



# Understanding vaccine scepticism among complementary and alternative medicine users: A comprehensive mixed-methods investigation

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## ABSTRACT

The use of complementary and alternative medicine (CAM) has been widely recognized as a potential contributor to the emergence of vaccine scepticism and refusal. However, a direct correlation between trust in CAM and vaccine scepticism is still a matter of discussion. The objective of this study is to explore the multidimensional factors that explain the association between CAM usage and vaccine scepticism. Qualitative and quantitative research designs were adopted to examine whether visiting CAM practitioners directly contributes to vaccine scepticism and to identify whether antivaccination attitudes are caused by other social, and cultural factors. These findings support the idea that CAM users tend to exhibit more vaccine scepticism compared to non-users. However, preferring a holistic health model, individual autonomy, and a negative perception of biomedicine representatives emerged as more influential factors in understanding the connection between the prevalence of CAM utilization and vaccine scepticism. Taken together, these results suggest that CAM itself is not the direct predictor of vaccine scepticism. To build trust between the population and vaccines, this information can be used to develop targeted interventions aimed at strategies to improve healthcare services and develop the soft skills of medical doctors.

## 1. Introduction

Although scepticism toward vaccines has existed since the invention of vaccination, it has never been so widespread and intense worldwide. Given that such scepticism poses a serious threat to public health, its significant rise, defined as negative attitudes and beliefs about vaccination, represents one of the main issues of the healthcare sector. The outbreak of the COVID-19 pandemic has raised concerns to unprecedented levels. Researchers who conducted a systematic review on the determinants of vaccine scepticism from a global perspective found that it is a complex and context-specific phenomenon, varying across time, place, and vaccines (Larson et al., 2014). It seems highly unlikely that the current acceptance of vaccines will shift in the near term. Similarly, it appears implausible that biomedicine will succeed in stopping this ongoing trend. The COVID-19 pandemic not only increased these apprehensions but also led to an intensified exploration of the factors behind vaccine scepticism.

Furthermore, various follow-up studies indicate that the utilization of complementary and alternative medicine (CAM) in many countries worldwide has either shown an upward trend or has remained stable in recent years (Canizares et al., 2017; Esmail, 2017; Gunnarsdottir et al., 2020; MacLennan et al., 2006; Pokladnikova and Selke-Krulichova, 2018; Thomas et al., 2003). Not surprisingly, the usage of CAM has been recognized as a potential contributor to the emergence of scepticism (Fasce et al., 2023; Frawley et al., 2018) and some works have proved that antivaccination sentiment within CAM practitioners is significant (Wardle et al., 2016). This is not a recent development; rather, it has been a long-standing trend and CAM has consistently opposed the practice of immunization (Ernst, 2011). During the 19th and early 20th centuries, homeopaths were notably prominent among those staunchly opposed to vaccination (Tizard, 2023). A more recent impact can be identified in the examination of CAM websites, revealing a frequent occurrence of misleading positions on vaccines (Caulfield et al., 2017), and some evidence suggests that CAM practitioners tend to frame

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vaccination decisions in terms of individual and family choices rather than emphasising the broader public health benefits and consequences (Deml et al., 2019). Furthermore, studies concluded that people who support CAM tend to be more hesitant or unwilling to receive the COVID-19 vaccine (Soveri et al., 2021). However, it is worth noting that not all research supports a direct association between trust in CAM and vaccine scepticism. Some studies indicate that vaccine scepticism seems to result from a specific cultural and psychological perspective (Browne et al., 2015), and emphasize holistic health beliefs as predictors of both CAM and vaccination attitudes (Bryden et al., 2018). Others highlight highly individualized factors (Wardle et al., 2017), or distrust of conventional medicine as a primary predictor of vaccine scepticism and CAM use (Hornsey et al., 2020). In some research on the topic, participants suggested that willingness to use CAM did not directly have an impact on their decisions about vaccine rejections (Attwell et al., 2018). While CAM endorsement and vaccine scepticism may appear linked in some cases, these connections remain complex and multifaceted. After reviewing the relevant literature, it can be assumed that the relationship between CAM and vaccine scepticism is explained by other factors, rather than by the direct utilization of CAM methods.

To deepen our understanding of the origins of vaccine scepticism, especially its connection to CAM advocacy, a more extensive and thorough examination is required. The objective of this study is to explore the factors that explain the association between people visiting healthcare practitioners specializing in CAM and scepticism towards vaccination using a mixed-methods approach. To our knowledge, no investigations have been recorded in the literature based on a combination of surveys conducted in a national representative sample with qualitative interviews on the relationship between CAM and vaccine scepticism. This work is aiming to ascertain whether CAM usage directly correlates with vaccination scepticism, or whether antivaccination attitudes are caused by other social and cultural factors. The hypothesis that will be tested is that CAM use may be indirectly associated with vaccine scepticism. In addition to examining the link between visiting CAM practitioners and vaccine scepticism, our analysis also investigates the relationship between a holistic model of health, distrust in physicians, and negative attitudes and beliefs about vaccination.

## 2. Method

### 2.1. Study design

The study uses an explanatory sequential mixed-methods design. It unfolds in two separate, yet interconnected phases. The process starts with the gathering and examination of quantitative data. Subsequently, qualitative data collection and analysis ensue to elucidate or amplify the initial quantitative findings (Creswell and Clark, 2017). The subsequent qualitative phase is structured to build on the outcomes of the quantitative one. Integrating both methods offers the potential to mitigate some drawbacks of a single-method design and enhance the conclusions by enabling the corroboration of the findings. Moreover, the results can be structured with a quantitative section preceding a qualitative one, offering readers a clear separation of content. Quantitative data were collected through a representative survey, while qualitative insights were obtained through in-depth interviews, aimed at examining the perceptions of the vaccine. Given that the purpose of this research was to explore vaccine scepticism and pro-CAM attitudes, the quantitative investigation provided significant information on the sociodemographic characteristics of the respondents and the association between visiting particular CAM practitioners and vaccine scepticism among a national sample of adults in Slovakia.

