

Use of complementary medicine and its association with SARS-CoV-2 vaccination during the COVID-19 pandemic: a longitudinal cohort study

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Summary

AIMS OF THE STUDY: Patients are increasingly using and requesting complementary medicine therapies, especially during the COVID-19 pandemic. However, it remains unclear whether they use them in conjunction with conventional medicine or to replace vaccination or other approaches and whether they discuss them with their physicians as part of shared decision-making. This study aimed to evaluate the use and initiation of complementary medicine during the COVID-19 pandemic, focusing on the association between complementary medicine use and COVID-19 vaccination status.

METHODS: This study is a part of the longitudinal cohort of the CoviCare program, which follows all outpatients tested for COVID-19 at the Geneva University Hospitals. Outpatients tested for COVID-19 were contacted 12 months after their positive or negative test between April and December 2021. Participants were asked about their vaccination status and if they had used complementary medicine in the past 12 months. Complementary medicine use was defined based on a specific list of therapies from which participants could choose the options they had used. Logistic regression models adjusting for age, sex, education, profession, severe acute respiratory system coronavirus 2 (SARS-CoV-2) infection, and pre-existing conditions were used to evaluate the association between being unvaccinated and complementary medicine use. SARS-CoV-2 infection status was evaluated for effect modification in the association between being unvaccinated and complementary medicine use.

RESULTS: This study enrolled 12,246 individuals (participation proportion = 17.7%). Their mean age was 42.8 years, 59.4% were women, and 63.7% used complementary medicine. Complementary medicine use was higher in women, the middle-aged, and those with a higher education level, a SARS-CoV-2 infection, or pre-existing comorbidities. A third of cases initiated complementary medicine therapies as prevention against COVID-19. Being unvaccinated was associated with complementary medicine

use (adjusted odds ratio [aOR] 1.22 [1.09–1.37]), and more specifically when these therapies were used for COVID-19 prevention (aOR 1.61 [1.22–2.12]). Being unvaccinated was associated with the use of zinc (aOR 2.25 [1.98–2.55]), vitamin D (aOR 1.45 [1.30–1.62]), and vitamin C (aOR 1.59 [1.42–1.78]), and more specifically when these therapies were used for COVID-19 prevention. Only 4% of participants discussed using complementary medicine with their primary care physicians.

CONCLUSION: While complementary medicine is increasingly used, it is rarely discussed with primary care physicians. Complementary medicine use, especially for COVID-19 prevention, is associated with COVID-19 vaccination status. Communication between physicians, patients, and complementary medicine therapists is encouraged to facilitate a truly holistic approach to making a shared decision based on the best available information.

Introduction

The National Center for Complementary and Integrative Health defines integrative health [1] as combining conventional and complementary approaches in a coordinated manner. Complementary medicine is not typically part of conventional medical care or may have origins outside usual Western practice [1]. Complementary medicine use is widespread in outpatient and inpatient care [2], depending on the approaches considered, and more so in specific diseases such as cancer or other chronic diseases [3–6]. Complementary medicine can complement conventional medicine and be used to treat illnesses, reduce side effects, and maintain well-being [7]. A small proportion of individuals (8% of complementary medicine users in Europe in 2014) used complementary medicine exclusively instead of conventional medicine [8].

Complementary medicine use was shown to be significant during the coronavirus disease 2019 (COVID-19) pandemic, depending on the therapies and populations. A recent meta-analysis of 62 studies showed that 64% of individuals used complementary medicine [9], with some statistical heterogeneity that should be explored further. Some low-

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quality studies limited this meta-analysis. Complementary medicines were used for acute symptomatic treatment [10], as potential prevention approaches [11, 12], and to treat post-COVID-19 symptoms [10, 13]. In Switzerland, a recent study showed that 76% of consultations with traditional Chinese medicine physicians and therapists were related to COVID-19, primarily for recovery from or preventing this disease [14]. Individuals also used complementary medicine approaches to treat long-term health conditions during the COVID-19 pandemic and improve overall well-being [15]. Individuals used therapies such as massage, acupuncture, reflexology, self-help practices, homeopathy, natural remedies, and vitamins and minerals. The use of vitamins and minerals was particularly common, including vitamin B, vitamin C, vitamin D, magnesium, calcium, iron, zinc, and selenium [15].

In general, the use of complementary medicine, nutrition, and supplementation strategies has often been debated in medical approaches. A recent evidence report by the United States Preventive Services Task Force reviewed 84 studies to assess the potential benefits of vitamin use in lowering the incidence of diseases. Vitamin use was associated with little to no benefit in preventing cancer, cardiovascular disease, and death [16]. However, another recent meta-analysis found cardiovascular health benefits with some nutrients [17].

There is little evidence that patients consulted their physicians when using or considering complementary medicine approaches for COVID-19 [18]. Patients could consider these therapies separate from conventional medicine and thus do not feel the need to discuss them with their physicians or potentially consider their physician insufficiently informed or authoritative about them. Patients could also feel some prejudice and refrain from informing their physician about complementary medicine use. Additionally, physicians may not initiate this conversation, potentially leading to misunderstandings or harmful behaviours.

Complementary medicine use is common in individuals with chronic diseases and can be associated with positive health behaviours focusing on well-being [7]. However, in some cases, it can also be associated with rejecting conventional medicine [8], including vaccination. Studies have shown that complementary medicine use was associated with a tendency towards vaccine hesitancy or rejection [19–21], considered more as a conventional medicine approach. Misinformation about COVID-19 vaccination was shown to correlate with vaccine hesitancy [22]. Integrating complementary medicine and improving information are needed to achieve a truly integrative medicine approach. The role of primary care physicians is vital in advising patients on complementary medicine use as a potential adjunct to conventional therapy and not as a substitute.

Vaccination against severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has been one of the main factors associated with improved outcomes during the acute phase of SARS-CoV-2 infection and related to the post-COVID condition [23]. Vaccination remains one of the most effective preventative measures for decreasing disease or reducing adverse outcomes for individuals and society. Therefore, vaccination status is an important element to consider, especially when dealing with a pandemic. COVID-19 vaccines received much attention, some of

which stopped their use. Vaccine hesitancy increased significantly during the COVID-19 pandemic due to mediated controversies about using mRNA-based vaccines, with more than a quarter of the global population reporting being unwilling to be vaccinated against COVID-19 [24]. In Switzerland, vaccine uptake was shown to be multifactorial and influenced by sociodemographic factors [25]. In Geneva, Switzerland, vaccine hesitancy was associated with younger age, female sex, and highly skilled jobs [26]. One question that should be considered is the role of complementary medicine as an alternative to conventional medicine in such contexts and its association with general vaccine uptake.

Therefore, this study evaluated the use and initiation of complementary medicine during the COVID-19 pandemic and its association with vaccination status by age, sex, profession, educational status, SARS-CoV-2 infection, and comorbidities.

