaccinations?" was 29 ± 5.7 years, whereas of mothers who responded affirmatively – 34 ± 6.5. Also, among young fathers, opponents of vaccinations were more numerous (Tab. 2, Fig. 1). The number of proponents of vaccinations grew with the level of education (Fig. 2). There were no opponents of vaccinations among parents with medical education. 10% of urban dwellers and 3% of people from rural areas declared themselves opponents of vaccinations, yet the difference was not statistically significant ($p = 0.19$).

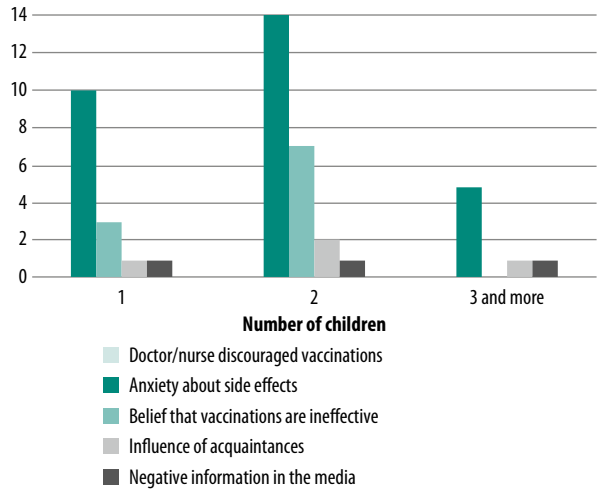

Fig. 5. Number of children vs. reason for negative attitude towards vaccinations

Reluctance to vaccinate increased significantly with the number of children in a family ($p = 0.016$). 8% of parents with one child and as many as 11.6% of parents with at least three children were against vaccinations (Fig. 3).

Opponents of vaccinations presented many reasons for their stance (it was a multiple-choice question, with the possibility of providing one's own answer). The most frequent causes were the following ones: fear of side effects (64%), doubts over efficacy of vaccinations (24%), acquaintances' opinions (3%), information found on the Internet (3%). Importantly, no respondent indicated the doctor/nurse as a person who discouraged vaccination. As many as one-quarter of opponents of vaccinations did not define the reason for which they are against preventive vaccinations. Opinions of the opponents of vaccinations depended on education. Individuals with primary education raised doubts over the efficacy of vaccines. On the other hand, those with vocational education feared side effects, finding inefficacy of vaccinations less important. In general, the majority (64.4%) among opponents of vaccinations pointed to their apprehension about adverse effects of vaccinations, and, subsequently, to the inefficacy of vaccinations (24.4%) (Fig. 4).

Anxiety over vaccine injuries and doubts over their efficacy were predominant among younger mothers, whereas older mothers were mostly apprehensive of the adverse effects of vaccinations. No significant difference was observed between fathers' responses in relation to their age.

Irrespective of the number of children in a family, the greatest apprehension about vaccinations was caused by the issue of side effects. In comparison to the rest of parents, in the group of families with three and more children, the influence of the media was significantly more pronounced (television, press, Internet, radio) (Fig. 5).

62.4% of the total number of parents under the study, mainly with higher education, heard about anti-vaccination movements. Information about these movements reached

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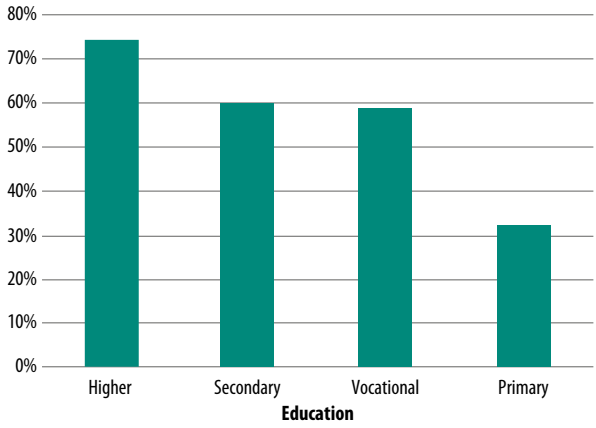