For the purpose of this study, validated and reliable questionnaire scales were used. To enhance the validity of the content, a section of the questionnaire was pre-tested via an online survey. To enhance content validity, pretesting involved evaluating the questionnaire on a sample of 102 subjects. This was conducted through an online survey during June

and July 2019. The insights gained from the pre-test analysis significantly contributed to refining the questionnaire. Following the analysis of the data collected in the quantitative phase of the research, prerequisite criteria for the qualitative segment were established. In conjunction with the quantitative findings, an extensive review of the literature contributed to establishing a conceptual foundation for the interview. Accordingly, a preliminary semi-structured interview guide was formulated, enabling the posing of predetermined open-ended questions along with subsequent follow-up inquiries (Kallio et al., 2016). Following the internal testing of the preliminary interview guide in collaboration with other investigators within the research team and field testing with potential respondents, it became feasible to improve the quality of data collection. In the last step, a final version of the semi-structured interview guide was developed.

### 2.2. Data collection and sample

#### 2.2.1. Survey sampling and data collection

A representative survey was conducted among Slovakian residents aged 18 years and older. A sample of 1,000 citizens of the Slovak Republic participated in the survey. Data collection was carried out during April 2023, with randomly selected respondents from the online panel [www.populacia.sk](http://www.populacia.sk), by the IPSOS research agency, which used computer-assisted self-interviewing (CASI). This sample size was representative of the 18-year-old and older Slovakian adult population, estimated at 4.5 million citizens, with a confidence level of 95% and a confidence interval (CI) of 3%, determined by quota sampling. This was used to ensure representation of key sociodemographic characteristics, including gender, age, education, and place and region of residence. The most significant difference, 3.3%, was observed among respondents with an elementary school education (9.7% in the sample compared to 13% in the population). In all other categories, the discrepancy between the sample and the population was no more than 1%. In addition to the sociodemographic factors targeted by quota sampling, the survey collected additional information on marital status, monthly household income, religious affiliation, household size, and employment status. The total number of completed questionnaires was 1,030, while 30 questionnaires were discarded after a logical check. Questionnaires with an extremely short response time and those showing straight lines were excluded. The survey achieved a response rate of 60%.

Healthcare in Slovakia operates as a public system primarily funded through taxation. The healthcare sector includes both public and private providers and is governed by a compulsory social health insurance system. Three competing health insurance companies, one is public and two are private, negotiate contracts with healthcare providers based on quality, pricing, and service volumes (OECD, 2021). Slovakia's COVID-19 vaccination rate was among the lowest in Europe, with just over half of the population receiving two doses, significantly below the EU average of 73% (Áč, 2023).

To measure vaccine scepticism the survey used the Vaccine Conspiracy Beliefs Scale (VCBS), representing a frequently employed gauge of conspiracy beliefs regarding vaccines, as the main dependent variable. The original scale was developed by Shapiro et al. as a potentially useful measurement to further elucidate the correlates of vaccine hesitancy (Shapiro et al., 2016). According to the authors of the scale, the VCBS is anticipated to streamline future research aimed at understanding vaccine hesitancy and tackling the obstacles to vaccination across various vaccines. Furthermore, it has been validated by other studies (Caycho-Rodríguez et al., 2022; Kowalska-Duplaga and Duplaga, 2023; Ock et al., 2022; Pisanti and Soraci, 2023). To create the Slovak iteration of the seven-item VCBS, we translated the initial English version of the scale into Slovak. We aimed to utilise a language suitable for the cultural context of Slovakia. Once the Slovak version of the scale was finalised, a backward translation was created, and subsequently the back-translated version was compared with the original English scale. In general, no significant disparities were identified between the original

and the back-translated versions. The VCBS initially comprised seven items, and the participants indicated their degree of agreement or disagreement with each statement on a seven-point scale, ranging from “strongly agree” (1) to “strongly disagree” (7) (Table 1). During the analysis, we reversed the scale so that lower values indicate disagreement with the statement and higher values represent agreement. The reliability coefficient (Cronbach’s  $\alpha = 0.966$ ) demonstrates the internal consistency of the VCBS scale (Table 2). Therefore, we calculated the overall scale score and rescaled it from 0 to 1 to facilitate later interpretation of the linear regression coefficients (Table 2).

One of our key independent variables in the analysis is visiting CAM practitioners. In the survey, respondents were not asked to recall a specific timeframe; rather, they were asked to specify the frequency of their visits to particular CAM specialists with the following question: How often do you visit or have you visited any healthcare providers?

**Table 1**

Descriptive statistics of the Vaccine Conspiracy Belief Scale (VCBS), holistic model of health, distrust in physicians.

