© Pediatr Med Rodz 2022, 18 (4), p. 362–370
DOI: 10.15557/PiMR.2022.0054

Ewa Łoś-Rycharska[1], Paulina Marczyńska[1], Maria Popielarz[1], Joanna Wolska[1], Ola Sobieska-Poszwa[1], Emilia Rynkowska[1], Inga Dziembowska[2], Aneta Krogulska[1]

Received: 17.11.2022
Accepted: 27.01.2023
Published: 31.03.2023

Implementation of prophylactic vaccinations in children from the Kuyavian-Pomeranian Voivodship

Realizacja szczepień ochronnych u dzieci z województwa kujawsko-pomorskiego

[1] Department of Paediatrics, Allergology and Gastroenterology, Ludwik Rydygier Collegium Medicum in Bydgoszcz, Nicolaus Copernicus University in Toruń, Bydgoszcz, Poland
[2] Department of Pathophysiology, Ludwik Rydygier Collegium Medicum in Bydgoszcz, Nicolaus Copernicus University in Toruń, Bydgoszcz, Poland
Correspondence: Ewa Łoś-Rycharska, Department and Clinic of Paediatrics, Allergology and Gastroenterology, Ludwik Rydygier Collegium Medicum in Bydgoszcz, Nicolaus Copernicus University in Toruń (UMK), Marii Skłodowskiej-Curie 9, 85-094 Bydgoszcz, Poland, tel.: +48 52 585 48 50, fax: +48 52 585 40 86, e-mail: klped@cm.umk.pl

ORCID iDs
1. Ewa Łoś-Rycharska https://orcid.org/0000-0001-5591-7201
2. Inga Dziembowska https://orcid.org/0000-0002-0536-2380
3. Aneta Krogulska https://orcid.org/0000-0002-5280-1876

Abstract

Introduction: Protective vaccinations are an important element of health prophylaxis. Their implementation depends on the parents' attitudes and their socio-economic situation. **Aim:** The aim of the study was to evaluate the implementation of vaccinations in children in the Kuyavian-Pomeranian region. **Materials and methods:** The study included 278 parents of children hospitalised in the Department of Paediatrics, Allergology and Gastroenterology, Antoni Jurasz University Hospital No. 1 in Bydgoszcz. A self-made questionnaire concerning the implementation of compulsory and recommended vaccinations depending on demographical factors and two standardised psychological scales (the Plopa Parental Attitude Scale and the STAI – State-Trait Anxiety Inventory). **Results:** 93.53% of respondents consider vaccinations necessary. 96.40% of children were vaccinated according to the vaccination schedule. In 3.24%, compulsory vaccination was abandoned at least once, and the vaccination schedule was modified for 67.99% of children. Recommended vaccinations were provided by 47.12% of children, more often from cities, parents with higher education and income and less often with at least three children. Most parents (57.19%) look for information about vaccinations, most often from a doctor and the Internet, less often from posters, leaflets, magazines, and least often from friends and the media. Mothers who are looking for information about vaccination from Internet have lower level of anxiety. **Conclusions:** The majority of the society implements compulsory vaccinations, and less than half of them are recommended. The implementation is influenced by the financial situation and education of parents. There is a need for individualised education of the society, depending on the social group of recipients.

Keywords: vaccination, infections, diseases, parental knowledge

Streszczenie

Wstęp: Szczepienia ochronne stanowią ważny element profilaktyki zdrowotnej. Ich realizacja zależy od postaw rodziców oraz ich sytuacji społeczno-ekonomicznej. **Cel:** Celem pracy była ocena realizacji szczepień dzieci i młodzieży w regionie kujawsko-pomorskim. **Materiał i metody:** Badaniem objęto 278 rodziców dzieci hospitalizowanych w Klinice Pediatrii, Alergologii i Gastroenterologii Szpitala Uniwersyteckiego nr 1 im. Antoniego Jurasza w Bydgoszczy. Zastosowano autorski kwestionariusz ankiety dotyczący realizacji szczepień obowiązkowych i zalecanych w zależności od wybranych czynników demograficznych oraz dwie wystandaryzowane ankiety psychologiczne (Skala Postaw Rodzicielskich Plopy oraz Inwentarz Stanu i Cechy Lęku – State-Trait Anxiety Inventory, STAI). **Wyniki:** 93,53% ankietowanych wskazało, że uważa szczepienia dzieci za potrzebne. 96,40% dzieci było szczepionych zgodnie z Programem Szczepień Ochronnych. U 3,24% badanych dzieci przynajmniej raz zrezygnowano ze szczepienia obowiązkowego, kalendarz szczepień modyfikowano w przypadku 67,99% dzieci. Szczepienia zalecane realizowało 47,12% dzieci, częściej z miast, których rodzice cechowali się wyższym wykształceniem i dochodem, a rzadziej mieli co najmniej troje dzieci. Większość rodziców (57,19%) poszukiwała informacji o szczepieniach – najczęściej u lekarza i w internecie, rzadziej czerpiąc wiedzę z plakatów, ulotek, czasopism, a najrzadziej – od znajomych i z mediów. Korzystanie z internetowych informacji na temat szczepień wiązało się z niższym poziomem lęku u matek. **Wnioski:** Większość społeczeństwa realizuje obowiązkowe, a niespełna połowa – zalecane szczepienia dzieci. Na realizację szczepień wpływają sytuacja finansowa i wykształcenie rodziców. Potrzebna jest zindywidualizowana edukacja społeczeństwa dotycząca szczepień, ukierunkowana na określone grupy społeczne, do których jest kierowana.

Słowa kluczowe: szczepienia ochronne, choroby zakaźne, wiedza rodziców

INTRODUCTION

Vaccinations are an important element of health prophylaxis in the developmental age. Undoubtedly, they help to avoid contracting certain diseases or alleviate their presentation in a vaccinated child, and in the population aspect – they minimise the overall number of cases, thus reducing the risk of further infections[1–4]. As has been shown, the majority of Polish parents consider vaccination as an important measure to prevent infectious diseases: 92% have no concerns about compulsory vaccinations, 77% have no doubts as to whether to vaccinate their children, and 52% are satisfied with the vaccination system[5].

In Poland, there is a Protective Vaccination Programme for children and adolescents, under which free vaccination cycles are implemented[2,6]. While they are carried out in most children, some parents do not agree to their implementation, guided by the fear of complications or excessive immunisation, or the anticipation that the child will become immunised without vaccination.

