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Traditional Chinese medicine for the COVID-19 pandemic: An online cross-sectional survey among health care workers

--Manuscript Draft--

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Abstract:	Background: During the coronavirus disease (COVID-19) pandemic, health care workers (HCWs) have faced a heightened risk of infection. Preventative measures are critical to mitigate the spread of COVID-19 and protect HCWs. Traditional Chinese medicine (TCM) has been recommended to prevent and treat COVID-19 in China. We conducted this survey to investigate the use of infection control behaviors, preventative and therapeutic interventions, and outcomes among HCWs during the surge of Omicron variant infections to explore the association of preventative measures with outcomes and to investigate the factors influencing the adoption of TCM as a preventative measure. Methods: The questionnaire consisted of 23 sections with 154 questions intended for HCWs. The targeted respondents comprised all HCWs from Xiamen Hospital Affiliated of Beijing University of Chinese Medicine. The recruitment process was open between March 17 and June 1, 2022. Chi-square test was used to estimate the relationship between prevention and outcomes. Multivariable logistic regression was used to investigate factors influencing the use of TCM as a preventative measure. Results: Among the 1122 participants who completed the questionnaire, 79.71% took preventative measures, including TCM (56.21%), physical activities (52.37%) and food supplements (26.99%). Xiamen preventative formula (a government-approved fixed prescription) (45.22%) and Lianhua Qingwen preparations (18.95%) were the most commonly used Chinese medicines. Thirty-six participants reported flu-like symptoms and three were diagnosed with COVID-19. Flu-like symptoms were not associated with prevention, vaccination, or TCM. Frontline working experience (OR = 0.61, 95% CI: 0.46–0.80), good knowledge of post-COVID-19 syndrome (OR = 0.57, 95% CI: 0.39–0.84), Western medicine qualifications (OR = 2.41, 95% CI: 1.51–3.86), nurses (OR = 1.70, 95% CI: 1.21–2.40), and medical technicians (OR = 2.27, 95% CI: 1.25–4.10) were associated with the willingness of using TCM as a preventative measure. Conclusion: Complementary medicine, especially TCM, could be used for COVID-19 prevention. Knowledge of COVID-19 may prompt people to use TCM to prevent COVID-19. Multicenter studies and prospective cohort follow-up studies are needed to provide further insights into the use of TCM for COVID-19 management.

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Response to Reviewers:	

Dear Prof. Ava Lorenc,

Enclosed for your consideration is an original article, entitled

"Traditional Chinese medicine for the COVID-19 pandemic: An online cross-sectional survey among health care workers" **(original article)**.

All authors of this study have directly participated in the planning, execution and drafting of this paper, and they have read and approved the final version. No similar or same contents of this study have been submitted to or are being considered for publication by any other journal.

In this paper, we investigated preventative measures, including traditional Chinese medicine and other measures such as food supplements, physical activities, of health care workers who encountered Omicron variants of COVID-19. We also explored the association of preventative measures with outcomes and the factors influencing the adoption of traditional Chinese medicine (TCM) as a preventative measure.

The results of this study showed that (1) more than half of health care workers chose TCM to prevent COVID-19, followed by physical activities and food supplements; (2) preventative measures, TCM or vaccination was not associated with onsets of flu-like symptoms; (3) experience of frontline work, good knowledge of post-COVID-19 syndrome and medical qualifications could be associated with the willingness to use TCM as a preventative measure. We expect that complementary medicine, especially TCM, would be applied for COVID-19 management after confirmation of future multicenter studies and prospective cohort follow-up studies.

Prof. Jianping Liu, Ph.D. Xiaoyang Hu and Ph.D. Chunli Lu are editorial board members of this journal. The authors have no other conflict of interest to declare.

This study was sponsored by the Xiamen Municipal Bureau of Science and Technology (No. 3502Z2021YJ12).

Your consideration of this manuscript for publication in your journal is sincerely appreciated.

Kind regards,

Corresponding authors on behalf of all authors

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June 19, 2023.

Essential Submission checklist for European Journal of Integrative Medicine (EuJIM)
Last updated: 27 February 2023

Before submitting, please review and submit this Submission Checklist of list critical items. If any of the items below are omitted or incorrectly checked or marked as not applicable the article may **be rejected**. Submissions may also be rejected if any of the relevant reporting checklists are not submitted or are incorrectly checked or marked.

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Yes* or *n/a	**Item**		**For more information see**
	Manuscript has been checked by a native English speaker with good literacy skills.		Yes
	Manuscript has been checked for **plagiarism,** including self plagiarism.		Yes
	[clinical trials only] The **clinical trial is registered** in a public trials registry AND the **registration date** is before the date when participant recruitment commenced. The registration number must be inserted at the end of the abstract and within the manuscript	[protocols only] The submission date for a clinical trial **protocol** is prior to completing participant recruitment and for a systematic review, prior to completing full paper screening. This information is in the cover letter and manuscript.	Registration of clinical trials
	[human studies only] The **full details of ethical approval**: name of institution, committee and approval number in Methods.	[plant studies only] **Plant Studies** have a specimen voucher number for every plant tested or batch number where plant/substance procured from commercial source and full details of how the plant was identified and independently verified.	Yes
There are **TWO types of checklists.** You must upload a copy of this **Submission checklist PLUS all relevant Reporting checklist(s).**			
	This submission checklist is completed and submitted		Yes
	All relevant **Reporting checklist(s)**, including extensions are completed and submitted. *When uploading reporting checklists select item type*: Reporting Checklist. *In the description enter:* the name of reporting checklist (e.g. CONSORT Abstract, PRISMA 2020, STRICTA, CONSORT Herb, CONSORT TCM etc.) **If a reporting checklist is not submitted,** a satisfactory explanation is provided in the cover letter to the editor		EQUATOR Network reporting guidelines http://www.equator-network.org/
ORIGINAL MANUSCRIPT FILE			
	Original Manuscript File – confirm that all the following sections are reported and are in this order in the manuscript		Yes
	Title page – title at the top of the page, author names and details are identical to electronic submissions		Article structure *Subdivision - numbered sections*
	Abstract: structured with headings. Identical to electronic submission. Maximum 350 words.		Structured abstract
	Keywords: identical to the those entered in the electronic submission.		Keywords

	Word count: Article text only (excluding abstract, references and tables)	Yes
	Abbreviations: full list of abbreviations. Also spelt out when first used in the Abstract and Article text.	Keywords - *Abbreviations*
	Main text: Article text headings Original research articles: **1. Introduction, 2. Methods, 3. Results, 4. Discussion, 5. Conclusion** Protocols: **1. Introduction, 2. Methods, 3. Discussion, 4. Conclusion** Opinion articles: **1. Introduction, *(plus optional headings to suit the article)*, 3. Conclusion** Headings are numbered, with subheadings numbered 1.1 (then 1.1.1, 1.1.2, ...), 1.2, etc.	Article structure
	Financial support: The full details of any funding, including in-kind support for interventions, equipment etc.	Role of the funding source and Article structure
	Acknowledgements: are made for Individuals, groups or institutions.	Article structure - *Acknowledgements*
	Data availability: statement is made.	Research data
	References: formatted according to the Guide for Authors	References
	Figures & Tables Legends: The last page lists the legends for any Figures, followed by Tables, in their numerical order	Yes
	The Original Manuscript File has **page numbers** and **line numbers**	Yes
OTHER FILES (uploaded separately and NOT in the Original Manuscript File)		
	Highlights are uploaded as a separate editable file	Highlights
	Each **Figure** is uploaded separately and numbered	Artwork
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	Author Agreement is signed by **ALL** authors using template NOTE: Scanned signatures can be pasted. You may convert this file to a .pdf file and use electronic signatures. Sign in English not another language.	Author agreement template.
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	Any **supplementary material** is clearly referenced within the manuscript as 'Appendix'	Article structure-Appendices and Supplementary material
FINAL CHECK of PDF file to be submitted		
	The final .**pdf for submission** has been downloaded and checked	Yes
	Files are in the correct order (Cover letter, this Submission checklist, Highlights, Original manuscript file, Figures, Tables, Author agreement, CRediT author statement, Declaration of Competing Interest, Supplementary material, Reporting checklists)	Yes
	The **links to the supplementary material** have been checked and the correct files have been uploaded	Yes

Dr. Ava Lorenc

Co-Editor,

Re: Manuscript EUJIM-D-23-00275: "Traditional Chinese medicine for the COVID-19 pandemic: An online cross-sectional survey among health care workers" by Jianping Liu and Xiaohua Pei, on behalf of all co-authors.

June 8, 2023.

Dear PhD. Lorenc:

Thank you for considering our manuscript as a potentially acceptable publication in European Journal of Integrative Medicine.

We have revised the manuscript point by point, according to the helpful comments made by the reviewer and editors, and we updated the revised manuscript in which all the inserted words are in red and all the deleted are in blue with deleting lines.

Sincerely yours,

Jianping Liu and Xiaohua Pei,

On behalf of co-authors.

Editor:

1. Change Highlights to bullets instead of numbers.

Response: Thank you for your kind reminder. We have changed the bullets instead of numbers in Highlight file.

2. Highlights should define acronyms and must be max 85 characters each. Suggest changing the third highlight to "Insufficient evidence for any recommendations for preventative Chinese herbal medicines. Prospective cohort studies or randomized

controlled studies are needed".

Response: Thank you for your helpful comments. We have added the acronym of traditional Chinese medicine (TCM) and reduced each item to 85 characters. We have also changed the third highlight according to your suggestion. However, as each item in the highlights can be a maximum of 85 characters, we have divided the third highlight into two items (Highlights minor revision file).

"The highlights of the findings as follows:

- More than 50% of health care workers chose traditional Chinese medicine (TCM) to prevent Omicron.
- Frontline experience, post-COVID-19 knowledge, and medical qualifications are linked to TCM use.
- Limited evidence for recommendations of preventative TCMs.
- Prospective cohort studies or randomized controlled studies are needed for conclusive findings."

3. Remove 'Category of paper: original article'.

Response: Thank you for your kind reminder. We have deleted 'Category of paper: original article' in Title page.

4. Add author ORCID numbers.

Response: Thanks for your helpful comments. We have added ORCID numbers of all authors in another file entitled "ORCID numbers of all authors" file.

5. Remove formatting bubbles in track changes.

Response: Thank you for your helpful comments. We have removed formatting bubbles in track changes in "Revised manuscript with track changes" file.

6. Check English throughout. Some examples: "who confirmed informed consents were the targeted respondents", "the commonly used Chinese medicine", "Well

knowledge", "HCWs could be a conducive population", "some irrelevant people". "there was few evidence".

Response: Thank you for your helpful comments. We have thoroughly reviewed the manuscript for English language errors and utilized an English Language Editing Service to ensure adherence to proper English. Additionally, we have attached the certificate as a supplementary file.

7. References should be in brackets and not superscript.

Response: Thank you for your kind reminder. We have placed the references in brackets.

8. Capitlisation of Omicron is inconsistent.

Response: Thank you for your kind reminder. We have revised “Omicron” throughout the manuscript.

9. Limitations should be a separate section or paragraph.

Response: Thank you for your helpful comments. We have revised the “Limitation” to form a separate paragraph (Page 18).

Reviewer #2: Thanks for providing responses to all the comments and feedback. This is an important study and can be considered for publication if the following minor points were addressed.

1. In "exercise or activities", please specify whether the activities are "physical activities" or "daily activities". From Table 2, it seems the activities are physical activities. Please revise the expression throughout the manuscript.