Descriptive Statistics				
VCBS (Vaccine Conspiracy Beliefs Scale)	Answers	Min. (Strongly agree)	Max. (Strongly disagree)	Mean
V1. Vaccine safety data is often fabricated.	932	1	7	3,91
V2. Immunizing children is harmful, and this fact is covered up.	916	1	7	4,47
V3. Pharmaceutical companies cover up the dangers of vaccines.	937	1	7	3,59
V4. People are deceived about vaccine efficacy.	936	1	7	3,80
V5. Vaccine efficacy data is often fabricated.	932	1	7	4,05
V6. People are deceived about vaccine safety.	936	1	7	3,79
V7. The government is trying to cover up the link between vaccines and autism.	863	1	7	4,23
<b>Holistic model of health</b>				
H1. Physical and mental health are maintained by an underlying energy or vital force.	926	1	5	2,43
H2. Health and disease are a reflection of balance between positive life-enhancing forces and negative destructive forces	924	1	5	2,47
H3. The body is essentially self-healing and the task of a healthcare provider is to assist in the healing process	976	1	5	2,87
H4. A patient’s symptoms should be regarded as a manifestation of a general imbalance or dysfunction affecting the whole body	921	1	5	2,31
<b>Distrust in physicians</b>				
T1. All things considered, doctors can be trusted.	980	1	5	2,48
T2. Doctors discuss all treatment options with their patients.	977	1	5	2,99
T3. The medical skills of doctors are not as good as they should be. <sup>a</sup>	974	1	5	2,68
T4. Doctors care more about their earnings than about their patients. <sup>b</sup>	973	1	5	2,56

a,b Items T3 and T4 were reversely coded during analysis so that higher values indicated a lack of trust.

**Table 2**

Sociodemographic characteristics of the sample with selected variables included in the models in the analysis.

Variable	N	%	Mean	Min	Max
<b>Gender</b>	1000	100	0,53	0 (male)	1 (female)
Male (0)	477	48			
Female (1)	523	52			
<b>Education</b>	1000	100	6	1 (no education)	11 (postgraduate)
No formal education and elementary education (1–3)	97	10			
Secondary vocational qualification, no diploma (4)	247	24			
Vocational education with diploma, upper secondary education, post-secondary education, short cycle tertiary education (5–8)	416	42			
Tertiary education from bachelor’s degree to PhD. (9–11)	240	24			
<b>Household income netto</b>	1000	100	0,8	0 (low income)	2 (high income)
until 1000 € - low (0)	376	38			
1001€ - 2000 € - middle (1)	440	44			
2001€ and more - high (2)	184	18			
<b>CAM user</b>	1000	100	0,44	0 (non user)	1 (regular user)
Non regular user (0)	666	55			
Regular user (1)	444	44			
<b>Vaccine Conspiracy Beliefs Scale<sup>a</sup></b>	810		0,5	0 (minimum belief)	1 (high belief)
<b>Holistic model of health<sup>b</sup></b>	863		14	4 (low)	20 (high)
<b>Distrust in physicians<sup>c</sup></b>	949		12	4 (high trust)	20 (low trust)

<sup>a</sup> Cronbach’s  $\alpha = 0.966$ .

<sup>b</sup> Cronbach’s  $\alpha = 0.804$ .

<sup>c</sup> Cronbach’s  $\alpha = 0.707$ .

Answers range from regularly, at least once a year (1), to several times in life (2), once, (3), or never (4). Taking into account the cultural and historical dimensions of alternative healthcare practices in the region, the survey collected data on the following CAM practitioners and specialists: folk healers/herbalists, homeopaths, osteopaths/chiropractors, acupuncturists, spiritual healers/psychics, and health advisors/nutritionists. The survey in this part focused solely on non-physician CAM practitioners. An additional question examined whether a medical doctor provided or offered any of the listed forms of CAM health care; however, this was not included in the analysis. The quantitative research results show that the percentage of visits to CAM practitioners ranged from 10.9% to 20.8%. The highest preference was observed for the health advisor/nutritionist, with a total of 163 (20.8%) respondents reporting regular or multiple visits to this CAM healthcare practitioner. Following this, folk healers/herbalists were the second most preferred option, with 166 (19.7%) respondents. Osteopaths/chiropractors were next at 131 (17.0%), then homeopaths at 111 (13.8%), acupuncturists at 102 (13.0%), and spiritual healers/psychics again at 83 (10.9%). For further analysis, we converted all responses into a dichotomous variable,

where a value of 1 indicates regular visits to one or more CAM practitioners, and a value of 0 represents the opposite. Based on that, 44% of the respondents regularly used one or more CAM therapies (Table 2).

The survey assessed the preference for a holistic model of health using a five-point Likert scale ranging from 1 (strongly agree) to 5 (strongly disagree). The items for the next independent variable were selected and modified from the Complementary, Alternative and Conventional Medicine Attitude Scale (CACMAS), which was created to identify how opinions of healthcare recipients influence the use of CAM (Betthausen et al., 2014; Elif et al., 2018; McFadden et al., 2010). To evaluate individuals' integration of various dimensions of health of individuals in the context of CAM practices, the study used only the holistic balance subscale, which has proven reliable (McFadden et al., 2010). The holistic balance subscale encompasses the following questions: "H1. Physical and mental health are maintained by an underlying energy or vital force," "H2. Health and disease are a reflection of balance between positive life-enhancing forces and negative destructive forces," "H3. The body is essentially self-healing and the task of a healthcare provider is to assist in the healing process," and "H4. A patient's symptoms should be regarded as a manifestation of a general imbalance or dysfunction affecting the whole body" (Table 1). Similarly, as in the case of the VCBS, the scales were reversed during the analysis so that lower values indicate disagreement with the statement and higher values represent agreement. The result of the reliability analysis (Cronbach's  $\alpha = 0.804$ ) confirmed the internal consistency of the scale; thus, we calculated the summary scale score. The final scale score ranged from 4 to 20, with a higher value representing agreement with the holistic approach (Table 2).

