



# Thinking magically or thinking scientifically: Cognitive and belief predictors of complementary and alternative medicine use in women with and without cancer diagnosis

Vladimíra Čavojová<sup>1</sup> · Zuzana Kaššaiová<sup>1</sup> · Jakub Šrol<sup>1</sup> · Eva Ballová Mikušková<sup>1</sup>

Accepted: 20 June 2023 / Published online: 31 July 2023  
© The Author(s) 2023

## Abstract

This paper examines the predictors of belief in the efficacy of complementary and alternative medicine (CAM) and its use, including cognitive factors (scientific reasoning, health literacy, locus of control), beliefs (holistic and magical health beliefs pseudoscientific beliefs, and trust in doctors), sociodemographic factors, and cancer diagnosis. The sample consisted of 177 women (41.8% with a cancer diagnosis;  $M_{\text{age}} = 38.81$ ,  $SD = 11.43$ ). Beliefs in efficacy and use of CAM were the main outcome measures; preference for CAM over conventional treatment was a secondary outcome measure. Pseudoscientific/magical beliefs and external locus of control were the strongest predictors of positive attitudes toward CAM and its higher use, as well as preference for CAM instead of conventional treatment. Cancer diagnosis predicted only higher CAM use, but not more positive attitudes to CAM, nor preference for CAM instead of conventional medicine. Women with cancer had significantly more pseudoscientific beliefs than women without cancer and had a higher external locus of control over their health. Women with pseudoscientific/magical beliefs favor CAM treatments independently of the cancer diagnosis, although the diagnosis of cancer also contributes to their higher use of CAM. In other words, it seems improbable that women would turn toward CAM treatment only after being diagnosed with cancer.

**Keywords** Complementary and alternative medicine (CAM) · Scientific reasoning · Magical thinking · Pseudoscientific beliefs · Health Literacy · Cancer

Why do people prefer alternative medicine to conventional treatment, even though it has been repeatedly shown in large and controlled studies it does not have the same effectiveness and may even be harmful? The reasons for resorting to CAM are usually to strengthen the body's defenses, relieve symptoms and side effects of treatment, improve emotional well-being, and desire for more control. Cancer patients appear to be a particularly vulnerable group, as a diagnosis of cancer is frightening and can make people feel like they are losing control, which is associated with higher susceptibility to various unfounded beliefs, including magical thinking and pseudoscientific remedies (Šrol et al., 2021; Van Prooijen, 2019).

Beliefs in the efficacy of complementary and alternative medicine (CAM) are a subset of pseudoscientific beliefs, as CAM is usually defined as anything but conventional

medicine (Wardwell, 1994). CAM is also often used as an umbrella term for a heterogeneous group of practices with varying degrees of efficacy and pseudoscientific basis. The boundaries between conventional medicine and CAM practices are sometimes flexible and permeable (Kaptchuk & Eisenberg, 2001), especially as new evidence (or lack thereof) about treatments is found. Without sufficient scientific understanding, it may be difficult for lay people to judge the quality of evidence in favor of one treatment over the other. However, the biggest problem with CAM is not that people will end up with ineffective treatment, but that the belief in the efficacy of CAM over conventional medicine is associated with other negative health behaviors and outcomes, such as vaccination skepticism (Bryden et al., 2018), and postponing seeking medical help (Latte-Naor et al., 2018), which is particularly detrimental to cancer patients. For example, Johnson et al. (2018) found that patients who initially chose alternative medicine over conventional therapies for treatment of cancers with the highest 5-year relative survival rates (such as breast cancer, colorectal cancer, and lung cancer) had a significantly increased risk of death.

✉ Vladimíra Čavojová  
vladimira.cavojova@savba.sk

<sup>1</sup> Institute of Experimental Psychology, Centre of Social and Psychological Sciences, Slovak Academy of Sciences, Dúbravská Cesta 9, 841 04 Bratislava, Slovakia

The main objective of this article, therefore, is to examine whether belief in the efficacy of CAM and preference for CAM over conventional treatments are best predicted by scientific reasoning or magical thinking and by feelings of control over one's life (i.e., internal locus of control). We will examine these predictors in samples of women with and without a cancer diagnosis to determine whether the threat of cancer alters the relative power of these predictors.

## Who is most vulnerable to CAM?

Most medical research focused on identifying which group of people is most prone to using CAM and it was found that being female (Boutin et al., 2000; MacLennan et al., 2002), middle-aged (Astin, 1998; Bishop & Lewith, 2010), having a higher income (MacLennan et al., 2002; Thomas & Coleman, 2004), and more education (Astin, 1998; MacLennan et al., 2002; McFarland et al., 2002), were associated with increased CAM use. Several studies examined differences between patients with cancer and the general population in their CAM use and found that cancer patients and cancer survivors have a greater tendency to utilize CAM than individuals in the general population (Buckner et al., 2018; Fox et al., 2013; Matsuno et al., 2012). Similarly, as for the general population, CAM use among women with cancer was associated with higher education level (Conrady & Bonney, 2017), higher income, full-time job (Rakovitch et al., 2005), but with younger age (Latte-Naor et al., 2018; Pedersen et al., 2009).

In general, women use CAM more often than men, are more likely to have ever used CAM (51.5% versus 44.3%), and among CAM users, a higher percentage of women used CAM over the past 12 months than men (53.5% vs. 42.7% in Alwhaibi & Sambamoorthi, 2016 and 42% and 24%, in Kristoffersen et al., 2015). Gender differences in CAM use seem to be consistent among different cultures: middle to upper-class women use CAM more often in Western, as well as non-Western cultures (Keshet & Simchai, 2014). Higher use of CAM among women is often attributed to neglect of women's health care needs in public health care and may serve as an emancipating, empowering alternative (Keshet & Simchai, 2014; Kristoffersen et al., 2014). However, an interesting difference was found between men and women in their motivation to use CAM: while men used CAM more for cultural reasons, women used CAM based on their belief in its scientific evidence (Abdalla et al., 2020). Therefore, in this study, we decided to focus specifically on women and examine whether the diagnosis of cancer would predict higher reliance on CAM practices.

## Psychological predictors of CAM use

Belief in the efficacy of CAM is considered a subset of more general pseudoscientific beliefs and it correlates

strongly with other types of unfounded beliefs, such as conspiracy theories, magical beliefs, or paranormal beliefs (Čavojská et al., 2020; Šrol, 2022). Belief in the efficacy of CAM might share common ground with paranormal beliefs. Indeed, positive correlations between beliefs in CAM, paranormal beliefs, magical food and health beliefs, and intuitive thinking were found in some studies (Bryden et al., 2018; Lindeman, 2011; Saher & Lindeman, 2005). Belief in the scientific basis of CAM correlated positively with holistic health beliefs and vitamin use and negatively with antibiotic use (Hyland et al., 2003). It seems that one of the crucial predictors of CAM use is the belief in its efficacy based on one's spiritual outlook (Astin, 1998). Moreover, Astin, (1998) found that only a minority of people rely on CAM as a primary treatment and people are drawn to use CAM because alternative treatments seem to be more congruent with their philosophical outlook on life, beliefs, and values. Thus, we included several subsets of magical/pseudoscientific beliefs specifically related to health in this study.

However, there is a difference between the use of CAM and actual belief in its efficacy (Verhoef et al., 2005). For example, in a study by Čavojská and Ersoy, (2020), scientific reasoning predicted belief in CAM but not the use of CAM. Pro-CAM attitudes were a stronger predictor than CAM use also in another study focusing on other health behaviors, such as vaccination (Bryden et al., 2018). While attitudes are a strong predictor of behavior (theory of planned behavior; Ajzen, 2002), there is usually a gap between intentions and behavior, therefore it is reasonable to expect a stronger effect of some beliefs on forming of pro-CAM attitudes, while their association with CAM use may be weaker. Therefore, we examined CAM attitudes and CAM use separately and we expect that positive attitudes toward CAM, as well as higher CAM use, will be associated with various kinds of magical/pseudoscientific beliefs.