Materials and methods

Outpatients tested at the Geneva University Hospitals were routinely followed by the CoviCare program, which evaluates symptom persistence, functional capacity, treatment, and healthcare utilisation in individuals positive or negative for SARS-CoV-2 [27]. The CoviCare program has been previously described [27]. Briefly, the CoviCare program follows all participants who tested positive or negative for SARS-CoV-2 at the Geneva University Hospitals (outpatient testing). Initially, only five centres were open for testing in Geneva, Switzerland, during the pandemic, of which the Geneva University Hospitals were the largest, ensuring a higher representativeness of the population. Testing was accessible everywhere in the canton by April 2021, and the representativeness of the general population might have decreased even though the Geneva University Hospitals offered the highest availability of appointments and welcomed the most individuals for testing in the canton. Between April and December 2021, individuals in the general population with a positive or negative COVID-19 reverse transcription polymerase chain reaction (RT PCR) test as outpatients were contacted 12 months after being tested. All participants provided written informed consent, and the study was approved by the Cantonal Research Ethics Commission of Geneva, Switzerland (protocol number: 2021-00389).

The follow-up questionnaire was distributed to participants as a personalised link sent via email. It included questions about baseline characteristics, profession, education, comorbidities, vaccination status, the evolution of symptoms since testing, treatment (including a list of pharmacological and non-pharmacological options), healthcare utilisation (hospitalisations and visits to their primary care physician or other specialists), and functional capacity.

Age categories were defined as <40, 40–59, and ≥60 years based on previous studies suggesting that middle age may predict persistent symptoms [28]. Participants were considered unvaccinated if they received no vaccine doses against SARS-CoV-2. Education was categorised as follows: “primary” included compulsory education and no formal education; “apprenticeship” included apprenticeships; “secondary” included secondary school and specialised schools; and “tertiary” included universities, high-

er professional education, and doctorates. Occupation was categorised as follows: “unskilled workers” were qualified employees practising manual labour, craftsmen, traders, farmers, and employees without specific training; “skilled workers” were qualified employees (non-manual labour); “highly-skilled workers” were employees in a profession requiring intermediate training; “professional managers” were managers in companies with >10 employees or individuals in a profession requiring university training; “independent workers” were individuals who worked as consultants, were independent, or were managers in companies with <10 employees.

Treatment-related questions included chronic treatment over the past 12 months for all participants (not necessarily associated with COVID-19) and acute treatment during the first 10 days after the SARS-CoV-2 test (positive or negative). Therapies were evaluated, including complementary medicine approaches. Complementary medicine use as part of acute and chronic treatment was evaluated and still considered when used in combination with conventional medicine therapies. Complementary medicine approaches included the following therapies: zinc, vitamin D, vitamin C, vitamin B12, selenium, any other vitamins or minerals, or a mix of vitamins/minerals, oligo-elements, probiotics, essential oils, herbal therapy, specific diet, osteopathy, acupuncture, meditation, hypnosis, shiatsu, reflexology, traditional Chinese medicine, and luminotherapy. Participants were asked whether they started treatment before or after a SARS-CoV-2 infection and whether the treatment was associated with COVID-19 prevention or therapy. Participants were also asked whether their symptoms improved due to the treatment using a five-point Likert scale: “Yes”, “Somewhat yes”, “Indifferent”, “Somewhat no”, and “No”. The “Yes/Somewhat yes” and “No/Somewhat no” options were subsequently combined. The survey instrument is available in the appendix, table S1.

Data were collected using REDCap (v11.0.3) and analysed using the Stata statistical software (version 16.0; Stata-Corp). The data are presented as numbers (percentages) and were compared between groups using the chi-square test. A p-value of <0.05 was considered statistically significant. Complementary medicine use was stratified by age, sex, education, profession, and SARS-CoV-2 infection status. Missing data were considered missing at random since the variables considered in the models had few missing data points (all participants had known sex, age, and SARS-CoV-2 infection status; 12,207 participants had known education; and 11,188 participants had known profession). Logistic regression models were used to evaluate associations between COVID-19 vaccination status and the use of complementary medicine and specific therapies such as zinc, vitamin D, or vitamin C supplementation. Multivariable regression models were used to calculate adjusted odds ratios (aOR) with a 95% confidence interval (95% CI). The aORs were adjusted for age, sex, education, profession, SARS-CoV-2 infection status, and pre-existing comorbidities. Pre-existing comorbidities included being obese or overweight, headache disorders, sleep disorders, hypertension, anxiety, depression, cognitive disorders, respiratory disease, cardiovascular disease, diabetes, cancer, hyperthyroidism, hypothyroidism, and chronic pain, including fibromyalgia. Factors for adjustment were chosen

based on the distribution of complementary medicine use. A subgroup analysis evaluated the association between COVID-19 vaccination status and the use of complementary medicine and specific therapies such as zinc, vitamin D, or vitamin C supplementation among participants who reported taking them for COVID-19 prevention or treatment. Effect modification was assessed for SARS-CoV-2 infection status as an effect modifier in the association between complementary medicine use and COVID-19 vaccination status.

Results

This study enrolled 12,246 individuals in the follow-up (participation proportion = 17.7%; figure 1). Their mean age was 42.8 (standard deviation [SD] 14.8) years, 59.4% were women, 65.2% had a tertiary education, and half were highly skilled workers or professional managers. Notably, 31.6% of the complementary medicine users and 21.1% of the non-complementary medicine users had complementary insurance. Overall, 26.2% of the participants had at least one positive SARS-CoV-2 test. The mean time from testing to follow-up was 285 (SD 74) days. At the time of follow-up, 82.0% of the participants were vaccinated. Half of the participants had received the Pfizer-BioNTech COVID-19 vaccine and half the Moderna COVID-19 (mRNA-1273) vaccine. The participants' baseline characteristics are shown in table 1.

Complementary medicine use

Some form of complementary medicine was used by 63.7% of participants: 62.4% for chronic treatment and 17.9% for acute treatment.