To uncover the effect of distrust in physicians on vaccination scepticism, the survey used a trust scale consisting of four items that addressed key aspects of this topic. The scale was adapted from the International Social Survey Programme (ISSP) healthcare module (Souček and Hofreiter, 2022). The first aspect of the scale measures general trust ("T1. All things considered, doctors can be trusted"); the second addresses honesty ("T2. Doctors discuss all treatment options with their patients"); the third considers competence ("T3. The medical skills of doctors are not as good as they should be"); and the final one evaluates fidelity ("T4. Doctors care more about their earnings than about their patients") (Table 1). To capture low trust, the scale of items T3 and T4 were negatively recoded so that a high value indicated a high level of distrust in physicians. The Cronbach's  $\alpha$  was calculated (Cronbach's  $\alpha = 0.707$ ). Following this, the scale score was calculated with a minimum score of 4 and a maximum score of 20 where a higher score indicates higher distrust in physicians (Table 2). Additionally, an exploratory factor analysis was conducted. Regarding items concerning distrust in physicians, the analysis revealed a factor, with the loading factors of the four components ranging from 0.660 to 0.773. The factor score was correlated with a manually constructed index of distrust ( $r = 0.99$ ,  $p < 0.001$ ).

To measure the level of education, the survey used a scale with 11 grades. Values 1 to 3 represent no formal education (1), unfinished elementary education (2), and finished elementary education (3). Vocational high school with no diploma is represented by value (4). Values of 5–8 indicate vocational high school with diploma (5), upper secondary education (6), non-tertiary education (7), and short-cycle tertiary education (8). Finally, values 9 to 11 cover various types of tertiary education, ranging from a bachelor's degree (9), master's degree (10) to a completed doctoral or equivalent degree (11) (Table 2).

### 2.2.2. Qualitative sampling and data collection

In the next phase of the research, semi-structured interviews were conducted with CAM users regarding their perception of different health-related issues, including vaccination. First, different CAM practitioners were contacted by letters requesting assistance in identifying and connecting with CAM users interested in participating in the investigation. Additionally, social media platforms were utilized to

recruit CAM users. Among those who showed interest, we purposely selected individuals to ensure a diverse sample encompassing a range of age groups, residential locations, and sex. Throughout the course of the investigation, a total of 20 respondents were interviewed, each providing valuable insights and perspectives relevant to the study objectives and inquiries (Patton, 2014). All participants were required to have experience visiting a CAM practitioner in the last five years. We recognize that memory fades in quality over time, potentially affecting detailed recall. To address this concern, we prioritize recent visits in participant selection whenever possible. The qualitative research tool used for this research comprised an interview guide customized for conducting in-depth interviews. The guide questions were created to explore the perspectives on vaccination and CAM utilization. The vaccination questions were chosen by the authors of the present paper after reviewing scientific literature that included inquiries about attitudes, beliefs, and behaviours regarding vaccination scepticism.

Once we identified the topics that needed to be addressed, we drafted an interview guide containing all the questions categorized into four distinct areas: a) sociodemographic data on respondents, b) broad inquiries concerning health and medicine, c) the utilization of CAM, and d) perspectives on vaccination. In the final segment of the interviews, data were collected on sources of information about vaccinations and perceptions of their advantages and disadvantages, as well as their safety and efficacy, vaccine-induced immunity, childhood immunization, and the management of COVID-19 vaccinations in Slovakia. The structure of the questionnaire was intentionally designed to be adaptable to individuals, irrespective of whether they had children or not. Between December 2023 and March 2024, three authors of this study conducted semi-structured, face-to-face and online interviews at different locations in Slovakia, each lasting approximately 1 h. The participants voluntarily participated in the research, provided their consent to participate, and did not receive any cash incentive after interview completion. The included participants formed a diverse group. However, most of our respondents were women between the age of 25 and 60 years. Almost half of the respondents had completed a university degree, and most of the CAM practitioners visited were homeopaths, followed by acupuncturists. However, over half of the respondents used more than one CAM method.

## 2.3. Data analysis

### 2.3.1. Quantitative analysis

In accordance with the explanatory sequential mixed-methods design, we conducted separate analyses on both survey and qualitative data, subsequently integrating these datasets (Bazeley, 2009). To analyse the survey data and test the hypothesis, we created three linear regression models (Table 3). The first model examined the relationship between visiting a CAM practitioner and agreeing with antivaccination statements. The second model included a variable measuring inclination towards holistic health approaches. Finally, the third model examined the effect of distrust in physicians as an additional explanatory variable. All models were controlled for the following socio-demographic variables: age, gender, education, and monthly household income (Table 2). The linear regression analysis was carried out using R software.

### 2.3.2. Qualitative analysis

All interviews were recorded and transcribed verbatim. Subsequently, they were imported into NVivo 11 to facilitate analysis. Personal identification details, such as the names of participants, were anonymized. The following analysis of interviews was conducted using an inductive thematic analysis approach. Thematic analysis is a methodology utilized to identify, analyse, and report patterns or themes within data. This analysis consisted of six steps: 1. familiarizing yourself with the data, 2. generating initial codes, 3. searching for themes, 4. reviewing themes, 5. defining and naming themes, and 6. producing a report (Braun and Clarke, 2006). Following expansion or

