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Profiles of Vaccine Hesitancy: The Relation Between Personal Experience With Vaccines, Attitude Towards Mandatory Vaccination, and Support for Anti-Vaccine Arguments Among Vaccine Hesitant Individuals

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Supplementary Materials: Data [see [Index of Supplementary Materials](#)]



Abstract

This paper investigates the susceptibility to anti-vaccine rhetoric in the vaccine-hesitant population. Based on the literature on attitudes and attitude change it was assumed that susceptibility to anti-vaccine arguments may be related to personal experience with vaccination and to the strength of vaccine hesitant attitudes. The first aim of the study was to investigate the relation between personal experience with post-vaccination side effects and acceptance of select categories of anti-vaccine arguments. The second aim was to compare whether vaccination deniers and the vaccine-ambiguous group differ in their susceptibility to these arguments. The online survey was run in Poland on a final sample of 492 vaccine hesitant respondents. Results indicate that individuals who declared a negative experience with vaccination were persuaded by all types of anti-vaccine arguments. Moreover, pre-existing anti-vaccine skepticism may cause individuals to interpret negative symptoms as consequences of vaccines, further reinforcing the negative attitude. Additionally, it appeared that the vaccine-ambiguous believe in serious negative side effects of vaccination and ulterior motives of pharmaceutical companies, but do not believe that vaccines are ineffective. However, the opinion profile for vaccine deniers indicates that it may be a generalized



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stance, rather than a set of individual issues concerning different perceived negative aspects of vaccination.

Keywords

support for anti-vaccine arguments, personal experience, vaccine hesitancy, mandatory vaccination

- In this study we show that declared personal experience with post-vaccination side effects influences susceptibility to anti-vaccine rhetoric. We also claim that the “recalled” post-vaccine symptoms may be the result of pre-existing vaccine hesitancy.
- We compare the vaccination beliefs of vaccine deniers and vaccine-ambiguous individuals, showing that vaccine deniers have a generalized negative attitude towards vaccines, while the vaccine-ambiguous think that vaccines are effective and reliably researched.
- The results of our study contribute to a better understanding of skepticism towards vaccination, both from a theoretical and practical point of view.

Vaccination is widely considered as one of the greatest achievements of modern medicine and one of the most cost-effective health investments in history (Stefanelli & Rezza, 2014). Vaccines provide direct protection for the vaccinated individual, but also indirect benefits for those who are non-vaccinated, due to herd immunity (Kim, Johnstone, & Loeb, 2011; Lahariya, 2016). Although many experts agree that the development of vaccines greatly reduced the prevalence of infectious diseases, it seems that vaccines became a victim of their own success. This success has left people largely unconcerned about contagious diseases they have never seen. At the same time, there is a growing fear of the side effects of vaccination and doubts about its effectiveness. This has resulted in an alarming increase in the number of people not vaccinating themselves or their children (Dubé, Vivion, & MacDonald, 2015; Larson, 2013). While in Poland, where we conducted our study, there were about 6,000 vaccine avoiders per year between 2006 and 2013, this number tripled between 2014 and 2016, reaching about 50,000 in 2020 (NIZP, 2021). The problem of vaccine rejection also takes on additional importance in the context of recent studies on the willingness to vaccinate against COVID-19. The results for Poland showed that although there is a gradual increase in the willingness to get vaccinated against COVID-19, there is still a large percentage of persons who are afraid of the complications and of those who do not want to get vaccinated (e.g. Babicki & Mastalerz-Migas, 2021).

Vaccine deniers are still in the minority but due to easy access to the Internet, the arguments of anti-vaccine activists are easily published and distributed, reaching other people and raising concerns regarding vaccination among some of them. As the most recent studies on the activity of vaccine deniers on the Internet show, they are very active in promoting their views (Johnson et al., 2020). In contrast to the monothematic

narrative of pro-vaccination groups, which claim that vaccination is necessary for the health of the individual and society, anti-vaccine movements employ a wide variety of attention-grabbing arguments, which often relate to vaccination side effects or ineffectiveness, conspiracy theories and distrust in healthcare providers.

There are several explanations for what makes people susceptible to anti-vaccination rhetoric. They often addressed individual differences or the general decline of confidence in experts and science (see [Hornsey et al., 2018](#); [Nichols, 2017](#); [Rutjens et al., 2018](#)). In our research we assumed that such susceptibility may also be caused by personal experience of negative symptoms that occurred after vaccination, as well as by receiving similar information about post-vaccination problems from family or friends (mediated experience). Hence, the first aim of our study was to investigate the relation between direct and mediated experience with negative post-vaccination symptoms and beliefs in anti-vaccine arguments most commonly used by the anti-vaccination activists.