Fig. 6. Education of respondents vs. range of anti-vaccine movements

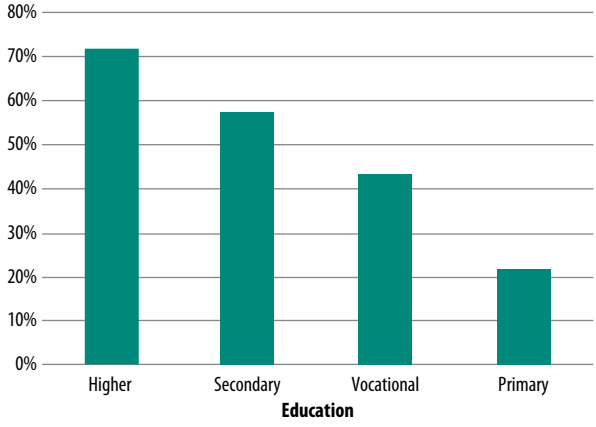

Fig. 7. Respondents' education vs. spreading negative information on preventive vaccination

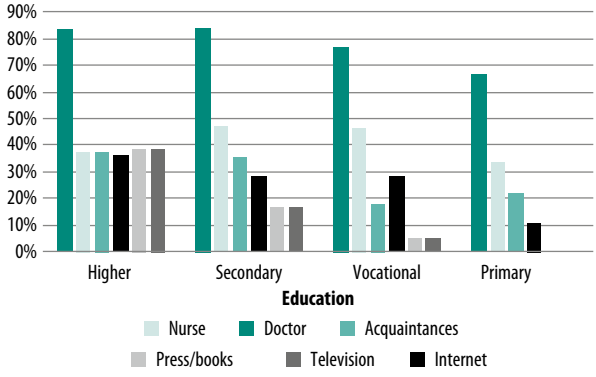

Fig. 8. Education of respondents vs. sources of knowledge about preventive vaccinations

parents with primary education significantly more rarely (only 33.3%) (Fig. 6).

A comparable number of urban and rural dwellers (61.0% vs. 64.9%, $p = 0.54$) got information about anti-vaccination movements. Respondents with one child heard about the movements more frequently (65.4%). Families with at least three children were less frequently informed about these movements (59.1%). Despite such massive promotions of

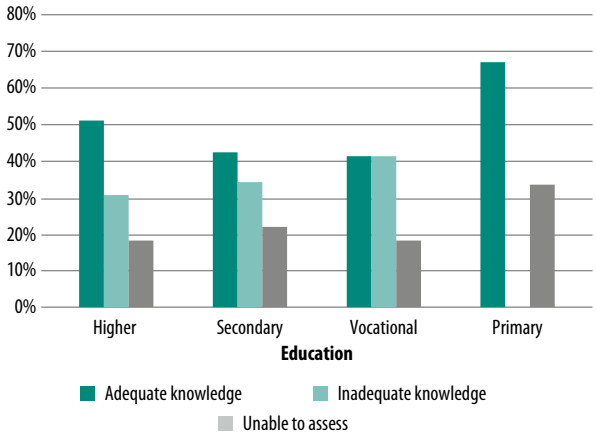

Fig. 9. Education of respondents vs. self-assessment of the knowledge about preventive vaccination

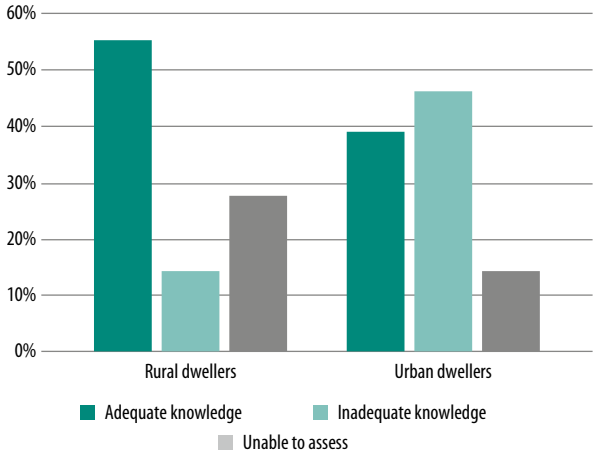

Fig. 10. Respondents' place of residence vs. self-assessment of the knowledge about preventive vaccination