Response: Thank you for your helpful comments. We have placed “exercise or activities” with “physical activities” throughout the full text.

2. Discussion, page 15/33, line 41-45, "For example, vitamin D has been recognised a

risk factor of COVID-19 and there were some trials to confirm its effectiveness. However, trials were ongoing, and the results need followed." Do you mean "lacking of vitamin D..."? English editing is needed for these two sentences.

Response: Thank you for your helpful comments. We have revised the following two sentences (Page 16):

"For example, vitamin D deficiency has been recognized as a risk factor for COVID-19, and some trials have been conducted to confirm its effectiveness [43,44]. However, ongoing trials require further follow-up for conclusive results [45,46]."

3. Discussion, page 16/33, line 17-19, "we failed to investigate whether preventative measures were related to onsets of COVID-19 or flu-like symptoms", please specify whether this refer to the current study or previous studies. Line 20-24, it is not clear about the logic relationship between the last sentence and the previous sentences.

Response: Thank you for your helpful comments. We have revised these sentences as follow (Page 17):

"However, in the current study, we failed to investigate whether preventative measures were related to the onset of COVID-19 or flu-like symptoms because of the lack of confirmed cases. Indeed, in China, only a few participants developed COVID-19 or experienced flu-like symptoms due to the effective prevention and control measures for COVID-19, as well as standardized medical procedures."

The highlights of the findings are as follows:

- ~~(1)~~ More than 50% of health care workers chose traditional Chinese medicine (TCM) to prevent Omicron. ~~More than half of the health care workers chose TCM to prevent Omicron;~~
- ~~(2)~~ Frontline experience, post-COVID-19 knowledge, and medical qualifications are linked to TCM use. ~~Experience of front line work, well knowledge of post COVID-19 syndrome and medical qualifications could be associated with the willingness of using TCM;~~
- (3) Limited evidence for recommendations of preventative TCMs. ~~No specific Chinese herbal medicine is recommended as preventative measures until sufficient evidence supports their preventive effect by prospective cohort studies or randomized controlled studies.~~
- Prospective cohort studies or randomized controlled studies are needed for conclusive findings.

Title Page

Traditional Chinese medicine for the COVID-19 pandemic: An online cross-sectional survey among health care workers

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~~**Category of paper:** original article~~

Abstract

Background: ~~Since the~~ During the coronavirus disease (COVID-19) pandemic, health care workers (HCWs) have faced a heightened risk of infection. ~~To~~ Preventative measures are critical to~~effectively~~ mitigate the spread of COVID-19 and protect HCWs~~, preventive measures are critical~~. Traditional Chinese medicine (TCM) has been recommended to prevent and treat COVID-19 in China. We conducted this ~~online cross-sectional~~ survey to investigate the use of infection control behaviors, preventative and therapeutic interventions, and outcomes among HCWs during the surge of Omicron variant infections~~surge,~~ to explore the association of preventative measures with outcomes and to investigate the factors influencing the adoption of TCM as a preventative measure~~s~~.

Methods: The questionnaire consisted of 23 sections with 154 questions intended for HCWs. The targeted respondents comprised ~~All~~all HCWs from Xiamen Hospital Affiliated of Beijing University of Chinese Medicine~~ who confirmed informed consents were the targeted respondents~~. The recruitment process was open between ~~17th~~ March 17 and ~~1st~~ June 1, 2022~~ on wjx.cn platform (a public, open access online survey platform to disseminate, collect and analyze data)~~. Chi-square test was used to estimate the relationship between prevention and outcomes. Multivariable logistic regression was used to investigate factors ~~that may influence~~influencing the use of TCM as a preventative measure~~s~~.

Results: Among the 1122 participants who completed the questionnaire, 79.71% ~~participants~~ took preventative measures, including TCM (56.21%), physical activities (52.37%) and food supplements (26.99%). Xiamen preventative formula (a government-approved fixed prescription~~approved by local government~~) (45.22%) and Lianhua Qingwen preparations (18.95%) were the most commonly used Chinese medicines. Thirty-six participants~~ (3.22%)~~ reported flu-like symptoms and three were diagnosed with COVID-19. Flu-like symptoms were not associated with prevention~~ (*P* = 0.475)~~, vaccination~~ (*P* = 0.377)~~, or TCM~~ (*P* = 0.547)~~. Frontline working experience (OR = 0.61, 95% CI: 0.46–0.80), good knowledge of post-COVID-19 syndrome (OR = 0.57, 95% CI: 0.39–0.84), Western medicine qualifications (OR = 2.41, 95%

CI: 1.51–3.86), nurses (OR = 1.70, 95% CI: 1.21–2.40), and medical technicians (OR = 2.27, 95% CI: 1.25–4.10) were associated with the willingness of using TCM as a preventative measures.

Conclusion: Complementary medicine, especially TCM, was mainlycould be used for COVID-19 prevention. Well knowledge Knowledge of COVID-19 may prompt people to use TCM to prevent COVID-19 with TCM. Multi-center studies and prospective cohort follow-up studies are needed to provide more further insights into the use of TCM for on COVID-19 management in TCM.

Keywords: retrospective treatment outcome, complementary therapy, Chinese herbs, non-pharmacological intervention, healthcare personnel, omicron Omicron variant

~~**Abbreviation:** BMI: body mass index; BUCM: Beijing University of Chinese Medicine; CHERRIES: Checklist for Reporting Results of Internet E-surveys checklist; CI: confidence interval; COVID-19: coronavirus disease; HCWs: health care workers; IP: Internet protocol; IQR: interquartile range; OR: odds ratio; STROBE: Strengthening the Reporting of Observational Studies in Epidemiology; TCM: traditional Chinese medicine; WHO: World Health Organization.~~

Word count: 44194536

Abbreviations: BMI: body mass index; BUCM: Beijing University of Chinese Medicine; CHERRIES: Checklist for Reporting Results of Internet E-surveys checklist; CI: confidence interval; COVID-19: coronavirus disease; HCWs: health care workers; IP: Internet protocol; IQR: interquartile range; OR: odds ratio; STROBE: Strengthening the Reporting of Observational Studies in Epidemiology; TCM: traditional Chinese medicine; WHO: World Health Organization.

1. Introduction

Coronavirus disease (COVID-19) is an infectious disease caused by the SARS-CoV-2 virus. As of ~~17th~~ February 17, 2023, the pandemic ~~has~~ had cumulatively infected 756.6 million people and resulted in 6.8 million deaths worldwide [1]. ~~[1]~~ SARS-CoV-2 has undergone various mutations, among which ~~and since 2022,~~ the ~~omicron~~Omicron variant has been the predominant strain since 2022 [2]. ~~[2]~~ Despite having a lower risk of severe COVID-19 and mortality compared to previous variants, the increased transmission rate of the ~~omicron~~Omicron variant has contributed to a substantial burden on the health care system [3-6]. ~~[3-6]~~

Since the onset of the COVID-19 pandemic, health care workers (HCWs) have been at an increased risk of exposure to the SARS-CoV-2 virus, leading to physical and psychological strain due to overwork, which may make them more vulnerable to infection [7,8]. ~~[7,8]~~ Considering the substantial transmission advantage of ~~omicron~~Omicron, preventing COVID-19 is especially critical for HCWs. The World Health Organization (WHO) living guideline recommends implementing ~~Infection~~ infection ~~Prevention~~ prevention and ~~Control~~ control measures, such as mask wearing, environmental cleaning, physical distancing, hand hygiene, respiratory etiquette, and personal protective equipment, to prevent the spread of COVID-19 [9]. ~~[9]~~ However, as yet, no method other than vaccination has proven~~There has not been any drug proving~~ effective in preventing COVID-19 ~~other than vaccination~~ [10]. ~~[10]~~ ~~However~~Notably, the efficacy of vaccines against ~~omicron~~Omicron is more preserved against severe disease than against infection~~,~~ and the effectiveness wanes as antibody titers decrease [3,11]. ~~[3,11]~~ The effectiveness of vaccines against infection ~~of~~ by ~~omicron~~Omicron variants is still controversial [12,13]. ~~[12,13]~~

The National Health Commission of the People's Republic of China has recommended ~~Traditional~~ traditional Chinese medicine (TCM) as a preventative and therapeutic approach for COVID-19 in its ~~guidelines~~ Guidelines for Integration of Chinese and Western Medicine [14], [15], [16], [17], [18], [19], [20]. ~~[14-20]~~ For example, Lianhua Qingwen granule and Jinhua Qinggan granule are among the remedies recommended for ~~both suspected and confirmed~~ patients with suspected or confirmed COVID-19, and have been proven~~, which has been proved~~ to help regulate the immune system and exert ~~the~~ antiviral~~anti-virus~~ effects ~~as shown in~~by clinical studies

and experiments [21], [22], [23], [24], [25]. [21-25]

Our previous online cross-sectional survey aimed to investigate the use of infection control behaviors, preventative and therapeutic interventions, and outcomes in the community during the COVID-19 pandemic in China and found ~~presented~~ that 22.3% (76/341) of respondents chose TCM as a means of prevention. The respondents who reported their occupations were predominantly HCWs (138/155) ~~and~~ suggesting that HCWs ~~could be~~represent a conducive population to collect data from. Furthermore, ~~Besides,~~ the variants involved in this study were undefined, and the association of outcomes with preventative interventions was unclear. Notably, ~~The~~ the data may vary across different waves of the pandemic and target population [26]. [26] ~~For~~ instance, HCWs in Xiamen ~~Since localized outbreaks occurred in Xiamen, Fujian province, China in Sep 2021 and May 2022, HCWs in Xiamen~~ accumulated experience in combating COVID-19 as a result of the localized outbreaks that occurred in Xiamen, Fujian province, China in September 2021 and May 2022. Therefore, we aimed to conduct this online cross-sectional survey specifically among HCWs in Xiamen during the ~~omicron~~Omicron pandemic to investigate infection control behaviors, preventative and therapeutic interventions, and outcomes. We will explore the association of preventative measures with outcomes and the factors influencing the adoption of TCM as a preventative measure~~s~~.

2. Methods

The study is reported following the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement, and the findings are reported following the Checklist for Reporting Results of Internet E-surveys checklist (CHERRIES) [27,28]. [27, 28]

2.1 Study design

An international retrospective survey of prevention, treatment, occurrence, and outcomes of COVID-19 in the community (RTO-COVID-19) involving 14 countries was ~~led~~ conducted by researchers at the University of Southampton and the University of Geneva. The original survey in the English version (available at: https://www.rtocovid19.com/) ~~were~~ was translated into the ~~Simplified~~ simplified Chinese version and adapted for HCWs by authors at Beijing University of Chinese ~~medicine~~ Medicine (BUCM) in May 2020 and January 2022 ~~respectively~~[26]. [26]

[在此处键入]

2.2 Study setting

The study was conducted online ~~in~~at Xiamen Hospital Affiliated of BUCM (Xiamen Hospital) ~~online~~.

The outbreak of COVID-19 ~~happened~~ occurred in Xiamen during the study period. Xiamen Hospital, as the only traditional Chinese hospital in Xiamen, ~~can represent~~is representative of the implementation of TCM preventative strategies in the city and can be used to provide a reference~~s~~ for the outbreak of future~~a new~~ pandemics. ~~In addition~~Additionally, many data~~there~~ were ~~quite a lot of~~ missing ~~data~~ from our previous study, which limited the interpretation of the results. Therefore, Xiamen Hospital, as an affiliated hospital of BUCM, was ~~the~~ a feasible study site to ensure that the data can be collected completely and reliably.