On the other hand, cognitive factors play an important role in health decisions, too. People with better scientific reasoning hold beliefs more consistent with scientific consensus and have more scientific knowledge (Dieckmann & Johnson, 2019; Downs et al., 2008; Drummond & Fischhoff, 2017). Scientific reasoning seems to be a stronger predictor of health-related unfounded beliefs than analytic thinking (Čavojská et al., 2022). Beliefs seem to be the most important driving force for behavior, even when cognitive factors are taken into account. For example, Čavojská and Ersoy (2020) found that while scientific reasoning negatively predicted belief in the efficacy of CAM, its role in actual reported use of CAM diminished after religious faith was introduced to the model. Interestingly, also Abdalla et al. (2020) found that while cultural reasons are more important for men when choosing CAM, women used CAM based on their belief in its scientific evidence.

On the other hand, the role of cancer health literacy is inconclusive. While some studies showed that patients with higher CAM use have significantly lower health literacy scores (Conrady & Bonney, 2017; Wilhelm & Euteneuer, 2021), others showed that they also can have more positive attitudes toward CAM because they tend to rely on rapidly available and unscientific, easily found sources of information (Dişsiz & Yilmaz, 2016; Jablotschkin et al., 2020). Therefore, we will also examine the role of cancer health literacy for both groups of women and its association with CAM use and attitudes.

A lack of trust in the medical professions can be another reason why patients ask for a second opinion or they can be prone to use CAM (van den Brink-Muinen & Rijken, 2006). People also can trust alternative practitioners because of their holistic views and therefore, they may feel that they understand the diseases better. However, due to the lack of research, we do not have enough evidence that clarifies the relationship between trust in doctors, CAM use, and attitudes toward CAM.

Moreover, ‘feeling more in control’ was associated with CAM use among women with cancer (Catt et al., 2006; Henderson & Donatelle, 2003), while chance health locus of control correlated with adverse health behaviors (Pitel & Ballová Mikušková, 2021). Therefore, we expect that the internal locus of control will be associated with increased CAM use, but we will explore the differences in locus of control between the women with and without a cancer diagnosis.

Psychological factors behind the increased use of CAM in women with cancer have not been yet conclusively established. While it seems sensible to expect that women with a cancer diagnosis will turn to all means that can help them to get better or at least alleviate the symptoms of illness or its treatment, little is known whether any actual shift in beliefs surrounding CAM and health occurs. Moreover, several conflicting factors can be at play: for example, women diagnosed with cancer are more likely to discuss their illness with their physicians or other sources that could increase their health literacy and reasoning, which is connected with less CAM use and pseudoscientific health beliefs (Čavoјová & Ersoy, 2020; Čavoјová et al., 2022). On the other hand, emotional factors, such as helplessness and loss of control can override rational processes and lead to higher acceptance of magical and pseudoscientific beliefs (e.g. Šrol et al., 2021) which can lead to increased CAM use. This is in line with terror management theory (Greenberg et al., 1997), which argues that when confronted with our own mortality and existential anxiety, people tend to cling to beliefs that transcend us. Our aim in this paper is to address these unknown issues and explore the differences between women with and without cancer diagnosis not only in CAM use but also in their beliefs, locus of control, trust in doctors, and

cancer health literacy. Our conceptual framework is shown in Fig. 1.

## Methods

### Participants and procedure

We recruited the participants for our study via social networks and specialized groups for people diagnosed with cancer (e.g. League against cancer, etc.) to enroll women with some experience with cancer. We employed a snowball technique and participants were encouraged to share the survey with their friends and relatives. The survey was run on the Qualtrics platform and it was open from May to the end of June 2021. Before conducting research, it was approved by the Ethical Committee of the Centre of Social and Psychological Sciences, SAS.

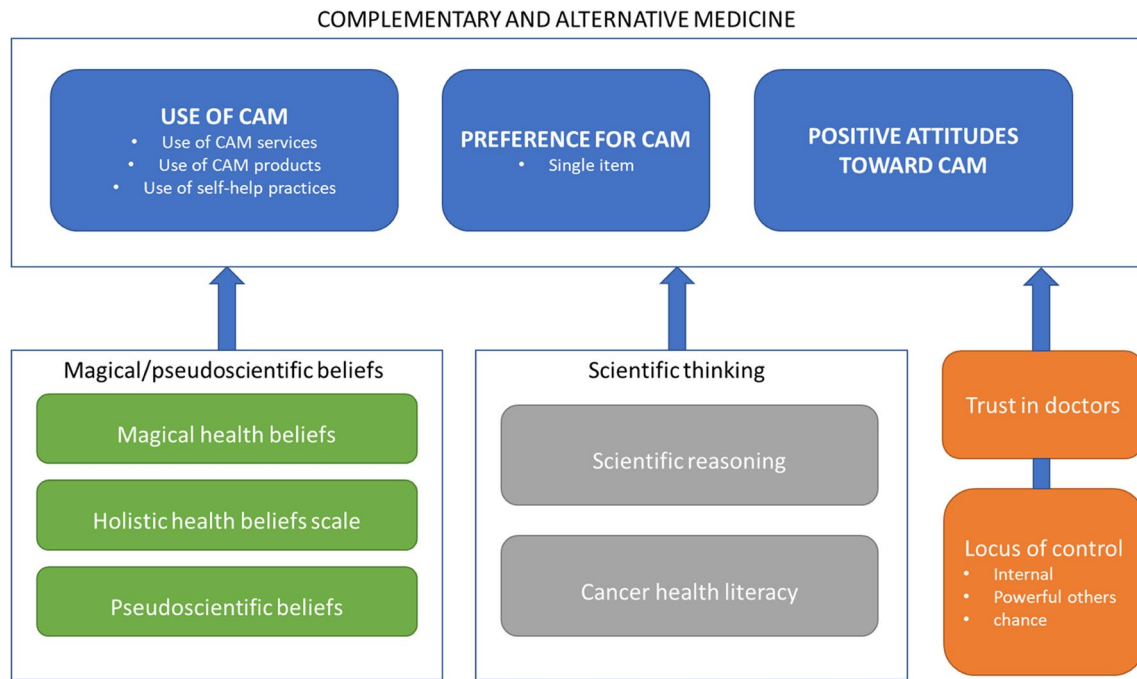
The final sample consisted of 177 women. One hundred and three women were not diagnosed with cancer (58.2%) and 74 women (41.8%) had been diagnosed with some type of cancer. The mean age of our sample was 38.81 ( $SD = 11.43$ ). Most of the women with cancer have been diagnosed with breast cancer ( $N = 55$ ), eight were diagnosed with cervical cancer, and the rest ( $N = 14$ ) had other kinds of cancer.<sup>1</sup> Seven women indicated that it was recurring cancer. For more details about the stage of cancer at the time of diagnosis and at the time of data collection, please see Table A.1 in the Appendix. Women diagnosed with cancer were also significantly (about ten years) older than women with no reported cancer. There were no other significant differences between the two samples in terms of income, number of people living in the same household, or the size of the city, and only a small difference ( $d = 0.31$ ) in education, as the younger women in our sample reported generally higher education than older women. For more details about the differences in demographic background, please see Table A.2 in the Appendix.