Moreover, because vaccine skepticism is an attitude that ranges from ambiguity to outright rejection, and there is a high rate of vaccine-ambiguous people in general population samples ([Maciuszek et al., 2021](#); [Murphy et al., 2021](#)), we also wanted to investigate the structure of beliefs in anti-vaccine arguments among these two groups of vaccine hesitant people, i.e., whether there are differences in beliefs between those ambiguous about vaccines and vaccine deniers. Below, we briefly address these two aims of our study.

Negative Experience With Vaccination and Susceptibility to Anti-Vaccine Arguments

The analyses of the anti-vaccine rhetoric show that vaccine deniers use several types of arguments. They usually refer to post-vaccination side effects (e.g., statements that vaccines cause autism or decrease the level of intelligence), civil liberty issues (e.g., that parents should have the freedom to decide about the vaccination of their children), or use medical populism and conspiracy theories (e.g., that pharmaceutical companies sell vaccines purely for profit) ([Lasco & Curato, 2019](#); [Moran, Lucas, Everhart, Morgan, & Prickett, 2016](#); [Sternisko, Cichocka, Cislak, & Van Bavel, 2020](#)). Although these arguments are widely spread on the Internet and different strategies are used to maximize their appeal and influence, only certain people are susceptible to them. This susceptibility can stem from individual characteristics, such as high religious identity, orthodoxy, conspiratorial thinking, or high reactance ([Hornsey, Harris, & Fielding, 2018](#); [Rutjens et al., 2018](#)). However, we assumed that apart from these characteristics, susceptibility to anti-vaccine arguments can be also strongly related to the personal experience with side effects of vaccines. A lot of research showed that attitudes formed through personal experience are stable over time, resistant to counterinfluence, and likely to serve as guides to behavior ([Albarracín & McNatt, 2005](#)). This is because direct experience with the object usually provides the individual with concrete, unambiguous and subjectively

certain information. Besides, very often such contact with an attitude object is associated with experiencing strong emotional involvement (Cohen & Reed, 2006). Recent evidence also indicates that people may incorporate negative experiences into their attitudes more quickly and strongly than positive experiences, and that people tend to over-generalize such negative personal experience not only results in strongly held attitudes and related behaviors, but can also be used as a very effective tool in persuasive communication (for a review, see Maio, Haddock, & Verplanken, 2019).

The analyses of anti-vaccine websites show that there are plenty of personal testimonies from parents who felt that their children were hurt by vaccines. These personal stories invoke strong images and emotional reactions, causing the reader to identify with the message and serving its persuasive effect (Kata, 2010). The other parents' accounts of perceived vaccine side effects may then create a substantial amount of vaccine skepticism, manifesting in the adoption of a delayed vaccine schedule, or in vaccine refusal (Cvjetkovic, Jeremic, & Tiosavljevic, 2017; Mills et al., 2005). In view of the above, the first aim of our study was to investigate if personal experience (direct or mediated) is related to vaccine side effects on the claims about vaccination. Moreover, we assumed that a negative personal experience may be related not only to beliefs regarding vaccine side effects, but also to generalized beliefs in anti-vaccine arguments (not even connected to side effects, e.g., vaccine ineffectiveness).

The Continuum of Vaccine Hesitancy – Vaccine Ambivalence vs. Vaccine Rejection

There is now much evidence in the social psychology literature that, contrary to the traditional conception that attitudes are either positive or negative, they should not be understood only in this dichotomous (or bipolar) way (Conner & Armitage, 2008; Luttrell, Petty, & Briñol, 2016). Also many researchers who are interested in the problem of attitudes towards vaccination point out that the discourse should move away from the polarized framing of pro- and anti-vaccine groups to a continuum which would include also those who are delaying vaccination, accepting only some vaccines, or who are ambivalent (Smith, 2017). These heterogeneous beliefs that lay on the continuum from vaccine acceptance to outright vaccine refusal are now called vaccine hesitancy. There is also a call from health experts and organizations for more research that would let us understand the factors that contribute to vaccine hesitancy in its broader spectrum (Larson, 2013; Murphy et al., 2021). Investigating those who are in the middle of this spectrum may be valuable from an applied view; this is because their attitudes are ambivalent (they see the pros and cons of vaccination) or weaker than strong attitudes of vaccine deniers that tend to be persistent over time and not susceptible to pro vaccine claims. Hence, they may be more susceptible to counter-persuasive arguments (Bassili, 1996) so it is easier to reach out to such hesitant people (than the extreme vaccine-deniers) and convince them to vaccinate. However, it must be noted that for the same

reason, well-prepared anti-vaccine arguments can persuade this group to become vaccine deniers. This is even more important since the number of vaccine-ambiguous people in the general population is larger than the number of strong vaccine rejecting people. In research which we conducted on a representative sample of Poles before and during the COVID 19, there were twice as many vaccine-ambiguous people as vaccine deniers (Stasiuk et al., 2018).