2.3 Participants

All potential HCWs, including clinicians, TCM practitioners, nurses, pharmacists, medical technicians, administrative staff, and medical students, in Xiamen Hospital were able to access the website of this survey without limitation. Purposive sampling was used~~.~~, and ~~There~~ there was no human-made selection bias on the participants.

Inclusion criteria

1) Any HCW in Xiamen Hospital ~~who can~~with access to the questionnaire; 2) ~~Any~~ any HCW who can read, understand, and provide information about the questionnaire; 3) HCWs who~~Person~~ checked “agree” on the informed consent page; and 4) ~~Adults~~ adults aged ≥ 18 years~~or older~~.

2.4 Ethics approval and informed consent

The study has been approved by Xiamen Hospital (2022-K00401, ~~16th~~ February 16, 2022) and University of Southampton (ERGO 56975, May 2020). All participants were invited to read the overview, benefits and risks, and confidentiality of the survey. Only those who ~~confirmed the~~provided informed consent were permitted to~~would~~ proceed to the questionnaire. All participants were free to withdraw at any time.

2.5 Development of the survey

2.5.1 Adaptation for ~~Health~~ health ~~Care~~ care ~~Workers~~ workers~~version~~

The online questionnaire was translated into ~~Simplified~~ simplified Chinese and localized to suit

HCWs and Chinese policies during the COVID-19 pandemic. First, considering that the participants of the questionnaire were HCWs~~,~~ and ~~they~~ had appropriate knowledge of COVID-19, we supplemented questions about health professional qualifications and~~,~~ professional titles~~,~~ and simplified the choices of preventative measures. For example, in the Chinese herb~~s part~~ section, we presented options by names of Chinese medicine rather than formulations. Then, we updated preventative measures according to the available evidence, e.g., Chinese patent injections, antibiotics, and antivirals (chloroquine ~~were~~ was not recommended for prevention).

The questionnaire was designed on wjx.cn. At least seven authors pretested the survey in different scenarios to improve the logic and wording before pilot testing. This procedure was repeated four times.

2.5.2 Pilot testing for ~~Health~~ health ~~Care~~ care ~~Workers~~ workers~~version~~

The questionnaire was tested by 12 HCWs before dissemination. The pilot testers ~~testing aimed to~~ checked the logic between questions and ambiguous expressions and ~~verify~~ verified medical issues. They tested the questionnaires based on their conditions.

2.6 Recruitment process

The open questionnaire was released on wjx.cn from ~~17th~~ March 17, ~~2022~~2022, and lasted for ~~three~~ 3 months. Each participant had only one account through which to answer questions. The survey was disseminated via the Office Automation System of the hospital. The authors and participants were also invited to forward the QR code posters via WeChat (the most popular social application in China, available ~~at:~~from https://weixin.qq.com/). All HCWs in Xiamen Hospital were invited to participate in this study through both methods.

2.7 Survey administration

After the participants had submitted their answers to~~The~~ wjx.cn,~~ is~~ a public, open access online survey platform in China, they received the~~. When the participants submitted the answers, it would~~ prompt "Your answer has been submitted~~,~~ and thank you for your participation," with non-monetary incentives. To prevent bias, the answers to questions were arranged in a random order. The questionnaire consisted of 23 sections with 154 questions, which additionally included one page of welcome and thanks ~~respectively~~. Participants could skip some questions due to the pre-

designed logic and their conditions. The questions appropriate for the participants ~~could be~~were mandatory, but a non-response option ~~would be~~was provided. All participants could return or review the questionnaire but could not change the answers once submitted. A ~~Recent~~ recent entry ~~would be kept~~was retained for duplicate~~d~~ entries ~~of~~ from the same Internet Protocol (IP) address.

2.8 Sample size

Referring to sample size estimation of multi-variable regression, the sample size was 5 to 10 times as large as the number of variables, with a larger sample size considered to result in greater accuracy of the results. ~~and it should be as large as possible.~~ In this questionnaire, there ~~was~~ were at least 230 ~~questionnaires~~ questions with 23 variables [29]. [29] We planned to ~~maximum~~ maximize the sample size~~,~~ but were limited by the project timeline~~,~~; the recruitment period was from March to June 2022.

2.9 Data collection and analysis

2.9.1 Data collection

The following data were collected:

(1) ~~response~~ Response rate (the number of visitors, participation rate, completion, and completeness rate)

(2) ~~basic~~ Basic characteristics~~:~~, including health professional qualifications, professional titles, physical and mental conditions, COVID-19 impact on individual development and behaviors, and experience of frontline work

(3) ~~diagnosis~~ Diagnosis (detection of SARS-CoV-2) and/or flu-like symptoms

(4) ~~preventative~~ Preventative measures (TCM, other complementary therapies, vaccination)

(5) ~~the relationship~~ Relationship between preventative measures and outcomes

(6) ~~the influencing~~ Influencing factors affecting TCM adoption as preventative measures

(7) ~~treatments~~ Treatments (TCM, conventional treatments, other complementary therapies) and outcomes (hospitalization, aggravation, and recovery conditions)

It is possible that ~~As this survey was~~the retrospective nature of the study led to~~, it may exist~~ self-reporting bias and recall bias. To minimize ~~the~~ potential bias, the questionnaire was designed explicitly and carefully. Moreover,~~Besides,~~ a suggestion that participants could complete the

questionnaire with the help of medical records was given to participants at the beginning of the questionnaire.

2.9.2 Confidentiality

Wjx.cn ~~has been~~is committed to the security of data stored on the Web server. The data security system has been officially certified according to Chinese laws. Wjx.cn cannot change the security classification of data without permission and cannot disclose data to any other party. The obligation of privacy policy or data security is permanent~~.~~ and ~~It~~ it supported IP addresses as unique identifiers, while also excluding individual multiple visits. ~~And information~~ Information that identified individuals (e.g., IP address, WeChat account) ~~would~~ were not ~~be~~ disclosed to anyone other than the members of the study team. The investigators, ~~the~~ sponsor, and ~~the~~ ethics committee ~~would be allowed~~were permitted to access the data to ensure its authenticity and accuracy, but no individual information ~~would not be~~was shared. All data collected were managed by the BUCM and Xiamen Hospital teams.

2.9.3 Data analysis

Data were managed in Excel Microsoft 365 and analyzed with wjx.cn and IBM SPSS Statistics Premium 28.0. ~~The data of incomplete~~ Incomplete survey data were not collected for analysis, and the~~. The~~ data from the pilot testing were not included in the final analysis. Descriptive analyses ~~were~~ are presented as numbers and percentages, ~~or~~ means and standard deviations, or median and interquartile range (IQR). The descriptive analyses included basic characteristics, diagnosis (detection of SARS-CoV-2), and/or flu-like symptoms, behavior measures, preventative measures, and treatments for symptoms.

To estimate behavior changes due to COVID-19, the McNamar Bowker test was used to ~~comparing~~ compare individual behavior changes before and after 2020. Chi-squared test was performed to estimate the relationship between preventative measures and outcomes. Chi-squared test or ~~t~~ t-test~~, as appropriate,~~ was performed to investigate potential influencing factors between the TCM ~~preventative group~~ and non-TCM preventative groups. The variables included visit time points (before or after the May 2022 Xiamen outbreak), age, ~~gender~~sex, body mass index (BMI), smoking status, alcohol consumption, working years, health professional qualifications, highest

education level, professional titles, physical and mental condition, experience of frontline work, vaccination status, and frequency of flu-like symptoms. The significant variables were entered into a stepwise multi-variable linear regression model to identify the factors influencing the willingness ~~of using~~to use TCM as a preventative measure~~s~~. As for the relationship between preventative measures and outcomes~~,~~ and the influencing factors affecting the willingness ~~of using~~to use TCM as a preventative measure~~s~~, sensitivity analysis was conducted in doctors and all respondents ~~respectively~~ to test the robustness of the results. A ~~Two~~ two-sided *P*-value < 0.05 was considered ~~as~~ significant. Odds ratios (ORs) and 95% confidence intervals (CIs) were used. Missing data in the analyzed items ~~were~~ are presented as non-values.

3. Results

3.1 Response rates

The survey was available online from ~~17th~~ March 17, 2022 to ~~1st~~ June 1, 2022 with ~~a total of~~ 4131 visits. Among the overall visits, 1176 completed the questionnaire and submitted their answers, and~~.~~ 54 participants noted that they would like to withdraw their questionnaires~~,~~; therefore, we removed those data. A total of 1122 questionnaires were finally collected ~~finally~~. The participation rate, defined as the percentage of~~ratio of~~ all unique visitors who agreed to ~~participate/survey~~complete ~~visitors~~the survey, was 28.47%. The ~~complete~~ completion rate was 100%, and the completeness rate was 95.41%. The generic information of participants ~~was~~ is presented in Table 1.

3.2 Basic characteristics of ~~1122~~ the included participants

3.2.1 Demographic characteristics and medical history

The participants'~~This section included~~ demographic characteristics, medicine background, and physical and mental conditions are~~, as~~ detailed in Table 1. A total of 448 (39.93%) doctors and 414 (36.90%) nurses participated in the survey. ~~A~~ The majority (266/448, 59.38%) of doctors possessed~~have been licensed to~~ TCM qualifications. Moreover, 886 participants (78.97%) reported no chronic diseases ~~and~~ or mental health problems~~.~~, approximately ~~About~~ half (91/183, 49.73%) ~~participants suffering~~suffered from chronic diseases, and one third (34/98, 34.69%) of those suffering from mental health problems reported that the conditions were under control~~led~~.

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3.2.2 Impact of COVID-19 ~~impact~~ on personal development and behaviors

Nearly half of the participants (512/1122, 45.64%) believed that the COVID-19 pandemic influenced their personal development with moderate to severe negative effects, including income~~s~~ or welfare (29.50%), position promotion (14.97%), and graduation (12.92%), as detailed in Appendix Fig. 1.

Furthermore, 765 participants (68.36%) ~~have been~~were involved in frontline work. ~~As to~~Regarding the relationship between the COVID-19 pandemic and flu-like symptoms, 185 participants (16.49%) reported a lower frequency of symptoms,~~and~~ 59 (5.08%) reported a higher frequency~~.~~ and ~~Most~~ most participants (67.56%) ~~thought~~ reported no change~~, details in~~ (Table 1). Additionally, after 2020, 1083 participants reported behavior changes due to COVID-19, including washing hands and wearing masks, maintaining social distancing, and ventilating and disinfecting workplaces ~~after 2020~~ ($P < 0.001$), as shown in Appendix Table 1.

3.3 Diagnosis (detection of SARS-CoV-2) and/or flu-like symptoms

~~As~~ According to China's policies during the COVID-19 pandemic, all participants ~~have~~ received multiple ~~times of~~ SARS-CoV-2 nucleic acid tests~~.~~, among which, 1119 (99.73%) were negative~~.~~ and ~~Three~~ three were diagnosed ~~as~~ with COVID-19 infection once, ~~with~~ including two asymptomatic infections and one symptomatic infection. Three confirmed participants recovered from COVID-19 in less than ~~seven~~ 7 days. The reasons for COVID-19 detection ~~were~~ are presented in Appendix Fig. 2.

