HUMAN VACCINES & IMMUNOTHERAPEUTICS
2017, VOL. 13, NO. 11, 2654–2658
https://doi.org/10.1080/21645515.2017.1365994

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RESEARCH PAPER

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Vaccination among Polish university students. Knowledge, beliefs and anti-vaccination attitudes

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ABSTRACT

Anti-vaccination movement has existed as long as the vaccines themselves, but its mode of action and social influences evolved over time. Such attitude with no doubt has negative impact on vaccination rates and eradication of infectious diseases. In this study, we used an online survey to examine vaccination attitudes of Polish university students of various degree and specialties. A total of 1,386 questionnaires were completed, among them 617 from students attending medical schools and 769 from students of non-medical schools. Up to 95.24% (N = 1320) of the study subjects, among them 98.70% and 92.46% of students of medical and non-medical specialties, respectively, declared willingness to vaccinate their children. 47.19% (N = 654) of participants have a contact with anti-vaccination propaganda at least once in a lifetimes. 42.64% (N = 591) of respondents were aware of the existence of anti-vaccination movements; 45.35% (N = 414) of participants, including 306 (51.52%) and 108 (33.86%) students of medical and non-medical disciplines, respectively, considered such movements as a negative phenomenon. Vaccination attitudes of students from medical and non-medical universities differed considerably. Vaccination knowledge and awareness among the students from non-medical universities were rather poor, markedly lower than in the students of medical disciplines. Nevertheless, irrespective of their major, Polish students have considerable knowledge gaps with regards to vaccination and need additional education in this matter.

ARTICLE HISTORY
Received 29 January 2017
Revised 14 July 2017
Accepted 7 August 2017

KEYWORDS
knowledge; students; vaccination

Introduction

Although vaccines have saved many lives, a growing number of people worldwide believe that they may be harmful.[1] This was reflected by a steadily decrease in vaccine coverage in Western countries (especially in the US) in the last decade, and resultant outbreaks of some vaccine-preventable diseases, such as pertussis,[2] measles,[3,4] and poliomyelitis.[5] The growing popularity of anti-vaccination attitudes stimulated progressive development of pro-vaccination movements (like VaccinateCalifornia[6]), since many well-educated people realize potential harmful social consequents of decreasing vaccine coverage in children and adults.

Anti-vaccination movement is driven by the lack of knowledge, as well as by concerns with regards to vaccine safety. A recently published study examining parental attitudes, knowledge and beliefs toward vaccination, demonstrated incomplete vaccine coverage in approximately 8% of Australian children, and identified ca. 4% of parents who were against vaccination of their offspring.[7] These negative attitudes resulted from vaccine safety concerns, non-evidence-based opinions that vaccine-preventable diseases do not pose a health threat, and obtaining vaccine information from the internet, rather than from health care professionals.[7] Unfortunately, these vaccination knowledge gaps are not limited solely to poorly educated people, but were also identified among students.[8] This implies that physicians should spend more time to familiarize their patients with the benefits and risks of immunization, as well as with potentially devastating consequences of the lack of vaccination consent. Leask et al. demonstrated that parents still consider physicians as a valuable source of information about vaccines, a key determinant of vaccination consent.[9]

We hypothesized that knowledge obtained during medical studies has a big impact on vaccination attitude. To verify this hypothesis, we compared vaccination attitudes presented by students of medical and non-medical disciplines. The survey consisted of 3 parts, examining general vaccination attitude, general vaccination knowledge and specific knowledge of measles and MMR vaccines. The choice of the latter vaccines was not accidental; measles is generally considered as a mild childhood disease, whereas MMR raises a lot of safety concerns among parents.[10] Principal aim of this study was to examine vaccination attitudes of young Polish adults, and to verify if formal education or actual level of medical knowledge are associated with more positive attitude to vaccines. We expected that subjects with higher formal levels of medical education will present with more positive vaccination attitudes.