The possibility of using paid, instead of reimbursed, polyvalent vaccines in children applies to diphtheria, tetanus, pertussis (DTP), *Haemophilus influenzae* type B (Hib), and hepatitis B vaccines. Due to the fact that the vaccination calendar during the period of application of these vaccines is very rich, reducing the number of injections in an infant is often a priority for parents[7].

In addition to the mandatory ones, parents have the option of having their children vaccinated with recommended vaccinations[2,8–10]. Since the end of the last century, the percentage of Polish children who are vaccinated as recommended has increased fourfold (15.2% of children born in 1998 vs. 74.3% of children born in 2005), and this percentage also changes depending on the expansion of the mandatory vaccination calendar[9]. Almost all mothers of children born in the current century are informed by a doctor about the possibilities of additional vaccinations; however, several years ago, less than 40% of parents received such information[9]. Gawlik et al.[11] indicate the need to improve the quality of information on recommended vaccinations. They showed that although the majority of parents are satisfied with it, some point out the need for this information to be extended, more detailed, and for the unfavourable aspects of immunisation – such as possible complications and side effects – to be included. The authors suggest that such information would improve the quality of parents' actions in the event of a vaccine adverse event (VAE) (properly prepared parents could accept a VAE more easily and would be able to take preventive measures, e.g. administer an antipyretic drug), as well as prevent unrealistic expectations related to vaccination. As shown by Lipska et al.[3], a parent's decision to purchase an additional vaccine is most often influenced by a doctor's advice, although over a dozen percent of the surveyed parents found a media campaign to be a significant influencing factor. Experiences of illness in the parent's own child or children in their family also play a role in making decisions about additional vaccinations, albeit this applies to a smaller percentage of parents[3].

Parents are afraid of post-vaccination complications and "overloading" the child with an excessive number of vaccines. Nevertheless, in terms of the implementation of recommended vaccinations or the use of modern multicomponent vaccines, another crucial issue is the economic aspect, as paid vaccinations are quite expensive for most parents[3,8,12–15]. Due to selective knowledge, the choice of vaccine and the time of its use in a child (which is related to the vaccination schedule and therefore costs) are for many parents a challenge that they are simply unable to meet.

The type of parental attitude, level of parental anxiety, readiness to acquire knowledge, openness to doctors' suggestions, and choices regarding the sources of medical information may also affect the implementation of vaccinations[16–18]. In recent years, the range of available vaccinations has expanded significantly; the mandatory and recommended vaccination calendars are constantly modified. The epidemiological situation is changing. Subsequent children from the same family are sometimes vaccinated according to different schedules. In the circumstances of media clutter and confusion around vaccinations, parents' striving for a significant individualisation of vaccination calendars has been noted. This is due to distrust in relation to the changing vaccination programmes, prejudice caused by conflicting information about individual vaccines, and lack of sufficient knowledge to reconsider the doubts[19]. Usually, parents do not completely reject the idea of vaccination, but they express particular concern and doubts regarding the legitimacy of administering certain vaccines to the child[5,20]. They demand that in the absence of significant health indications, vaccinations be postponed or some of them be abandoned. An example is the combined measles, mumps and rubella (MMR) vaccination, which is shrouded in myth regarding its connection with the development of autism. A meta-analysis of European studies on MMR vaccination coverage showed that the factors negatively affecting vaccination coverage include parents' insufficient knowledge, negative beliefs about vaccination, older age of children, lower socioeconomic status, in particular low income and low level of education, unregulated marital status, and large number of children in the family[13].

As demonstrated by the analysis, parents are more likely to be afraid of combined polyvalent vaccines than single vaccines, and they are most afraid of new vaccines, paradoxically finding older preparations more trustworthy since they are "tested"[21]. In a situation where the vaccination calendar is expanded almost every year, which increases the number of vaccination visits, the division of combined vaccinations into vaccinations with single pathogens raises the risk of not completing all vaccinations on time, not completing the already started vaccination cycles, and thus not immunising the child in the assumed time.

 DOI: 10.15557/PiMR.2022.0054

Parameter	*N* = 278 (100%)	*n* (%)
Gender of the subject	Female	269 (96.76)
	Male	9 (3.24)
Mother's age (35.98 years on average)	Up to 35 years old	140 (50.36)
	More than 35 years	138 (49.64)
Father's age (38.23 years on average)	Up to 35 years old	115 (41.37)
	More than 35 years	163 (58.63)
The child lives	With both parents	237 (85.25)
	With one of the parents	41 (14.75)
	In a multi-generational family	26 (8.27)
Place of residence	Large city/outskirts	117 (42.09)
	Small town	74 (26.62)
	Farm	87 (31.29)
Subjective assessment of the family's financial situation	Very good	20 (7.19)
	Good	135 (48.56)
	Average	120 (43.17)
	Poor	3 (1.08)
Average monthly income per family member	<500	35 (12.60)
	500–1,500	167 (60.07)
	1,500–2,500	56 (20.14)
	>2,500	20 (7.19)
Mother's education	Elementary	12 (4.32)
	Vocational	46 (16.55)
	Secondary	100 (35.97)
	Higher vocational (Bachelor's degree)	15 (5.39)
	Higher	105 (37.77)
Father's education	Elementary	7 (2.52)
	Vocational	88 (31.65)
	Secondary	105 (37.77)
	Higher vocational (Bachelor's degree)	12 (4.32)
	Higher	66 (23.74)
Number of children in the family	One	89 (32.01)
	Two	130 (46.76)
	Three	40 (14.39)
	More	19 (6.84)

Tab. 1. Structure of the study population

Romijnders et al.[22] divide parents into those who trust vaccinations, those who partly accept them and are able to present a number of arguments for and against a particular vaccination, and those who question vaccinations, whose claims are based on unreliable evidence. Williams et al.[23] demonstrate that there is also a group of parents who are insufficiently aware of the status of their children's vaccinations – they are unable to state which vaccinations have been administered to their children and to what extent. This imposes the obligation on the physician not only to provide accurate information, but also to meticulously document the implementation of vaccinations so that the completion of individual cycles can be controlled.

The aim of the study was to evaluate the implementation of the compulsory and recommended vaccination programme for children and adolescents in the Kuyavian-Pomeranian region. The influence of the level of anxiety and parental attitudes of mothers on decisions related to child vaccination was also studied.