Among the 1119 participants with negative SARS-CoV-2 nucleic acid tests, only a few participants (36/1119, 3.22%) ~~underwent~~ presented flu-like symptoms during the COVID-19 pandemic (Appendix Fig. 3). ~~Flu-like symptoms were presented in Appendix Fig. 3.~~ The symptoms lasted for an average of 16.33 (1~~–~~365) days and restricted the participant's normal activities for an average of 15.39 (0~~–~~365) days. The participants reported that flu-like symptoms caused varying degrees of discomfort, and the average ~~of~~ symptom severity was 4.53, where a ~~(~~score of 0 is the best and 10 is the worst~~)~~. The average score for concern about symptoms was 3.00, ~~(~~where a score of 0 is no concern and 10 is extremely concerned~~)~~.

3.4 Preventative measures and outcomes

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3.4.1 Overview of preventative measures

We collected ~~the~~ data from 1119 participants~~.~~, among whom 79.71% (892/1119) ~~participants~~ took preventative measure~~s.~~, including 56.21% ~~participants~~ who chose TCM and 58.18% who chose other measures to prevent COVID-19, as detailed in Table 2. Lianhua Qingwen preparations (granule or capsule) were ~~the~~ most~~mostly~~ commonly used (212/1119, 18.95%) as a Chinese patent medicine. Xiamen preventative formula (a fixed prescription approved by local government) was the most~~ly~~ commonly used (506/1119, 45.22%) as a Chinese herbal decoction whose herbal composition ~~were~~ is detailed in Appendix Table 2. Among non-pharmacological measures, moxibustion was most~~ly~~ commonly used (234/1119, 20.91%). The acupuncture points mainly included Zusanli (ST36), Zhongwan (RN12), Tianshu (ST25), Danzhong (RN17), and Dazhui (DU14). ~~As to~~Regarding other measures, ~~exercise or activities~~physical activities (586/1119, 52.37%) and food supplements (302/1119, 26.99%) were used quite often, as detailed in Table 2. ~~As to~~The COVID-19 vaccination rate ~~of~~ for different doses and vaccine brands~~,~~ is ~~details were~~ shown in Table 1. The reasons for vaccination ~~were~~ are shown in Appendix Fig. 4~~,~~ and those for non-vaccination included pregnancy, allergy, and cancer. ~~The concerns~~ Concerns about COVID-19 ~~were~~ decreased with vaccination~~.~~, ~~While~~ while the majority of participants (67.61%~~–~~73.89%) reported that infection control behaviors were ~~not affected~~unaffected, as detailed in Appendix Table 3.

3.4.2 Preventative measures and flu-like symptoms

A few ~~of~~ participants (36/1119, 3.22%) developed flu-like symptoms, although these were~~.~~ ~~However, the occurrence of symptoms was~~ not associated with preventative measures~~,~~ ~~or~~ vaccination, or TCM (P = 0.475, P = 0.377, P = 0.547).

3.5 Influencing factors of TCM

We identified four variables with P < 0.05 by ~~univariable~~ univariate analysis, including experience of frontline work (P < 0.001), health professional qualifications (P = 0.003), knowledge of post-COVID-19 syndrome (P = 0.002), and frequency of flu-like symptoms (P < 0.001)~~, details in~~ (Appendix Table 4). Then, we used the stepwise multi-variable linear regression model and found that experience of frontline work, health professional qualifications, and

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knowledge of post-COVID-19 were independent factors associated with TCM adoption. Participating in frontline working (OR = 0.61, 95% CI: 0.46–0.80, *P* < 0.001)~~, well~~ and good knowledge of post-COVID-19 syndrome (OR = 0.57, 95% CI: 0.39–0.84, *P* = 0.005) were the factors that contributed most to TCM adoption. In contrast ~~Participants~~ participants who were licensed to Western medicine ~~qualification~~ (OR = 2.41, 95% CI: 1.51–3.86, *P* < 0.001), nurses (OR = 1.70, 95% CI: 1.21–2.40, *P* = 0.002), and medical technicians (OR = 2.27, 95% CI: 1.25–4.10, *P* = 0.007) ~~may~~ tended to not prefer ~~to choose~~ TCM as a preventative measure~~s~~.

3.6 Treatments and outcomes

Among the 36 participants who developed flu-like symptoms, five ~~of them~~ did not take any measures and 31 ~~participants~~ reported their treatments. Twenty-two participants chose TCM, and 21 participants chose Western medicine. At the same time, 14 participants chose Integration of Traditional and Western ~~medicine~~Medicine, as detailed in Appendix Table 5. The source of treatments used by participants for flu-like symptoms ~~were~~ are presented in Appendix Table 6.

The average days from the occurrence of flu-like symptoms to ~~receiving~~ receive treatment~~s~~ was 2.55 (1–30) days~~.~~, and ~~The~~ the average ~~days for~~length of recovery was 21.93 (0–335) days. None of the participant~~s~~ ~~was~~ were hospitalized for flu-like symptoms. ~~34~~ Thirty-four participants, including five without any treatment, had recovered or improved~~.~~, while ~~Two~~ two ~~participants~~ reported ~~that they~~ still ~~suffered~~ suffering from symptoms of shortness of breath and anxiety.

3.7 Additional analysis

~~As for~~Regarding the relationship between preventative measures and outcomes~~,~~ and the influencing factors affecting the willingness ~~of using~~to use TCM as a preventative measure~~s~~, sensitivity analysis was conducted in doctors to test the robustness of the results. The occurrence of symptoms was not associated with preventative measures or vaccination or TCM (*P* = 0.506, *P* > 0.999, *P* = 0.203). ~~Well~~ Good knowledge of post-COVID-19 syndrome (OR = 0.35, 95% CI: 0.21–0.60, *P* < 0.001) ~~were~~ was the main factor~~s~~ that contributed to the adoption of TCM as a preventative measure~~ adoption.~~, while ~~Participants~~ participants licensed to Western medicine ~~qualification~~ (OR = 2.46, 95% CI: 1.56–3.88, *P* < 0.001) ~~may~~ tended to not prefer to choose TCM as preventative measures~~,~~; details are presented in Appendix Table 7. The results in doctors

were consistent with those in all respondents, except ~~whether~~ in cases where frontline experience contributed to TCM adoption.

4. Discussion

To the best of our knowledge, few studies have investigated the preventative measures selected by HCWs who encounter Omicron variants of COVID-19. Our previous study ~~showed~~ suggested that HCWs could be used as a conducive population to collect data, ~~and~~ although the association of outcomes with preventative interventions was unclear. In ~~This~~ this study, we ~~aims~~ aimed to conduct this online cross-sectional survey specifically among HCWs in Xiamen during the ~~omicron~~Omicron pandemic to investigate infection control behaviors, preventative and therapeutic interventions, and outcomes. We ~~will~~ additionally explored the association of preventative measures with outcomes and the factors influencing the adoption of TCM as a preventative measure~~s~~. With a~~The~~ participation rate of ~~was~~ 28.47~~%.~~ %, our results showed that ~~The study found that~~the majority of HCWs took preventative measures, ~~mainly including~~such as TCM, ~~exercise or activities~~physical activities, and food supplements, during the ~~omicron~~Omicron pandemic. Three respondents were diagnosed ~~as~~ with COVID-19 and 36 ~~respondents~~ developed flu-like symptoms~~.~~, although these were unrelated to the~~The occurrence of symptoms may be not associated with~~ preventative measures, ~~or~~ vaccination, ~~or~~ and TCM. The ~~Knowledge~~ knowledge of post-COVID-19 and doctors licensed to Western medicine ~~qualification~~ were independent factors associated with TCM adoption, which ~~was~~ is consistent with the results of sensitivity analysis. Considering the heavy workload and convenience of portable devices, we continued to use the wjx.cn platform to disseminate and collect the data. The response rate was ~~only~~ 28.47%, which although ~~was quite~~ low ~~but~~ was acceptable. As reported by a previous study, the response rate of surveys of health professions trainees ranged from 26.6% to 100%, with ~~and~~ a mean response rate of~~was~~ 73.1% [30]. [30] The reasons for the various response rates may result from unexplicit definitions and different recruitment methods, where lower response rates are observed for web surveys [30]. [30] ~~Besides~~Furthermore, the response rates for surveys have ~~been~~ decreased over the past decade, which may result from the use of long questionnaires and a surge of questionnaire surveys leaving people fatigued ~~for people, and long questionnaires may contribute~~

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to low response rate[31,32]. [31-32] There may be two reasons for The low response rate observed in this survey has two likely explanations. First, the total visits were 4131 and the total number of HCWs in Xiamen Hospital was 1583, which could indicates a relatively high number of that there were quite a few irrelevant people visiting the questionnaire. As the interested participants interested were HCWs in Xiamen Hospital, we illustrated those on the welcome page. Thus, some irrelevant people may visit the questionnaire without submission. Second, this was a quite comprehensive questionnaire covering diagnosis, preventative and treatment interventions, and outcomes, and it which took approximatelyabout 16 to 20 minutes to complete. It was a challenge for participants due toThe behavior fatigue that may be experienced by participants during the completion of the questionnaire may have resulted, which could result in reluctance to complete the questionnaire. Moreover, To to collect as many questionnaires as possible, we assumed that it was difficult for HCWs to spend more than 15 minutes to complete completing the questions at onceone sitting. As a result, the questionnaire was designed to allow for intermittent respondence responses with only one submission.

Our findings demonstrated that 79.71% of participants took preventative measures. The measures were comprehensive and variousvaried, which differed from previous findings in which 32.84% (112/341) took preventative measures in the general population with limited data. A previous study usingWith data available from Turkey and Saudi Arabia, showed that 39.3% and 22.1% of participants among the general population chose traditional and complementary medicine during the COVID-19 pandemic [33,34]. [33-34] It seemed that compared to the general population, HCWs paid more attention to COVID-19 prevention and self-care, with well a good knowledge of available measures. As for the willingness of usingto use TCM, differing from in contrast to the general population, we did not find the a significance significant difference between TCM and non-TCM groups in terms of gendersex, age, highest education level, and physical condition among HCWs [33]. [33] However, knowledge of COVID-19 or post-COVID-19 was positively correlated with the adoption of herbal products or TCM as preventative measures [33]. [33] Additionally, we found that the health professional qualifications may be also independently correlated with TCM adoption, which could be particular inunique to the HCWs population.