## Materials

### The use and attitudes toward complementary and alternative medicine

*The use of CAM.* We used The International Questionnaire to Measure Use of Complementary and Alternative

<sup>1</sup> There were 14 women who chose “other type of cancer”. These were: appendix of ovaries and uterus ( $N = 2$ ), Hodgins LGR ( $N = 1$ ), colon ( $N = 2$ ), kidney ( $N = 1$ ), lymphoma ( $N = 1$ ), non-specified ductal carcinoma ( $N = 1$ ), non-Hogins lymphoma ( $N = 1$ ), ovaries ( $N = 1$ ), lung cancer ( $N = 1$ ), thyroide gland ( $N = 1$ ), other (non-specified) ( $N = 2$ ).



**Fig. 1** Conceptual framework of the current study

Medicine (I-CAM-Q) modified by Bryden et al. (2018), which contains three sections: (1) provision of CAM services (homeopath, acupuncturist, herbalist, spiritual healer, chiropractor, naturopath, hypnotherapist, body manipulation therapies, hypnotherapy, body manipulation therapies such as Bowen Therapy or Reiki (excluding massage or physiotherapy), therapeutic massage, and other (please specify); (2) use of CAM products (herbs/herbal medicine; vitamins/minerals; homeopathic remedies; remedies for weight-loss, magnetic rings/bracelets, flour-free or chlorine-free distilled water for medical purposes, master mineral solutions (or its alternatives), other (please specify); (3) self-help practices (meditation, yoga or tai chi, detox or cleansing diet, prayer for your own health, relaxation techniques or visualization, aromatherapy, any form of traditional or spiritual healing ceremony). Participants rated every item on a 3-point scale (1 = *never*, 2 = *more than 12 months ago*, 3 = *in the last 12 months*). For all present analyses, we dichotomized the response scale so that participants who reported never using CAM practices and products were assigned a score of “0” and those who reported using it were assigned “1” for that particular item regardless of whether they used it more than a year ago or less than a year ago. Three sub-scale totals were calculated for the use in this study: services (Cronbach’s alpha = 0.58), products (Cronbach’s alpha = 0.45), and self-help practices (Cronbach’s alpha = 0.64). Cronbach’s alpha for the total scale was 0.73, so for some of the subsequent analyses, we also used the total CAM use score.

*CAM attitudes subscale* (Hyland et al., 2003) contained 6 questions measuring attitudes regarding the efficacy and desirability of CAM. Participants answered on a 5-point scale (1 = *totally disagree*, 5 = *totally agree*). Four items were recoded, so that a higher score reflected more positive attitudes toward CAM. Cronbach’s alpha was 0.80.

*Preference for CAM over classical medical treatment.* We included one additional question to distinguish whether participants used the above-mentioned services, products, and self-help as the main method of treatment or as a supplement to classical medical treatments, with choices ranging from 1 (= *exclusively alternative treatments*) to 5 (= *exclusively classical medicine*), with 3 (= *both according to circumstances*).

#### **Magical and pseudoscientific beliefs about health**

*The magical belief health subscale* (Lindeman et al., 2000) contained 10 questions related to health. Participants answered on a 5-point scale (1 = *totally disagree*, 5 = *totally agree*). Cronbach’s alpha was 0.88.

*The holistic health belief subscale* (Hyland et al., 2003) contained 5 questions measuring belief in a holistic model of health. Participants answered on a 5-point scale (1 = *totally disagree*, 5 = *totally agree*). Cronbach’s alpha was 0.74.

*The pseudoscientific beliefs scale* (Fasce & Picó, 2019) consisted of 30 questions related to various contemporary pseudoscientific treatments and beliefs. Participants answered on a 5-point scale (1 = *totally disagree*, 5 = *totally agree*).



*agree*). For the present study, six items asking about the efficacy of specific CAM treatments were excluded from the questionnaire. Cronbach's alpha was 0.82.

### Cognitive predictors

*Scientific reasoning* was measured using items based on the Scientific reasoning scale (Drummond & Fischhoff, 2017). For the present study, we used six items that were developed by (Bašnáková et al., 2021). For example, the “causation vs correlation” item was about increasing the birth rate: “A researcher wants to find out how to increase natality. He asks for statistical information and sees that there are more children born in cities that have more hospitals. This finding implies that building new hospitals will increase the birth rate of a population. Agree/Disagree”. Each correct answer was assigned 1 point and we calculated the total score as the sum of all correct answers, thus a higher number indicates better scientific reasoning. Cronbach's alpha was 0.45.

*Cancer health literacy* was measured by 11 items chosen from the CHLT-30 (Dumenci et al., 2014), which was also validated for populations without cancer (Dumenci et al., 2018). The test contained multiple-choice questions. For each correct answer, the participant received 1 point, so the higher score reflects higher health literacy. Cronbach's alpha was 0.44.

*Health locus of control* was measured by the Multidimensional Health Locus of Control (Wallston et al., 1978), which contained 18 questions in three subscales: Internal health locus of control (Cronbach's alpha = 0.72), Powerful Others health locus of control (Cronbach's alpha = 0.69), and Chance Health locus of control (Cronbach's alpha = 0.69).

*Trust in doctors* was measured by five items scale (Dugan et al., 2005). Participants answered on a 5-point scale ranging from 1 (*total disagree*) to 5 (*totally agree*). Cronbach's alpha was 0.76.

*Composite variables.* For simplicity and in order not to include multiple common predictors in the regression analyses predicting attitudes toward and use of CAM (see Table 2 below), we have created several composite variables for use in the regression analyses. First, composite magical and pseudoscientific health beliefs variable was created as a regression score extracted from the principal component analysis with three indicators – magical health beliefs, holistic health beliefs, and pseudoscientific beliefs (single component with eigenvalue > 1 accounted for 59% of the variance). Secondly, the same approach was used to reduce the three loci of control dimensions into a single variable. A single external locus of control component with eigenvalue > 1 was identified which accounted for 50% of the variance (internal locus of control variable loaded negatively onto the composite score). Finally, scientific reasoning and cancer health literacy scores were averaged into a single composite, both variables were standardized and their z-scores were averaged

( $r = 0.36$ ). These composite variables were used instead of individual scores in the regression analysis reported below.

## Results

### Prevalence of CAM use

Only 4% of our sample used CAM as the main method of treatment (1.4% of women with and 2.9% of women without a cancer diagnosis); the majority used CAM only as complementary to conventional medicine. However, 98.3% of participants had tried at least one CAM service, product, or self-help during the last year. The average number of CAM services used in the last 12 months was 4.5 ( $SD = 2.3$ ). The most often used CAM service in the last year was therapeutic massage (19.2%), the most often used CAM products were vitamins/minerals (97.2%) followed by herbs/herbal medicine (71.2%), and the most often used CAM self-help was a prayer for health (40.7%), followed by relaxation techniques (39.6%) and aromatherapy (39.0%).

### Correlations between variables and regression analysis

To explore further relationships between variables, we performed correlation analysis (Table 1).

The results showed that the use of CAM correlated with all belief variables ( $r$ -values ranging from 0.16 to 0.35), except for pseudoscientific beliefs, which were related only to the use of CAM products ( $r = 0.22$ ), but not CAM services or self-help practices. There was no correlation between CAM measures with scientific reasoning or with cancer health literacy. A positive correlation was found between CAM use and internal locus of control ( $r = 0.19$ ). Scientific reasoning and cancer health literacy showed expected negative correlations with some of the belief measures ( $r$ -values ranging from -0.18 to -0.52).