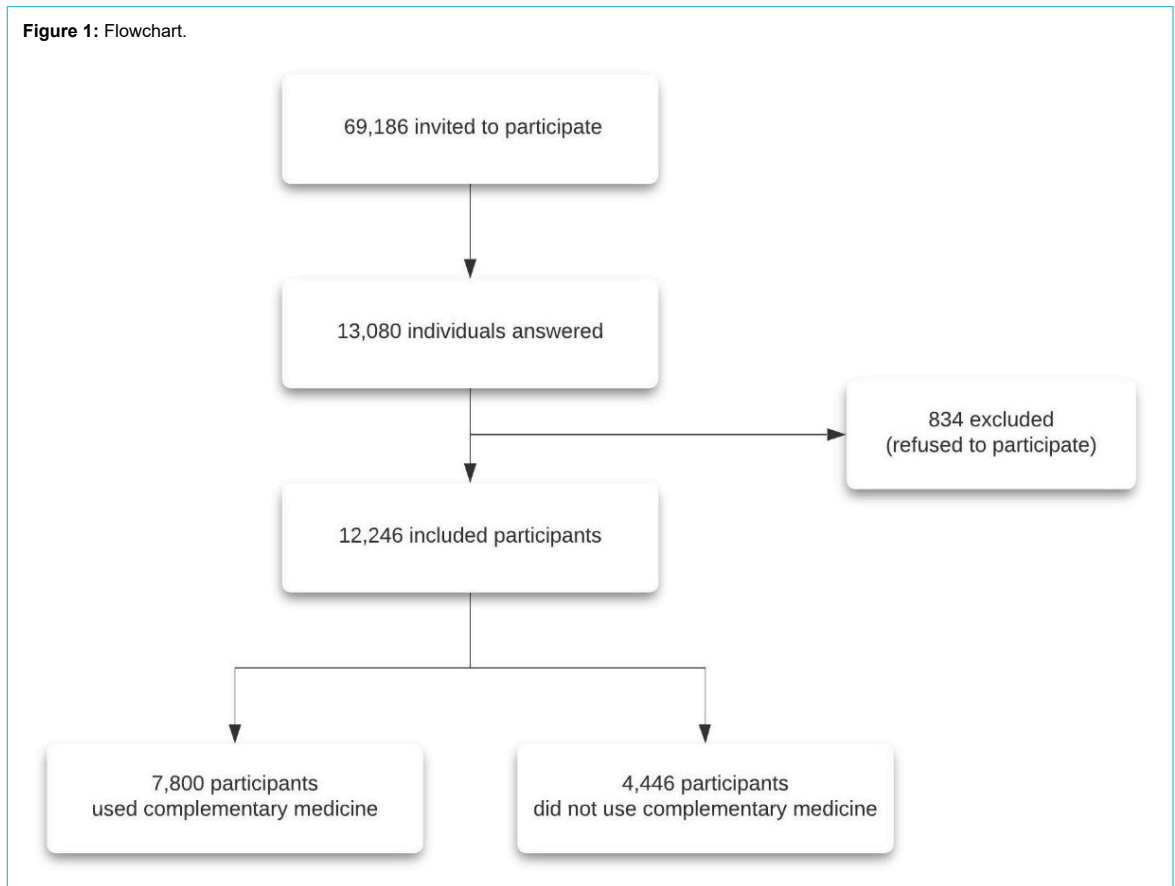
In addition, 38.9% of the participants used dietary supplements for chronic treatment within the 12 months before the questionnaire: 14.1% used zinc, 29.9% used vitamin D, and 23.6% used vitamin C. The participants also used therapies such as vitamin B12 (13.8%), a mix of minerals/vitamins (13.5%), selenium (2.5%), essential oils (8.1%), probiotics (8.7%), herbal medicine (7.0%), specific diets (4.4%), homoeopathy (2.5%), traditional Chinese medicine (1.9%), osteopathy (20.7%), acupuncture (8.3%), meditation (8.1%), hypnosis (3.3%), reflexology (3.4%), and luminotherapy (1.1%). Moreover, 17.8% of the participants used dietary supplements for acute treatment within 10 days of testing: 7.1% used zinc, 12.4% used vitamin D, and 13.2% used vitamin C.

Complementary medicine use was higher in women, those aged 40–60 years, those with a higher education level, those who were more highly skilled, those with a prior SARS-CoV-2 infection, and those who had pre-existing comorbidities. Treatment distributions by sex, age, education, profession, and SARS-CoV-2 infection status are described in the appendix, tables S2–S5.

Reasons for complementary medicine use

Figure 2 shows the proportion of participants who started complementary medicine therapy specifically for COVID-19 prevention or treatment. Between 10%–30% of participants started the therapy for COVID-19. Almost 25% of participants started zinc for COVID-19 (19.1% for

Figure 1: Flowchart.



prevention), 30% started vitamin D for COVID-19 (22.4% for prevention), and 40% started vitamin C for COVID-19 (30.4% for prevention). Other treatments initiated to treat or prevent COVID-19 were essential oils, herbal medicine, hypnosis, selenium, and oligo-elements. Most participants reported that the treatment improved their COVID-19 symptoms.

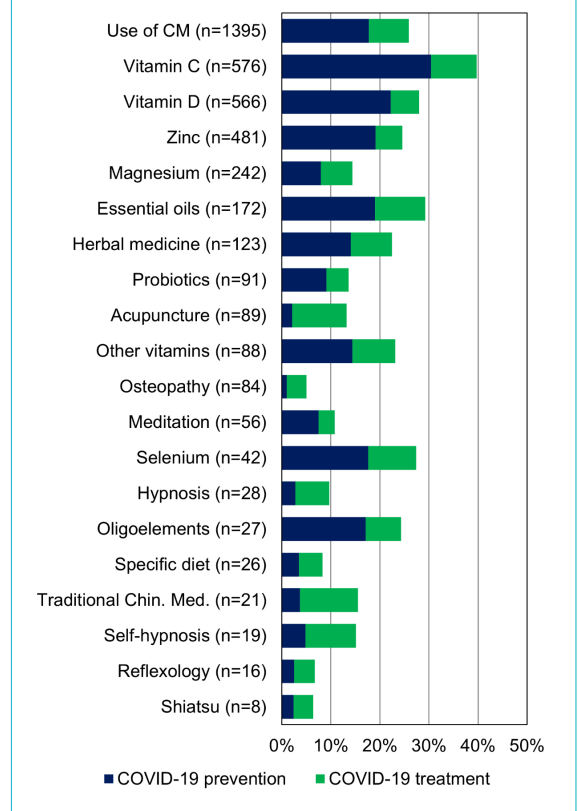
Communication with primary care physician

Only 461 (3.8%) participants had discussed complementary medicine therapies with their primary care physician, of which 418 used complementary medicine (5.4% discussed these therapies with their primary care physician), and 43 did not use complementary medicine (1.0% discussed these therapies with their primary care physician).

Association of complementary medicine use and COVID-19 vaccination status

Being unvaccinated was independently associated with general complementary medicine use (aOR 1.22 [1.09–1.37]), zinc use (aOR 2.25 [1.98–2.55]), vitamin D use (aOR 1.45 [1.30–1.62]), and vitamin C use (aOR 1.59 [1.42–1.78]). These associations were significant after adjusting for age, sex, education, profession, SARS-CoV-2 infection status, and pre-existing comorbidities. A subgroup analysis of participants who used complementary medicine therapies for COVID-19 was conducted. In this subgroup, being unvaccinated was strongly associated with using complementary medicine, zinc, vitamin D, or vitamin C for COVID-19 prevention. In addition, being unvaccinated was associated with using complementary medicine or vitamin C but not zinc or vitamin D for COVID-19

Figure 2: The proportion of participants who used complementary medicine (CM) to prevent or treat COVID-19. Traditional Chin. Med.: Traditional Chinese Medicine



treatment. SARS-CoV-2 infection status did not modify the association between complementary medicine use and COVID-19 vaccination. Figure 3 shows the adjusted odds ratios and associations between being unvaccinated and using complementary medicine therapies.