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TCM, ~~exercise or activities~~physical activities, and food supplements were common preventative measures ~~of~~ for HCWs~~.~~, all of which may represent~~These could be potentially~~ effective self-management measures in preventing respiratory infections. We found that 52.37% of participants chose ~~exercise or activities~~physical activities. Indeed, ~~It was~~it has been reported that moderate intensity exercise can be recommended as a non-pharmacological, ~~inexpensive~~inexpensive, and viable way to cope with COVID-19. Furthermore, ~~the~~ better exercise capacity was associated with ~~the~~ lower risks of hospitalization due to COVID-19 [35,36]. ~~[35-36]~~ We found that ~~about~~ approximately 26.99% of participants chose food supplements as a preventative measure~~s~~, including vitamin C, vitamin D, zinc, garlic, tea tree, and turmeric~~, etc~~. There ~~were~~ is evidence ~~supporting~~ to support the use of food supplements as potential effective and preventative agents against COVID-19, ~~but~~although this requires~~, required~~ experimental validation [37]. ~~[37]~~ The ~~Food~~food supplements mentioned above have been ~~proved~~ proven to play ~~the~~ an important role in immunity against virus infection [38], [39], [40], [41], [42]. ~~[38-42]~~ For example, vitamin D deficiency has been recognized as a risk factor ~~of~~ for COVID-19, and ~~there were~~ some trials have been conducted to confirm its effectiveness [43,44]. ~~[43-44]~~ However, ongoing trials require further follow-up for conclusive results~~trials were ongoing, and the results need followed~~ [45,46]. ~~[45-46]~~

~~As to~~Regarding our findings, 56.21% of participants chose TCM as a preventative measure~~.~~, including 45.22%~~ participants~~ who used the Xiamen preventative formula, which was modified based on Yupingfeng Powder, with the addition of dampness-expelling herbs. The most commonly used Chinese patent medicine was Lianhua Qingwen preparations, followed by Huoxiang Zhengqi preparations. COVID-19 was categorized as a “plague” in febrile disease,~~ and~~ with cold-dampness ~~was~~ as the syndrome [47,48]. ~~[47-48]~~ Reinforcing qi and expelling cold-dampness to enhance body resistance against virus was essential for COVID-19 prevention, which is the action of the Xiamen preventative formula and Lianhua Qingwen preparations [49]. ~~[49]~~ Moreover, ~~Modified~~ modified Yupingfen Powder, the Chinese classical prescription~~s~~, ~~have~~ has showed potential preventative effectiveness on iatrogenic infection in HCWs during the severe acute respiratory syndrome pandemic [47]. ~~[47]~~ Another cohort study showed that Huoxiang Zhengqi liquid combined with Jinhao Jiere granules may have potential preventative effects on

cold during the COVID-19 pandemic [50]. [50] ~~–~~However, in the current study, we failed to investigate whether preventative measures were related to the onset~~s~~ of COVID-19 or flu-like symptoms ~~due to few~~because of the lack of confirmed cases. Indeed, in China, only a few participants developed COVID-19 or experienced flu-like symptoms due to the effective prevention and control measures for COVID-19, as well as ~~As prevention and control measures which have been proved effect on COVID-19 prevention, and~~ standardized medical procedures ~~in China, there were few participants developing COVID-19 or flu-like symptoms~~ [9,51]. [9, 51]

This study is a preliminary investigation. Due to the strict public health measures taken by HCWs, the results showed that only three respondents were diagnosed with~~as~~ COVID-19~~,~~ and 36 respondents developed flu-like symptoms. Limited data suggest~~ed that there may be~~ few relationships between preventative measures and outcomes. Consequently, we will further explore whether complementary therapies can boost the immune system to prevent infectious diseases based on effective public health measures. The interventions of complementary medicine include ~~exercise or activities~~physical activities, vitamin D, and TCM~~and so on. As for~~Regarding TCM, it ~~could~~ would be appropriate to start~~commence~~ with a literature review to identify interventions for respiratory infectious diseases~~,~~ based on ancient Chinese books and published reports. ~~Then, we~~ We will then conduct investigator-initiated prospective cohort studies or randomized controlled trials to evaluate the preventative effect of TCM, including Chinese herbs and non-pharmacological TCM measures. ~~Besides~~Moreover, to improve compliance, ~~the study could~~it would be beneficial to recruit participants with ~~well~~ good knowledge of targeted disease or those who are licensed to TCM ~~qualification~~ or who integrate~~Integration of~~ Chinese and Western qualifications.

Regarding public health policy, there ~~is~~ are insufficient evidence-based studies on complementary medicine for preventing COVID-19, aligning with the results of the clinical practice guidelines developed in China [52]. [52] ~~–~~Based on current evidence, it is not recommended for HCWs to use complementary therapies ~~for prevention of COVID-19 in HCWs~~, such as Chinese herbs or TCM sachets, for the prevention of COVID-19.

~~To our knowledge, there was few evidence on preventative measures of HCWs who encountered~~

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omicron variants of COVID-19. However, there This study has several were some limitations that warrant discussion. First, this was a The study design was retrospective survey, which cannot identify causal inference between variables. Besides Moreover, it was unclear whether HCWs took preventative measures before or after exposure to the SARS-CoV-2 virus. ; Thus thus, it was also unknown whether these preventative measures focused on the prevention of the general population or the high-risk population. Second In addition, there was an inevitably inevitable potential recall bias limited by the survey questions asking participants to recall information (behavior measures, preventative measures or treatments). Finally, we only collected data only from one center in Xiamen, Fujian province. The preventative measures of HCWs may be not enough insufficient to represent those of all HCWs, because of the diversities of geography and individual experience. Further multi-center, prospective cohort studies could be conducted to provide more representative and comprehensive information. Future The studies can should also focus on explore exploring the association between of preventative measures with and outcomes, with the aim to accumulating accumulate experience in response to public health emergency emergencies.

5. Conclusion

The findings of this survey demonstrated that a considerable proportion of HCWs took measures to prevent COVID-19, especially TCM, exercise or activities physical activities, and food supplements to prevent COVID-19. Well-knowledge Knowledge of COVID-19 may prompt people to take use TCM as a preventative measures. Multi-center studies and prospective cohort follow-up studies were are needed to provide more insights on COVID-19 management in TCM.

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Declarations

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Data availability

The survey respondents were assured that ~~raw~~ personal data would not be shared. ~~and data~~Data ~~that support~~supporting the findings of this study are available from the corresponding author upon reasonable request.

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Tables: 2

Table 1. The basic characteristics of 1122 participants.

Table 2. Preventative measures of 1119 participants.

Table 1. The basic characteristics of 1122 participants

Items	Summary data (number and %, ~~/~~mean ± standard deviations, and range)	
Age (years)		33.00 ± 7.07 (18–60)
Gender	Men	848 (75.58)
	Women	274 (24.42)
Weight (kg)	Mean weight	60.39 ± 14.79 (40–138)
	Normal (self-~~cognition~~reported)	578 (51.52)
	Underweight (self-~~cognition~~reported)	68 (6.06)
	Overweight (self-~~cognition~~reported)	226 (20.14)
	Not reported	250 (22.28)
Height (cm)		162.48 ± 7.40 (106–188)
BMI		22.80 ± 5.10 (15.59–48.93)
Smoking	Mean cigarette amount	7.82 ± 4.10 (1–20)
	Yes	29 (2.58)
	No	1093 (97.42)
Alcohol consumption	Yes	220 (19.61)
	No	902 (80.39)
Highest education level	Bachelor	756 (67.38)

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	Master	201 (17.91)
	Doctor	11 (0.98)
	Others	154 (13.73)
Health professional qualifications		
	TCM	266 (23.71)
	Integration of traditional and Western medicine	67 (5.97)
	Western medicine	115 (10.25)
	Nursing	414 (36.90)
	Chinese medicine pharmacist	25 (2.23)
	Western medicine pharmacist	12 (1.07)
	Medical technician	60 (5.35)
	Students [a]	99 (8.82)
	Not health professionals	60 (5.35)
	Not reported	4 (0.36)
Professional titles		
	Senior	149 (13.28)
	Intermediate	297 (26.47)
	Junior	344 (30.66)
	Students	254 (22.64)
	Not reported	78 (6.95)
Working years	Mean years	12.52 ± 8.93 (0–40)
	0–20	711 (711/868, 81.91)
	21–40	157 (157/868, 18.09)
Physical conditions		
	Chronic disease	183 (16.31)
	Healthy	939 (83.69)
Mental conditions		

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	Mental health problem	98 (8.73)
	Healthy	1024 (91.27)
Working/living status		
	Frontline	765 (68.36)
	Medium/high risk [b]	190 (16.98)
	Low risk	471 (42.09)
SARS-CoV-2 nucleic acid test		
	Negative	1119 (99.73)
	Positive	3 (0.27)
Flu-like symptoms		
	Symptoms occurred	36 (36/1119, 3.22)
	Healthy	1083 (1083/1119, 96.78)
Flu vaccination		334 (29.77)
The first dose of COVID-19 vaccine~~vaccination~~		1099 (97.95)
	Beijing Institute of Biological Products	810 (808/1099, 73.52)
	Beijing Sinovac	227 (227/1099, 20.66)
	Wuhan Institute of Biological Products	16 (16/1099, 1.46)
	Sinopharm	7 (7/1099, 0.64)
	CanSinoBIO	7 (7/1099, 0.64)
	Pfizer BioNTech	7 (7/1099, 0.64)
	Anhui Zhifei Longcom Biopharmaceutical	5 (5/1099, 0.45)
	Janssen	2 (2/1099, 0.18)
	Others	18 (18/1099, 1.64)
The second dose of COVID-19 ~~vaccination~~vaccine		1086 (1086/1099, 98.82)
	Beijing Institute of Biological Products	758 (808/1086, 69.80)
	Beijing Sinovac	257 (227/1086, 20.90)
	Wuhan Institute of Biological Products	30 (30/1086, 2.76)

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Pfizer BioNTech	9 (9/1086, 0.83)
Anhui Zhifei Longcom Biopharmaceutical	6 (6/1086, 0.55)
Sinopharm	5 (5/1086, 0.46)
Bharat Biotech	2 (2/1086, 0.18)
Others	19 (64/1086, 1.75)
The third/booster dose of COVID-19 ~~vaccination~~vaccine	934 (934/1086, 86.00)
Beijing Institute of Biological Products	334 (334/934, 35.76)
Beijing Sinovac	262 (262/934, 28.05)
Changchun Institute of Biological Products	213 (213/934, 22.81)
Wuhan Institute of Biological Products	41 (41/934, 4.39)
Anhui Zhifei Longcom Biopharmaceutical	10 (10/934, 1.07)
Sinopharm	5 (5/934, 0.54)
Pfizer BioNTech	4 (4/934, 0.43)
Others	65 (65/934, 6.96)
COVID-19 impact on personal development	6.37 ± 2.44 (0–10)
No problems	353 (31.46)
Mild impact	69 (6.15)
Moderate impact	234 (20.86)
Severe impact	278 (24.78)
Not reported	188 (16.76)
Relationship between COVID-19 pandemic and flu-like symptoms	
Higher frequency	57 (5.08)
No change	758 (67.56)
Lower frequency	185 (16.49)
Not ~~apply~~applicable	122 (10.87)

Note: BMI, body mass index~~; cm, centimeters; kg, kilograms; yr, years~~. a. students indicate medical or nursing students from ~~medicine~~ medical universities. b. medium risk indicates coming

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in contact with less than 50~~addition confirmed~~ COVID-19 patients within a ~~14~~ 14-day~~s~~ period~~but not exceeding 50 patients,~~ or coming in contact with more than 50~~addition confirmed~~ COVID-19 patients ~~exceeding 50 patients, without clustering onset within 14 days~~over a long period; high risk indicates coming in contact with more than 50~~addition confirmed~~ COVID-19 patients ~~exceeding 50 patients, with clustering onset~~ within ~~14 days~~a 14-day period.