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Results

Socio-demographic characteristics of the study subjects

The study included 1,386 respondents, all declaring being Polish university students. The sample was divided into 2 subgroups: medical university students (MUS, n = 617) and non-medical university students (NMUS, n = 769). Mean age of the study subjects was 21.58 ± 1.89 y. The study group included 1,013 (73.09%) women and 373 men (26.91%). Approximately one third of the study subjects (32.32%, n = 448) originated from a countryside, 25.32% (n = 351) from cities with more than 250,000 inhabitants, another 25.04% (n = 347) from smaller towns with no more than 50,000 inhabitants, and 17.32% (n = 240) from middle-size towns (50,000 to 250,000 inhabitants). The majority of respondents lived in 5 Polish provinces: lubelskie (n = 328, 23.67%), podkarpackie (n = 263, 18.98%), mazowieckie (n = 253, 18.25%), małopolskie (n = 135, 9.74%) and świętokrzyskie (n = 93, 6.71%). Nearly a half of the study subjects studied at one of 5 universities: Medical University of Lublin (n = 206, 14.86%), Warsaw Medical University (n = 127, 9.16%), Jagiellonian University (n = 107, 7.72%), Rzeszów Technical University (n = 102, 7.36%) and Maria Curie-Skłodowska University (n = 81, 5.84%). 33 (2.38%) respondents declared having at least one child.

Intention to vaccinate

The intention to vaccinate their child (in non-parents) or the fact of child's vaccination (in parents) were declared by 95.24% (n = 1320) of the study subjects, including 98.7% of MUS and 92.46% of NMUS (p<0.00001).

Anti-vaccination movement

Nearly a half of the study subjects (n = 654, 47.19%) declared that they have experienced a form of anti-vaccination propaganda at least once; this proportion was significantly higher among MUS (n = 330, 53.49%) than in NMUS (n = 324, 42.13%; p = 0.00003). 5.73% of students who have ever experienced an anti-vaccination propaganda and 3.37% of those who have not, declared a negative vaccination attitude (p = 0.06962). 42.64% of the study subjects (n = 591), among them 61.10% (n = 377) of MUS and 27.83% (n = 214) of NMUS declared being aware of the existence of organized anti-vaccination movements with more or less official leaders; the intergroup difference in the distribution of answers to this question turned out to be statistically significant (p < 0.0001). The proportion of MUS who considered the existence of organized anti-vaccination movements as an unfavourable phenomenon was significantly higher than the respective percentage of NMUS (Table 1). The percentage of MUS declaring that parents who do not vaccinate their children should be penalized or fined, was higher than among NMUS (Table 2).

Table 1. "What is your opinion about the anti-vaccination movement?"

Opinion	Total	MUS	NMUS	p
Definitely negative 414 (45.35%)	306 (51.52%)	108 (33.86%)	<0.000001	
Rather negative	178 (19.50%)	106 (17.85%)	72 (22.57%)	
Neutral	263 (28.81%)	155 (26.09%)	108 (33.86%)	
Rather positive	45 (4.93%)	21 (3.54%)	24 (7.52%)	
Definitely positive	13 (1.42%)	6 (1.01%)	7 (2.19%)	

Table 2. "Do you think that parents who do not vaccinate their children should be penalized?"

Opinion	Total	MUS	NMUS	p
Definitely no	158 (11.40%)	30 (4.86%)	128 (16.64%)	<0.000001
Rather no	236 (17.03%)	68 (11.02%)	168 (21.85%)	
Neutral	294 (21.21%)	101 (16.37%)	193 (25.10%)	
Rather yes	337 (24.31%)	182 (29.50%)	155 (20.16%)	
Definitely yes	361 (26.05%)	236 (38.25%)	125 (16.25%)	

Vaccination knowledge

While both MUS and NMUS most often pointed to 1 per 1,000,000 as the incidence rate of vaccine-related severe adverse events, the latter had a tendency to select more extreme answers (mostly 1:10,000). The intergroup differences in the distribution of answers to this question turned out to be statistically significant (Table 3). Two thirds of the study subjects declared that natural immunity does not persist longer than the post-vaccination immunity (46.18%, n = 640 rather does not, and 21.07%, n = 292 definitely does not). This opinion was shared by nearly 3 fourths of MUS (43.11%, n = 266 rather does not, and 30.15%, n = 186 definitely does not) and less than 2 thirds of NMUS (48.63%, n = 374 rather does not, and 13.78%, n = 106 definitely does not; p = 0.589658).

According to 36.94% of the respondents only one thiomersal-containing vaccine is still available in Poland; the proportions of study subjects who estimated the number of available thiomersal-containing vaccines at 2, 3, 4 and at least 5 were 29.87% (n = 414), 18.33% (n = 254), 3.54% (n = 49), and 11.33% (n = 157) respectively. The study groups differed significantly in terms of the distribution of answers to this question (Table 4).