Discussion

Over two-thirds of participants used complementary medicine during the COVID-19 pandemic. Women, those aged 40–59 years, and those who were highly educated were the most likely to use some of these therapies. Up to a third of participants started these therapies for COVID-19. Notably, using general complementary medicine or zinc, vita-

min D and vitamin C supplements was associated with being unvaccinated.

Complementary medicine use doubled during the COVID-19 pandemic compared to the 2017 Swiss Health Survey [7], when approximately 28.9% of individuals used complementary medicine. This increase was especially associated with taking vitamins and minerals. However, complementary medicine, excluding vitamins and minerals, was still used by 32.9%, showing an overall increase in the use of these therapies. Complementary medicine therapies are most often used by women, those aged 40–59 years, and highly skilled individuals. Women are more open to complementary medicine [29], and its use has been

Table 1:
Participants' baseline characteristics (n = 12,246)*.

	Total	Use of complementary medicine	No use of complementary medicine	p-value
	n (%)	n (%)	n (%)	
Age category (years)				0.033
<40	5582 (45.6)	3488 (44.7)	2094 (47.1)	
40–59	5037 (41.1)	3269 (41.9)	1768 (39.8)	
≥60	1627 (13.3)	1044 (13.4)	583 (13.1)	
Sex				<0.001
Male	4968 (40.6)	2528 (32.4)	2440 (54.9)	
Female	7278 (59.4)	5273 (67.6)	2005 (45.1)	
Education (n = 12,207)				<0.001
Primary	529 (4.3)	253 (3.3)	276 (6.2)	
Apprenticeship	1229 (10.1)	690 (8.9)	539 (12.2)	
Secondary	1712 (14.0)	1085 (13.9)	627 (14.2)	
Tertiary	7955 (65.2)	5275 (67.8)	2680 (60.6)	
Other	531 (4.3)	342 (4.4)	189 (4.3)	
Prefer not to answer	251 (2.1)	139 (1.8)	112 (2.5)	
Profession (n = 11,188)				<0.001
Unskilled workers	2161 (19.3)	1397 (19.4)	764 (19.2)	
Skilled workers	2489 (22.2)	1757 (24.4)	732 (18.4)	
Highly skilled workers	3738 (33.4)	2405 (33.4)	1333 (33.4)	
Professional managers	1872 (16.7)	1145 (15.9)	727 (18.2)	
Other	267 (2.4)	162 (2.2)	105 (2.6)	
Prefer not to answer	661 (5.9)	336 (4.7)	325 (8.2)	
Complementary insurance	3401 (27.8)	2464 (31.6)	937 (21.1)	<0.001
SARS-CoV-2 vaccinated**	10,123 (82.5)	6419 (82.0)	3704 (83.3)	0.079
SARS-CoV-2 infection	3237 (26.2)	2159 (27.5)	1078 (24.1)	<0.001
Hospitalisation	1230 (10.0)	905 (11.5)	325 (7.3)	<0.001
Due to COVID-19	128 (1.0)	93 (1.2)	35 (0.8)	0.035
SARS-CoV-2 reinfection	158 (1.3)	123 (1.6)	35 (0.8)	<0.001
Comorbidities				
Obese or overweight	1862 (15.1)	1257 (16.0)	605 (13.5)	<0.001
Headache disorders	1603 (13.0)	1272 (16.2)	331 (7.4)	<0.001
Sleep disorders	1609 (13.0)	1281 (16.3)	328 (7.3)	<0.001
Hypertension	1030 (8.3)	840 (10.7)	190 (4.2)	0.001
Anxiety	1030 (8.3)	840 (10.7)	190 (4.2)	<0.001
Cognitive disorders	801 (6.5)	653 (8.3)	148 (3.3)	<0.001
Depression	766 (6.2)	594 (7.6)	172 (3.8)	<0.001
Respiratory disease	532 (4.3)	389 (4.9)	143 (3.2)	<0.001
Cardiovascular disease***	291 (2.4)	208 (2.6)	83 (1.9)	0.006
Diabetes	89 (0.7)	64 (0.8)	25 (0.6)	0.559
Cancer	89 (0.7)	64 (0.8)	25 (0.6)	0.108
Hyperthyroidism	42 (0.6)	33 (0.9)	9 (0.3)	0.004
Hypothyroidism	141 (2.1)	103 (2.7)	38 (1.3)	<0.001
Chronic pain, including fibromyalgia	77 (1.1)	71 (1.9)	6 (0.2)	<0.001

* Complementary medicine.

** Vaccinated is considered receiving at least one vaccine dose against SARS-CoV-2.

*** Cardiovascular disease excluded hypertension.

higher in populations with higher education levels and socio-economic status [29]. These groups might be searching for alternative treatment options and potentially choose to avoid paternalistic approaches in medicine by looking for information and adopting carefully selected therapies [30–32]. In addition, without confirmed treatments (e.g. post-COVID-19), individuals may try unconventional therapies using a precautionary principle.