Following that, it is especially important to understand this target and its concerns about the vaccination. Taking this into account the second aim of our study was to investigate which anti-vaccine arguments are convincing for the vaccine-ambiguous people and which vaccine-deniers believe in.

Method

Participants

We drew vaccine-hesitant individuals from a nationwide Polish sample ($N = 3,000$, representative in terms of age, gender, education and size of place of residence, recruited by means of random quota sampling), using two selection criteria. The first selection criterion was the answer to the question ‘What is your stance on mandatory vaccination’, which could be either ‘I agree’, ‘I am ambiguous, as I see positive and negative sides of it’ or ‘I oppose’. The second selection criterion was the opinion regarding the statement “Vaccines do more harm than good”. Answers to this statement were measured on an 11-point Likert scale (0 - *strongly disagree* – 10 - *strongly agree*). If a respondent answered that they supported vaccination (first selection) or if they chose an answer less than 4 (second selection) they did not proceed to the next part of the questionnaire (they received a thank you note and information about completion of the study). The final sample consisted of 493 vaccine-hesitant individuals. Sample demographics are presented in Table 1. The study was run online by the Ariadna Nationwide Research Panel counterpart of mTurk – a company specialized in polling large samples for the purpose of research. The panel enables random selection of the sample from among 100,000 registered and verified users. Additionally, it has been awarded certificates issued by recognized organizations associated with social research companies (including ESO-MAR). For participation in the survey, respondents received credit points that they could exchange for gifts.

Table 1*Sample Demographics*

Sample description	Vaccine-hesitant (n = 252)	Vaccine deniers (n = 241)	p for group difference	Total (N = 493)
Answer to 'Vaccines do more harm than good' (0-10)	M = 5.10, SD = .555	M = 9.24, SD = 1.11	< .001	M = 7.13, SD = 2.25
Sex	131 female, 121 male	133 female, 108 male	.476	264 female, 229 male
Age	M = 40.89, SD = 12.31	M = 40.63, SD = 12.31	.822	M = 40.76, SD = 12.52
Has children	164 yes, 88 no	172 yes, 69 no	.134	336 yes, 157 no
Residence ^a	57/34/61/56/44	64/22/71/47/37	.300	121/56/132/103/81
Education ^b	6/32/70/26/28/90	4/18/76/36/29/78	.235	10/50/146/62/57/168

^aRural/small town (under 20k residents)/medium town (20-99k residents)/city (100-500k residents)/large city (over 500k residents).

^bPrimary/Vocational/Secondary/Post-secondary/Bachelor's degree/Master's degree or higher.

Materials and Procedure

The presented survey consisted of thirty questions. Five of these questions concerned demographics (age, gender, place of residence, education, profession). Two questions were the selection criteria described earlier. One question pertained to the participants' negative experiences with vaccination ("Did someone in your family, or someone you know have health issues after vaccination?"), followed by a request to describe these issues. Twenty-one questions concerned the participants' beliefs and stances toward various aspects of vaccines and vaccination.

Questions pertaining to the participants' opinions about vaccination were based on arguments most frequently used by anti-vaccine activists. Observations of these arguments were taken at a conference titled *How to live in a world of pseudo-medicine. What your doctor will never tell you*, organized by vaccine skeptics in Poland (Rzeszow), where the leaders of anti-vaccine movements presented their views on the topic. We attended this conference (as part of its audience) and analyzed the presented arguments and classified them into six categories representing six aspects of vaccine hesitancy. Below we specify the categories. Questions pertaining to each of them are presented in the [Appendix](#).

1. Opinion about anti-vaccination activists (AV support)- three statements which measured the general opinion and support for anti-vaccine movements and their leaders, Cronbach's alpha = .839.
2. Beliefs about side effects of vaccination (Side effect) - five statements measured beliefs that vaccines have harmful side effects, especially those shown by anti-vaccine movements as arguments against mandatory vaccination, Cronbach's alpha = .839.
3. Doubts about the need for vaccination (Need) – five statements about what would happen if people would not vaccinate, and whether vaccines were historically useful in preventing epidemics, Cronbach's alpha = .821.
4. Doubts about the effectiveness of vaccination (Effectiveness) – two statements measuring doubts about whether vaccines protect against diseases. This category was separate from Need, as it directly questioned whether vaccines work, Cronbach's alpha = .718.
5. Doubts about research on vaccines (Research) – three statements reflecting doubts about the quality of vaccination research, Cronbach's alpha = .790.
6. Doubts about the intentions of medical professionals (Intentions) – four statements which addressed doubts about the intentions of pharmaceutical companies and medical professionals who endorse vaccination.