**Table 3**  
Variables explaining vaccine scepticism: results of linear regression models.

Predictors	Model 1 <sup>a</sup>				Model 2 <sup>b</sup>				Model 3 <sup>c</sup>						
	Estimates	std. Error	CI	t-statistic	p	Estimates	std. Error	CI	t-statistic	p	Estimates	std. Error	CI	t-statistic	p
(Intercept)	0.538	0.047	0.447–0.630	11.530	<0.001	0.065	0.060	-0.053–0.184	1.083	0.279	-0.304	0.067	-0.436–0.172	-4.525	<0.001
Gender [Female]	0.048	0.022	0.004–0.092	2.154	0.032	0.036	0.021	-0.006–0.078	1.672	0.095	0.022	0.020	-0.018–0.062	1.086	0.278
Age [Years]	0.002	0.001	0.001–0.004	3.221	0.001	0.001	0.001	-0.000–0.003	1.746	0.081	0.001	0.001	-0.000–0.002	1.738	0.083
Education [1 to 11]	-0.026	0.005	-0.036–0.017	-5.419	<0.001	-0.019	0.005	-0.028–0.010	-4.199	<0.001	-0.018	0.004	-0.027–0.010	-4.282	<0.001
Income [Middle]	-0.053	0.025	-0.102–0.004	-2.107	0.035	-0.056	0.024	-0.103–0.009	-2.344	0.019	-0.031	0.023	-0.076–0.013	-1.384	0.167
Income [High]	-0.085	0.033	-0.149–0.021	-2.588	0.010	-0.089	0.031	-0.151–0.028	-2.856	0.004	-0.059	0.029	-0.117–0.001	-2.001	0.046
CAM user [Regular]	0.066	0.022	0.022–0.109	2.970	0.003	0.007	0.022	-0.035–0.049	0.317	0.751	-0.010	0.020	-0.050–0.030	-0.502	0.616
Holistic model of health [scale]						0.038	0.003	0.032–0.044	11.920	<0.001	0.034	0.003	0.028–0.040	11.272	<0.001
Distrust in physicians [scale]											0.044	0.004	0.036–0.052	10.668	<0.001
Observations	810					719					709				
R <sup>2</sup> /R <sup>2</sup> adjusted	0.084/0.077					0.240/0.233					0.340/0.333				
AIC	432.883					229.468					127.809				
log-Likelihood	-208.442					-105.734					-53.904				

<sup>a</sup> Model with CAM use as main independent variable.

<sup>b</sup> Model with CAM use and holistic model of health as main independent variables.

<sup>c</sup> Full model: CAM use, holistic model of health, distrust in physicians as main independent variables.

complementary mixed-methods research designs, quantitative and qualitative data analyses were conducted independently, with integration taking place during the discussion of results and drawing of conclusions (Bazeley, 2009).

### 3. Results

#### 3.1. Quantitative results

A representative national survey of 1,000 Slovakian residents aged 18 years and older was conducted in order to investigate vaccine scepticism among CAM users. This sample, representing the 4.5 million adults with a 95% confidence level of 95% and a 3% confidence interval, used quota sampling to ensure demographic representation by gender, age, nationality, education, and region.

Table 3 presents the results of the three linear models. Regarding socio-demographic factors, the regression results shown in Table 3 and Model 1 indicate that women are slightly more inclined towards a vaccine scepticism (CI 0.004–0.092,  $p = 0.032$ ). Similarly, older age has a comparable effect (CI 0.001–0.004,  $p = 0.001$ ). In contrast, higher education (CI -0.036 to -0.017,  $p < 0.001$ ) and higher income are associated with a lower likelihood of vaccination scepticism.

##### 3.1.1. The association between CAM use and vaccine scepticism

Our analysis confirms that people who reported visiting any type of CAM healthcare practitioner were more inclined to vaccine scepticism (95% CI: 0.022–0.109,  $p = 0.003$ ). It has been proven that people who regularly visit a CAM practitioner are more open to vaccine scepticism than individuals who report visiting a CAM practitioner either once in their lifetime or never. This evidence supports the generally accepted view that a higher prevalence of visits to CAM practitioners will significantly influence vaccine scepticism. However, the coefficient of determination shows that Model 1 explains 7% of the variability in the dependent variable ( $R^2_{\text{adjusted}} = 0.077$ ).

##### 3.1.2. A preference for a holistic view and a lack of trust in medical doctors are more significant factors in vaccine scepticism

Furthermore, the findings of Model 2 indicate that having a preference for a holistic health model (95% CI: 0.032–0.044,  $p < 0.001$ ) serves as a more significant predictor of vaccine scepticism than regularly visiting CAM practitioners. This implies that individuals who embrace a holistic approach to health, which often focuses on the interconnectedness of the mind, body, and spirit, are more likely to express vaccine scepticism. Additionally, in Model 2, only education and household income remained as the most significant explanatory variables among the selected demographic variables. The inclusion of the holistic health variable significantly improved the coefficient of determination. Model 2 now explains 23% of the variability in the dependent variable ( $R^2_{\text{adjusted}} = 0.233$ ). Although holistic balance corresponds to the use of CAM, it appears as a distinctive factor. The results in Model 3 revealed that holistic balance (CI 95% 0.028–0.040,  $p < 0.001$ ) together with distrust of medical doctors (CI 95% 0.036–0.052,  $p < 0.001$ ) are the most robust predictors of vaccine scepticism, and Model 3 covers 33% of variability ( $R^2_{\text{adjusted}} = 0.333$ ). Education and high household income remained a significant explanatory variable in this case as well. This examination showed that the relationship between general dissatisfaction with doctors, as well as doctor communication style, self-interest, and medical skills, and vaccine scepticism is more significant than the usage of CAM in itself (Fig. 1). These results provide further support for the hypothesis that vaccine scepticism is caused by factors other than engagement with CAM practitioners.