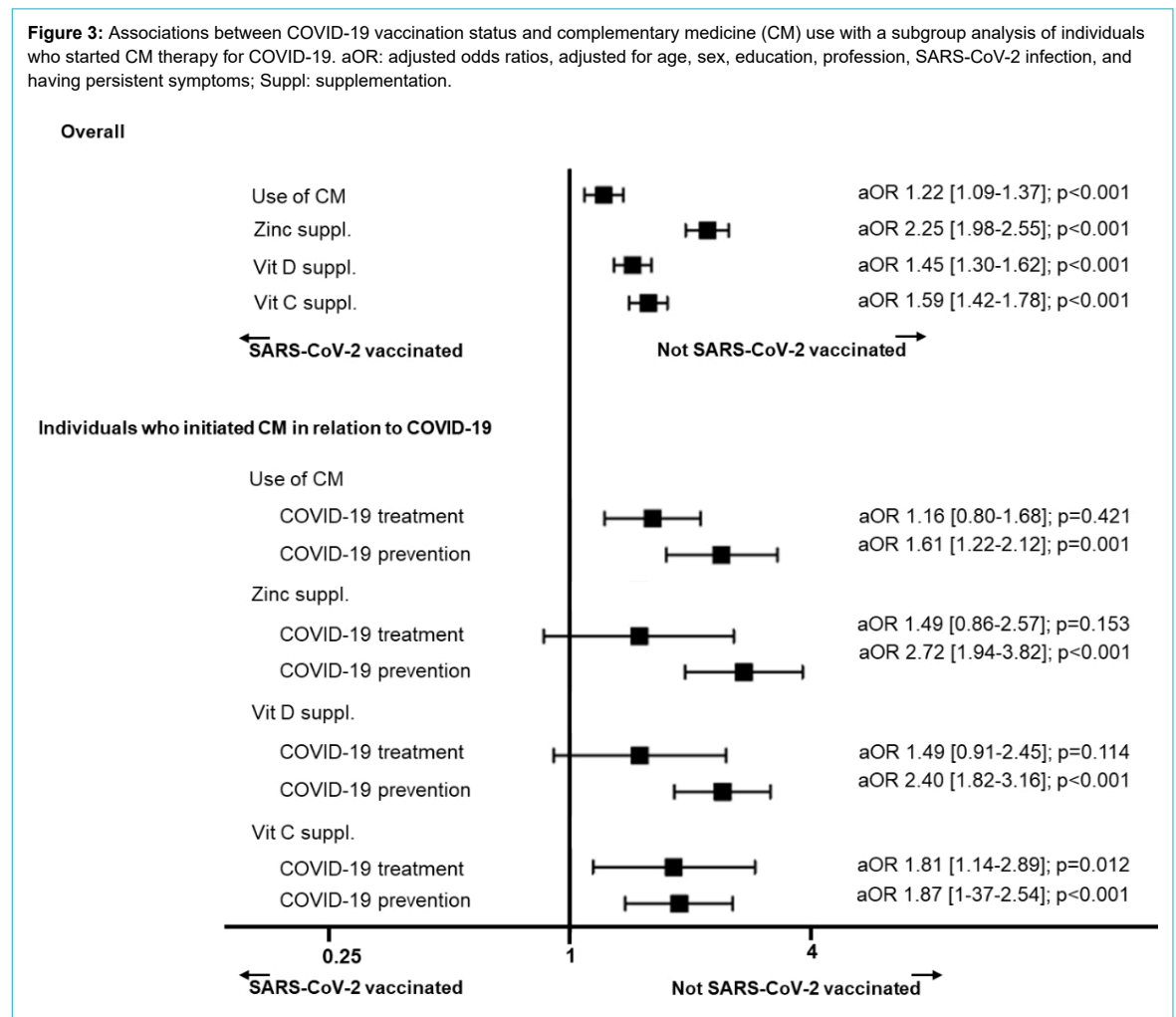
Almost a third of participants started complementary medicine therapy for COVID-19, especially vitamins or minerals. While most had started the therapies to prevent SARS-CoV-2 infection, some also started them as acute or chronic treatment for COVID-19. Studies have shown a mitigated response to the usefulness of these therapies in the acute COVID-19 infection phase [33]. Some studies have shown the benefit of complementary medicine [10], especially in patients with persistent symptoms due to COVID-19 or post-COVID-19 syndrome [13]. However, greater caution is warranted when using it as a preventive measure against COVID-19 alone [34–36] and not adjunct to conventional medicine.

Our results are consistent with studies showing a surge in complementary medicine use during the COVID-19 pandemic [10, 37, 38]. In addition to showing similar results, our study strengthens the body of knowledge on this subject by showing the prevalence of complementary medicine use directly associated with COVID-19 prevention or

treatment. This increase in complementary medicine use associated with COVID-19 is potentially driven by the lack of treatment options at the beginning of the COVID-19 pandemic and to improve overall well-being [12].

Our results showed that individuals who used complementary medicine, especially to prevent COVID-19, were less likely to be vaccinated. Notably, the vaccination campaign was launched in Geneva, Switzerland, in December 2020. In May 2021, vaccination was open to all adults regardless of comorbidities or age. To date, 80% of Geneva residents aged 16–64 years and 90% of residents aged ≥65 years have received at least one vaccine dose against COVID-19 [39]. SARS-CoV-2 vaccination has been shown to be highly effective against acute and long-term complications, including the risk of developing post-COVID-19 syndrome [23]. Our study chose to define and evaluate specific dietary supplements, including zinc, vitamin D, and vitamin C, and their association with COVID-19 vaccination status based on published studies and their use during COVID-19. Due to their frequent use during the COVID-19 pandemic, the National Institute of Health issued guidelines and data on the level of evidence (or sometimes the lack thereof) behind the use of zinc, vitamin D, and vitamin C [34–36]. While zinc, vitamin D, and vitamin C might have some immune-modulating or antiviral properties [10–12, 40–42], they should not be considered an either/or approach regarding vaccination. Individuals who would like to adopt complementary medicine should not

Figure 3: Associations between COVID-19 vaccination status and complementary medicine (CM) use with a subgroup analysis of individuals who started CM therapy for COVID-19. aOR: adjusted odds ratios, adjusted for age, sex, education, profession, SARS-CoV-2 infection, and having persistent symptoms; Suppl: supplementation.



choose one therapy over another, and an integrative approach is recommended in these cases. Information campaigns on vaccines should consider how to reach and better inform this population. Our results are similar to pre-pandemic studies showing reduced vaccine uptake among individuals who use complementary medicine therapies [19–21, 43–45], both for vaccines in general and specifically for the flu vaccine [20]. These results are more significant now than ever, impacting individual and public health in situations such as pandemics or increased risks of respiratory and other viruses.

Only 3.8% of all participants had discussed complementary medicine use with their primary care physician (5.4% of complementary medicine users and 1.0% of non-complementary medicine users), showing limited communication with physicians. This lack of discussion reduces physicians' ability to advise individuals for or against specific treatments and integrate them into their overall care. Individuals might then choose one type of medicine over another based on misinformation. Misinformation has been shown to be associated with vaccine hesitancy [22], and the latter is associated with distrust of conventional medicine [44]. Trust in doctors predicted vaccination behaviours and attitudes [43]. Therefore, primary care physicians should initiate the discussion and lead the conversation around vaccination and complementary medicine use [45]. Complementary medicine therapies can have benefits, and participants in our study reported a subjective improvement in their symptoms. Therefore, there is an urgent need to train and provide more knowledge to primary care physicians on complementary medicine in general and vaccine-related topics [46] to improve factual information transfer and general communication. Considering their potential influence on patients' decisions, complementary medicine practitioners should also be included in vaccination and information campaigns [47].

The limitations of our study included potential reverse causality and indication biases, not knowing whether complementary medicine use was initiated before or after COVID-19 vaccination. These biases were mitigated by adjusting for pre-existing comorbidities and SARS-CoV-2 infection, among other factors. The self-reported nature of the follow-up and the subjective improvement in symptoms limit the general interpretation of our results. The benefits of complementary medicine therapies cannot be confirmed, and efficacy outcomes were not studied. However, participants did report feeling better, which is important in overall well-being. Another limitation was the lack of information on why patients and physicians did not discuss complementary medicine use; this insight could be helpful in the future to improve the conversation between patients and physicians. A further limitation was the classification of occupational status based on training and manual compared to non-manual labour. While this categorisation has its limitations with potential ascertainment bias, it follows the same categorisations used in other cohort studies in Geneva. A final limitation was that the population was mostly educated professionals, with higher response rates from women and individuals answering by email and in French, limiting the generalizability of our results.

Conclusion

The prevalence of using complementary medicine during the COVID-19 pandemic was high, and there was an increased uptake associated with COVID-19 prevention or treatment. Complementary medicine use varied by age, sex, education, and profession. Individuals using complementary medicine, especially for prevention, were less likely to be vaccinated against COVID-19. Despite their high use, there was a lack of communication about complementary medicine therapies with the primary care physician. The role of physicians in advising and helping patients make their choices is important. Further research should explore the potential fears and barriers to communication about complementary medicine use between patients and primary care physicians. After considering all the risks and benefits, choosing complementary medicine can be a shared decision, complementing or integrating with conventional management.