MATERIALS AND METHODS

The results of a voluntary survey conducted among 500 parents of patients of the Department of Paediatrics, Allergology and Gastroenterology at the Antoni Jurasz University Hospital No. 1 in Bydgoszcz in 2017–2018 were analysed.

The study was approved by the Bioethics Committee at the Collegium Medicum of the Nicolaus Copernicus University in Bydgoszcz (approval number KB580/2015).

The inclusion criteria for the study included having at least one child over one year of age as well as written consent to participate in the study, and the exclusion criteria included deep prematurity, birth weight <2,000 g, and other conditions of the perinatal period requiring postponement or significant modification of the vaccination schedule, as well as chronic diseases requiring significant modifications to the vaccination schedule.

Of the 500 questionnaires distributed, 323 (64.6%) were returned. 278 (55.6%) correctly completed questionnaires were qualified for the analysis. The characteristics of the study population are presented in Tab. 1.

Among the research methods, an original questionnaire, the Plopa Parental Attitude Scale, and the State-Trait Anxiety Inventory (STAI) were used.

The original questionnaire contained questions about the implementation of preventive vaccinations in a currently hospitalised child. The survey included questions related to:

1. respondents' beliefs about the need for vaccinations;
2. implementation of mandatory vaccinations (including deviations from the programme);
3. implementation of recommended paid vaccinations;
4. sources of parents' knowledge about vaccinations.

In addition, information was collected on the period by which vaccinations were delayed, the reasons for certain modifications to the vaccination schedule, and the type of recommended vaccines selected. The survey also asked about the child's demographic data and family status (single-parent family, multi-generational family, etc.), parents' age, place of residence, family's financial situation, or parents' education, as well as the number of children in the family.

For the purpose of analysing the factors that influence the implementation of vaccinations, parents additionally completed two questionnaires: the Plopa Parental Attitude Scale[24] and the STAI[25]. Due to the small number of questionnaires correctly completed by fathers, only questionnaires completed by mothers were qualified for the final analysis. The Plopa questionnaire, designed to study parental attitudes, contains 50 diagnostic statements grouped in 5 dimensions corresponding to 5 parental attitudes: Acceptance–Rejection (AR), Excessive Demands (ED), Autonomy (Aut), Inconsistency (I), Excessive Protection

DOI: 10.15557/PiMR.2022.0054

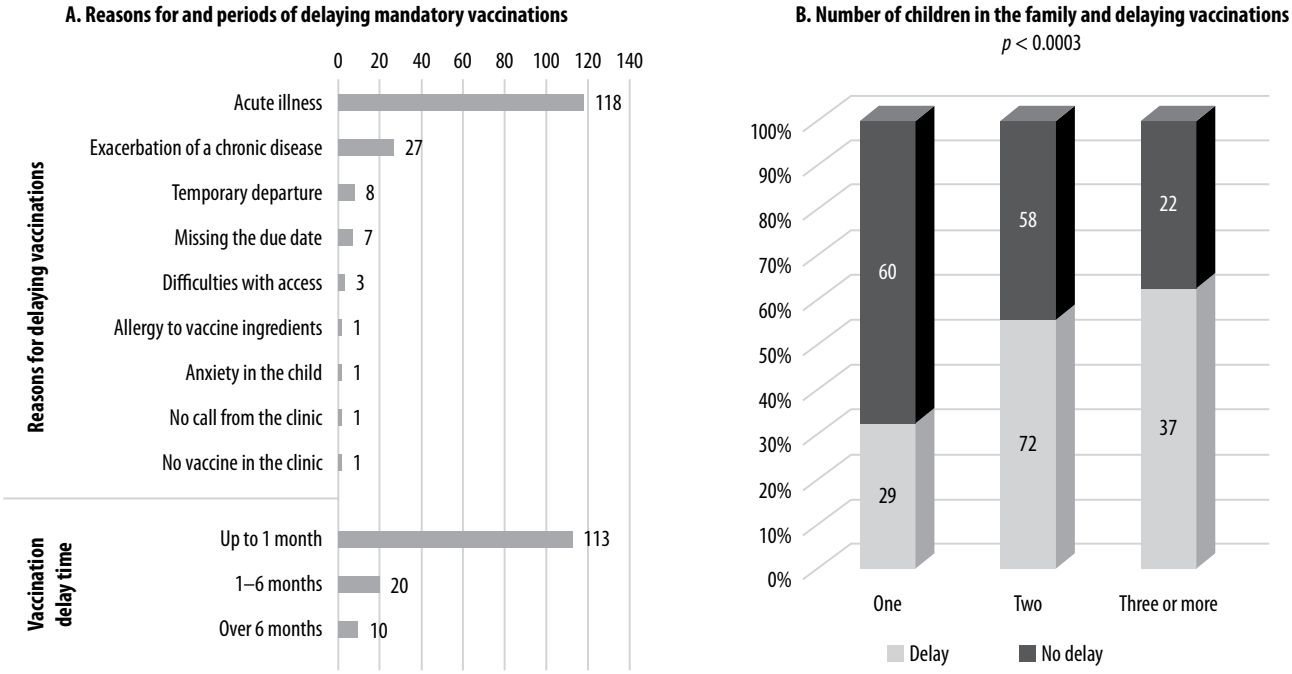

Fig. 1. Implementation of mandatory vaccinations

(EP). The STAI is a tool designed to test anxiety understood as a temporary, situation-conditioned state of an individual and as a relatively permanent personality trait. It consists of two subscales, one of which (X-1) is used to measure anxiety as a state, and the other (X-2) to measure anxiety as a trait.

After completing the questionnaires, parents anonymously deposited them in designated boxes. The study was approved by the Bioethical Committee No. 580/2015, and each patient gave their written consent to participate in it.

The statistical analysis was performed using the chi-squared test (demographic data) or analysis of variance (psychological tests). Differences were considered statistically significant at $p < 0.05$.

RESULTS

260 (93.53%) of the surveyed mothers considered vaccinations in their children necessary, 4 (1.44%) considered them unnecessary, and 14 (5.03%) had no opinion.