Next, we proceeded to examine whether the use of CAM and attitudes toward CAM are best predicted by sociodemographic factors, beliefs, or cognitive factors, therefore we performed hierarchical regression analyses. Socio-demographic factors, such as age, education, and cancer diagnosis were entered in the first step, factor score for magical beliefs, holistic health beliefs, pseudoscientific beliefs, locus of control, and trust in doctors was entered in the second step, and scientific reasoning and cancer health literacy composite score was entered in the third step. Results are shown in Table 2.

Positive attitudes toward CAM were predicted mostly by pseudoscientific/magical beliefs, trust in doctors, and internal locus of control; reasoning and literacy did not seem to play a role in having more positive or negative attitudes toward CAM. Also, both uses of CAM and the preference for CAM were predicted most strongly by pseudoscientific/

**Table 1** Descriptive statistics and correlations between the main variables in the present study for the whole sample

	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. use of CAM services	1.22	1.40	1													
2. use of CAM products	2.59	1.07	<b>.39</b>	1												
3. use of CAM self-help	2.80	1.79	<b>.33</b>	<b>.32</b>	1											
4. use of CAM (total)	6.62	3.22	<b>(.75)</b>	<b>(.68)</b>	<b>(.81)</b>	1										
5. preference for CAM	4.37	0.99	<b>-.26</b>	<b>-.18</b>	<b>-.31</b>	<b>-.34</b>	1									
6. attitudes toward CAM	14.9	4.88	<b>.28</b>	<b>.32</b>	<b>.28</b>	<b>.39</b>	<b>-.58</b>	1								
7. magical health beliefs	26.3	8.35	<b>.24</b>	<b>.28</b>	<b>.20</b>	<b>.31</b>	<b>-.39</b>	<b>.50</b>	1							
8. holistic health beliefs	22.1	2.89	<b>.16</b>	<b>.23</b>	<b>.35</b>	<b>.34</b>	<b>-.06</b>	<b>.10</b>	<b>.26</b>	1						
9. pseudoscientific beliefs	63.8	11.0	.14	<b>.22</b>	.06	<b>.17</b>	<b>-.21</b>	<b>.39</b>	<b>.63</b>	<b>.22</b>	1					
10. scientific reasoning	4.99	1.12	<b>-.07</b>	<b>-.12</b>	.11	<b>-.01</b>	<b>.06</b>	<b>-.25</b>	<b>-.38</b>	<b>-.09</b>	<b>-.52</b>	1				
11. cancer health literacy	10.0	1.25	.11	.02	.11	.12	.08	<b>-.10</b>	<b>-.18</b>	.05	<b>-.29</b>	<b>.36</b>	1			
12. internal locus of control	19.1	3.84	.11	.14	<b>.16</b>	<b>.19</b>	<b>-.20</b>	<b>.25</b>	<b>.29</b>	<b>.30</b>	<b>.22</b>	<b>-.15</b>	<b>-.08</b>	1		
13. others locus of control	17.9	4.29	<b>-.11</b>	<b>-.10</b>	<b>-.11</b>	<b>-.14</b>	<b>.21</b>	<b>-.27</b>	<b>-.11</b>	<b>-.02</b>	.02	<b>-.11</b>	<b>-.08</b>	<b>-.14</b>	1	
14. chance locus of control	14.6	4.47	<b>-.08</b>	.10	<b>-.06</b>	<b>-.03</b>	.11	.04	.13	<b>-.09</b>	<b>.33</b>	<b>-.30</b>	<b>-.23</b>	<b>-.30</b>	<b>.31</b>	1
15. trust in doctors	2.66	0.65	.12	.12	.10	.10	<b>-.21</b>	<b>.30</b>	.09	.13	<b>.19</b>	.00	<b>-.08</b>	<b>-.02</b>	<b>-.19</b>	<b>.05</b>

Correlations are based on 177 observations. Correlations in parentheses indicate part-whole relationships. Correlations of  $r > .15$  are significant at  $p < .05$ ,  $r > .20$  are significant at  $p < .01$ , and  $r > .25$  are significant at  $p < .001$ . Correlations that appear in bold are significant ( $p < .05$ )

**Table 2** Summaries of linear regressions predicting CAM use and attitudes toward CAM

	CAM use total		CAM preference		CAM attitudes	
	$\beta$	<i>p</i>	$\beta$	<i>p</i>	$\beta$	<i>p</i>
<b>Step 1</b>						
Age	.07	.423	-.02	.794	.13	.123
Education	.08	.319	.09	.267	.02	.845
Cancer diagnosis	<b>-.14</b>	.094	<b>-.15</b>	.084	.04	.615
	$R^2 = .036, F = 2.17^{n.s.}$		$R^2 = .023, F = 1.39^{n.s.}$		$R^2 = .014, F = 0.827^{n.s.}$	
<b>Step 2</b>						
Age	.02	.855	.04	.614	.05	.552
Education	.08	.273	.08	.273	.03	.636
Cancer diagnosis	<b>-.18</b>	<b>.046</b>	<b>-.12</b>	.179	.02	.776
Pseudoscientific and magical health beliefs	<b>.27</b>	<b>&lt; .001</b>	<b>.30</b>	<b>&lt; .001</b>	<b>.41</b>	<b>&lt; .001</b>
Trust in doctors	.06	.395	.14	.061	<b>.21</b>	<b>.002</b>
External locus of control	<b>-.19</b>	<b>.015</b>	<b>.18</b>	<b>.023</b>	<b>-.16</b>	<b>.027</b>
	$\Delta R^2 = .128, F = 8.67^{***}$		$\Delta R^2 = .161, F = 11.15^{***}$		$\Delta R^2 = .276, F = 22.07^{***}$	
<b>Step 3</b>						
Age	.02	.793	.04	.616	.04	.573
Education	.05	.465	.08	.275	.04	.535
Cancer diagnosis	<b>-.17</b>	<b>.047</b>	<b>-.12</b>	.180	.02	.790
Pseudoscientific and magical health beliefs	<b>.36</b>	<b>&lt; .001</b>	<b>-.30</b>	<b>&lt; .001</b>	<b>.38</b>	<b>&lt; .001</b>
Trust in doctors	.06	.395	<b>-.14</b>	.062	<b>.21</b>	<b>.002</b>
External locus of control	<b>-.16</b>	<b>.044</b>	<b>.18</b>	<b>.026</b>	<b>-.17</b>	<b>.019</b>
Reasoning & literacy	<b>.21</b>	<b>.007</b>	<b>-.01</b>	.949	<b>-.08</b>	.276
	$\Delta R^2 = .035, F = 7.34^{**}$		$\Delta R^2 = .000, F = 0.00^{n.s.}$		$\Delta R^2 = .005, F = 1.19^{n.s.}$	

The table shows the results of three regressions predicting the use of CAM, preference for CAM over the classical medical treatment, and attitudes toward CAM. The results include standardized regression coefficients ( $\beta$ ) and their statistical significance, as well as explained variance in the outcome ( $R^2$ ) and its change ( $\Delta R^2$ ) at every step of the model. Significant predictors ( $p < .05$ ) are presented in bold. \*\*  $p < .01$ , \*\*\*  $p < .001$

magical beliefs and internal/external locus of control. Trust in doctors did not predict the use of CAM nor preference for CAM. However, the use of CAM was predicted also by having a cancer diagnosis and – unexpectedly – higher reasoning and literacy.