Responses to statements within the above categories were measured on an 11-point Likert scale from 0 (*strongly disagree*) to 10 (*strongly agree*). All statements are presented in the [Appendix](#).

We planned to conduct two separate analyses of the above aspects. The first one concerned the effects of participants' declared personal experience on vaccine-hesitancy. We wanted to investigate whether having personal negative experiences with vaccines, i.e., whether members of their family or their acquaintances developed problems after vaccination, are related to opinions of vaccine-hesitant individuals. As was mentioned above, we asked participants a question about negative experiences with vaccination, with the possible answers *yes*, *no* and *I do not remember*. We assumed that some individuals with strong anti-vaccination beliefs would be unwilling to declare that they have no personal experience to back up their beliefs, so they would state they do not remember to avoid cognitive dissonance.

The second one investigated the potential differences between those who strongly reject mandatory vaccination and those who are ambiguous on the subject, in order to search for potential risk factors which may turn ambiguous individuals into vaccine deniers. Results were investigated by means of profile analyses with Bonferroni-adjusted pairwise comparisons. The selection criterion between participants who strictly oppose mandatory vaccination (vaccine deniers) and those ambiguous about the matter (the strictly vaccine-hesitant group) was the answer to the question *How would you describe your attitude towards mandatory vaccination?* Participants who answered *I am against*

mandatory vaccination were considered vaccine deniers ($N = 241$), and those who answered *I am ambiguous, as I see positive and negative sides of vaccination* were considered strictly vaccine hesitant ($N = 252$). Participants who supported mandatory vaccination were not part of this analysis. Again, we investigated the relation between this variable and the six aspects of vaccine hesitancy.

Results

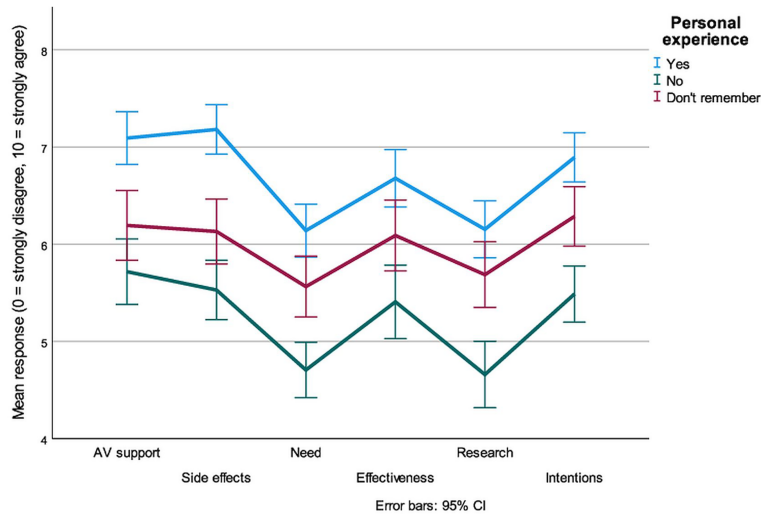
Personal Experience

Out of the 493 participants, 231 declared having such personal experience with side effects of vaccines. A further 135 declared that they do not remember, and 127 declared they did not have any. These differences were statistically significant at $\chi^2(2, N = 493) = 40.763, p < .001$. Unfortunately, the descriptions of this personal experience provided by participants were too vague for analyses (many answers stated that children ‘got sick’, ‘had post-vaccination symptoms’ or were left blank; other popular answers included fever, autism or allergies).

We tested if the declared personal experience is related to the six aspects of vaccine hesitancy (described in Method section): 1. Opinion about anti-vaccination activists; 2. Beliefs about side effects of vaccination; 3. Doubts about the need for vaccination; 4. Doubts about the effectiveness of vaccination; 5. Doubts about research on vaccines; 6. Doubts about the intentions of medical professionals.

We ran a profile analysis, comparing the profiles of answers to these six aspects in participants who stated having, not having or not remembering having personal experience with negative post-vaccination effects (i.e., using Personal Experience as a between-group variable and the six aspects of vaccine hesitancy as six within-group variables within the SPSS profile analysis). Please keep in mind that the analysis was run on a group of already vaccine-hesitant individuals.

Predictably, there were significant differences in the answers of subjects who declared having personal experience with negative side effects of vaccination, not having it and not remembering having it, $F(2,490) = 33.027, p < .001, \eta_p^2 = .119$. However, these profiles exhibited parallelism, indicating that personal experience led to a generalized more anti-vaccine answer to all questions: the interaction term of Profile \times Personal experience was nonsignificant at $F(7.427, 1819.570) = 1.606, p = .124, \eta_p^2 = .007$. The profile plot is presented in Figure 1. The plot also includes an indifference line at 5.0: All of the questions had answers ranging from 0 (*I strongly disagree*) to 10 (*I strongly agree*). As a consequence, scores between 0-4 indicated disagreement with a statement (i.e., a pro-vaccine stance), and scores between 6-10 indicated agreement (an anti-vaccine opinion). A score of 5 therefore indicated indifference or no prevailing opinion (*Neither agree nor disagree*).