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Table 2. Preventative measures ~~from~~ of 1119 participants

Preventative measures ~~category~~	Summary data (number~~,~~ %)
Traditional Chinese Medicine	629 (56.21)
Chinese herbal decoction	544 (86.49)
Xiamen preventative formula	506 (93.01)
Self-prescription	62 (11.40)
Chinese patent medicine	265 (42.13)
Lianhua Qingwen preparation	212 (80.00)
Huoxiang Zhengqi preparations	111 (41.89)
Shuanghuanglian preparation	102 (38.49)
Banlangen (*Isatidis Radix*) granule	98 (36.98)
Shufeng Jiedu preparation	68 (25.66)
Ganmao Qingre granule	61 (23.02)
Jinhua Qinggan granule	58 (21.89)
Qingfei Paidu granule	1 (0.38)
Shengmaiyin liquid	1 (0.38)
Others	15 (5.66)
Moxibustion	234 (37.20)
Tuina	124 (19.71)
Cupping	117 (18.60)
Acupuncture	115 (18.28)
Manual acupuncture	74 (64.35)
Needle warming moxibustion	67 (58.26)
Electroacupuncture	54 (46.96)
Press needle	35 (30.43)
Laser acupuncture	10 (8.70)

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	Tai Chi	81 (12.88)
Other measures		651 (58.18)
	~~Exercises or activities~~Physical activities	586 (90.02)
	Walking, hiking	442 (75.43)
	Aerobic exercise	303 (51.71)
	Anaerobic exercise	164 (27.99)
	Yoga	135 (23.04)
	Meditation, mindfulness	98 (16.72)
	Others	48 (8.19)
	Food supplements	302 (46.39)
	Vitamin supplements	225 (74.50)
	Vitamin C	193 (85.78)
	Vitamin D	131 (58.22)
	Vitamin E	110 (48.89)
	Vitamin B_{12}	107 (47.56)
	Vitamin A	104 (46.22)
	Multivitamin	89 (29.47)
	Probiotics	139 (46.03)
	Amino acid, protein	134 (44.37)
	Mineral supplements	96 (31.79)
	Calcium	91 (94.79)
	Zinc	72 (75.00)
	Magnesium	62 (64.58)
	Selenium	57 (59.38)
	Copper	44 (45.83)
	Omega-3 fatty acid	72 (23.84)
	Special food	193 (29.65)

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Fruits and vegetables	176 (91.19)
~~Orange~~ Oranges	169 (96.02)
Carrots	143 (81.25)
Celery	119 (67.61)
~~Lemon~~ Lemons	104 (59.09)
~~Onion~~ Onions	99 (56.25)
~~Simmering s~~Soup	122 (63.21)
Broth soup	107 (87.70)
Vegetable soup	105 (84.07)
Ginger soup	68 (55.74)
Onion soup	36 (29.51)
Tea	96 (49.74)
Black tea	81 (84.38)
Green tea	74 (77.08)
Fermented tea	29 (30.21)
Bee products	64 (33.16)
Honey	60 (93.75)
Propolis	32 (50.00)
Royal jelly	29 (45.31)
Spices	59 (30.57)
Ginger (*Zingiberis rhizoma recens*)	56 (94.92)
Garlic (*Allii sativi bulbus*)	54 (91.53)
Green Chinese onion (*Allium fistulosum*)	48 (81.36)
Hot pepper (*Capsici fructus*)	43 (72.88)
Turmeric (*Curcumae longae rhizoma*)	25 (42.37)
Special diets	36 (18.56)
Home remedies	192 (29.49)

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	Nasal rinse	142 (73.96)
	Inhalation (steam)	53 (27.60)
	Essential oils	44 (22.92)
	Tea Tree (*Melaleuca alternifolia*)	33 (75.00)
	Savory (*Satureja hortensis*)	28 (63.64)
	Lemon (*Citrus limonum*)	23 (52.27)
	Thyme (*Thymus vulgaris*)	14 (31.82)
	Marjoram (*Origanum ma~~r~~jorana*)	13 (29.55)
	~~Ravansara~~ Ravensara (*Ravensara aromatica*)	13 (29.55)
	Eucalyptus (*Eucalyptus globulus*)	12 (27.27)
	Gelodurat®	11 (25.00)
	Oregano (*Origanum ~~vnlgare~~vulgare*)	10 (22.73)
No special treatments		227 (20.29)

~~**Tables:** 2~~

~~**Table 1.** The basic characteristics of 1122 participants;~~

~~**Table 2.** Preventative measures from 1119 participants.~~

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Title Page

Traditional Chinese medicine for the COVID-19 pandemic: An online cross-sectional survey among health care workers

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Abstract

Background: During the coronavirus disease (COVID-19) pandemic, health care workers (HCWs) have faced a heightened risk of infection. Preventative measures are critical to mitigate the spread of COVID-19 and protect HCWs. Traditional Chinese medicine (TCM) has been recommended to prevent and treat COVID-19 in China. We conducted this survey to investigate the use of infection control behaviors, preventative and therapeutic interventions, and outcomes among HCWs during the surge of Omicron variant infections to explore the association of preventative measures with outcomes and to investigate the factors influencing the adoption of TCM as a preventative measure.

Methods: The questionnaire consisted of 23 sections with 154 questions intended for HCWs. The targeted respondents comprised all HCWs from Xiamen Hospital Affiliated of Beijing University of Chinese Medicine. The recruitment process was open between March 17 and June 1, 2022. Chi-square test was used to estimate the relationship between prevention and outcomes. Multivariable logistic regression was used to investigate factors influencing the use of TCM as a preventative measure.

Results: Among the 1122 participants who completed the questionnaire, 79.71% took preventative measures, including TCM (56.21%), physical activities (52.37%) and food supplements (26.99%). Xiamen preventative formula (a government-approved fixed prescription) (45.22%) and Lianhua Qingwen preparations (18.95%) were the most commonly used Chinese medicines. Thirty-six participants reported flu-like symptoms and three were diagnosed with COVID-19. Flu-like symptoms were not associated with prevention, vaccination, or TCM. Frontline working experience (OR = 0.61, 95% CI: 0.46–0.80), good knowledge of post-COVID-19 syndrome (OR = 0.57, 95% CI: 0.39–0.84), Western medicine qualifications (OR = 2.41, 95% CI: 1.51–3.86), nurses (OR = 1.70, 95% CI: 1.21–2.40), and medical technicians (OR = 2.27, 95% CI: 1.25–4.10) were associated with the willingness of using TCM as a preventative measure.

Conclusion: Complementary medicine, especially TCM, could be used for COVID-19 prevention. Knowledge of COVID-19 may prompt people to use TCM to prevent COVID-19. Multicenter

studies and prospective cohort follow-up studies are needed to provide further insights into the use of TCM for COVID-19 management.

Keywords: retrospective treatment outcome, complementary therapy, Chinese herbs, non-pharmacological intervention, healthcare personnel, Omicron variant

Word count: 4536

Abbreviations: BMI: body mass index; BUCM: Beijing University of Chinese Medicine; CHERRIES: Checklist for Reporting Results of Internet E-surveys checklist; CI: confidence interval; COVID-19: coronavirus disease; HCWs: health care workers; IP: Internet protocol; IQR: interquartile range; OR: odds ratio; STROBE: Strengthening the Reporting of Observational Studies in Epidemiology; TCM: traditional Chinese medicine; WHO: World Health Organization.

1. Introduction

Coronavirus disease (COVID-19) is an infectious disease caused by the SARS-CoV-2 virus. As of February 17, 2023, the pandemic had cumulatively infected 756.6 million people and resulted in 6.8 million deaths worldwide [1]. SARS-CoV-2 has undergone various mutations, among which the Omicron variant has been the predominant strain since 2022 [2]. Despite having a lower risk of severe COVID-19 and mortality compared to previous variants, the increased transmission rate of the Omicron variant has contributed to a substantial burden on the health care system [3-6].

Since the onset of the COVID-19 pandemic, health care workers (HCWs) have been at an increased risk of exposure to the SARS-CoV-2 virus, leading to physical and psychological strain due to overwork, which may make them more vulnerable to infection [7,8]. Considering the substantial transmission advantage of Omicron, preventing COVID-19 is especially critical for HCWs. The World Health Organization (WHO) living guideline recommends implementing infection prevention and control measures, such as mask wearing, environmental cleaning, physical distancing, hand hygiene, respiratory etiquette, and personal protective equipment, to prevent the spread of COVID-19 [9]. However, as yet, no method other than vaccination has proven effective in preventing COVID-19 [10]. Notably, the efficacy of vaccines against Omicron is more preserved against severe disease than against infection and the effectiveness wanes as antibody titers decrease [3,11]. The effectiveness of vaccines against infection by Omicron variants is still controversial [12,13].

The National Health Commission of the People’s Republic of China has recommended traditional Chinese medicine (TCM) as a preventative and therapeutic approach for COVID-19 in its Guidelines for Integration of Chinese and Western Medicine [14], [15], [16], [17], [18], [19], [20]. For example, Lianhua Qingwen granule and Jinhua Qinggan granule are among the remedies recommended for patients with suspected or confirmed COVID-19, and have been proven to help regulate the immune system and exert antiviral effects by clinical studies and experiments [21], [22], [23], [24], [25].

Our previous online cross-sectional survey aimed to investigate the use of infection control behaviors, preventative and therapeutic interventions, and outcomes in the community during the

COVID-19 pandemic in China and found that 22.3% (76/341) of respondents chose TCM as a means of prevention. The respondents who reported their occupations were predominantly HCWs (138/155) suggesting that HCWs represent a conducive population to collect data from. Furthermore, the variants involved in this study were undefined, and the association of outcomes with preventative interventions was unclear. Notably, the data may vary across different waves of the pandemic and target population [26]. For instance, HCWs in Xiamen accumulated experience in combating COVID-19 as a result of the localized outbreaks that occurred in Xiamen, Fujian province, China in September 2021 and May 2022. Therefore, we aimed to conduct this online cross-sectional survey specifically among HCWs in Xiamen during the Omicron pandemic to investigate infection control behaviors, preventative and therapeutic interventions, and outcomes. We will explore the association of preventative measures with outcomes and the factors influencing the adoption of TCM as a preventative measure.

2. Methods

The study is reported following the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement, and the findings are reported following the Checklist for Reporting Results of Internet E-surveys checklist (CHERRIES) [27,28]. [27, 28]

2.1 Study design

An international retrospective survey of prevention, treatment, occurrence, and outcomes of COVID-19 in the community (RTO-COVID-19) involving 14 countries was conducted by researchers at the University of Southampton and the University of Geneva. The original survey in the English version (available at: https://www.rtocovid19.com/) was translated into the simplified Chinese version and adapted for HCWs by authors at Beijing University of Chinese Medicine (BUCM) in May 2020 and January 2022 [26].

2.2 Study setting

The study was conducted online at Xiamen Hospital Affiliated of BUCM (Xiamen Hospital).

The outbreak of COVID-19 occurred in Xiamen during the study period. Xiamen Hospital, as the only traditional Chinese hospital in Xiamen, is representative of the implementation of TCM preventative strategies in the city and can be used to provide a reference for the outbreak of future

pandemics. Additionally, many data were missing from our previous study, which limited the interpretation of the results. Therefore, Xiamen Hospital, as an affiliated hospital of BUCM, was a feasible study site to ensure that the data can be collected completely and reliably.

2.3 Participants

All potential HCWs, including clinicians, TCM practitioners, nurses, pharmacists, medical technicians, administrative staff, and medical students, in Xiamen Hospital were able to access the website of this survey without limitation. Purposive sampling was used, and there was no human-made selection bias on the participants.

Inclusion criteria

1) Any HCW in Xiamen Hospital with access to the questionnaire; 2) any HCW who can read, understand, and provide information about the questionnaire; 3) HCWs who checked "agree" on the informed consent page; and 4) adults aged ≥ 18 years.

2.4 Ethics approval and informed consent

The study has been approved by Xiamen Hospital (2022-K00401, February 16, 2022) and University of Southampton (ERGO 56975, May 2020). All participants were invited to read the overview, benefits and risks, and confidentiality of the survey. Only those who provided informed consent were permitted to proceed to the questionnaire. All participants were free to withdraw at any time.