#### 3.2. Qualitative results

Although the results of the qualitative investigation mirror the quantitative data, the following analysis of the interviews provides us

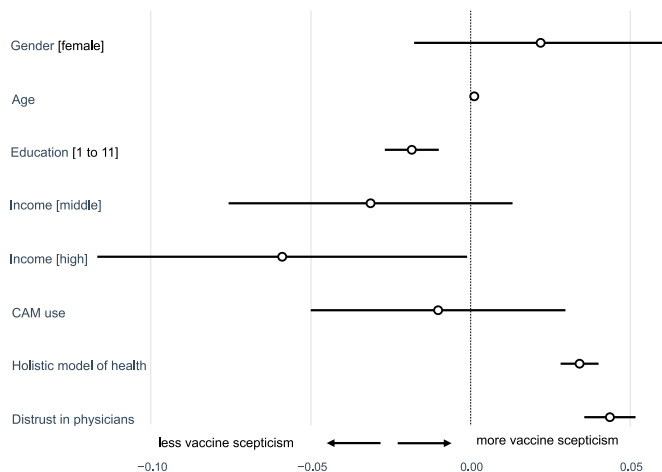


Fig. 1. Selected predictors of vaccine scepticism.

with a deeper and more holistic understanding of vaccine scepticism among CAM users. After a careful review of the transcripts, our thematic analysis refined two major themes corresponding with the selected topic (Fig. 2).

3.2.1. Individual responsibility for one's own health and adopting a holistic philosophy

After evaluating the topic, analysis revealed that autonomy and personal freedom represent a significant topic among individuals with experience in CAM. By valuing personal experiences and trusting in their own decision-making abilities, some of the respondents highlighted themselves as authorities on their own health. The feeling of self-reliance gives them confidence in rejecting conventional medical advice and tailoring treatments to their preferences. Consequently, certain CAM therapies corresponding to their beliefs and values were evaluated as more helpful than biomedicine, as one of the participants stated:

“I am satisfied because I do everything to feel good and healthy so that I don't need doctors. Actually, that is why I try to do my best because I have some experience from the past. Unfortunately, that experience forced me to pay more attention to myself, focus on my health, and search for alternative treatments.” (Female, 30s)

Most of our respondents did not reject the benefits of vaccines;

rather, they simply expressed the individual opinion that vaccines are not suitable for them. The belief in the individual's right to control their private life and healthcare care management supports a holistic approach to life. Therefore, several respondents suggested that they regularly take care of their health in a way that corresponds to their philosophical and ideological viewpoints. A statement from an interview with one respondent reflects the view that general balance affects the whole body and mind.

“Well, first of all, everything has to be in harmony, which means being balanced in terms of nutrition, movement, and stress factors. Relationships are also important; they support one's own experience or feeling of health. (Female, 40s)”

The adoption of a holistic philosophy plays one of the key roles in the statements of our respondents. Each respondent displayed an individual understanding of multidimensional aspects of health, often involving the interconnectivity of physical, emotional, and spiritual factors. This holistic perspective also includes, but is not limited to, the proper use of foods, herbs, or physical activity. Moreover, they view the decision to accept or refuse vaccines as an integral part of their autonomy to make decisions regarding their health situation and behaviour. Because they are convinced of their own individual superior knowledge, vaccines are considered a profound example of biomedical intervention that contradicts a holistic wellness-orientated lifestyle.

3.2.2. Critique of health authorities and healthcare situation in the country

Not surprisingly, one of the main findings related to antivaccination attitudes was the tendency to criticize health authorities and representatives of expert systems. This criticism often focused on perceived shortcomings in communication, transparency, and decision-making processes. Many participants expressed distrust towards health authorities and medical experts, questioning their motives and credibility, as well as the reliability of the information provided. Some individuals felt that health authorities and expert systems (Attwell et al., 2017) did not adequately address their concerns or provide sufficient evidence to support their recommendations.

“I don't trust doctors, not as individuals, because not every doctor can apply medical knowledge in practice or has sufficient capacity of his own. (Female, 30s)”

In response to a direct question regarding how they consider modern advancements and state-of-the-art medicine in general, almost all the participants acknowledged that biomedicine is a powerful method for solving different and complicated health concerns. Most of these issues

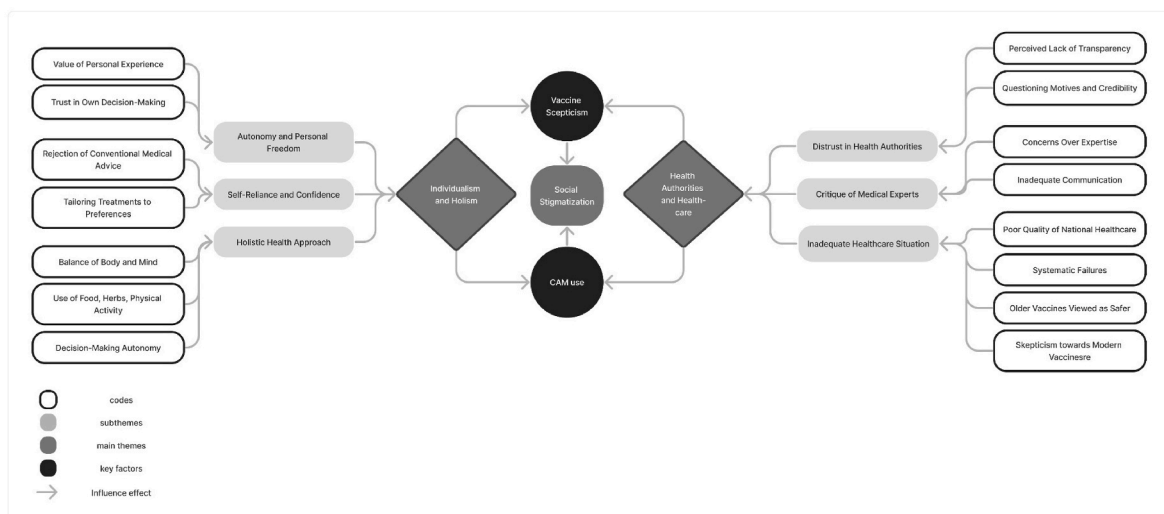


Fig. 2. Explanatory framework for the qualitative analysis of the association between CAM use and vaccine scepticism.