Figure 1*Effects of Personal Experience on Vaccine Hesitancy Profile*

Note. Horizontal line indicates indifference between supporting and rejecting a given aspect.

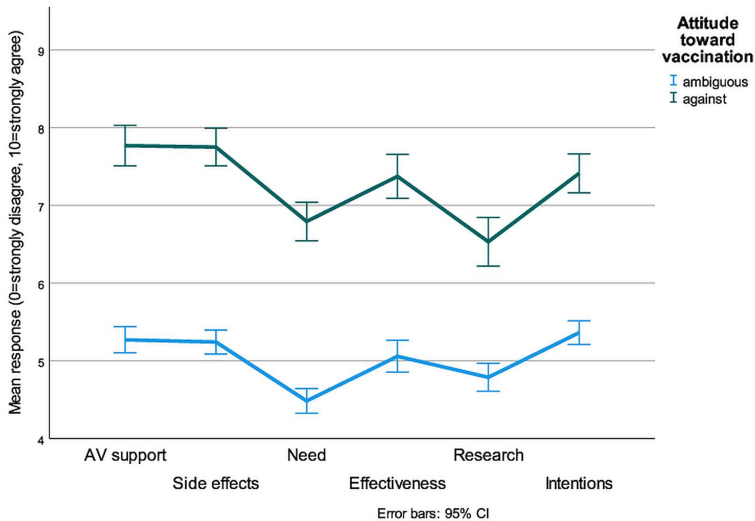
An in-depth analysis was run using pairwise comparisons (Bonferroni adjusted) for all of the above aspects of vaccine hesitancy across personal experience.

1. Opinion about anti-vaccination activists (AV support). It turned out that there were significant differences in opinion about anti-vaccination activists determined by personal experience. Participants who declared having personal experience presented the highest level of support ($M = 7.09$, $SE = 0.18$, both $p < .001$), however those without personal experience ($M = 5.72$, $SE = 0.18$), and those who did not remember ($M = 6.19$, $SE = 0.18$), did not significantly differ ($p = .185$).
2. Beliefs about side effects of vaccination (Side effects). Again, all differences were significant with $p < .05$; participants who declared personal experience had the highest belief in side effects ($M = 7.18$, $SE = 0.13$), those declaring not having personal experience had the lowest ($M = 5.53$, $SE = 0.13$) and those who did not remember were in the middle ($M = 6.13$, $SE = 0.17$).
3. Doubts about the need for vaccination (Need). The difference between participants who declared having personal experience ($M = 6.14$, $SE = 0.20$) and those who did not remember ($M = 5.56$, $SE = 0.20$) was not significant ($p = .078$). Participants who declared no personal experience had a significantly lower degree of doubts whether vaccinations are needed than both other groups ($M = 4.70$, $SE = 0.20$, $p < .001$). In fact, a one-sample t -test against the indifference level of 5.0 indicated that this particular opinion was pro-vaccine, $t(126) = -2.036$, $p = .044$.

4. Doubts about the effectiveness of vaccination (Effectiveness). All differences were significant with $p < .05$; participants who declared personal experience had the highest doubts about effectiveness ($M = 6.68, SE = 0.15$), those declaring not having personal experience had the lowest ($M = 5.41, SE = 0.20$) and those who did not remember were in the middle ($M = 6.09, SE = 0.19$).
5. Doubts about research on vaccines (Research). The difference between participants who declared having personal experience ($M = 6.15, SE = 0.14$) and those who did not remember ($M = 5.69, SE = 0.18$) was not significant ($p = .126$). Participants who declared no personal experience had a significantly lower degree of doubts about the quality of research on vaccination than both other groups ($M = 4.66, SE = 0.19$, both $p < .001$). Again, their opinion about the quality of research was ambivalent, nearly pro-vaccine, $t(126) = -1.97, p = .051$.
6. Doubts about the intentions of medical professionals (Intentions). All differences were significant with $p < .01$; participants who declared personal experience had the highest doubts about the intentions of pharmaceutical companies and medical professionals ($M = 6.89, SE = 0.12$), those declaring not having personal experience had the lowest ($M = 5.49, SE = 0.16$) and those who did not remember were in the middle ($M = 6.29, SE = 0.16$).