Almost all respondents (96.40%) had their children vaccinated according to the vaccination schedule. There were no significant differences between the frequency of vaccinations in accordance with the current vaccination calendar and family status, parents' age, place of residence, financial situation of the family, parents' education, or the number of children in the family ($p > 0.05$). 138 respondents (49.64%) declared that they had delayed vaccinations. Most often, the delays resulted from an acute disease and did not last longer than a month (Fig. 1 A). In most cases, vaccination delays concerned large families (Fig. 1 B). There were no statistically significant differences between delaying mandatory vaccinations and other parameters. For 9 (3.24%) children, some vaccinations were abandoned. Resignation from vaccination despite the lack of medical contraindications concerned MMR (3 children), DTP (2 children), Hib (3 children), hepatitis B (2 children), tuberculosis (Bacille Calmette-Guérin, BCG) (1 child), and polio (3 children) vaccines. The reasons for resignation included: fear of complications caused by the vaccine ($n = 4$), belief that vaccination against rare diseases is not needed ($n = 3$), lack of faith in the effectiveness of the vaccine ($n = 2$), and lack of consent of the other parent ($n = 1$). There were no statistically significant correlations between the frequency of abandoning compulsory vaccinations and demographic data.

142 parents (51.08%) chose to use a combined vaccine instead of single or less combined vaccines. This was most often motivated by the desire to reduce the child's pain and stress and the convenience of use (113 respondents), less often by the belief that these vaccines are more modern and safer (43 people) or that they contain a smaller amount of additional substances in one solvent (23 people). Advice obtained from the doctor was decisive for 4 people. Statistically, multi-ingredient vaccines were significantly more often purchased for children of parents with high incomes ($p < 0.04$) and with higher education ($p < 0.0003$ for mothers, $p < 0.000001$ for fathers), and less often for children from large families ($p < 0.02$) (Fig. 2).

Recommended vaccinations were purchased by 133 parents (47.84%), most often from large cities ($p < 0.04$), with high income ($p < 0.0008$) and very good or good financial situation ($p < 0.004$), with higher education ($p < 0.000001$ for mothers, $p < 0.000001$ for fathers), and less often in families with three or more children ($p < 0.02$) (Fig. 3 A). The most common reason for the decision to purchase recommended vaccinations was the parent's own initiative to protect the

 DOI: 10.15557/PiMR.2022.0054

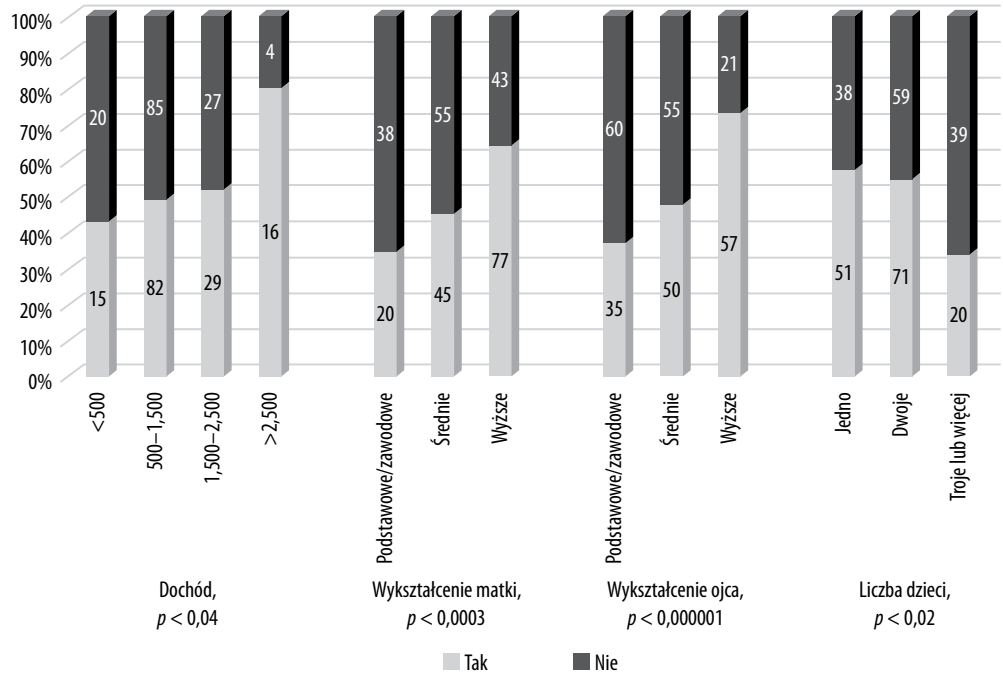

Fig. 2. Implementation of the vaccination schedule with paid combination vaccines