anti-vaccination movements, the majority of respondents acknowledged that they did not significantly influence their opinion on child preventive vaccinations. As many as 58.1% of respondents admitted coming into contact with information discouraging parents from vaccinating their children. It is worth stressing here that significantly more frequently these respondents belonged to the group of parents with higher education, in comparison to those with primary education (71.8% vs. 22.2%, $p = 0.005$) (Fig. 7). Negative information re preventive vaccinations was received by almost 65% of the surveyed rural dwellers and 54% urban dwellers ($p = 0.08$). The sources of the information were mainly the Internet (71.3%), television (45%), acquaintances' opinions (45%), and 26% of respondents found such information in the press (it was a multiple-choice question).

78% of the surveyed parents encountered campaigns promoting the Childhood Immunisation Programme. The majority of these parents, because as many as 80%, find such campaigns useful. Among all the recipients of the campaigns promoting vaccines, only 5% out of the surveyed parents was against children's vaccinations; there was significantly more opponents of vaccinations among people who

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were not the recipients of these campaigns (15%; $p < 0.01$). This would indicate effectiveness of the programmes promoting preventive vaccinations.

Parents indicate: the paediatrician (82.4%), nurse (42%), the Internet (33%), television (30.9%), acquaintances' opinions (30.5%), magazines and books (20.6%) as sources of knowledge about vaccinations. In all groups, in terms of level of education attained, a doctor was indicated as the main source of information about vaccinations. Most often, however, among people with higher and secondary education (Fig. 8).

Although 60% of respondents consider their own knowledge about vaccinations sufficient, only 35% provided correct responses to the control questions concerning the subject of the study. Respondents with primary education assessed their knowledge most highly (Fig. 9) despite the fact that the answers to the control questions were not satisfactory in this group (Tab. 3).

A vast majority, as many as three-quarters, of those who negatively assessed their own knowledge about vaccinations expressed the will to supplement it. Rural dwellers assessed their knowledge as more comprehensive than urban dwellers (55% vs. 39%). 46% among the surveyed city dwellers assessed their knowledge insufficient, out of which 71% pointed out that they wished to expand this knowledge (Fig. 10). Over 63% of respondents realised that unvaccinated persons could be a threat to the population. The group of urban dwellers with higher education was characterised by the greatest awareness of the risk, in contrast to people with primary education and living in rural areas, whose awareness was lowest (Tab. 3).

70% among respondents realise the possibility of contracting a disease despite being vaccinated against it (Tab. 4). The possibility of falling ill with the disease against which one had been vaccinated is mostly denied by urban dwellers with secondary education (Tab. 4). As many as 15% of the surveyed, predominantly people with vocational and primary education, claim that a vaccination provides lifelong immunity. The claim is denied by 34.8% of respondents (Tab. 5).

The questionnaire included two open questions which concerned post-vaccination complications and circumstances in which vaccination should be postponed. Temperature, malaise, swelling at the spot of injection, and weakness were most frequently named as post-vaccination complications. Autism, loss of hearing and vision, and mental impairment were also mentioned in the responses. In the question about the reasons for postponing vaccinations respondents named

	Yes	It depends on the disease	No	I do not know	*p* factor
Total*	29.6%	33.9%	17.6%	18.9%	
Education:					0.037
• Primary	2 (22.2%)	1 (11.1%)	1 (11.1%)	5 (55.6%)	
• Vocational	6 (15.4%)	16 (41.0%)	7 (18.0%)	10 (25.6%)	
• Secondary	31 (30.4%)	35 (34.3%)	22 (21.6%)	14 (13.7%)	
• Higher	29 (37.2%)	23 (29.5%)	11 (14.1%)	15 (19.2%)	
Place of residence:					0.003
• Cities/towns	43 (31.6%)	37 (27.2%)	33 (24.3%)	23 (16.9%)	
• Rural areas	26 (26.8%)	42 (43.3%)	8 (8.3%)	21 (21.6%)	
Family model:					0.393
• 2 + 1	21 (26.9%)	29 (37.2%)	15 (19.2%)	13 (16.7%)	
• 2 + 2	37 (33.3%)	36 (32.4%)	21 (19%)	17 (15.3%)	
• 2 + >2	11 (25.0%)	14 (31.8%)	5 (11.4%)	14 (31.8%)	
* All the answers provided were analysed. Therefore, the number of analysed answers differs from the number of respondents.					