related to biomedicine were linked to the inadequate healthcare situation in the country, with the respondents expressing opinions of the poor quality of the national healthcare service and the systematic failure experienced in direct contact with health professionals.

“I perceive that the level of education at universities is on a downward trend. Well, uh, this is partly the answer. For God’s sake, as if in a few years a person should be afraid to go to that doctor, because he simply will not have a guarantee that he will be competent enough to solve, diagnose, and treat if this trend continues downward. (Male 50s)”

In the case of vaccines, we noted different viewpoints. Although, on the one hand, the respondents expressed the sentiment that older vaccines had undergone more extensive tests and were safer and more effective, on the other, and despite the belief in the high effectiveness of biomedicine, modern vaccines, especially against COVID-19, were associated with a decrease in quality and reliability. This was often attributed to factors such as rushed development, inadequate testing, or the inclusion of unnecessary additives.

“Only now, this period has raised those doubts because I have never seen anything developed so quickly before. The process [of developing the COVID-19 vaccine] was rushed, and I actually told myself that I would not participate in something like that. (Female 60s)”

Scepticism towards authority figures and biomedicine representatives and opinions on the poor quality of the national healthcare service are not just shaping antivaccination attitudes, but also determining the prevalence of CAM use.

“I realized that they [doctors] were just guessing, and that made me feel quite sick. I realized that I probably cannot continue to live like this, constantly waiting for them to succeed, so I started attending a homeopathic course. (Female 50s)”

Due to a preference for CAM and their antivaccine attitudes, the respondents very frequently mentioned feeling socially stigmatized in society. This may result in a deepening of polarization within society based on ideological preferences.

#### 4. Discussion

To our knowledge, this study is the first to investigate the relationship between the use of CAM and vaccination scepticism using a mixed-methods approach. Given that mixed-methods research on pro-CAM and antivaccination is very limited, the most serious advantage of this investigation is the expansion of our understanding of the complex relationship between visiting CAM practitioners and scepticism towards vaccination. The results provide insight into the factors that contribute to vaccine scepticism and the complexities related to individual beliefs and attitudes towards health-related issues.

In the first section, the present investigation was designed to determine the effect of sociodemographic influences on antivaccine attitudes. The analyses carried out suggest that women, individuals with lower levels of education and income, and older people are more likely to express scepticism towards vaccines. This result clearly demonstrates that socioeconomic status, age, and gender play a decisive role in shaping negative attitudes towards vaccination. Some previous research findings on vaccine scepticism have been inconsistent in terms of this conclusion. One analysis showed that vaccine hesitancy was higher among men, younger respondents, those without children, individuals with lower levels of education, and residents of smaller towns (Hornsey et al., 2020). In Poland, strong antivaccination beliefs were linked to high religiosity and residing in a town with a medium-sized or small population (Włodarska et al., 2021). A study conducted on Canadian parents, which evaluated the reliability of the VCBS, found that there were no gender differences relating to belief in vaccine conspiracies (Shapiro et al., 2016).

The most important outcome was the identification of a link between the search for unconventional healthcare through CAM practitioners and a higher likelihood of vaccine scepticism. The study confirmed previous findings that CAM users tend to exhibit more vaccine scepticism compared to non-users of CAM (Fong and Fong, 2002; Wilson et al., 2005; Zuzak et al., 2008). This suggests a deep-rooted scepticism towards conventional medical practices among certain segments of the population. Vaccine scepticism and negative attitudes towards vaccines were also confirmed during several interviews with respondents. Most of the participants in our investigation were quite unified in expressing doubts and concerns about the risks associated with vaccination during the interviews. However, a deeper analysis revealed that the doubts about the safety and effectiveness of vaccination are mostly related to COVID-19 vaccines, but not immunization in general. Furthermore, data obtained during the qualitative phase of the research suggest that it would be incorrect to assume that CAM directly functions as a substitute for vaccination. Despite the faith often expressed by the respondents in different forms of CAM therapies, they recognize the unique role of vaccines in disease prevention. In particular, in cases of vaccines for children or travel, where the risks of preventable diseases are substantial, some individuals cited historical successes of vaccines, such as those for polio or smallpox, as evidence of their efficacy. Taken together, the relationship between pro-CAM attitudes and vaccine scepticism is much more complex and multidimensional, as indicated by various research findings in this area (Attwell et al., 2018). These results suggest that the interaction between CAM and vaccination is complex, multifaceted, and often highly personalized (Browne et al., 2015; Bryden et al., 2018; Hornsey et al., 2020; Wardle et al., 2016).