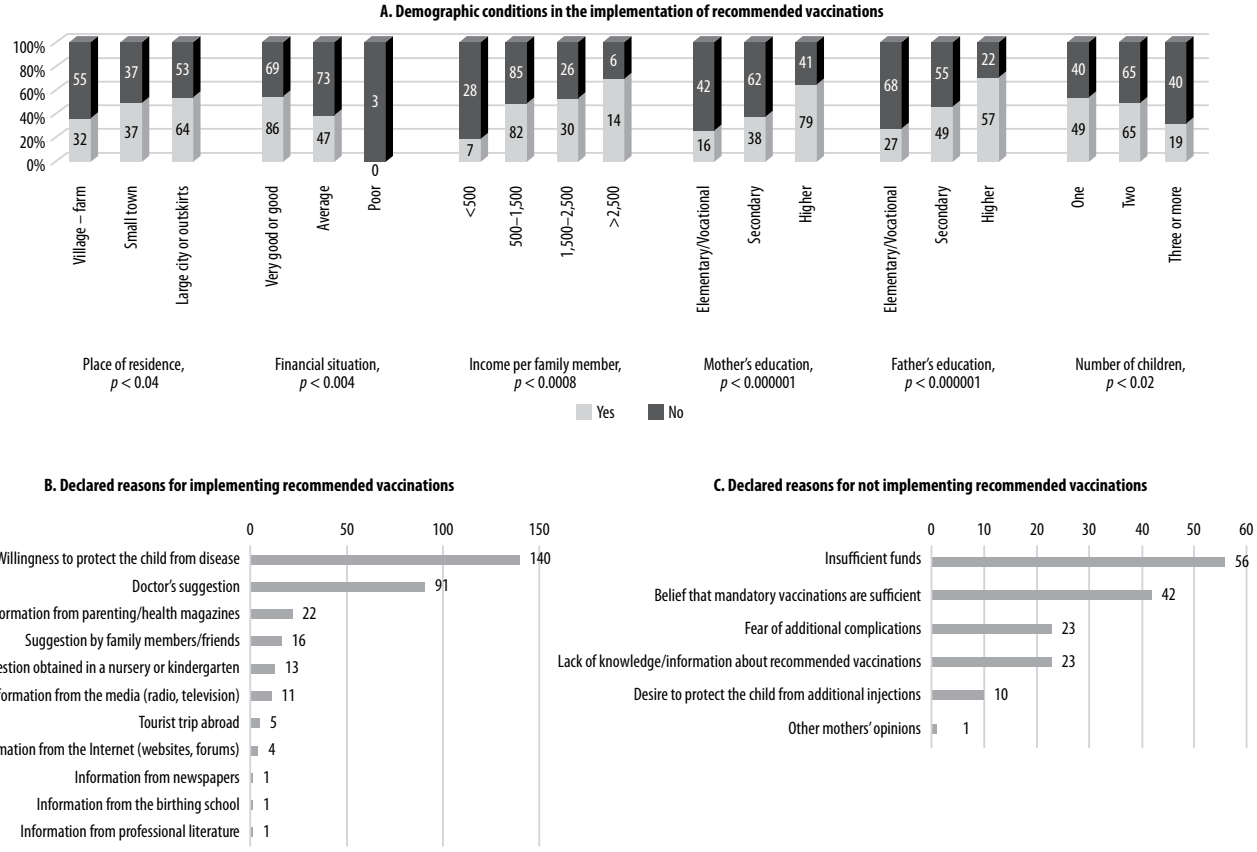

Fig. 3. Implementation of recommended vaccinations

child against additional diseases, then a doctor's suggestion, and less often – other reasons (Fig. 3 B). For those parents who did not provide their children with recommended vaccinations, the main reason was the lack of funds, and only slightly less frequently – the belief that the compulsory vaccination programme is sufficient (Fig. 3 C).

Out of 145 parents of children who had not used additional vaccinations by the time they participated in

DOI: 10.15557/PiMR.2022.0054 PEDIATR MED RODZ Vol. 18 No. 4, p. 362–370

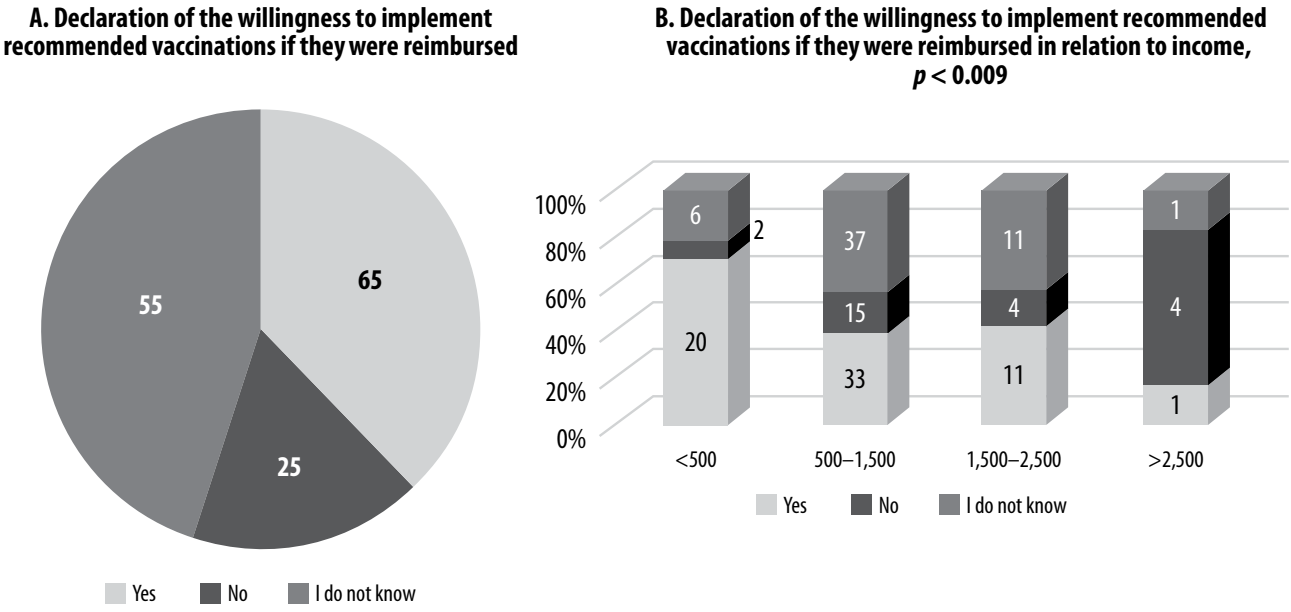

Fig. 4. Declarations of the willingness to implement recommended vaccinations if they were reimbursed

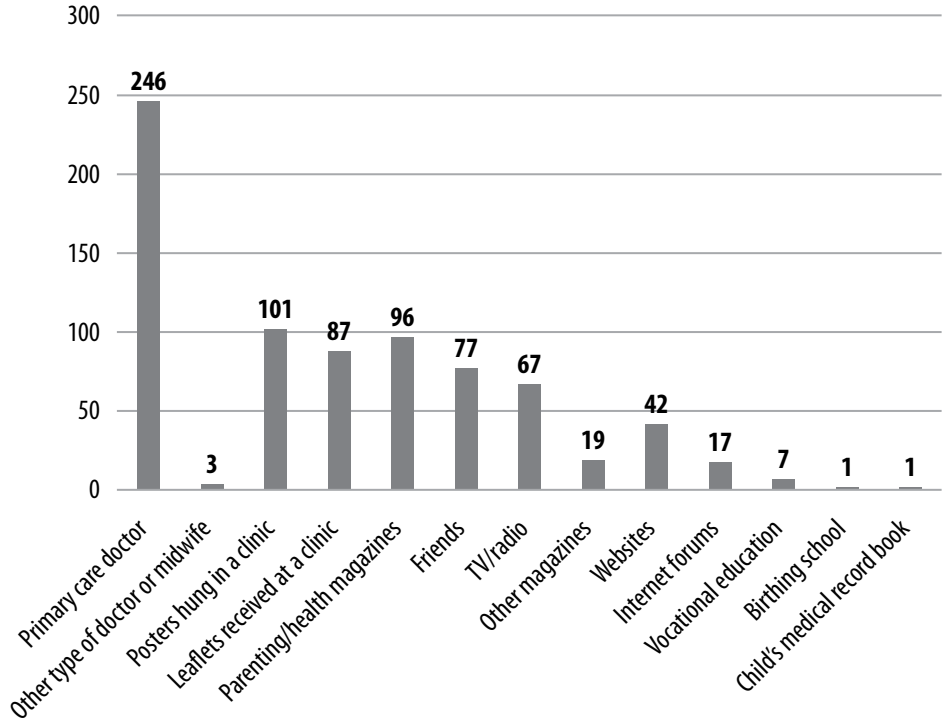

Fig. 5. Sources of parents' knowledge about vaccinations

the survey, only 65 (44.83%) stated that they would take advantage of an opportunity to do so free of charge (Fig. 4 A) – the more often, the lower their income was (Fig. 4 B). There were no other statistically significant correlations between the declared will to implement recommended vaccinations if they were reimbursed and demographic parameters.