Attitude Toward Mandatory Vaccination

We ran a profile analysis similar to the one for personal experience (a SPSS profile analysis with attitude toward mandatory vaccination as a between-group variable, and the six aspects of vaccine hesitancy as a within-group variable). Results indicated significant differences in answers between vaccine deniers (VD) and the vaccine ambiguous group (VA): $F(1,491) = 359.69, p < .001, \eta_p^2 = .42$. The VD group had stronger anti-vaccine opinions than the VA group, which is not at all surprising. Pairwise comparisons indicated that these differences were significant for all six aspects (all $p < .001$). Profiles were not parallel (interaction term Profile x Opinion on mandatory vaccination was significant at $F(3.741, 1836.689) = 14.220, p < .001, \eta_p^2 = .013$), mainly due to a stronger increase in opinion about anti-vaccination activists than for other aspects, however the effect size was rather marginal. Profile plots are presented in [Figure 2](#).

Figure 2*Effects of Attitude Toward Mandatory Vaccination on Vaccine Hesitancy Profile*

Note. Horizontal line indicates indifference between supporting and rejecting a given aspect.

As can be seen in the profile plots, those against mandatory vaccination seemed to have strong, strictly anti-vaccine opinions in all aspects. The ambiguous group had an interesting profile to be investigated using one-sample *t*-tests against indifference. It turned out that the ambiguous group demonstrated anti-vaccine opinions in aspects (1) – Opinion about anti-vaccination activists, $M = 5.27$, $SD = 1.36$, $t(251) = 3.16$, $p = .002$, (2) – Beliefs about side effects of vaccination, $M = 5.24$, $SD = 1.24$, $t(251) = 3.08$, $p = .002$, and (6) – Doubts about the intentions of medical professionals, $M = 5.36$, $SD = 1.21$, $t(251) = 4.75$, $p < .001$. However, their opinion on (4) the effectiveness of vaccination was ambiguous, $M = 5.06$, $SD = 1.65$, $t(251) = 0.55$, $p = .581$, and they presented positive (pro-vaccine) opinions about (3) the need for vaccination, $M = 4.22$, $SD = 1.47$, $t(251) = -6.40$, $p < .001$ and about (5) research on vaccines, $M = 4.79$, $SD = 1.45$, $t(251) = -2.31$, $p < .022$.

A particularly interesting difference between the ambiguous and anti-vaccine groups occurred for the question “Should there be an epidemic of a contagious disease, modern medicine will be able to handle it”. We expected vaccine deniers to reject this statement as part of a general rejection of medicine. It turned out to be the opposite: the ambiguous group had a lower belief in medicine handling such a disease ($M = 5.54$, $SD = 1.93$) than vaccine deniers, $M = 6.75$, $SD = 3.03$; $t(491) = 5.31$, $p < .001$.

Discussion

The presented study adds to the body of research on vaccine-hesitancy. During recent years, misinformation about vaccination has been spreading readily across the Internet and it is often resistant to correction (Faasse, Chatman, & Martin, 2016). Anti-vaccination activists use different arguments against vaccination, trying to persuade the public about the dangers or ineffectiveness of vaccines, and the conspiracy of “Big Pharma” and health providers. Taking into account the alarming numbers of vaccine deniers, more detailed analyses and research are important to understand the factors influencing the acceptance of anti-vaccine arguments.

Personal Experience With Vaccine Side Effects

In our research we wanted to test the role of personal experience with vaccination in vulnerability to vaccination concerns among vaccine hesitant people. The results showed that there were clear differences in opinions about vaccines depending on declared personal experience. Not surprisingly, individuals who experienced (or knew someone who experienced) negative symptoms after vaccination were more convinced that vaccination can cause serious health problems (such as autism or long-term general weakness). However, they were also persuaded by other anti-vaccine arguments, not related to vaccines’ side effects – such as the opinion that vaccines do not protect against serious diseases and do not decrease the risk of epidemics. The vaccine hesitant respondents who declared a personal negative experience with vaccination were also more positive toward anti-vaccine movements and more convinced that medical professionals and pharmaceutical companies offer vaccines for their own gains, rather than for the public benefit. It is possible that this generalized vulnerability to anti-vaccine rhetoric can be explained by a mechanism similar to the negative halo effect.

The halo effect is a general cognitive bias, usually described in the literature on impression formation. It states that a single negative attribute can bias subsequent impression formation judgements on unrelated dimensions in a negative direction (Forgas & Laham, 2017; Gräf & Unkelbach, 2016). In regard to our results, it can be assumed that the direct or mediated experience with side effects of vaccination causes an understandable negative opinion about the side effects of vaccines, which may then transfer to the evaluation of other aspects of vaccination, resulting in a generalized negative attitude and higher susceptibility to anti-vaccine arguments.