### Comparing women with a diagnosis and without a diagnosis

Lastly, we examined the differences between women with and without cancer diagnosis after controlling for differences in age and education. The statistical control for demographic factors was necessary as women without a cancer diagnosis were about 10 years younger on average ( $M=34.16$ ,  $SD=10.22$ ) in comparison with women that have been diagnosed with cancer ( $M=45.31$ ,  $SD=9.79$ ) ( $t=7.29$ ,  $p<0.001$ ,  $d=1.11$ ). Also, there was a marginally significant difference in education level, women diagnosed with cancer reported lower education ( $M_{rank}=80.84$ ) than women without the diagnosis ( $M_{rank}=94.86$ ),  $U=3207$ ,  $p=0.050$ ,  $r=0.16$ . Therefore, in further analyses, we controlled for the differences in age and education (Table 3).

After controlling for age and education, we found that women with a cancer diagnosis had significantly more pseudoscientific beliefs than women without the diagnosis. Another significant difference was that women without cancer diagnosis have a higher internal locus of control over their health

while women diagnosed with cancer felt that their health is more in the hands of their doctors or chance/destiny. There was no difference in cancer health literacy, but rather surprisingly, women without cancer diagnosis had higher scientific reasoning compared to women with cancer diagnosis. In terms of their attitude towards CAM or their overall use of CAM services, products, and self-help practices, there were no significant differences between women with diagnosed cancer and without the diagnosis of cancer. Table A.3 in the Appendix also shows the only differences in attending a herbalist and an acupuncturist and the use of non-fluorinated and non-chlorinated water, which women with cancer used more often.

### Discussion

The most important finding is that pseudoscientific/magical beliefs are the strongest predictor of positive attitudes toward CAM and its higher use, as well as using CAM instead of conventional treatment. Another factor that was the significant predictor of all three dependent variables was the external locus of control. On the other hand, cancer diagnosis predicted only higher CAM use (in line with findings of (Buckner et al., 2018; DiGianni et al., 2002; Fox et al., 2013; Matsuno et al., 2012), but not more positive attitudes to CAM, nor using CAM instead of conventional medicine.

**Table 3** The comparisons of all main variables between women with and without cancer diagnosis

	with cancer diagnosis ( $n=74$ )		without cancer diagnosis ( $n=103$ )		pairwise comparison		
	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	<i>t</i>	<i>p</i>	<i>d</i>
use of CAM services	1.39	0.170	1.10	0.141	1.25	.212	0.22
use of CAM products	2.70	0.134	2.52	0.111	1.01	.315	0.18
use of CAM self-help practices	3.07	0.226	2.61	0.187	1.47	.144	0.26
total use of CAM	7.16	0.403	6.22	0.334	1.68	.094	0.30
preference for CAM	4.54	0.124	4.24	0.103	1.74	.084	0.31
positive attitudes toward CAM	14.7	0.619	15.1	0.513	−0.504	.615	0.09
magical health beliefs	27.1	1.030	25.8	0.853	0.947	.345	0.17
holistic health beliefs scale	22.4	0.366	21.8	0.303	1.11	.268	0.19
pseudoscientific beliefs	66.2	1.30	62.2	1.08	<b>2.24</b>	<b>.027</b>	<b>0.39</b>
scientific reasoning	4.75	0.135	5.16	0.112	<b>−2.19</b>	<b>.030</b>	<b>0.38</b>
cancer health literacy	10.03	0.157	9.99	0.130	0.179	.858	0.03
internal locus of control	18.0	0.478	19.9	0.396	<b>−2.80</b>	<b>.006</b>	<b>0.49</b>
powerful others locus of control	19.3	0.525	16.8	0.435	<b>3.45</b>	<b>&lt;.001</b>	<b>0.61</b>
chance locus of control	15.7	0.532	13.8	0.440	<b>2.51</b>	<b>.013</b>	<b>0.44</b>
trust in doctors	2.54	0.082	2.74	0.068	−1.71	.090	0.30

The table presents the results of analyses of covariance with cancer diagnosis (with diagnosis / without diagnosis) as a fixed factor and age and education as covariates. The descriptives for the two groups are estimated marginal means (after controlling for age and education). The pairwise comparisons show the results of the *t*-tests based on the estimated marginal means, along with their statistical significance (*p*) and effect size (Cohen's *d*) for the difference

Before discussing our results in more detail, we have to note that the prevalence of CAM use was not very high and there were marked differences depending on the individual types of CAM. Although women with cancer used overall more CAM practices, there were only a few significant differences in the level of individual CAM practices (exceptions were: acupuncture, herbalist, and flour-free and chlorine-free water). Use of individual CAM practices ranged from as low as 1% (master mineral solution, naturopath) to 88% (herbs), with vitamins used by practically the whole sample (100% women with a cancer diagnosis, 99% women without a cancer diagnosis). These results are generally in line with reports from other studies (Berretta et al., 2016; Harris et al., 2012; Keene et al., 2019). It seems that CAM services, such as visiting a spiritual healer, chiropractic, homeopath, acupuncturist, and herbalist, are used by 14% to 34% of women with cancer, on the other hand, using free self-help practices or CAM products that are relatively cheap, is more prevalent and ranges from 36 to 88%. The CAM methods that could be considered most useless or even dangerous, such as wearing magnetic bracelets, hypnotherapy, or MMS, are used by less than 12% of women with a cancer diagnosis in our sample.

Our results generally suggest that magical and pseudoscientific beliefs play the most important role in adopting positive attitudes toward CAM and the use of CAM, irrespective of a cancer diagnosis. Even though having cancer did predict higher use of CAM, pseudoscientific and magical beliefs remained the strongest predictor of CAM use. Thus, it seems that women who incline toward holistic and magical beliefs about health tend to favor CAM treatments independently of the cancer diagnosis, although the diagnosis of cancer also contributes to their higher use of CAM. In other words, it seems improbable that women would turn toward CAM treatment only after being diagnosed with cancer.

Not at all surprising was also the finding that women with a more internal locus of control use CAM more often than women with a more external locus of control, who rely on the advice from their physicians. Women with a more internal locus of control also tended to prefer CAM treatment over traditional treatment. The effect of internal locus of control was similarly strong as the effect of a cancer diagnosis.

Trust in doctors seems to play a role only in increasing the positive attitudes toward CAM. This was an unexpected result because we assumed that trust in doctors would play a role in decreasing attitudes toward CAM. But one possible explanation is that participants misinterpreted the word "doctor" and might not differentiate between holistic practitioners (who are not licensed to practice medicine) and medical doctors. Their answers could therefore indicate trust in both groups of specialists. It would be necessary for future research to clarify our focus only on medical doctors.

Another surprising finding was that literacy and reasoning was significant predictor of higher CAM use. Upon further examination, we concluded that it is probably some statistical artifact, as there were no correlations between the measures of cancer health literacy and scientific reasoning on one hand and measures of CAM use on the other. Moreover, scientific reasoning and to a lesser extent also cancer health literacy correlated negatively with magical beliefs and pseudoscientific beliefs, and scientific reasoning correlated moderately negatively also with positive attitudes toward CAM – all results in the expected direction and in line with previous research (Čavojová & Ersoy, 2020; Čavojová et al., 2020).

### Comparing women with a diagnosis and without a diagnosis

There was no difference between women with and without cancer diagnosis in using CAM after we controlled for age and education. Both groups of women seem to use a similar number of CAM treatments and both groups use it mostly to complement, not replace conventional medicine. Similarly, women in our sample had a similar level of magical beliefs, holistic health beliefs, and attitudes toward CAM regardless of their cancer diagnosis. However, women with cancer had significantly more pseudoscientific beliefs than women without cancer.