Measles and measles-mumps-rubella vaccine

The study groups differed significantly in their opinions regarding the safety of MMR vaccine (p = 0.0045): 29.98% (n = 185) of MUS and 24.45% (n = 188) of NMUS believed that it is absolutely safe, 64.18% (n = 396) and 66.58% (n = 512), respectively, declared that it is rather safe, and 8.97% (n = 69) believed it is rather unsafe while 5.83% (n = 36) believed it is absolutely unsafe. The largest proportion of MUS estimated the prevalence of severe measles complications at 1:1,000 (n = 163, 26.42%) or 1:10,000 (n = 149, 24.15%), whereas NMUS typically believed that complication of measles occur in 1:100,000 (n = 167, 21.72%) or 1:10,000 cases (n = 159, 20.68%); these intergroup differences were statistically insignificant (Table 5).

Table 3. "How common are adverse effects of vaccination?"

Answer	Total	MUS	NMUS	p
1:10 000	191 (13.78%)	62 (10.05%)	129 (16.78%)	0.000256
1:100 000	406 (29.29%)	181 (29.34%)	225 (29.26%)	
1:1 000 000	555 (40.04%)	273 (44.27%)	282 (36.67%)	
1:10 000 000	234 (16.88%)	101 (16.37%)	133 (17.30%)	

Table 4. "How many thiomersal-containing vaccines are still available in Poland?"

Answer	Total	MUS	NMUS	p
1	512 (36.94%)	265 (42.95%)	247 (32.12%)	<0.000001
2	414 (29.87%)	192 (31.12%)	222 (28.87%)	
3	254 (18.33%)	86 (13.94%)	168 (21.85%)	
4	59 (3.54%)	18 (2.92%)	31 (4.03%)	
5 or more	157 (11.33%)	56 (9.08%)	101 (13.13%)	

Herd immunity

While the largest proportion of both MUS and NMUS declared that a minimum vaccine coverage that provides herd immunity is: 95% (n = 254, 41.17% vs. n = 225, 29.26%) or 90% (n = 157, 25.45% vs. n = 198, 25.75%), distributions of answers to this question differed significantly between the study groups (Table 6).

Vaccination knowledge score

MUS presented with significantly higher vaccination knowledge scores than NMUS (43.73 ± 19.73% vs. 35.35 ± 19.24%, $p < 0.000001$). The proportion of correct answers to vaccination knowledge questions varied from 0% in both groups to 100% and 80% in MUS and NMUS, respectively. Importantly, vaccination knowledge scores of vaccination opponents turned out to be significantly lower than in vaccination proponents (22.12 ± 17.93% vs. 39.84 ± 19.62%, $p<0.000001$).

Consequences of inadequate vaccination coverage

The most commonly chosen major consequence of inadequate vaccination coverage included – an increase in the incidence of infectious diseases (n = 558), followed by a recurrence of already eradicated diseases (n = 424), epidemics (n = 273), higher incidence of disease complications (n = 201), a decrease in herd immunity (n = 174), greater mortality (n = 167), higher risk in non-vaccinated subjects (n = 125), mutation of pathogens (n = 103), and higher economic burden of therapy (n = 84). Alarmingly, up to 358 respondents were not able to identify any harmful consequences of inadequate vaccination coverage.

Adverse effects of vaccination

The list of 5 most commonly selected adverse effects of vaccination included fever (n = 503), pain, swelling and redness at the injection site (n = 380), allergic reaction (n = 250), post-vaccination ailment (n = 191) and rash (n = 183). Other, slightly less often chosen answers were weakness (n = 143) and anaphylactic shock (n = 135).

Table 5. "How common are severe measles complications?"

Answer	Total	MUS	NMUS	p
1:100	163 (11.76%)	86 (13.94%)	77 (10.01%)	0.426095
1:1,000	309 (22.29%)	163 (26.42%)	146 (18.99%)	
1:10,000	308 (22.22%)	149 (24.15%)	159 (20.68%)	
1:100 000	279 (20.13%)	112 (18.15%)	167 (21.72%)	
1:1 000 000	224 (16.16%)	84 (13.61%)	140 (18.21%)	
1:10 000 000	103 (7.43%)	23 (3.73%)	80 (10.40%)	

Table 6. Percentage of population to be vaccinated to sustain herd immunity.