Tab. 3. Parents/guardians' knowledge about vaccinations: do unvaccinated people pose a threat to the population?

	Yes	No	I do not know	*p* factor
Total*	70.4%	12.1%	17.5%	
Education:				0.077
• Primary	7 (77.8%)	0	2 (22.2%)	
• Vocational	24 (61.5%)	4 (10.3%)	11 (28.2%)	
• Secondary	73 (71.6%)	18 (17.6%)	11 (10.8%)	
• Higher	55 (70.5%)	5 (6.4%)	18 (23.1%)	
Place of residence:				0.092
• Cities/towns	92 (67.7%)	21 (15.4%)	23 (16.9%)	
• Rural areas	72 (74.2%)	6 (6.2%)	19 (19.6%)	
Family model:				0.185
• 2 + 1	51 (65.4%)	12 (15.4%)	15 (19.2%)	
• 2 + 2	85 (76.6%)	11 (9.9%)	15 (13.5%)	
• 2 + >2	28 (63.6%)	4 (9.1%)	12 (27.3%)	
* All the answers provided were analysed. Therefore, the number of analysed answers differs from the number of respondents.				

Tab. 4. Parents/guardians' knowledge about vaccinations: is it possible to contract a disease despite being vaccinated?

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	Yes	No	Only some of them	I do not know	*p* factor
Total*	15.1%	34.8%	30.4%	19.7%	
Education:					0.065
• Primary	2 (22.2%)	2 (22.2%)	0 (0%)	5 (55.6%)	
• Vocational	11 (28.2%)	11 (28.2%)	9 (23.1%)	8 (20.5%)	
• Secondary	14 (13.7%)	38 (37.3%)	35 (34.3%)	15 (14.7%)	
• Higher	7 (9.0%)	29 (37.2%)	25 (32.0%)	17 (21.8%)	
Place of residence:					0.002
• Cities/towns	29 (21.3%)	50 (36.8%)	32 (23.5%)	25 (18.4%)	
• Rural areas	6 (6.2%)	31 (32.0%)	39 (40.2%)	21 (21.6%)	
Family model:					0.357
• 2 + 1	10 (12.8%)	26 (33.3%)	23 (29.5%)	19 (24.4%)	
• 2 + 2	17 (15.3%)	39 (35.2%)	37 (33.3%)	18 (16.2%)	
• 2 + >2	8 (18.2%)	16 (36.4%)	11 (25.0%)	9 (20.4%)	
* All the answers provided were analysed. Therefore, the number of analysed answers differs from the number of respondents.					

Tab. 5. Parents/guardians' knowledge about vaccinations: do vaccinations provide lifelong immunisation?

"an illness," a cold, malaise and rhinitis, less frequently, allergy or a grace period that follows antibiotic treatment.

DISCUSSION

Most parents describe themselves as vaccine proponents, despite hesitancy and concerns. In the studies carried out in 2014 by Kalinowski et al., none of the respondents declared themselves as a vaccine opponent[17]. In the subsequent studies, from 2016, by Faleńczyk at al. over 98% of the parents were in favour of vaccinations[18]. On the other hand, in our material, collected in 2017, as many as 7% of parents were against vaccinations, whereas 90% of them were in favour. This indicates an increase in the number of vaccine opponents, which took place over the years. This is probably related to a better epidemiological situation and stronger actions of anti-vaccine movements that use for this purpose the mass media such as television and the Internet. On 2 June 2018 in Warsaw a mass meeting was held against mandatory vaccinations organised by an anti-vaccine association STOP NOP. The organisation collected the required number of signatures to establish a committee of the legislative initiative of citizens. Members of the organisation drafted a public Bill on voluntary vaccination in Poland.