Women without cancer diagnosis showed a higher internal locus of control over their health, while women with cancer felt that their health is more in the hands of their doctors or chance/destiny (i.e. had a more external locus of control). This finding is in line with previous studies (Gibek & Sacha, 2019; Ranchor et al., 2010) suggesting that people with cancer are more likely to be reliant on external sources of control, such as health workers or their family members than on internal sources. One possible explanation for this finding can relate to the perceived nature of cancer and also the extensive treatment with uncertain outcomes may reduce patients' beliefs in personal control over their illness. Sense of control over one's life (i.e., internal locus of control) is associated with many positive outcomes (e.g., Waller & Bates, 1992), while lower internal locus of control is associated with poorer adaptation to treatment and higher depression in cancer patients (Arraras et al., 2002). Thus, it seems important that clinicians should empower cancer patients more by giving them more control over the treatment or encouragement about how changes to lifestyle choices might improve their chances of recovery.

Even after controlling for age and education, the women without cancer diagnosis in our sample had significantly higher scientific reasoning than women with cancer. This was probably due to the nature of our data collection – we used social networks for addressing women with cancer and we also advertised the survey on our institutional webpage. Although we can only speculate in this regard, it is possible



that followers of the institutional webpage are more interested in our research than the general public and thus we succeeded only in addressing women with higher scientific reasoning who shared it with their contacts, but we were successful only in reaching rather limited and self-selected sample, while women with cancer that accessed our survey via cancer patients supporting groups were from more diverse background and possibly differed also in other variables besides scientific reasoning that we did not measure. We are well aware of the importance of collecting the data from the representative samples in future studies but collecting the data from cancer patients remains to be problematic.

### Limitations of the present research

The main limitation of our research was a self-selected sample that did not allow us to match women with and without cancer diagnoses on all relevant characteristics. Despite this limitation, we believe that our results contribute to our understanding of the factors that lead women to the use of CAM and that cancer diagnosis is not the crucial factor that makes women turn to CAM. We saw that even though women without a diagnosis in our sample were higher in scientific reasoning (possibly due to self-selection), still the main driving force to CAM was their magical and pseudoscientific beliefs. However, these results are tentative and need to be supported by further research on a larger and more representative sample. It would be also important to verify these results also on the general population including men.

Another limitation of the current research is the CAM questionnaire we used. Although it showed good psychometric properties, it focused our attention on possible cultural differences. Moreover, the subscale CAM services may be more dependent on the financial situation of a participant, and in the current research, it was also probably affected by the ongoing COVID-19 pandemic, as due to the lockdown measures, many of services (not only CAM) were closed and unavailable. Similarly, the use of vitamins in this questionnaire is underspecified and could be also over-reported due to the pandemic (e.g., a higher intake of vitamin D was often recommended as prevention against COVID-19). Also, in the next research, we would like to focus more on CAM practices that are possibly more harmful.

### Conclusion

The main contribution of our study was that although women with and without a cancer diagnosis differed in some predictor variables, such as locus of control, pseudoscientific beliefs, and science reasoning, the strongest predictor of use of and attitudes toward CAM was pseudoscientific and

magical beliefs about health. A positive aspect of our results was also the finding that few women preferred CAM to conventional treatment and that most reported CAM treatments were relatively harmless. The study also highlights the need for more accurate CAM measurement, as there are many conceptualizations of what CAM encompasses, and we need to better understand the motivations of people who turn to CAM treatments. In addition, there are many grey areas, as some complementary treatments are even prescribed by physicians, and other CAM treatments have been shown to be effective for some diagnoses (e.g., massage, yoga, or body manipulation techniques to relieve spinal pain) but are sometimes used for very different purposes (e.g., some of the pseudoscientific beliefs and conspiracy theories against CAM have been shared by esoteric groups and yoga teachers). There is also a difference if people wear crystals mainly for aesthetic reasons (harbouring the irrational belief that they can also use them to open their chakras and/or get rid of some mild symptoms) or if they really believe that wearing such crystals will protect them from COVID-19 or cure their cancer. Perhaps there is no harm in a cancer patient believing that her breast cancer was caused by blocked emotions due to a maternal conflict and having a life coach "unblock" her using magnets if she still follows the recommended treatments; however, such esoteric beliefs tend to cluster (Lobato et al., 2014) to form the breeding ground for more dangerous conspiracy theories (Brotherton, 2015) and subsequent denial of more effective interventions, and should not be taken lightly.

**Supplementary Information** The online version contains supplementary material available at <https://doi.org/10.1007/s12144-023-04911-8>.

**Acknowledgements** This research is part of project "Integrative strategy in development of personalized medicine of selected malign oncological diseases and its effect on the quality of life" (313011V446) and it was also funded by Slovak Research Development Agency under grant number APVV-20-0335.

Materials and data for this study are publicly available at: <https://osf.io/ghycv/>.

**Funding** Open access funding provided by The Ministry of Education, Science, Research and Sport of the Slovak Republic in cooperation with Centre for Scientific and Technical Information of the Slovak Republic

**Data availability** The materials and the dataset generated and/or analyzed during the current study are available in the OSF repository, <https://osf.io/ghycv/>.

### Declarations

**Ethics approval, guidelines and consent** All methods were carried out in accordance with APA standards and ethical requirements of Slovak Academy of Sciences. The study was approved by the Ethical Committee of the Center for Social and Psychological Sciences, SAS. Informed consent was obtained from all subjects.