2.5 Development of the survey

2.5.1 Adaptation for health care workers

The online questionnaire was translated into simplified Chinese and localized to suit HCWs and Chinese policies during the COVID-19 pandemic. First, considering that the participants of the questionnaire were HCWs and had appropriate knowledge of COVID-19, we supplemented questions about health professional qualifications and professional titles and simplified the choices of preventative measures. For example, in the Chinese herb section, we presented options by names of Chinese medicine rather than formulations. Then, we updated preventative measures according to the available evidence, e.g., Chinese patent injections, antibiotics, and antivirals (chloroquine was not recommended for prevention).

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The questionnaire was designed on wjx.cn. At least seven authors pretested the survey in different scenarios to improve the logic and wording before pilot testing. This procedure was repeated four times.

2.5.2 Pilot testing for health care workers

The questionnaire was tested by 12 HCWs before dissemination. The pilot testers checked the logic between questions and ambiguous expressions and verified medical issues. They tested the questionnaires based on their conditions.

2.6 Recruitment process

The open questionnaire was released on wjx.cn from March 17, 2022, and lasted for 3 months. Each participant had only one account through which to answer questions. The survey was disseminated via the Office Automation System of the hospital. The authors and participants were also invited to forward the QR code posters via WeChat (the most popular social application in China, available from https://weixin.qq.com/). All HCWs in Xiamen Hospital were invited to participate in this study through both methods.

2.7 Survey administration

After the participants had submitted their answers to wjx.cn, a public, open access online survey platform in China, they received the prompt “Your answer has been submitted and thank you for your participation,” with non-monetary incentives. To prevent bias, the answers to questions were arranged in a random order. The questionnaire consisted of 23 sections with 154 questions, which additionally included one page of welcome and thanks. Participants could skip some questions due to the pre-designed logic and their conditions. The questions appropriate for the participants were mandatory, but a non-response option was provided. All participants could return or review the questionnaire but could not change the answers once submitted. A recent entry was retained for duplicate entries from the same Internet Protocol (IP) address.

2.8 Sample size

Referring to sample size estimation of multivariable regression, the sample size was 5 to 10 times as large as the number of variables, with a larger sample size considered to result in greater accuracy of the results. In this questionnaire, there were at least 230 questions with 23 variables

[29]. We planned to maximize the sample size but were limited by the project timeline; the recruitment period was from March to June 2022.

2.9 Data collection and analysis

2.9.1 Data collection

The following data were collected:

(1) Response rate (the number of visitors, participation rate, completion, and completeness rate)

(2) Basic characteristics, including health professional qualifications, professional titles, physical and mental conditions, COVID-19 impact on individual development and behaviors, and experience of frontline work

(3) Diagnosis (detection of SARS-CoV-2) and/or flu-like symptoms

(4) Preventative measures (TCM, other complementary therapies, vaccination)

(5) Relationship between preventative measures and outcomes

(6) Influencing factors affecting TCM adoption as preventative measures

(7) Treatments (TCM, conventional treatments, other complementary therapies) and outcomes (hospitalization, aggravation, and recovery conditions)

It is possible that the retrospective nature of the study led to self-reporting bias and recall bias. To minimize potential bias, the questionnaire was designed explicitly and carefully. Moreover, a suggestion that participants could complete the questionnaire with the help of medical records was given to participants at the beginning of the questionnaire.

2.9.2 Confidentiality

Wjx.cn is committed to the security of data stored on the Web server. The data security system has been officially certified according to Chinese laws. Wjx.cn cannot change the security classification of data without permission and cannot disclose data to any other party. The obligation of privacy policy or data security is permanent and it supported IP addresses as unique identifiers, while also excluding individual multiple visits. Information that identified individuals (e.g., IP address, WeChat account) were not disclosed to anyone other than the members of the study team. The investigators, sponsor, and ethics committee were permitted to access the data to ensure its authenticity and accuracy, but no individual information was shared. All data collected

were managed by the BUCM and Xiamen Hospital teams.

2.9.3 Data analysis

Data were managed in Excel Microsoft 365 and analyzed with wjx.cn and IBM SPSS Statistics Premium 28.0. Incomplete survey data were not collected for analysis, and the data from the pilot testing were not included in the final analysis. Descriptive analyses are presented as numbers and percentages, means and standard deviations, or median and interquartile range (IQR). The descriptive analyses included basic characteristics, diagnosis (detection of SARS-CoV-2), and/or flu-like symptoms, behavior measures, preventative measures, and treatments for symptoms.

To estimate behavior changes due to COVID-19, the McNamar Bowker test was used to compare individual behavior changes before and after 2020. Chi-squared test was performed to estimate the relationship between preventative measures and outcomes. Chi-squared test or t-test was performed to investigate potential influencing factors between the TCM and non-TCM preventative groups. The variables included visit time points (before or after the May 2022 Xiamen outbreak), age, sex, body mass index (BMI), smoking status, alcohol consumption, working years, health professional qualifications, highest education level, professional titles, physical and mental condition, experience of frontline work, vaccination status, and frequency of flu-like symptoms. The significant variables were entered into a stepwise multivariable linear regression model to identify the factors influencing the willingness to use TCM as a preventative measure. As for the relationship between preventative measures and outcomes and the influencing factors affecting the willingness to use TCM as a preventative measure, sensitivity analysis was conducted in doctors and all respondents to test the robustness of the results. A two-sided *P*-value < 0.05 was considered significant. Odds ratios (ORs) and 95% confidence intervals (CIs) were used. Missing data in the analyzed items are presented as non-values.

3. Results

3.1 Response rates

The survey was available online from March 17, 2022 to June 1, 2022 with 4131 visits. Among the overall visits, 1176 completed the questionnaire and submitted their answers, and 54 participants noted that they would like to withdraw their questionnaires; therefore, we removed

those data. A total of 1122 questionnaires were finally collected. The participation rate, defined as the percentage of all unique visitors who agreed to complete the survey, was 28.47%. The completion rate was 100%, and the completeness rate was 95.41%. The generic information of participants is presented in Table 1.

3.2 Basic characteristics of the included participants

3.2.1 Demographic characteristics and medical history

The participants' demographic characteristics, medicine background, and physical and mental conditions are detailed in Table 1. A total of 448 (39.93%) doctors and 414 (36.90%) nurses participated in the survey. The majority (266/448, 59.38%) of doctors possessed TCM qualifications. Moreover, 886 participants (78.97%) reported no chronic diseases or mental health problems, approximately half (91/183, 49.73%) suffered from chronic diseases, and one third (34/98, 34.69%) of those suffering from mental health problems reported that the conditions were under control.

3.2.2 Impact of COVID-19 on personal development and behaviors

Nearly half of the participants (512/1122, 45.64%) believed that the COVID-19 pandemic influenced their personal development with moderate to severe negative effects, including income or welfare (29.50%), position promotion (14.97%), and graduation (12.92%), as detailed in Appendix Fig. 1.

Furthermore, 765 participants (68.36%) were involved in frontline work. Regarding the relationship between the COVID-19 pandemic and flu-like symptoms, 185 participants (16.49%) reported a lower frequency of symptoms, 59 (5.08%) reported a higher frequency and most participants (67.56%) reported no change (Table 1).

Additionally, after 2020, 1083 participants reported behavior changes due to COVID-19, including washing hands and wearing masks, maintaining social distancing, and ventilating and disinfecting workplaces ($P < 0.001$), as shown in Appendix Table 1.

3.3 Diagnosis (detection of SARS-CoV-2) and/or flu-like symptoms

According to China's policies during the COVID-19 pandemic, all participants received multiple SARS-CoV-2 nucleic acid tests, among which, 1119 (99.73%) were negative and three were

diagnosed with COVID-19 infection once, including two asymptomatic infections and one symptomatic infection. Three confirmed participants recovered from COVID-19 in less than 7 days. The reasons for COVID-19 detection are presented in Appendix Fig. 2.

Among the 1119 participants with negative SARS-CoV-2 nucleic acid tests, only a few participants (36/1119, 3.22%) presented flu-like symptoms during the COVID-19 pandemic (Appendix Fig. 3). The symptoms lasted for an average of 16.33 (1–365) days and restricted the participant's normal activities for an average of 15.39 (0–365) days. The participants reported that flu-like symptoms caused varying degrees of discomfort, and the average symptom severity was 4.53, where a score of 0 is the best and 10 is the worst. The average score for concern about symptoms was 3.00, where a score of 0 is no concern and 10 is extremely concerned.

3.4 Preventative measures and outcomes

3.4.1 Overview of preventative measures

We collected data from 1119 participants, among whom 79.71% (892/1119) took preventative measures, including 56.21% who chose TCM and 58.18% who chose other measures to prevent COVID-19, as detailed in Table 2. Lianhua Qingwen preparations (granule or capsule) were most commonly used (212/1119, 18.95%) as a Chinese patent medicine. Xiamen preventative formula (a fixed prescription approved by local government) was the most commonly used (506/1119, 45.22%) as a Chinese herbal decoction whose herbal composition is detailed in Appendix Table 2. Among non-pharmacological measures, moxibustion was most commonly used (234/1119, 20.91%). The acupuncture points mainly included Zusanli (ST36), Zhongwan (RN12), Tianshu (ST25), Danzhong (RN17), and Dazhui (DU14). Regarding other measures, physical activities (586/1119, 52.37%) and food supplements (302/1119, 26.99%) were used quite often, as detailed in Table 2.

The COVID-19 vaccination rate for different doses and vaccine brands is shown in Table 1. The reasons for vaccination are shown in Appendix Fig. 4 and those for non-vaccination included pregnancy, allergy, and cancer. Concerns about COVID-19 decreased with vaccination, while the majority of participants (67.61%–73.89%) reported that infection control behaviors were unaffected, as detailed in Appendix Table 3.

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3.4.2 Preventative measures and flu-like symptoms

A few participants (36/1119, 3.22%) developed flu-like symptoms, although these were not associated with preventative measures, vaccination, or TCM ($P = 0.475$, $P = 0.377$, $P = 0.547$).

3.5 Influencing factors of TCM

We identified four variables with $P < 0.05$ by univariate analysis, including experience of frontline work ($P < 0.001$), health professional qualifications ($P = 0.003$), knowledge of post-COVID-19 syndrome ($P = 0.002$), and frequency of flu-like symptoms ($P < 0.001$) (Appendix Table 4). Then, we used the stepwise multivariable linear regression model and found that experience of frontline work, health professional qualifications, and knowledge of post-COVID-19 were independent factors associated with TCM adoption. Participating in frontline working (OR = 0.61, 95% CI: 0.46–0.80, $P < 0.001$) and good knowledge of post-COVID-19 syndrome (OR = 0.57, 95% CI: 0.39–0.84, $P = 0.005$) were the factors that contributed most to TCM adoption. In contrast participants who were licensed to Western medicine (OR = 2.41, 95% CI: 1.51–3.86, $P < 0.001$), nurses (OR = 1.70, 95% CI: 1.21–2.40, $P = 0.002$), and medical technicians (OR = 2.27, 95% CI: 1.25–4.10, $P = 0.007$) tended to not prefer TCM as a preventative measure.