Answer	Total	MUS	NMUS	p
80,00%	149 (10.75%)	44 (7.13%)	105 (13.65%)	<0.000001
85,00%	187 (13.49%)	61 (9.89%)	126 (16.38%)	
90,00%	355 (25.61%)	157 (25.45%)	198 (25.75%)	
95,00%	479 (34.56%)	254 (41.17%)	225 (29.26%)	
100,00%	216 (15.58%)	101 (16.37%)	115 (14.95%)	

Questions addressed to parents

Due to a very low proportion of parents in the study group (n = 33), answers to this set of questions were not analyzed.

Discussion

Owing a recent remarkable increase in the popularity of anti-vaccination movements, it is not surprising that nearly a half of our respondents had at least one contact with an anti-vaccination propaganda. This is particularly evident in the Internet era. According to Kata, up to 70% of Google search results in the US, were in fact the links to anti-vaccination movement websites,[11] 43% vaccine-dedicated Facebook pages examined by Buchanan and Beckett turned out to be strictly against vaccination.[12] Although, a proportion of vaccine opponents among participants of our study who have had ever a contact with anti-vaccination propaganda was higher than among those who have not, this difference was only at a threshold of statistical significance. However, this does not mean that anti-vaccination propaganda has no impact on vaccination attitudes of young adults, and this issue should be addressed in future research.

General attitude of our respondents to vaccination of children can be interpreted in 2 ways. Assuming that declared attitudes will be followed by a relevant action, i.e. vaccination, approximately 95% of immunization proponents seem to be perspective sufficient proportion to sustain herd immunity. On the other hand, 5% (or even 8% in the case of NMUS) of potential opponents may constitute a serious threat in future. Due to growing activity of anti-vaccination movements, the fraction of vaccination refusals may increase over time. However, 95% vaccination acceptance rate still should be considered satisfactory taking into account published data for various Western countries. According to Smith et al., immunisation refusal rate among parents of 24- to 35-month-old children from the USA has reached 14%.[13] and although some may still consider this rate quite low, it needs to be carefully monitored. While in our study, the proportion of MUS who declared that they would refuse vaccination of their offspring was even smaller (< 2%), this group should be watched equally carefully since as future healthcare providers, they may have a strong impact on parental decisions regarding immunisation.[14]

Only about one third of our respondents were able to correctly estimate the risk of severe post-vaccination adverse effects which according to literature approximates 1 per 100,000 vaccinations.[15] This is particularly alarming in the case of MUS who should be well aware of potential risks and benefits of vaccination.

In turn, a relatively high proportion of the study subjects (75% of our study subjects, among them more than 80% of MUS and more than 70% of NMUS) correctly identified the minimum vaccination rate necessary to sustain herd immunity.[16]

Although a large body of evidence proved safety and effectiveness of pediatric vaccines, among them MMR vaccine,[17,18] their use still raises serious parental concerns. In this context low percentage of correct answers of our respondents to detailed questions regarding vaccines and their safety should be considered alarming, especially in the case of MUS. Owing their future profession, the latter should be vaccine advocates and possess broader knowledge of the topic, including possible adverse effects of vaccination, to adequately address any parental concerns. Our hereby presented findings imply that general knowledge of vaccines and vaccination was significantly lower among vaccine opponents than among the proponents of immunization. Consequently, education of parents, young adults and children may exert a beneficial effect on vaccination rates in general population.

Our respondents listed addition of mercury and thiomersal to vaccines as the most popular parental concerns, which indeed is frequently brought, especially in low-immunisation groups.[19] Thiomersal is commonly linked with an increased risk of autism spectrum disorder, although there is no published evidence in question nor contraindications for thiomersal use.[20] Consequently, reliable information about health effects of thiomersal and its content in available vaccines seems to be a key determinant of parental vaccination consent. According to data published by Polish National Institute of Hygiene (Państwowy Zakład Higieny), 4 vaccines available in Polish market still contain thiomersal.[21] However, this answer was chosen be the smallest proportion of our respondents, less than 4% of the whole study-group. These were MUS, who particularly underestimated the number of marketed thiomersal-containing vaccines, which again seems alarming taking into account their future professional role as vaccine advocates and source of reliable information about potential benefits and risk of vaccination.

Study limitations

Although the study sample was relatively large, some of the participants might not be really the students, or at least did not provide a true information about their major study discipline. This might represent a serious source of bias. Second, in the study of students who in a vast majority were not parents, the willingness to vaccinate their children or to refuse vaccination, might be to a large degree solely a declaration; totally different distribution of answers to this question might have been obtained if the study group consisted primarily of parents.