However, some other interesting conclusions can be drawn from the descriptions of negative post-vaccination symptoms provided by the participants, as well as from the answers of people who declared that they do not remember if they had experience with side effects. We received a total of 324 descriptions of such symptoms, and while a majority of them can be considered medically viable adverse reactions (e.g., fever, nausea, rashes, crying and whining in children), there were forty declared cases of autism (two of

which directly mentioned the MMR vaccine), eighteen declared cases of developmental delay or similar issues, seven cases of epilepsy, seven cases of death and one case of heavy metal poisoning. This shows that the “recalled” post-vaccine symptoms may to an extent be the result of a preexisting negative attitude towards vaccination, i.e., anti-vaccine individuals may have declared such symptoms despite not actually experiencing them, or despite them having nothing to do with vaccination. There are several psychological mechanisms we need to take into account: (1) confirmation bias, (2) availability heuristic, and (3) source monitoring errors.

Confirmation bias consists of an individual actively seeking information consistent with their pre-existing hypothesis, and avoiding information indicative of alternative explanations (Koriat et al., 1980). Nickerson (1998) also postulated that confirmation bias caused a restriction of attention to the favored hypothesis – even should data indicate an alternative, and even should the individual be told about the alternative, they will fail to consider the relevance of the data to the alternative hypothesis (Nickerson, 1998). This effect is one of the more basic cognitive biases, easy to observe in the general population, and even affects scientists (Hergovich et al., 2010). Therefore, a pre-existing negative attitude toward vaccines may cause individuals to interpret negative symptoms as consequences of vaccines, further reinforcing the negative attitude.

The availability heuristic (Tversky & Kahneman, 1973) is set on the premise that elements which are easier to recall are considered more probable. Conversely, elements difficult to recall are assigned a low probability, and ease of retrieval is key for the heuristic to occur (Schwarz et al., 1991). The heuristic, in turn, is based on the phenomenon of cognitive availability: it is easier to recall elements which often repeat, but also which are emotionally loaded, shocking, relevant for an individual, uncommon or bizarre. Vaccine-hesitant individuals are likely to be more exposed to information about negative consequences of vaccination, and additionally such information is relevant to their selves and emotionally loaded, as it pertains to potential health risks for them and their significant others. As such, they are more likely to recall instances of negative post-vaccination symptoms, and to ‘guess’ that they, or their significant others, are likely to have had them. The availability heuristic may therefore cause vaccine-hesitant individuals to ‘recall’ and state having such negative experiences.

Failure to correctly recall the source of information is one of the more prevalent memory errors, responsible among others for suggestibility (Shapiro & Purdy, 2005), the misinformation effect (Johnson et al., 1993) and memory conformity (Gabbert & Hope, 2013). Remembering the source from which a piece of information was received is significantly more difficult than remembering the information itself, especially if an individual receives similar information (e.g., information on the same subject) from various sources. It is therefore possible that vaccine-hesitant individuals, who are likely to receive reports of negative post-vaccination symptoms (e.g., from Internet forums or social media) may mistakenly recall these pieces of information as reported by their

significant others, and therefore more believable and worth repeating – thus adding to the spread of disinformation about vaccines.

As a result, vaccine hesitancy may be self-reinforcing in nature, as it makes individuals more likely to assume that negative symptoms experienced by them or their significant others are related to vaccination. This also explains why the ‘Do not remember’ group placed perfectly between those who declared remembering and those who declared not experiencing negative post-vaccination symptoms.

The Structure of Vaccine Hesitancy

In the past several years, the discourse on vaccine attitudes has moved away from the polarized framing of pro- and anti-vaccine groups, and toward treating these attitudes as a continuum, ranging from individuals actively requesting vaccines, through vaccine ambiguity, to complete refusal of vaccination. The second aim of our study was to compare the susceptibility to different arguments of anti-vaccine movements among the vaccine ambiguous and vaccine deniers. The opinion profile for vaccine deniers indicates that it may be a generalized stance, rather than a set of individual issues concerning different perceived negative aspects of vaccination. This means that preventative action for vaccine deniers should be general in nature, debunking and preventing the spread of disinformation about vaccines. This group tends to strongly believe that vaccines have serious negative side effects, are not effective in protecting individuals and society against infectious diseases, and not reliably tested before being introduced to the market. Vaccine deniers are also convinced that anti-vaccination leaders know more about vaccines than physicians do, and that these leaders act in the public interest, contrary to medical professionals. Interestingly, although vaccine deniers do not trust the knowledge of scientists who do research on vaccines, they believe (more than vaccine ambiguous individuals) that modern medicine would be able to handle an epidemic. It looks like (at least some) anti-vaccine individuals actually believe in medicine (although they do not believe in vaccination).