Data availability statement

Our data are available to researchers upon reasonable request to the corresponding author, including de-identified participant data or other additional related documents.

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Appendix

Table S1. Survey instrument	
Employment status	Salaried Retired Student Independent Looking after home/family Unemployed Disability Other
Education	Primary (compulsory education, no formal education) Apprenticeship Secondary (secondary education, specialized schools) Tertiary (universities, higher professional education, doctorates) Other Prefer not to answer
Civil status	Single In couple, not married Married or registered partnership Divorced or separated Widowed Other
Living situation	Alone Single parent with children In couple, without children In couple, with children Cohabitation Other
Work status	Salaried Retired Student or in training Independent worker Homemaker Unemployed Disability Other
Profession	Unskilled workers (manual labor, craftsmen, traders, farmers, employees without specific training) Skilled workers (employees with specific training) Highly skilled workers (employees with intermediate training) Professional-Managers (company managers with more than 10 employees, individuals with a profession requiring university training) Independent (consultants, were independent or were company managers with fewer than 10 employees) Other Prefer not to answer

Smoking status	I have never smoked I am a current smoker I am an ex-smoker, but stopped prior to my SARS-CoV-2 infection I am an ex-smoker, but stopped after my SARS-CoV-2 infection Prefer not to answer
Physical activity	I do not do any physical activity I am partially active I am completely active Prefer not to answer
Compared to before the test date, your physical activity is:	The same Less More
Do you suffer from any of the following conditions (multiple answers possible)	None Overweight Sleep disorders Migraine Hypertension Anxiety Irritable bowel syndrome Depression Chronic fatigue syndrome Respiratory disease Other arthritic disorder (specify) Tension headache Tendinitis Obesity Anemia Attention disorders Memory disorders Hypothyroidism Other digestive disorder (specify) Cardiovascular disease Other type of headache (specify) Diabetes Immunosuppression Deep vein thrombosis Dysmenorrhea Hyperthyroidism Rheumatoid arthritis Other neurologic disorder (specify) Fibromyalgia Ulcerative colitis Multiple sclerosis Other psychiatric disorder (specify) Reactive arthritis Renal disease Ankylosing spondylitis Crohn disease Lupus Sjogren disease Cirrhosis
If condition checked, specify	[This condition] is new since my test date I suffer from [this condition] since before my test date Prefer not to answer
Height in cm	
Weight in kg	

Did you have COVID-19 compatible symptoms at time of testing?	Yes, I had symptoms Yes, but very few symptoms No, I did not have symptoms Prefer not to answer	
After your test date, how did your symptoms evolve?	I never had symptoms My symptoms disappeared My symptoms are fluctuating My symptoms are constant Other Prefer not to answer	
What was or has been the duration of symptoms since they started?	0-10 days 11-20 days 21-30 days 1-2 months 2-3 months 3-4 months 4-5 months 5-6 months 6-7 months 8-9 months 9-10 months 10-11 months 11-12 months More than 12 months Do not know	
After your laboratory confirmed test at the Geneva University Hospitals, did you have any nasopharyngeal swab (RT-PCR or antigenic test) positive for COVID-19?	Yes No	If yes, date of test
Have you had any serological testing for COVID-19	Yes No	If yes, date of test and result
Have you been vaccinated against SARS-CoV-2	Yes No Prefer not to answer	If yes, number of doses and date of each dose
Which type of vaccine did you receive	Comirnaty® (BNT162b2) vaccine of Pfizer/BioNTech (mRNA-1273) vaccine of Moderna Vaxzevria (previously COVID-19 vaccine of Oxford/AstraZeneca) Sinopharm BIBP vaccine of China National Pharmaceutical Group Sputnik V vaccine of Gamaleya Research Institute of Epidemiology and Microbiology Janssen Vaccine of Johnson&Johnson Do not know Prefer not to answer Other	
Have you been hospitalized since your test date?	Yes No Prefer not to answer	If yes, was the hospitalization related to COVID-19 and date of hospitalization
Have you seen a physician or healthcare professional in relation to your symptoms? (multiple answers possible)	Yes, my primary care physician Yes, I have been to the emergency room Yes, I have seen another specialist, physician or healthcare professional (specify) No	If yes, how many times for each answer and is this a new follow-up since your test date?

In the past 2 weeks, which of the following symptoms have you experienced, even if fluctuating? (multiple answers possible)	<ul style="list-style-type: none"> Fatigue Headache Change in smell Mental exhaustion Myalgia Dyspnea Difficulty concentrating Insomnia Stress Change in taste Loss of memory Paraesthesia Arthralgia Neck pain Anxiety Cough Sadness Loss of smell Palpitations Dizziness Back pain Throat pain Diarrhea Nausea Abdominal pain Loss of taste Hair loss Lack of equilibrium Lack of appetite Chest pain Constipation Generalized pain Fever > 38 C Rash Malaise Vomiting Toe pain or redness Finger pain or redness Other Prefer not to answer
If symptom checked, did you have this symptom regularly (most days) prior to the test?	<ul style="list-style-type: none"> Yes No Prefer not to answer
Current symptom intensity	<ul style="list-style-type: none"> Mild Moderate Severe
Current symptom frequency	<ul style="list-style-type: none"> Never Rarely Often Always

Treatment	Paracetamol Anti-inflammatory Aspirin Immunosuppressive therapy Antihypertensives Diabetes medication Inhaled sprays Corticosteroids Anticoagulation Antidepressant Sleep medication Anxiolytics Antipsychotics Mood stabilizers Vitamin D Vitamin C Vitamin B12 Magnesium Zinc Selenium Folic acid Mix of vitamins and minerals Other vitamins Other minerals Probiotics Essential oils Herbal medicine Specific diet Essential oils Oligoelements Homeopathic treatment Herbal medicine Osteopathy Acupuncture Meditation Hypnosis Self-hypnosis Shiatsu Reflexology Traditional Chinese medicine Luminotherapy
If treatment was initiated in relation to symptoms, did the symptoms improve?	Yes Rather yes Do not know No Rather no