The psychological analysis showed that neither the level of anxiety nor the type of parental attitude of mothers had a statistically significant impact on the choice of the vaccination schedule (reimbursed vaccines vs. multi-combination paid vaccines), the type of compulsory vaccination that was abandoned, or the decision to implement additional vaccinations ($p < 0.5$). There was also no statistically significant relationship between adherence to vaccination dates and the level of anxiety and parental attitudes of mothers.

100% of the respondents answered the multiple-choice question about the sources of knowledge about preventive vaccinations. For 246 respondents (88.49%), the knowledge

 DOI: 10.15557/PiMR.2022.0054

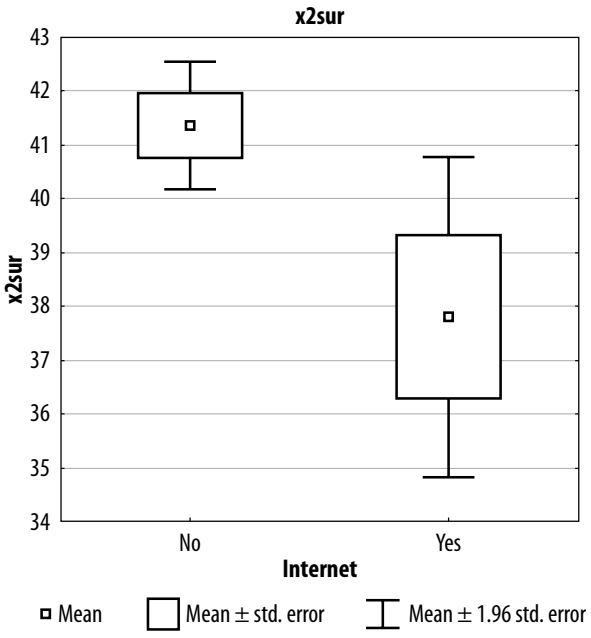

Fig. 6. The level of anxiety in mothers who use or do not use information about vaccinations from the Internet

about preventive vaccinations came from a general practitioner. For many, the source of knowledge was also the materials available in the clinic (posters for 36.33% and leaflets for 31.29% of the respondents). Significant sources of knowledge about vaccinations were also health magazines, friends, and the media (including the Internet) (Fig. 5). Most of the respondents (207, i.e. 74.46%) obtained information about vaccinations from more than one source.

The psychological analysis showed that mothers who learnt about vaccinations from the Internet presented a lower level of anxiety than those who did not use the Internet for this purpose ($p = 0.08$) (Fig. 6). No other differences were found in the analysis of parental attitudes and levels of anxiety in relation to knowledge about vaccinations.

DISCUSSION

Most of the parents surveyed in the presented study believed that preventive vaccination in children is necessary. The few mothers who had a different opinion revealed an attitude of rejection towards their children. Similar results were published by Faleńczyk et al., who found that over 98% of parents are in favour of compulsory vaccination[26]. The prevailing positive attitude of parents towards vaccination, as well as their conviction that the obligation to vaccinate is justified, are also described by authors from other European countries[20,27].

Almost all respondents vaccinated their children according to the vaccination calendar, which corresponds to the observations of other authors from various regions of Poland, who estimate the level of implementation of the mandatory vaccination calendar to be 96.2–100%[5,8,9,26]. However, there are certain difficulties in implementing the mandatory vaccination schedule, including delaying subsequent vaccinations. In our own research, at least one delay in vaccination concerned almost half of the children, but the delay typically did not exceed one month, and its cause was transient – e.g. acute illness. Pieszka et al.[7] also showed that the majority of parents vaccinate their children in accordance with the applicable vaccination calendar, and modifications or deviations from the calendar are mainly conditioned by permanent or temporary contraindications, less often deliberate postponement of the vaccination date. Nevertheless, according to Kałucka and Łopata[28], almost 1/5 of parents deliberately delay vaccinations, and 2.4% refuse to have them performed whatsoever. In addition, Rogalska et al.[29] found that about 3% of parents resign from vaccination due to negative opinions about it that they have encountered. Similar results have been obtained in our own study. Furthermore, it has been shown that 15% of parents believe that some vaccinations are more dangerous than the diseases they are supposed to protect against. The information that contributed to this opinion and the consequent decision not to vaccinate often came from a doctor or was taken from the media or from friends[5].

The results of our research do not seem to confirm the issue described by other authors that is parents' greater concerns about new, multi-component vaccines than about older, monovalent vaccines[21]. Although the applicable vaccination calendar was modified in as many as 2/3 of children, the changes consisted primarily in the use of a paid combination vaccine instead of vaccines offered free of charge, or in the inclusion of additional vaccines. The reason for such behaviour was not only the parents' desire to reduce the number of injections in the child, but also, frequently, their belief in the better quality and greater safety profile of newer preparations. Similar results were obtained by Pieszka et al.[7]. Our research has shown that parents' education, income, and number of children were significant determinants for their decisions whether to purchase polyvalent vaccines and additional recommended vaccines.

In addition, this study has demonstrated that less than half of parents purchased recommended vaccinations, and about 45% declared their willingness to take advantage of such vaccinations if they were free of charge. The analysis has indicated that the financial aspect, i.e. the high cost of additional vaccinations, constitutes a barrier to vaccination coverage only in families with a lower economic status. In better-off families, other factors probably have a larger impact on the decision not to take additional vaccinations, e.g. belief in sufficient immunisation through the implementation of the compulsory vaccination program, fear of complications, reluctance to subjecting the child to additional injections, or lack of knowledge. Most Polish authors describe comparable results of their own observations, indicating that 33–53% of parents implement recommended vaccinations to various extents[3,5,7,26]. An important factor

DOI: 10.15557/PiMR.2022.0054

influencing the implementation of additional vaccinations is their price[3,7,8,26]. It is pointed out that reimbursement thereof would improve vaccination coverage in 44.83–76% of children[3,26].