Apart from an increasing number of opponents of vaccination, it is possible to note an expanding range of negative information on preventive vaccination. In the study of Faleńczyk from 2016 only 29% of the respondents encountered such pieces of information[18]. In our material over 58% of respondents indicated that they came into contact with information that presented vaccinations in an unfavourable light.

In our material, parents who had at least three children were opponents of vaccinations significantly more often than parents with one child, despite the fact that the respondents who had one child heard about anti-vaccine movements more often. Interestingly, the number of offspring did not influence the level of knowledge about vaccinations. In the study of Kalinowski et al. from 2014, there was analysed parents' opinion on vaccinations depending on whether or not a respondent had children. As it was indicated, people who did not have children expressed negative opinion on vaccinations more often than those who had a child/children. People not having children believed that vaccinations carried a great risk of complications. Moreover, childless people were less convinced as to the necessity to vaccinate children in order to avoid many serious diseases than people who had children[17].

Inadequate knowledge of parents/guardians about vaccinology has a substantial impact on the epidemiological status of our country and number of vaccinated children. This study proves the impact of the level of parents or guardians' education on their decisions regarding vaccinations. This is consistent with the results obtained by Rogalska et al.[16]. In our material, respondents with higher education encountered negative information on preventive vaccination more often; similar observations were described in the study from 2016[18], yet it did not significantly influence the decisions taken. People with higher education also heard about anti-vaccine movements more often, but it was just this group in which the number of vaccine supporters was the greatest.

In recent years one can observe severe undermining of the authority of medical personnel, suspiciousness of huge pharmaceutical concerns, more and more common spreading of the information on the harmfulness of vaccines and an array of conspiracy theories relating to the obligation of vaccinations[5]. The question about parents' source of knowledge becomes important in this regard. In this study this source was mainly a physician, which is also confirmed by other authors[12,16,19–21]. In the study of Faleńczyk et al., respondents predominantly chose information leaflets, with the doctor and nurse holding the second place. On the other hand, in the same study, respondents indicated the doctor as the most reliable source of information, with only 3.5% of the surveyed indicating the Internet[18]. Therefore, it is of crucial significance to update the physician's knowledge in modern vaccinology and to devote time to talking with the parent. The special importance of a conversation between the doctor and a parent may be replaced with easily accessible yet unreliable information found on the

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Internet. And, although the Internet also provides access to genuine information based on scientific proofs, a person unrelated to medicine or science is usually unable to differentiate these pieces of information from the ones posted by vaccine opponents, whose information is often manipulated to fit opponents' theses.

The fact that as many as 45% of the surveyed encountered negative opinions about vaccinations on television, is of particular concern. In the study of Tarczoń et al., television was indicated by respondents as the medium thanks to which they saw pro-vaccine actions (about 60%), but, at the same time, it was described as the source of disturbing information about vaccinations (49%)[12]. It is difficult to influence quality of the information on vaccines that can be found by parents on the Internet or heard by them from the family or acquaintances. One should assume, however, that content on television is reliable and verified by people with expertise in vaccinology. Unfortunately, in 2016 and 2017 on public television there were shown extensive materials with false and unreliable information regarding vaccinations. This is strongly opposed by medical community. Materials of similar content were also broadcast on the public radio. Because of their high accessibility, the mentioned media should be more widely used as a source of different kinds of informational and promotional campaigns on vaccinology. What is particularly important, in the present study no respondent indicated the doctor or nurse as the source of the information about harmfulness of vaccinations. In the light of the importance of medical authority, such cases, even very scarce, could have a profound negative impact on parents' decisions concerning vaccinations. During the march of STOP NOP anti-vaccine organisation that took place in Warsaw in June 2018 only (as many as) two doctors delivered their speeches, echoing the postulates of the organisation which aims to abolish the obligation of vaccinations in Poland.