**Competing interests** The Authors declare that there is no conflict of interest.

**Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

## References

- Abdalla, S. M., Al-Ghanam, N. M., Almutairi, H. H., Albeladi, K. E., Alanazi, M. A., Ahmed, S. M., & Mohamed, Y. (2020). Gender Differences in the Use of Complementary and Alternative Medicine (CAM) Practice: A Community-Based Survey. *Journal of Research in Medical and Dental Science*, 8(5), 86–91. [www.jrmds.in](http://www.jrmds.in)
- Ajzen, I. (2002). Perceived Behavioral Control, Self-Efficacy, Locus of Control, and the Theory of Planned Behavior<sup>1</sup>. *Journal of Applied Social Psychology*, 32(4), 665–683. <https://doi.org/10.1111/j.1559-1816.2002.tb00236.x>
- Alwhaibi, M., & Sambamoorthi, U. (2016). *Sex Differences in the Use of Complementary and Alternative Medicine among Adults with Multiple Chronic Conditions*. <https://doi.org/10.1155/2016/2067095>
- Arraras, J. I., Wright, S. J., Jusue, G., Tejedor, M., & Calvo, J. I. (2002). Coping style, locus of control, psychological distress and pain-related behaviours in cancer and other diseases. *Psychology, Health and Medicine*, 7(2), 181–187. <https://doi.org/10.1080/13548500120116139>
- Astin, J. A. (1998). Why patients use alternative medicine. *JAMA*, 279(19), 1548–1553. <https://doi.org/10.1001/jama.279.19.1548>
- Bašnáková, J., Čavojová, V., & Šrol, J. (2021). Does concrete content help people to reason scientifically? *Science & Education*, 30(4), 809–826. <https://doi.org/10.1007/s11191-021-00207-0>
- Berretta, M., Pepa, C., Della, Tralongo, P., Fulvi, A., Martellotta, F., Lleshi, A., Nasti, G., Fisichella, R., Romano, C., Divitiis, C. De, Taibi, R., Fiorica, F., Francia, R. Di, Mari, A. Di, Pup, L. Del, Crispo, A., Paoli, P. De, Santorelli, A., Quagliariello, V., ... Facchini, G. (2016). Use of Complementary and Alternative Medicine (CAM) in cancer patients: An Italian multicenter survey. *Oncotarget*, 8(15), 24401–24414. <https://doi.org/10.18632/ONCOTARGET.14224>
- Bishop, F. L., & Lewith, G. T. (2010). Who uses CAM? A narrative review of demographic characteristics and health factors associated with CAM use. *Evidence-Based Complementary and Alternative Medicine: ECAM*, 7(1), 11–28. <https://doi.org/10.1093/ecam/nen023>
- Boutin, P. D., Buchwald, D., Robinson, L., & Collier, A. C. (2000). Use of and attitudes about alternative and complementary therapies among outpatients and physicians at a municipal hospital. *The Journal of Alternative and Complementary Medicine*, 6(4), 335–343. <https://doi.org/10.1089/10755530050120709>
- Brotherton, R. (2015). *Suspicious minds. Why we believe conspiracy theories*. Dublin: Bloomsbury Sigma.
- Bryden, G. M., Browne, M., Rockloff, M., & Unsworth, C. (2018). Anti-vaccination and pro-CAM attitudes both reflect magical beliefs about health. *Vaccine*, 36(9), 1227–1234. <https://doi.org/10.1016/j.vaccine.2017.12.068>
- Buckner, C. A., Lafrenie, R. M., Dénomée, J. A., Caswell, J. M., & Want, D. A. (2018). Complementary and Alternative Medicine Use in Patients Before and After a Cancer Diagnosis. *Current Oncology*, 25(4), 275–281. <https://doi.org/10.3747/CO.25.3884>
- Catt, S., Fallowfield, L., & Langridge, C. (2006). What non-prescription treatments do UK women with breast cancer use? *European Journal of Cancer Care*, 15(3), 279–285. <https://doi.org/10.1111/J.1365-2354.2006.00652.X>
- Čavojová, V., & Ersoy, S. (2020). The role of scientific reasoning and religious beliefs in use of complementary and alternative medicine. *Journal of Public Health*. <https://doi.org/10.1093/pubmed/fdz120>
- Čavojová, V., Šrol, J., & Jurkovič, M. (2020). Why should we try to think like scientists? The role of scientific reasoning in susceptibility to epistemically suspect beliefs and cognitive biases. *Applied Cognitive Psychology*, 34(1), 85–95. <https://doi.org/10.1002/acp.3595>
- Čavojová, V., Šrol, J., & Ballová Mikušková, E. (2022). How scientific reasoning correlates with health-related beliefs and behaviors during the COVID-19 pandemic? *Journal of Health Psychology*, 27(3), 534–547. <https://doi.org/10.1177/1359105320962266>
- Dieckmann, N. F., & Johnson, B. B. (2019). Why do scientists disagree? Explaining and improving measures of the perceived causes of scientific disputes. *Plos One*, 14(2), e0211269. <https://doi.org/10.1371/journal.pone.0211269>
- DiGianni, L. M., Garber, J. E., & Winer, E. P. (2002). Complementary and alternative medicine use among women with breast cancer. *Journal of Clinical Oncology: Official Journal of the American Society of Clinical Oncology*, 20(18 Supp), 34S-38S.
- Dişsiz, G., & Yilmaz, M. (2016). Complementary and alternative therapies and health literacy in cancer patients. *Complementary Therapies in Clinical Practice*, 23, 34–39. <https://doi.org/10.1016/J.CTCP.2016.02.004>
- Downs, J. S., de Bruin, W. B., & Fischhoff, B. (2008). Parents' vaccination comprehension and decisions. *Vaccine*, 26(12), 1595–1607. <https://doi.org/10.1016/j.vaccine.2008.01.011>
- Drummond, C., & Fischhoff, B. (2017). Development and validation of the Scientific Reasoning Scale. *Journal of Behavioral Decision Making*, 30(1), 26–38. <https://doi.org/10.1002/bdm.1906>
- Dugan, E., Trachtenberg, F., & Hall, M. A. (2005). Development of abbreviated measures to assess patient trust in a physician, a health insurer, and the medical profession. *BMC Health Services Research*, 5(1), 1–7. <https://doi.org/10.1186/1472-6963-5-64>
- Dumenci, L., Matsuyama, R., Riddle, D. L., Cartwright, L. A., Perera, R. A., Chung, H., & Siminoff, L. A. (2014). Measurement of Cancer Health Literacy and Identification of Patients with Limited Cancer Health Literacy. *Journal of Health Communication*, 19(02), 205. <https://doi.org/10.1080/10810730.2014.943377>
- Dumenci, L., Matsuyama, R. K., Riddle, D. L., Cartwright, L., & Siminoff, L. A. (2018). Validation of the Cancer Health Literacy Test-30 for Populations Without Cancer. *HLRP: Health Literacy Research and Practice*, 2(2). <https://doi.org/10.3928/24748307-20180207-01>
- Fasce, A., & Picó, A. (2019). Conceptual foundations and validation of the Pseudoscientific Belief Scale. *Applied Cognitive Psychology*, 1–12. <https://doi.org/10.1002/acp.3501>
- Fouladbakhsh, J. M., & Stommel, M. (2009). Gender, Symptom Experience, and Use of Complementary and Alternative Medicine Practices Among Cancer Survivors in the U.S. Cancer Population. *Oncology Nursing Forum*, 37(1), E7–E15. <https://doi.org/10.1188/10.ONF.E7-E15>
- Fox, P., Butler, M., Coughlan, B., Murray, M., Boland, N., Hanan, T., Murphy, H., Forrester, P., Brien, M. O., & Sullivan, N. O. (2013). Using a mixed methods research design to investigate complementary alternative medicine (CAM) use among women with breast cancer in Ireland. *European Journal of Oncology Nursing*, 17(4), 490–497. <https://doi.org/10.1016/J.EJON.2012.10.008>