The limitation of the conducted analysis is the inclusion of parents of children in a wide age range. Due to the fact that the Preventive Vaccination Programme in Poland has changed several times in recent years, it was difficult to assess the frequency of particular vaccinations recommended in the study population. New vaccines are constantly appearing on the market, some of which are successively included in the Vaccination Programme. As a result of the promotional activities for new preparations, public awareness is increasing, although knowledge about diseases that can be prevented by vaccination is still insufficient[10,16,30]. This is reflected in the results obtained in our research, as almost 30% of parents who do not implement recommended vaccinations believed that mandatory vaccinations are sufficient, 15.86% were afraid of post-vaccination complications, and 15.86% stated that they did not know about recommended vaccinations.

Parents surveyed in our study most often declared that the direct reason for their decision to implement recommended vaccinations in their children was the desire to protect them against additional diseases; doctor's suggestions were indicated by a small number of parents. However, most parents declared that they acquire their knowledge about vaccinations from the doctor; it thus can be indirectly concluded that it was the doctor who influenced the parents' behaviour regarding the implementation of additional vaccinations. Numerous authors emphasise the important role of the doctor as a propagator of vaccination[9,15,17,18,20,22,29,31,32]. It has been shown that the most desirable form of education by the doctor is a brief and straightforward conversation, tailored to the patient's needs, both from the point of view of the assessment made by the parents themselves[9,26,29] and the objective assessment of the effectiveness of this education[32]. Educational materials available in clinics (posters, leaflets) also play a significant role[9,26], which has been noted in our study as well.

Some Polish studies provide concerning data, showing that parents quite often do not feel well informed about vaccinations during a doctor's visit and consider the information obtained to be incomplete and unconvincing, and indicate the Internet and friends' opinions as their main sources of information[28,33]. The Internet is currently used as a source of information in many areas of life, including medicine[13,26,29]. Some authors showed that the Internet, although widely used, was considered a reliable source of information about vaccinations by a small percentage (4–8%) of parents[21,29]. Nevertheless, in our own study, mothers who used information about vaccinations from the Internet presented a lower level of anxiety. The level of parental anxiety can also significantly influence their decisions related to vaccination[34]. Parents' fear of vaccinations has been shown to be most frequently caused by misconceptions about VAE, downplaying infectious diseases, doubts regarding the effectiveness of vaccinations, and conspiracy theories[35]. According to Dońka et al.[36], some parents delay vaccination or refuse to have their children vaccinated precisely because of the increased level of anxiety. Therefore, it should be pointed out that the Internet can be a powerful tool in the hands of well-prepared public health educators, with great potential to promote pro-health behaviours, and not just a source of unverified and harmful information. A critical approach to the content obtained in this way surely is valuable since the Internet, which is an excellent carrier–base of new information, is also a source of outdated, untested and incomplete information, as well as an important vehicle for the anti-vaccination movements[4,37]. The doctor's role is thus to indicate credible yet easily comprehensible websites about vaccination. A practical form of both education and self-control of vaccination implementation can be a mobile application[38]. Parents commonly encounter educational and advertising campaigns concerning vaccinations in various media and evaluate them highly[26]. Nonetheless, only a small percentage of them indicate the media as a source of information on vaccinations, as confirmed by both our own results and those obtained by other authors[9,26]. The parents surveyed in our study often obtained information from press intended for parents, considering it a good source of information about vaccinations. Furthermore, parents learn about vaccinations from people around them[13] – other parents[26] as well as family members and friends[9,16]. Salmon et al.[39] indicate that the school staff environment could have a positive impact on parents' attitudes towards vaccination.

CONCLUSIONS

1. The mandatory Protective Vaccination Programme is complied with by the majority of the population. Deviations from the vaccination schedule most often consist in replacing free vaccinations with more modern, paid polyvalent vaccines, as well as in slightly delaying vaccination dates.
2. Recommended vaccinations are implemented by less than half of parents. Limitations in this regard seem to be related to parents' financial situation and level of education.
3. Due to the constant progress of vaccinology, the changing availability of vaccinations, the changing epidemiological situation, and the diverse economic and life circumstances of patients, it is necessary to individualise educational activities in the field of vaccination so as to take into account parental attitudes and the level of anxiety of parents.

Conflict of interest

The authors do not declare any financial or personal links to other persons or organisations that could adversely affect the content of this publication or claim rights thereto.