In the studies of Tarczoń et al.[12], Faleńczyk et al.[18], the majority of respondents indicated that they encountered campaigns that promoted vaccinations (76.2%, 86.5% and 78%, respectively). What proves such campaigns effective this is the fact that as many as 80% of respondents assessed these pieces of information as useful, and that only 5% of the recipients of these campaigns are opponents of vaccinations. Similar conclusions were put forward by the authors of the study from 2009, in which a significant correlation was found between the knowledge of preventive vaccination and coming into contact with campaigns that promote vaccinations (as many as 92% people came into contact with public campaigns that promote vaccinations in the group of the people familiar with the range of diseases preventable with vaccinations, whereas among parents unfamiliar with this range it was 70%)[12].

Tarczoń et al. also indicated that parents with greater awareness in terms of vaccinology significantly more often (as many as 94.8%) are in favour of immunisation, with both mandatory and additional vaccines than parents being mostly unfamiliar with the possibilities of modern vaccinology (support for vaccinations in this group was 75.5%)[12]. In the questionnaire parents could assess their own knowledge of preventive vaccinations. In the study of Faleńczyk et al. the level of self-evaluation of the knowledge corresponded with the actual level of the respondents' knowledge of vaccinations[18]. In our material, on the other hand, almost two-thirds of the surveyed assessed the level of their own knowledge as sufficient, but only over one-third of respondents provided correct answers to the questions concerning vaccinations. High, unsubstantiated with facts, self-evaluation of parents' knowledge points to the necessity of education in the sphere.

Rural dwellers assessed their own knowledge more highly and it was they who provided slightly better answers to the questions related to vaccinations. On the other hand, the studies of Kalinowski et al. and Rogalska et al. indicated no significant impact of the place of residence on parents' knowledge of vaccinations[16,17]. In the study of Faleńczyk et al., respondents with higher education assessed their knowledge most highly, whereas respondents with primary and vocational education described it as the worst[18].

In the presented study, the surveyed people with primary education best assessed their knowledge, whereas respondents with higher and secondary education did best in answering the control questions verifying knowledge of vaccinations. Thus, a statement can be made that these are just people with higher and secondary, despite their low self-assessment (or perhaps the awareness that this knowledge is not complete), who are best educated in the subject of vaccinations. Also, in the studies of Kalinowski et al. and Rogalska et al. the level of knowledge of vaccinations was higher in people with higher education in comparison to the surveyed with primary and vocational education[17,22].

In the study of Kalinowski et al. gender was the factor that influenced the level of knowledge; these were mothers who had more extensive basic knowledge of vaccinations[17]. This fact was not confirmed in our study.

Detailed data analysis indicated that parents' knowledge, although self-assessed as high, proves to be quite limited. Consequently, parents may be prone to information manipulation on the part of anti-vaxxer (proepidemic) organisations[16]. Certainly, low parents' knowledge in the subject of vaccinology helps arguments of the proponents of anti-vaccine movements to get through[16].

The fact that only 63% of the surveyed realise that the unvaccinated may pose a threat to other people seem to have the most dangerous consequences. Many people believe that vaccines may cause autism. It should not be surprising, however, in the circumstances in which a paediatrician with 32 years of professional experience voices similar theses, contradicted by numerous clinical studies and meta-analysis, at a mass meeting of anti-vaxxers[23].

Efforts should be made to expand parents' knowledge in the subject of vaccinology[1]. The media (television, radio, Internet, press) should be used to a greater extent for

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spreading reliable and straightforward information[19,24]. Since, in the name of freedom, promotion of harmful content may have damaging implications, introduction of the supervision over the content broadcast by the above media is advisable. Due to the fact that this is the doctor and medical personnel who serve as the source of reliable information, the emphasis should be put on their training not only in the current state-of-the-art, but also in effective communication with parents[12,13,25].

CONCLUSIONS

The number of opponents of preventive vaccinations is systematically growing. Despite increasing contribution of the media in providing information on vaccinations, the doctor is still the main source of information for parents on the subject. Parents' level of education influences their understandings of the issue of vaccinations and health awareness. The knowledge of parents in terms of preventive vaccination seems inadequate.

Monitoring of parents' attitudes and opinions concerning preventive vaccinations will help in better directing promotional campaigns in social media as well as in adjusting healthcare workers' activities to specific social groups.

Conflict of interest

The authors declare no competing financial or personal connections to other persons or organisations that could influence the content of the publication and legitimate claim to this publication.

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