Unfortunately, the existing literature on anti-vaccine attitudes is not very optimistic, showing that so far there is no effective interventions targeting people who reject vaccination (see: [Brewer et al., 2017](#)). Perhaps this is because their negative attitude is made up of a set of different beliefs about different aspects of vaccination (they believe it is ineffective, harmful, insufficiently researched and forced on society for the benefit of medical representatives). Since the social psychology literature shows that such attitudes are enduring and resistant to change ([Luttrell et al., 2016](#)), special efforts should be directed at convincing the ambiguous individuals. However, this will require understanding the structure of their attitudes and what specifically their doubts are about.

In contrast to vaccine deniers, the attitude of vaccine-ambiguous individuals is heterogeneous. They moderately positively evaluate the anti-vaccine movements and are rather convinced by their arguments about the serious negative side effects of vaccina-

tion and “Big Pharma conspiracy”. On the other hand, they seem to think that vaccines are effective and reliably researched. Following that, preventive actions for vaccine-ambiguous groups should focus on reducing their concerns about negative side effects of vaccination, presenting the prosocial aspect of why medical professionals recommend vaccines, and strengthening the positive points of their attitude (i.e., vaccines being effective protection against serious diseases).

Recent years, especially during pandemics, have seen an increase in research on attitudes toward vaccination. Our study extends the knowledge on this topic by showing that the relationship between negative experiences with vaccinations may be two-sided (Brewer et al., 2017). Moreover, our results support the previously presented view that attitudes toward vaccination are not black and white but extend along a continuum, and show the set of beliefs of individuals at different points along this continuum.

Limitations of the Study

The final sample in our study consisted of only vaccine hesitant individuals because we wanted to compare the set of beliefs of vaccine ambiguous and vaccine determined opponents. Undoubtedly, this can be considered a limitation of our study. Including the group of individuals declaring support for vaccination and comparing their beliefs with that of vaccine hesitant individuals would have provided a better understanding of the continuum of attitudes toward vaccination. Therefore, in our subsequent studies on predictors of vaccine skepticism as well as attitudes toward vaccination against Sars-nCoV-2, we have already included both supporters and vaccine hesitant individuals (Maciuszek et al., 2021; Stasiuk et al., 2021).

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Data Availability: For this article, a dataset is freely available (Stasiuk, Maciuszek, Polak, & Doliński, 2021).

Supplementary Materials

The Supplementary Materials contain the study dataset (in a Polish and English version) and codebook (for access see [Index of Supplementary Materials](#) below).

Index of Supplementary Materials

Stasiuk, K., Maciuszek, J., Polak, M., & Doliński, D. (2021). *Supplementary materials to "Profiles of vaccine hesitancy: The relation between personal experience with vaccines, attitude towards*

mandatory vaccination, and support for anti-vaccine arguments among vaccine hesitant individuals" [Research data and codebook]. OSF. <https://osf.io/96mrb>

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Appendix: Questions Pertaining to the Six Aspects of Vaccine Hesitancy

Aspect / Questions

AV Support

- I support the actions of movements which oppose mandatory vaccination (q10)
 - Members of movements which oppose mandatory vaccination know more about vaccines than physicians do (q8)
 - Members of movements which oppose mandatory vaccination act for the public interest (q9)
-

Side effects

- Dangers associated with side effects of vaccination are larger than positive effects of vaccination (q18)
 - Vaccines cause autism (q19)
 - Vaccines contain large quantities of harmful chemical substances (q20)
 - Vaccines lead to a prolonged debilitation/weakness of the body (q21)
 - Vaccines have caused a decrease in the population's IQ (q22)
-

Need

- Making vaccination voluntary will increase the risk of epidemics of diseases such as tuberculosis, polio or measles* (q11)
 - If people stop vaccinating, the risk of epidemics of diseases such as tuberculosis, polio or measles will increase* (q12)
 - Epidemics of diseases such as tuberculosis, polio or measles disappeared thanks to vaccines* (q14)
 - Even if nobody was vaccinated, there would not be an epidemic (q15)
 - Should there be an epidemic of a contagious disease (e.g., polio, smallpox, measles, tuberculosis), modern medicine will be able to handle it (q13)
-

Effectiveness

- Vaccines do not actually protect against serious diseases (q16)
 - Most of the vaccinated children will eventually get sick with one of the diseases they were vaccinated against (q17)
 - Research
 - I trust the knowledge of scientists who do research on vaccines* (q1)
 - Scientists who work on new vaccines know what they are doing* (q2)
 - Before vaccines are introduced to the public, they undergo robust and reliable tests in independent labs* (q3)
-

Intentions

- Mandatory vaccination was introduced to prevent the spread of diseases* (q4)
 - Mandatory vaccination was introduced under pressure from pharmaceutical companies to further their interests (q5)
 - Medical professionals recommend vaccines out of their own interest (q6)
 - Medical professionals recommend vaccines because they care for patients' well-being* (q7)
-

Note. (*) indicates reverse coding.



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