Table S2. Distribution of complementary medicine use by sex and age (n = 12,246)								
	Male		Female	P-value	below 40	40-59	60 and above	P-value
Chronic treatment overall	N (%)		N (%)		N (%)	N (%)	N (%)	
Use of complementary medicine	2,528 (50.9)		5,273 (72.4)	<0.001	3,488 (62.5)	3,269 (64.9)	1,044 (64.2)	0.033
Zinc	508 (10.2)		1,217 (16.7)		734 (13.1)	764 (15.2)	227 (14.0)	
Vitamin D	1,059 (21.3)		2,599 (35.7)		1,434 (25.7)	1,612 (32.0)	612 (37.6)	
Vitamin C	963 (19.4)		1,926 (26.5)		1,324 (23.7)	1,210 (24.0)	355 (21.8)	
Vitamin B12	481 (9.7)		1,212 (16.7)		788 (14.1)	690 (13.7)	215 (13.2)	
Magnesium	869 (17.5)		2,096 (28.8)		1,225 (21.9)	1,313 (26.1)	427 (26.2)	
Osteopathy	707 (14.2)		1,834 (25.2)		1,210 (21.7)	1,050 (20.8)	281 (17.3)	
Acupuncture	257 (5.2)		761 (10.5)		418 (7.5)	484 (9.6)	116 (7.1)	
Meditation	230 (4.6)		757 (10.4)		477 (8.5)	428 (8.5)	82 (5.0)	
Mix of vitamins/minerals	501 (10.1)		1,156 (15.9)		738 (13.2)	713 (14.2)	206 (12.7)	
Selenium	94 (1.9)		211 (2.9)		104 (1.9)	153 (3.0)	48 (3.0)	
Other vitamins	224 (4.5)		503 (6.9)		302 (5.4)	324 (6.4)	101 (6.2)	
Other minerals	90 (1.8)		247 (3.4)		137 (2.5)	162 (3.2)	38 (2.3)	
Oligoelements	60 (1.2)		176 (2.4)		85 (1.5)	121 (2.4)	30 (1.8)	
Probiotics	238 (4.8)		824 (11.3)		513 (9.2)	455 (9.0)	94 (5.8)	
Essential oils	189 (3.8)		808 (11.1)		478 (8.6)	416 (8.3)	103 (6.3)	
Phytotherapy	202 (4.1)		653 (9.0)		378 (6.8)	395 (7.8)	82 (5.0)	
Specific diet	117 (2.4)		421 (5.8)		241 (4.3)	240 (4.8)	57 (3.5)	
Hypnosis	87 (1.8)		319 (4.4)		230 (4.1)	157 (3.1)	19 (1.2)	
Self-hypnosis	48 (1.0)		170 (2.3)		92 (1.6)	106 (2.1)	20 (1.2)	
Shiatsu	51 (1.0)		163 (2.2)		84 (1.5)	113 (2.2)	17 (1.0)	
Reflexology	94 (1.9)		319 (4.4)		179 (3.2)	183 (3.6)	51 (3.1)	
Traditional Chinese medicine	58 (1.2)		178 (2.4)		103 (1.8)	113 (2.2)	20 (1.2)	
Luminotherapy	24 (0.5)		112 (1.5)		74 (1.3)	52 (1.0)	10 (0.6)	

Acute treatment within 10 days of test								
Use of complementary medicine as acute treatment	705 (14.2)		1,477 (20.3)	<0.001	921 (16.5)	976 (19.4)	285 (17.5)	0.001
Zinc	277 (5.6)		591 (8.1)		339 (6.1)	421 (8.4)	108 (6.6)	
Vitamin D	471 (9.5)		1,050 (14.4)		587 (10.5)	722 (14.3)	212 (13.0)	
Vitamin C	538 (10.8)		1,074 (14.8)		715 (12.8)	711 (14.1)	186 (11.4)	
Homeopathy	70 (1.4)		235 (3.2)		107 (1.9)	164 (3.3)	34 (2.1)	

Table S3.							
Distribution of complementary medicine use by education (n = 12,120)							
	Primary	Apprenticeship	Secondary	Tertiary	Other	Prefer not to answer	P-value
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	
Chronic treatment overall							
Use of complementary medicine	251 (47.8)	684 (56.2)	1,079 (63.3)	5,235 (66.2)	335 (64.0)	138 (55.6)	<0.001
Zinc	49 (9.3)	132 (10.8)	217 (12.7)	1,217 (15.4)	68 (13.0)	27 (10.9)	
Vitamin D	122 (23.2)	305 (25.0)	469 (27.5)	2,488 (31.5)	162 (31.0)	75 (30.2)	
Vitamin C	88 (16.8)	238 (19.5)	379 (22.2)	1,998 (25.3)	111 (21.2)	48 (19.4)	
Vitamin B12	52 (9.9)	140 (11.5)	256 (15.0)	1,110 (14.0)	79 (15.1)	38 (15.3)	
Magnesium	86 (16.4)	254 (20.9)	415 (24.4)	1,992 (25.2)	141 (27.0)	45 (18.1)	
Osteopathy	51 (9.7)	219 (18.0)	351 (20.6)	1,750 (22.1)	119 (22.8)	28 (11.3)	
Acupuncture	20 (3.8)	88 (7.2)	128 (7.5)	716 (9.1)	43 (8.2)	13 (5.2)	
Meditation	24 (4.6)	54 (4.4)	117 (6.9)	734 (9.3)	35 (6.7)	12 (4.8)	
Mix of vitamins/minerals	28 (5.3)	126 (10.3)	205 (12.0)	1,178 (14.9)	79 (15.1)	28 (11.3)	
Selenium	5 (1.0)	16 (1.3)	37 (2.2)	229 (2.9)	12 (2.3)	3 (1.2)	
Other vitamins	27 (5.1)	57 (4.7)	98 (5.8)	488 (6.2)	39 (7.5)	10 (4.0)	
Other minerals	5 (1.0)	17 (1.4)	27 (1.6)	260 (3.3)	18 (3.4)	7 (2.8)	
Oligoelements	2 (0.4)	21 (1.7)	28 (1.6)	177 (2.2)	8 (1.5)	0 (0.0)	
Probiotics	11 (2.1)	79 (6.5)	120 (7.0)	787 (10.0)	43 (8.2)	14 (5.6)	
Essential oils	23 (4.4)	83 (6.8)	133 (7.8)	685 (8.7)	50 (9.6)	11 (4.4)	
Herbal medicine	18 (3.4)	67 (5.5)	95 (5.6)	619 (7.8)	44 (8.4)	6 (2.4)	
Specific diet	19 (3.6)	28 (2.3)	72 (4.2)	384 (4.9)	23 (4.4)	8 (3.2)	
Hypnosis	16 (3.0)	27 (2.2)	77 (4.5)	241 (3.0)	32 (6.1)	6 (2.4)	
Self-hypnosis	7 (1.3)	11 (0.9)	30 (1.8)	162 (2.1)	5 (1.0)	2 (0.8)	
Shiatsu	7 (1.3)	14 (1.1)	27 (1.6)	152 (1.9)	12 (2.3)	2 (0.8)	
Reflexology	7 (1.3)	38 (3.1)	65 (3.8)	263 (3.3)	27 (5.2)	6 (2.4)	
Traditional Chinese medicine	6 (1.1)	26 (2.1)	30 (1.8)	155 (2.0)	10 (1.9)	6 (2.4)	
Luminotherapy	5 (1.0)	9 (0.7)	23 (1.3)	89 (1.1)	7 (1.3)	2 (0.8)	