Conclusions

Although the proportion of vaccination proponents identified in our study seems acceptable, still there is a need for an educational campaign to prevent a decrease in this percentage and optimally to make it even higher. Owing crucial role of health care professional in enforcing parental vaccination consent, all medical university students should possess adequate knowledge regarding potential benefits and risks of vaccination, to be able to address all parental concerns. Vaccination knowledge among Polish students, irrespective of their major, seems to be inadequate, and some efforts need to be undertaken to change this unfavourable situation.

Material and methods

The study was designed as an internet survey with a self-prepared online questionnaire about vaccines and anti-vaccination movement, addressed to students of various degrees from Polish state-funded universities. The respondents were recruited via Facebook groups of their faculties; we used this attitude since such groups are usually not open to all Facebook users and members need to verify their eligibility to the group administrator before enrolment.

Survey

Prior to preparation of the survey, the list of problems to be addressed by the study was discussed by the authors. As no previously validated published survey covering all these problems, especially from a perspective of Polish public healthcare system, was available, a novel instrument was developed. Its clarity and applicability was verified during a preliminary face-to-face study in a group of students from author's university.

The survey consisted of 4 parts, referring to sociodemographic characteristics of the study subjects (part I), vaccines and anti-vaccination movement (part II), measles-mumps-rubella vaccine (part III), and a separate part dedicated solely to parents (part IV). A total of 30 questions were included in the survey, 8 in part I, 11 in part II, 4 in part III, and 7 in part IV. The survey was prepared as an online form, available in March 2015. Protocol of the study was approved by the Local Bioethics Committee at the Medical University of Lublin.

Questions

Questions were formed in a non-judgemental manner, without suggesting any answer. The first group of questions (about sociodemographic characteristics) referred to age, sex, place of origin, university, current year and degree of the studies, province (region) of residence, and having children. Part II, referring to vaccines and anti-vaccination movement, included the following questions: "Will you vaccinate you child/children?" with specification of a reason behind "no" answer if any, "How common are adverse effects of vaccination?," "Name 2–5 adverse effects of vaccinations you know," "Has anyone ever tried to convince you that vaccination is harmful?," "Do you know what an anti-vaccination movement is?," "What is your opinion about the anti-vaccination movement?," "Do you agree that the post-disease immunity persists longer than the post-vaccination immunity?," "Do you think that parents who do not vaccinate their children should be penalized?," "Name 2–5 consequences of a decrease in the percentage of vaccinated people," and "How many thiomersal-containing vaccines are still available in Poland?." The third group of questions addressed the safety of MMR vaccine, frequency of severe complications of measles and types thereof, and minimum percentage of vaccinated people that is necessary to sustain herd immunity. The last group of questions was addressed solely to students who already had children. They were asked if they have vaccinated their children with polyvalent vaccines (e.g. 3 in 1 or 5 in 1), with specification of a reason behind "no" answer if any, as well as about additional vaccinations (not included in the official vaccination schedule) given to their children, types thereof, and the reason to choose a given

additional vaccination or not. Finally, they were asked if they were more likely to immunise their children with an additional vaccine if its cost was reimbursed.

Vaccination knowledge score

Each correct answer to vaccination knowledge questions "What is the minimum percentage of vaccinated people that is necessary to sustain herd immunity?," "How many thiomersal-containing vaccines are still available in Poland?," "Do you agree that the post-disease immunity persists longer than the post-vaccination immunity?," "How common are adverse effects of vaccination?" was granted with 1 point, except from the question about the persistence of post-vaccination and post-disease immunity, where answers "definitely no" and "rather no" were granted with 2 and 1 point, respectively. Maximum value of vaccination knowledge score was 5 points.

Procedure and participants

The survey was addressed to students of various degrees from all Polish state-funded universities. Each respondent was asked about his/her university affiliation. To provide a wide spectrum of respondents, as well as a reliability of the data, invitation to participate in the survey was posted on closed Facebook groups of various Polish state-funded universities. To avoid a potential bias, a small proportion of records, e.g., with extremely old declared age of the subjects or random answers to descriptive questions, were not included in the analysis.

Analysis

Statistical analysis of the results was performed with Statistica 10 (StatSoft, USA). Depending on the type of analyzed variable and its distribution, the significance of intergroup differences was verified with Pearson chi-square test or Mann-Whitney U-test.

Disclosure of potential conflicts of interest

The authors declare that there is no conflict of interests regarding the publication of this article.

Acknowledgments

We would like to thank all our friends who have helped us in delivering the questionnaires to the appropriate student groups.

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