Based on our investigation, a preference for a holistic health model emerged as a more influential factor in understanding the connection between the prevalence of CAM use and vaccine scepticism. Analysis of the survey showed that individuals subscribing to this worldview are more inclined to vaccine scepticism. Simultaneously, the qualitative part of the investigation suggested that people turn to CAM as an alternative to biomedicine, which they see as indifferent to their health concerns. From an examination of the data, it seems that a perspective that addresses the physical, emotional, and mental parts of being is linked to a higher chance of viewing vaccines skeptically. Rather than interpreting the association between a prevalence of CAM usage and vaccine scepticism as predicting a relationship, it should be understood as an outcome of a specific viewpoint integrating various components of health. This result is consistent with other studies that concluded that vaccination scepticism reflects part of a broader health worldview and attitudinal mindset (Browne et al., 2015; Bryden et al., 2018). At the same time, our respondents often highlighted the importance of individual responsibility for their own health situation. Therefore, it is appropriate to suggest that the relationship between the holistic perspective and individual autonomy is cooperative. The respondents tended to believe that their own and often holistic understanding of health issues is more accurate or relevant than the advice they receive from medical doctors or other representatives of the expert system. They described that they conducted their own research on various medical topics, including vaccines, and their level of trust in official sources on COVID-19 vaccines was very low. The participants confidently asserted their right to make decisions about CAM and vaccines based on their personal freedom. They believe that they have the right to choose their own healthcare paths without interference from external authorities, such as government mandates or medical professionals.

The most practically relevant result is that vaccine scepticism is influenced by a lack of trust in physicians. This finding is partially in agreement with other findings which showed that nonvaccinating parents share a perception of vaccination expert systems as corrupted by profit motives (Attwell et al., 2017), or that the main reason why people refuse vaccines is a mistrust of conventional treatments and institutions (Hornsey et al., 2020; Jamison et al., 2019; Rozbroj et al., 2019). Our participants openly expressed scepticism about the competence,

transparency, and motives of medical doctors. Several negative perceptions of biomedicine were attributed to previous non-satisfying experiences with particular healthcare providers, who seemed to prioritize other aspects than those expected by our respondents. This negative perception of biomedical representatives not only has the potential to increase vaccine scepticism, but also influences broader healthcare choices. Therefore, many participants turn to CAM, viewing it as a more trustworthy and personalized approach to health. While negative experiences with health authorities persisted as a topic in the interviews, critique of health authorities is associated with disappointment in the national healthcare situation and the level of healthcare provision. The respondents criticized the lack of access to quality healthcare services, in addition to the overloaded system, impersonal approach of doctors, and long waiting times for examination. Based on personal experiences and encounters with medical professionals, the participants frequently expressed increased scepticism towards COVID-19 vaccines. Consequently, they repeated their concerns about the rushed development and decreasing quality of modern vaccines. Taken together, the results suggest that vaccine scepticism and willingness to use CAM treatments instead of biomedicine reflect a broader distrust of medical professionals in the context of a national health service.

## 5. Limitations

Several important limitations of this study need to be considered. One of the main restrictions is related to the methodology used in the investigation. For our research, an explanatory sequential mixed-methods design was employed. Although this approach offers the benefit of exploring selected phenomena from multiple perspectives, the sequential nature of the design may restrict the depth of exploration in the qualitative phase, especially given that it is structured to build upon the outcomes of the quantitative phase. It reduces the focus on qualitative insights that could be gained independently. Another issue is related to the methods utilized for data collection. One major drawback of the self-reported collection technique conducted without direct assistance from the interviewer is that there might be limited accuracy in these data. Additionally, it could be expected that individuals who were willing to participate in interviews have stronger opinions on the topic, and the results might be subject to bias. Finally, the investigation focused on vaccine scepticism and pro-CAM attitudes among a national sample of adults in Slovakia. It is therefore hard to generalize the findings to other countries with differing cultural contexts.

## 6. Conclusion

The results of this study indicate that people who regularly visit CAM practitioners are more likely to be vaccine sceptics and have a higher tendency to vaccine scepticism. This is in line with other findings, suggesting that trust in CAM is one of the factors affecting vaccine scepticism. This research conducted among people visiting healthcare professionals specializing in CAM extends our knowledge for a deeper understanding of the other aspects behind this relationship. This implies that CAM itself is not the direct predictor of vaccine scepticism; rather, an individualized holistic worldview and a lack of trust in medical professionals play a much more significant role in antivaccine attitudes. In addition, this investigation has shown that instead of expressing general dissatisfaction with biomedicine, the respondents displayed frustration with the individuals representing conventional medicine and the quality of the healthcare services provided. Notably, in the interviews, the participants indicated that their use of CAM did not cause their vaccine scepticism, although they considered alternative healthcare options to be more valuable in dealing with several health issues. Instead of critiquing CAM and vaccine scepticism, which contribute to the further polarization of society, a key policy priority regarding building trust in vaccines should therefore focus on strategies to improve healthcare services and develop medical doctors' soft skills. A future

follow-up evaluation investigating vaccine scepticism among complementary and alternative medicine users would be very useful to address vaccine scepticism more deeply.

## CRediT authorship contribution statement

**Ivan Souček:** Writing – review & editing, Writing – original draft, Visualization, Supervision, Software, Resources, Methodology, Investigation, Formal analysis, Conceptualization. **Roman Hofreiter:** Writing – review & editing, Visualization, Software, Methodology, Investigation, Formal analysis. **Kamila Koza Beňová:** Investigation.

## Disclaimers

The views expressed in this submitted article are solely those of the author and do not represent an official position or endorsement by the institution or funder.

## Statement of ethics

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional research committee (Research Ethics Committee of Matej Bel University, reference 363/2023).

## Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors used OpenAI's GPT-4 model in order to improve readability and language. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

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## Declaration of competing interest

The authors declared no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

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## Data availability

Data will be made available on request.

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