References

1. Dornbusch HJ, Hadjipanayis A, Del Torso S et al.: We strongly support childhood immunisation – statement from the European Academy of Paediatrics (EAP). Eur J Pediatr 2017; 176: 679–680.
2. Bednarek A, Zarzycka D: Potrzeba i założenia nowoczesnej edukacji na przykładzie szczepień ochronnych. Probl Hig Epidemiol 2015; 96: 1–7.
3. Lipska E, Lewińska M, Górnicka G: Realizacja szczepień zalecanych u dzieci i opinie rodziców na temat tych szczepień. Nowa Med 2013; 2: 64–69.
4. Marchewka AK, Majewska A, Młynarczyk G: Działalność ruchu antyszczepionkowego, rola środków masowego komunikowania oraz wpływ poglądów religijnych na postawę wobec szczepień ochronnych. Post Mikrobiol 2015; 54: 96–102.
5. Rogalska J, Augustynowicz E, Gzyl A et al.: Postawy rodziców wobec szczepień ochronnych w Polsce. Przegl Epidemiol 2010; 64: 91–97.
6. Augustynowicz A, Wrześniewska-Wal I: Aspekty prawne obowiązkowych szczepień ochronnych u dzieci. Pediatr Pol 2013; 88: 120–126.
7. Pieszka M, Waksmańska W, Woś H: Wiedza rodziców dzieci do drugiego roku życia na temat szczepień ochronnych. Med Og Nauk Zdr 2016; 22: 221–226.
8. Jackowska T, Kłyszewska M: Realizacja szczepień zalecanych u dzieci i ocena świadomości ich rodziców. Pediatr Pol 2010; 85: 201–206.
9. Kochman D, Rudzińska T: Analiza przyczyn decyzji rodziców o poddaniu szczepieniom dzieci w wieku 0–2 lat. Pediatr Pol 2008; 83: 357–362.
10. Drozd-Dąbrowska M, Topczewska K, Korzeń M et al.: Parental knowledge about meningococcal disease and vaccination uptake among 0–5 years old Polish children. Int J Environ Res Public Health 2019; 16: 265.
11. Gawlik K, Woś H, Waksmańska W et al.: Opinie rodziców na temat szczepień ochronnych u dzieci. Med Og Nauk Zdr 2014; 20: 360–364.
12. Kennedy J: Populist politics and vaccine hesitancy in Western Europe: an analysis of national-level data. Eur J Public Health 2019; 29: 512–516.
13. Tabacchi G, Costantino C, Napoli G et al.; The ESCULAPIO Working Group: Determinants of European parents' decision on the vaccination of their children against measles, mumps and rubella: a systematic review and meta-analysis. Hum Vaccin Immunother 2016; 12: 1909–1923.
14. Czajka H: Dlaczego szczepienia ochronne są nadal potrzebne? Dev Period Med 2018; 22: 171–178.
15. Gust DA, Woodruff R, Kennedy A et al.: Parental perceptions surrounding risks and benefits of immunization. Semin Pediatr Infect Dis 2003; 14: 207–212.
16. Ganczak M, Owsianka B, Korzeń M: Factors that predict parental willingness to have their children vaccinated against HPV in a country with low HPV vaccination coverage. Int J Environ Res Public Health 2018; 15: 645.
17. Pettke A, Jocham S, Wiener A et al.: Vaccination against influenza at a European pediatric cancer center: immunization rates and attitudes among staff, patients, and their families. Support Care Cancer 2017; 25: 3815–3822.
18. Mergler MJ, Omer SB, Pan WKY et al.: Association of vaccine-related attitudes and beliefs between parents and health care providers. Vaccine 2013; 31: 4591–4595.
19. Matkowska-Kocjan A, Szenborn L: Częściowi przeciwnicy szczepień – wyzwanie dla lekarza prowadzącego szczepienia niemowląt i małych dzieci. Med Prakt Szczepienia 2016; 4: 77–84.
20. Kundi M, Obermeier P, Helfert S et al.: The impact of the parent–physician relationship on parental vaccine safety perceptions. Curr Drug Saf 2015; 10: 16–22.
21. Mrożek-Budzyn D, Kiełtyka A, Mróz E: Opinions about vaccination among mothers who delivered newborns in two hospitals in Krakow and Myślenice. Przegl Epidemiol 2016; 70: 471–478.
22. Romijnders KAGJ, van Seventer SL, Scheltema M et al.: A deliberate choice? Exploring factors related to informed decision-making about childhood vaccination among acceptors, refusers, and partial acceptors. Vaccine 2019; 37: 5637–5644.
23. Williams ER, Meza YE, Salazar S et al.: Immunization histories given by adult caregivers accompanying children 3–36 months to the emergency department: are their histories valid for the *Haemophilus influenzae* B and pneumococcal vaccines? Pediatr Emerg Care 2007; 23: 285–288.
24. Dominiak-Kochanek D, Gosk U: Postawy rodzicielskie matek i ojców wobec synów i córek w różnych fazach adolescencji. CNS 2014; 4: 69–84.
25. Wrześniewski K, Sosnowski T, Jaworowska A et al.: Inwentarz stanu i cechy lęku STAI. Polska adaptacja STAI. Pracownia Testów Psychologicznych Polskiego Towarzystwa Psychologicznego, Warszawa 2006.
26. Faleńczyk K, Piekarska M, Pluta A et al.: Czynniki wpływające na postawy rodziców wobec szczepień ochronnych u dzieci. Post N Med 2016; 29: 380–385.
27. Lovrić Makarić Z, Kolarić B, Tomljenović M et al.: Attitudes and beliefs related to childhood vaccinations among parents of 6 years old children in Zagreb, Croatia. Vaccine 2018; 36: 7530–7535.
28. Kałucka S, Łopata E: Rezygnacja rodziców ze szczepień obowiązkowych – niebezpieczne dla dzieci i dorosłych. Geriatr 2017; 11: 272–278.
29. Rogalska J, Augustynowicz E, Gzyl A et al.: Źródła informacji oraz wiedza rodziców na temat szczepień ochronnych w Polsce. Przegl Epidemiol 2010; 64: 83–90.
30. Napolitano F, Della Polla G, Angelillo IF: Knowledge, attitudes, and behaviors of parents towards recommended adult vaccinations: an explanatory survey in the geographic area of Naples, Italy. Int J Environ Res Public Health 2019; 16: 2070.
31. Fenton AT, Elliott MN, Schwebel DC et al.: Unequal interactions: examining the role of patient-centered care in reducing inequitable diffusion of a medical innovation, the human papillomavirus (HPV) vaccine. Soc Sci Med 2018; 200: 238–248.
32. Tymińska J, Wysocki J: Is one minute enough to convince parents to vaccinate their child? Przegl Epidemiol 2017; 71: 439–455.
33. Kowalska M, Gajda M, Barański K et al.: Sources of parental knowledge about the safety of vaccinations in Poland. Health Promot Int 2019; 34: 1191–1199.
34. Langley JM, Halperin SA, Smith B: A pilot study to quantify parental anxiety associated with enrollment of an infant or toddler in a phase III vaccine trial. Vaccine 2003; 21: 3863–3866.
35. Nitsch-Osuch A: Lęk, odrzucenie, teorie spiskowe. Smutna historia ruchów antyszczepionkowych – fakty *vs.* mity dotyczące szczepień. Academia. Magazyn Polskiej Akademii Nauk 2016; 1: 21–23.
36. Dońka K, Suwała M, Zarzycka D et al.: Postawy i edukacja wakcynologiczna rodziców. Pielęgniarstwo XXI Wieku 2018; 17: 13–19.
37. Słopiecka A, Kwiecień E: Przyczyny negatywnych postaw ludności wobec szczepień. Hygeia Public Health 2014; 49: 685–689.
38. Seeber L, Conrad T, Hoppe C et al.: Educating parents about the vaccination status of their children: a user-centered mobile application. Prev Med Rep 2017; 5: 241–250.
39. Salmon DA, Moulton LH, Omer SB et al.: Knowledge, attitudes, and beliefs of school nurses and personnel and associations with nonmedical immunization exemptions. Pediatrics 2004; 113: e552–e559.

DOI: 10.15557/PiMR.2022.0054