Acute treatment within 10 days of test							
Use of complementary medicine as acute treatment	66 (12.6)	185 (15.2)	288 (16.9)	1,485 (18.8)	95 (18.2)	42 (16.9)	0.001
Zinc	17 (3.2)	66 (5.4)	88 (5.2)	639 (8.1)	38 (7.3)	15 (6.0)	
Vitamin D	43 (8.2)	142 (11.7)	201 (11.8)	1,029 (13.0)	69 (13.2)	28 (11.3)	
Vitamin C	38 (7.2)	134 (11.0)	203 (11.9)	1,119 (14.2)	66 (12.6)	31 (12.5)	
Homeopathy	5 (1.0)	31 (2.5)	37 (2.2)	207 (2.6)	19 (3.6)	5 (2.0)	

Table S4.							
Distribution of complementary medicine use by profession (n = 11,140)							
	Unskilled workers	Skilled workers	Highly skilled workers	Professional managers	Other	Prefer not to answer	P-value
Chronic treatment overall	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	
Use of complementary medicine	334 (50.8)	1,385 (64.7)	1,738 (70.5)	2,387 (64.3)	1,138 (61.1)	161 (61.0)	<0.001
Zinc	73 (11.0)	297 (13.7)	382 (15.3)	556 (14.9)	271 (14.5)	41 (15.4)	
Vitamin D	156 (23.6)	668 (30.9)	789 (31.7)	1,150 (30.8)	561 (30.0)	84 (31.5)	
Vitamin C	124 (18.8)	509 (23.6)	591 (23.7)	910 (24.3)	449 (24.0)	70 (26.2)	
Vitamin B12	64 (9.7)	333 (15.4)	345 (13.9)	502 (13.4)	266 (14.2)	40 (15.0)	
Magnesium	127 (19.2)	551 (25.5)	657 (26.4)	917 (24.5)	464 (24.8)	62 (23.2)	
Osteopathy	102 (15.4)	453 (21.0)	687 (27.6)	771 (20.6)	357 (19.1)	45 (16.9)	
Acupuncture	41 (6.2)	178 (8.2)	281 (11.3)	312 (8.3)	151 (8.1)	16 (6.0)	
Meditation	38 (5.7)	139 (6.4)	238 (9.6)	330 (8.8)	143 (7.6)	19 (7.1)	
Mix of vitamins/minerals	70 (10.6)	306 (14.2)	369 (14.8)	585 (15.7)	203 (10.8)	27 (10.1)	
Selenium	13 (2.0)	44 (2.0)	84 (3.4)	106 (2.8)	43 (2.3)	7 (2.6)	
Other vitamins	33 (5.0)	111 (5.1)	162 (6.5)	239 (6.4)	117 (6.3)	19 (7.1)	
Other minerals	12 (1.8)	46 (2.1)	80 (3.2)	129 (3.5)	44 (2.4)	9 (3.4)	
Oligoelements	5 (0.8)	41 (1.9)	72 (2.9)	75 (2.0)	33 (1.8)	5 (1.9)	
Probiotics	31 (4.7)	193 (8.9)	240 (9.6)	354 (9.5)	155 (8.3)	29 (10.9)	
Essential oils	45 (6.8)	165 (7.6)	302 (12.1)	257 (6.9)	150 (8.0)	18 (6.7)	
Herbal medicine	31 (4.7)	138 (6.4)	250 (10.0)	248 (6.6)	113 (6.0)	16 (6.0)	
Specific diet	25 (3.8)	102 (4.7)	129 (5.2)	160 (4.3)	78 (4.2)	15 (5.6)	
Hypnosis	20 (3.0)	96 (4.4)	104 (4.2)	98 (2.6)	61 (3.3)	3 (1.1)	
Self-hypnosis	10 (1.5)	27 (1.2)	77 (3.1)	62 (1.7)	30 (1.6)	2 (0.7)	
Shiatsu	12 (1.8)	39 (1.8)	48 (1.9)	61 (1.6)	45 (2.4)	3 (1.1)	
Reflexology	18 (2.7)	78 (3.6)	119 (4.8)	98 (2.6)	72 (3.8)	10 (3.7)	
Traditional Chinese medicine	14 (2.1)	49 (2.3)	65 (2.6)	60 (1.6)	30 (1.6)	3 (1.1)	
Luminotherapy	4 (0.6)	24 (1.1)	45 (1.8)	31 (0.8)	25 (1.3)	0 (0.0)	

Acute treatment within 10 days of test							
Use of complementary medicine as acute treatment	90 (13.7)	384 (17.9)	463 (18.8)	679 (18.3)	338 (18.1)	47 (17.8)	0.087
Zinc	33 (5.0)	137 (6.3)	216 (8.7)	278 (7.4)	130 (6.9)	22 (8.2)	
Vitamin D	62 (9.4)	270 (12.5)	334 (13.4)	498 (13.3)	239 (12.8)	31 (11.6)	
Vitamin C	70 (10.6)	284 (13.1)	334 (13.4)	510 (13.6)	250 (13.4)	39 (14.6)	
Homeopathy	10 (1.5)	57 (2.6)	94 (3.8)	80 (2.1)	44 (2.4)	6 (2.2)	

Table S5.			
Distribution of complementary medicine use by test result (n = 12,246)			
	No SARS-CoV-2 infection	SARS-CoV-2 infection	P-Value
Chronic treatment	N (%)	N (%)	
Use of complementary medicine	6,448 (63.6)	1,353 (64.3)	0.506
Zinc	1,259 (13.8)	482 (14.9)	
Vitamin D	2,700 (29.7)	985 (30.4)	
Vitamin C	2,073 (22.8)	836 (25.8)	
Vitamin B12	1,237 (13.6)	466 (14.4)	
Magnesium	2,170 (23.8)	816 (25.2)	
Osteopathy	1,825 (20.1)	739 (22.8)	
Acupuncture	742 (8.2)	287 (8.9)	
Meditation	719 (7.9)	276 (8.5)	
Mix of vitamins/minerals	1,201 (13.2)	468 (14.5)	
Selenium	231 (2.5)	80 (2.5)	
Other vitamins	530 (5.8)	200 (6.2)	
Other minerals	252 (2.8)	93 (2.9)	
Oligoelements	178 (2.0)	61 (1.9)	
Probiotics	789 (8.7)	283 (8.7)	
Essential oils	723 (7.9)	287 (8.9)	
Herbal medicine	620 (6.8)	239 (7.4)	
Specific diet	411 (4.5)	132 (4.1)	
Hypnosis	277 (3.0)	134 (4.1)	
Self-hypnosis	159 (1.7)	63 (1.9)	
Shiatsu	144 (1.6)	75 (2.3)	
Reflexology	313 (3.4)	106 (3.3)	
Traditional Chinese medicine	169 (1.9)	70 (2.2)	
Luminotherapy	108 (1.2)	28 (0.9)	

Acute treatment within 10 days of test			
Use of complementary medicine as acute treatment	1,696 (16.7)	486 (23.1)	<0.001
Zinc	530 (5.8)	347 (10.7)	
Vitamin D	979 (10.8)	557 (17.2)	
Vitamin C	1,007 (11.1)	621 (19.2)	
Homeopathy	204 (2.2)	105 (3.2)	