- Gibek, K., & Sacha, T. (2019). Comparison of health locus of control in oncological and non-oncological patients. *Contemporary Oncology/współczesna Onkologia*, 23(2), 115–120. <https://doi.org/10.5114/WO.2019.85638>
- Greenberg, J., Solomon, S., & Pyszczynski, T. (1997). Terror Management Theory of Self-Esteem and Cultural Worldviews: Empirical Assessments and Conceptual Refinements. *Advances in Experimental Social Psychology*, 29(C), 61–139. [https://doi.org/10.1016/S0065-2601\(08\)60016-7](https://doi.org/10.1016/S0065-2601(08)60016-7)
- Harris, P. E., Cooper, K. L., Relton, C., & Thomas, K. J. (2012). Prevalence of complementary and alternative medicine (CAM) use by the general population: A systematic review and update. *International Journal of Clinical Practice*, 66(10), 924–939. <https://doi.org/10.1111/J.1742-1241.2012.02945.X>
- Henderson, J. W., & Donatelle, R. J. (2003). The relationship between cancer locus of control and complementary and alternative medicine use by women diagnosed with breast cancer. *Psycho-Oncology*, 12(1), 59–67. <https://doi.org/10.1002/PON.636>
- Hyland, M. E., Lewith, G. T., & Westoby, C. (2003). Developing a measure of attitudes: The holistic complementary and alternative medicine questionnaire. *Complementary Therapies in Medicine*, 11(1), 33–38. [https://doi.org/10.1016/S0965-2299\(02\)00113-9](https://doi.org/10.1016/S0965-2299(02)00113-9)
- Jablotschkin, M., Bartsch, H. H., Gschwendtner, K., Hauer, J., Horneber, M., & Weis, J. (2020). Educational Program in Complementary and Alternative Medicine for Cancer Self-Help Groups. *Complementary Medicine Research*, 27(4), 222–229. <https://doi.org/10.1159/000504315>
- Johnson, S. B., Park, H. S., Gross, C. P., & Yu, J. B. (2018). Use of alternative medicine for cancer and its impact on survival. *JNCI Journal of the National Cancer Institute*, 110(1), 121–124. <https://doi.org/10.1093/jnci/djx145>
- Kaptchuk, T. J., & Eisenberg, D. M. (2001). Varieties of Healing. 2: A Taxonomy of Unconventional Healing Practices. *Annals of Internal Medicine*, 135(3), 196. <https://doi.org/10.7326/0003-4819-135-3-200108070-00012>
- Keene, M. R., Heslop, I. M., Sabesan, S. S., & Glass, B. D. (2019). Complementary and alternative medicine use in cancer: A systematic review. *Complementary Therapies in Clinical Practice*, 35, 33–47. <https://doi.org/10.1016/j.ctcp.2019.01.004>
- Keshet, Y., & Simchai, D. (2014). The ‘gender puzzle’ of alternative medicine and holistic spirituality: A literature review. *Social Science & Medicine*, 113, 77–86. <https://doi.org/10.1016/j.socscimed.2014.05.001>
- Kristoffersen, A. E., Stub, T., Salamonsen, A., Musial, F., & Hamberg, K. (2014). Gender differences in prevalence and associations for use of CAM in a large population study. *BMC Complementary and Alternative Medicine*, 14(1), 1–9. <https://doi.org/10.1186/1472-6882-14-463>
- Latte-Naor, S., Sidlow, R., Sun, L., Li, Q. S., & Mao, J. J. (2018). Influence of family on expected benefits of complementary and alternative medicine (CAM) in cancer patients. *Supportive Care in Cancer*, 26(6), 2063–2069. <https://doi.org/10.1007/S00520-018-4053-0>
- Lindeman, M. (2011). Biases in intuitive reasoning and belief in complementary and alternative medicine. *Psychology & Health*, 26(3), 371–382. <https://doi.org/10.1080/08870440903440707>
- Lindeman, M., Keskivaara, P., & Roschier, M. (2000). Assessment of Magical Beliefs about Food and Health. *Journal of Health Psychology*, 5(2), 195–209. <https://doi.org/10.1177/135910530000500210>
- Lobato, E. J. C., Mendoza, J., Sims, V., & Chin, M. (2014). Examining the relationship between conspiracy theories, paranormal beliefs, and pseudoscience acceptance among a university population. *Applied Cognitive Psychology*, 28(5), 617–625. <https://doi.org/10.1002/acp.3042>
- MacLennan, A. H., Wilson, D. H., & Taylor, A. W. (2002). The escalating cost and prevalence of alternative medicine. *Preventive Medicine*, 35(2), 166–173.
- Matsuno, R. K., Pagano, I. S., Maskarinec, G., Issell, B. F., & Gotay, C. C. (2012). Complementary and Alternative Medicine Use and Breast Cancer Prognosis: A Pooled Analysis of Four Population-Based Studies of Breast Cancer Survivors. <https://Home.Liebertpub.Com/Jwh>, 21(12), 1252–1258. <https://doi.org/10.1089/JWH.2012.3698>
- McFarland, B., Bigelow, D., Zani, B., Newsom, J., & Kaplan, M. (2002). Complementary and Alternative Medicine Use in Canada and the United States. *American Journal of Public Health*, 92(10), 1616–1618. <https://doi.org/10.2105/AJPH.92.10.1616>
- Pedersen, C. G., Christensen, S., Jensen, A. B., & Zachariae, R. (2009). Prevalence, socio-demographic and clinical predictors of post-diagnostic utilisation of different types of complementary and alternative medicine (CAM) in a nationwide cohort of Danish women treated for primary breast cancer. *European Journal of Cancer*, 45(18), 3172–3181. <https://doi.org/10.1016/J.EJCA.2009.09.005>
- Pitel, L., & Ballová Mikušková, E. (2021). The Irrational Health Beliefs Scale and Health Behaviors in a Non-Clinical Population. *European Journal of Health Psychology*, 28(3), 111–119. <https://doi.org/10.1027/2512-8442/a000075>
- Rakovitch, E., Pignol, J.-P., Chartier, C., Ezer, M., Verma, S., Dranitsaris, G., & Clemons, M. (2005). Complementary and alternative medicine use is associated with an increased perception of breast cancer risk and death. *Breast Cancer Research and Treatment*, 90(2), 139–148. <https://doi.org/10.1007/S10549-004-3779-1>
- Ranchor, A. V., Wardle, J., Steptoe, A., Henselmans, I., Ormel, J., & Sanderman, R. (2010). The adaptive role of perceived control before and after cancer diagnosis: A prospective study. *Social Science & Medicine*, 70(11), 1825–1831. <https://doi.org/10.1016/J.SOCSCIMED.2009.10.069>
- Saher, M., & Lindeman, M. (2005). Alternative medicine: A psychological perspective. *Personality and Individual Differences*, 39(6), 1169–1178. <https://doi.org/10.1016/j.paid.2005.04.008>
- Šrol, J. (2022). Individual differences in epistemically suspect beliefs: The role of susceptibility to cognitive biases. *Thinking & Reasoning*, 28(1), 125–162. <https://doi.org/10.31234/osf.io/4jcf7>
- Šrol, J., Mikušková, E. B., & Čavojová, V. (2021). When we are worried, what are we thinking? Anxiety, lack of control, and conspiracy beliefs amidst the COVID-19 pandemic. *Applied Cognitive Psychology*, 35(3), 720–729. <https://doi.org/10.1002/acp.3798>
- Thomas, K., & Coleman, P. (2004). Use of complementary or alternative medicine in a general population in Great Britain Results from the National Omnibus survey. *Journal of Public Health*, 26(2), 152–157. <https://doi.org/10.1093/pubmed/fdh139>
- van den Brink-Muinen, A., & Rijken, P. (2006). Does trust in health care influence the use of complementary and alternative medicine by chronically ill people? *BMC Public Health*, 6(1), 1–9. <https://doi.org/10.1186/1471-2458-6-188>
- Van Prooijen, J. W. (2019). An existential threat model of conspiracy theories. *European Psychologist*, 25(1), 16–25.
- Verhoef, M. J., Balneaves, L. G., Boon, H. S., & Vroegindewey, A. (2005). Reasons for and characteristics associated with complementary and alternative medicine use among adult cancer patients: A systematic review. In *Integrative Cancer Therapies* (Vol. 4, Issue 4, pp. 274–286). Sage Publications/Sage CA: Thousand Oaks, CA. <https://doi.org/10.1177/1534735405282361>
- von Conrady, D., & Bonney, A. D. (2017). Patterns of complementary and alternative medicine use and health literacy in general practice patients in urban and regional Australia. *Australian Family Physician*, 46(5), 316–320.
- Waller, K. V., & Bates, R. C. (1992). Health locus of control and self-efficacy beliefs in a healthy elderly sample. *American Journal of Health Promotion*, 6(4), 302–309. <https://doi.org/10.4278/0890-1171-6.4.302>
- Wallston, K. A., Wallston, B. S., & Devellis, R. (1978). Development of the Multidimensional Health Locus of Control (MHLC) Scales. *Health Education Monographs*, 6(2), 160–170.

- Wardwell, W. I. (1994). Alternative medicine in the United States. *Social Science & Medicine*, 38(8), 1061–1068. [https://doi.org/10.1016/0277-9536\(94\)90223-2](https://doi.org/10.1016/0277-9536(94)90223-2)
- Wilhelm, M., & Euteneuer, F. (2021). Does Health Literacy Make a Difference? Comparing the Effect of Conventional Medicine Versus Homeopathic Prescribing on Treatment Credibility and

Expectancy. *Frontiers in Psychology*, 0, 1859. <https://doi.org/10.3389/FPSYG.2021.581255>

**Publisher's note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.