3.6 Treatments and outcomes

Among the 36 participants who developed flu-like symptoms, five did not take any measures and 31 reported their treatments. Twenty-two participants chose TCM, and 21 participants chose Western medicine. At the same time, 14 participants chose Integration of Traditional and Western Medicine, as detailed in Appendix Table 5. The source of treatments used by participants for flu-like symptoms are presented in Appendix Table 6.

The average days from the occurrence of flu-like symptoms to receive treatment was 2.55 (1–30) days, and the average length of recovery was 21.93 (0–335) days. None of the participants were hospitalized for flu-like symptoms. Thirty-four participants, including five without any treatment, had recovered or improved, while two reported still suffering from symptoms of shortness of breath and anxiety.

3.7 Additional analysis

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Regarding the relationship between preventative measures and outcomes and the influencing factors affecting the willingness to use TCM as a preventative measure, sensitivity analysis was conducted in doctors to test the robustness of the results. The occurrence of symptoms was not associated with preventative measures or vaccination or TCM ($P = 0.506$, $P > 0.999$, $P = 0.203$). Good knowledge of post-COVID-19 syndrome (OR = 0.35, 95% CI: 0.21–0.60, $P < 0.001$) was the main factor that contributed to the adoption of TCM as a preventative measure, while participants licensed to Western medicine (OR = 2.46, 95% CI: 1.56–3.88, $P < 0.001$) tended to not prefer to choose TCM as preventative measures; details are presented in Appendix Table 7. The results in doctors were consistent with those in all respondents, except in cases where frontline experience contributed to TCM adoption.

4. Discussion

To the best of our knowledge, few studies have investigated the preventative measures selected by HCWs who encounter Omicron variants of COVID-19. Our previous study suggested that HCWs could be used as a conducive population to collect data, although the association of outcomes with preventative interventions was unclear. In this study, we aimed to conduct this online cross-sectional survey specifically among HCWs in Xiamen during the Omicron pandemic to investigate infection control behaviors, preventative and therapeutic interventions, and outcomes. We additionally explored the association of preventative measures with outcomes and the factors influencing the adoption of TCM as a preventative measure. With a participation rate of 28.47%, our results showed that the majority of HCWs took preventative measures, such as TCM, physical activities, and food supplements, during the Omicron pandemic. Three respondents were diagnosed with COVID-19 and 36 developed flu-like symptoms, although these were unrelated to the preventative measures, vaccination, and TCM. The knowledge of post-COVID-19 and doctors licensed to Western medicine were independent factors associated with TCM adoption, which is consistent with the results of sensitivity analysis. Considering the heavy workload and convenience of portable devices, we continued to use the wjx.cn platform to disseminate and collect the data. The response rate was 28.47%, which although low was acceptable. As reported by a previous study, the response rate of surveys of health professions trainees ranged from 26.6%

to 100%, with a mean response rate of 73.1% [30]. The reasons for the various response rates may result from unexplicit definitions and different recruitment methods, where lower response rates are observed for web surveys [30]. Furthermore, the response rates for surveys have decreased over the past decade, which may result from the use of long questionnaires and a surge of questionnaire surveys leaving people fatigued [31,32]. The low response rate observed in this survey has two likely explanations. First, the total visits were 4131 and the total number of HCWs in Xiamen Hospital was 1583, which indicates a relatively high number of irrelevant people visiting the questionnaire. As the interested participants were HCWs in Xiamen Hospital, we illustrated those on the welcome page. Thus, some irrelevant people may visit the questionnaire without submission. Second, this was a comprehensive questionnaire covering diagnosis, preventative and treatment interventions, and outcomes, which took approximately 16 to 20 min to complete. The behavior fatigue that may be experienced by participants during the completion of the questionnaire may have resulted in reluctance to complete the questionnaire. Moreover, to collect as many questionnaires as possible, we assumed that it was difficult for HCWs to spend more than 15 min completing the questions in one sitting. As a result, the questionnaire was designed to allow intermittent responses with only one submission.

Our findings demonstrated that 79.71% of participants took preventative measures. The measures were comprehensive and varied, which differed from previous findings in which 32.84% (112/341) took preventative measures in the general population with limited data. A previous study using data available from Turkey and Saudi Arabia, showed that 39.3% and 22.1% of participants among the general population chose traditional and complementary medicine during the COVID-19 pandemic [33,34]. It seemed that compared to the general population, HCWs paid more attention to COVID-19 prevention and self-care, with a good knowledge of available measures. As for the willingness to use TCM in contrast to the general population, we did not find a significant difference between TCM and non-TCM groups in terms of sex, age, highest education level, and physical condition among HCWs [33]. However, knowledge of COVID-19 or post-COVID-19 was positively correlated with the adoption of herbal products or TCM as preventative measures [33]. Additionally, we found that the health professional qualifications may

be independently correlated with TCM adoption, which could be unique to the HCW population.

TCM, physical activities, and food supplements were common preventative measures for HCWs, all of which may represent effective self-management measures in preventing respiratory infections. We found that 52.37% of participants chose physical activities. Indeed, it has been reported that moderate intensity exercise can be recommended as a non-pharmacological, inexpensive, and viable way to cope with COVID-19. Furthermore, better exercise capacity was associated with lower risks of hospitalization due to COVID-19 [35,36]. We found that approximately 26.99% of participants chose food supplements as a preventative measure, including vitamin C, vitamin D, zinc, garlic, tea tree, and turmeric. There is evidence to support the use of food supplements as potential effective and preventative agents against COVID-19, although this requires experimental validation [37]. The food supplements mentioned above have been proven to play an important role in immunity against virus infection [38], [39], [40], [41], [42]. For example, vitamin D deficiency has been recognized as a risk factor for COVID-19, and some trials have been conducted to confirm its effectiveness [43,44]. However, ongoing trials require further follow-up for conclusive results [45,46].

Regarding our findings, 56.21% of participants chose TCM as a preventative measure, including 45.22% who used the Xiamen preventative formula, which was modified based on Yupingfeng Powder, with the addition of dampness-expelling herbs. The most commonly used Chinese patent medicine was Lianhua Qingwen preparations, followed by Huoxiang Zhengqi preparations. COVID-19 was categorized as a “plague” in febrile disease, with cold-dampness as the syndrome [47,48]. Reinforcing qi and expelling cold-dampness to enhance body resistance against virus was essential for COVID-19 prevention, which is the action of the Xiamen preventative formula and Lianhua Qingwen preparations [49]. Moreover, modified Yupingfen Powder, the Chinese classical prescription, has showed potential preventative effectiveness on iatrogenic infection in HCWs during the severe acute respiratory syndrome pandemic [47]. Another cohort study showed that Huoxiang Zhengqi liquid combined with Jinhao Jiere granules may have potential preventative effects on cold during the COVID-19 pandemic [50]. However, in the current study, we failed to investigate whether preventative measures were related to the onset of COVID-19 or flu-like

symptoms because of the lack of confirmed cases. Indeed, in China, only a few participants developed COVID-19 or experienced flu-like symptoms due to the effective prevention and control measures for COVID-19, as well as standardized medical procedures [9,51].

This study is a preliminary investigation. Due to the strict public health measures taken by HCWs, the results showed that only three respondents were diagnosed with COVID-19 and 36 respondents developed flu-like symptoms. Limited data suggest few relationships between preventative measures and outcomes. Consequently, we will further explore whether complementary therapies can boost the immune system to prevent infectious diseases based on effective public health measures. The interventions of complementary medicine include physical activities, vitamin D, and TCM. Regarding TCM, it would be appropriate to start with a literature review to identify interventions for respiratory infectious diseases based on ancient Chinese books and published reports. We will then conduct investigator-initiated prospective cohort studies or randomized controlled trials to evaluate the preventative effect of TCM, including Chinese herbs and non-pharmacological TCM measures. Moreover, to improve compliance, it would be beneficial to recruit participants with good knowledge of targeted disease or those who are licensed to TCM or who integrate Chinese and Western qualifications.

Regarding public health policy, there are insufficient evidence-based studies on complementary medicine for preventing COVID-19, aligning with the results of the clinical practice guidelines developed in China [52]. Based on current evidence, it is not recommended for HCWs to use complementary therapies, such as Chinese herbs or TCM sachets, for the prevention of COVID-19.

This study has several limitations that warrant discussion. First, this was a retrospective survey, which cannot identify causal inference between variables. Moreover, it was unclear whether HCWs took preventative measures before or after exposure to the SARS-CoV-2 virus; thus, it was also unknown whether these preventative measures focused on the prevention of the general population or the high-risk population. Second, there was an inevitable potential recall bias limited by the survey questions asking participants to recall information (behavior measures, preventative measures or treatments). Finally, we collected data only from one center in Xiamen,

Fujian province. The preventative measures of HCWs may be insufficient to represent those of all HCWs because of the diversities of geography and individual experience. Further multicenter, prospective cohort studies could be conducted to provide more representative and comprehensive information. Future studies should also focus on exploring the association between preventative measures and outcomes, with the aim to accumulate experience in response to public health emergencies.

5. Conclusion

The findings of this survey demonstrated that a considerable proportion of HCWs took measures, especially TCM, physical activities, and food supplements to prevent COVID-19. Knowledge of COVID-19 may prompt people to use TCM as a preventative measure. Multicenter studies and prospective cohort follow-up studies are needed to provide more insights on COVID-19 management in TCM.

Declarations

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Data availability

The survey respondents were assured that personal data would not be shared. Data supporting the findings of this study are available from the corresponding author upon reasonable request.

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Tables: 2

Table 1. The basic characteristics of 1122 participants.

Table 2. Preventative measures of 1119 participants.

Table 1. The basic characteristics of 1122 participants

Items	Summary data (number and %, mean ± standard deviations, and range)	
Age (years)		33.00 ± 7.07 (18–60)
Gender	Men	848 (75.58)
	Women	274 (24.42)
Weight (kg)	Mean weight	60.39 ± 14.79 (40–138)
	Normal (self-reported)	578 (51.52)
	Underweight (self-reported)	68 (6.06)
	Overweight (self-reported)	226 (20.14)
	Not reported	250 (22.28)
Height (cm)		162.48 ± 7.40 (106–188)
BMI		22.80 ± 5.10 (15.59–48.93)
Smoking	Mean cigarette amount	7.82 ± 4.10 (1–20)
	Yes	29 (2.58)
	No	1093 (97.42)
Alcohol consumption	Yes	220 (19.61)
	No	902 (80.39)
Highest education level	Bachelor	756 (67.38)

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	Master	201 (17.91)
	Doctor	11 (0.98)
	Others	154 (13.73)
Health professional qualifications		
	TCM	266 (23.71)
	Integration of traditional and Western medicine	67 (5.97)
	Western medicine	115 (10.25)
	Nursing	414 (36.90)
	Chinese medicine pharmacist	25 (2.23)
	Western medicine pharmacist	12 (1.07)
	Medical technician	60 (5.35)
	Students [a]	99 (8.82)
	Not health professionals	60 (5.35)
	Not reported	4 (0.36)
Professional titles		
	Senior	149 (13.28)
	Intermediate	297 (26.47)
	Junior	344 (30.66)
	Student	254 (22.64)
	Not reported	78 (6.95)
Working years	Mean years	12.52 ± 8.93 (0–40)
	0–20	711 (711/868, 81.91)
	21–40	157 (157/868, 18.09)
Physical conditions		
	Chronic disease	183 (16.31)
	Healthy	939 (83.69)
Mental conditions		

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	Mental health problem	98 (8.73)
	Healthy	1024 (91.27)
Working/living status		
	Frontline	765 (68.36)
	Medium/high risk [b]	190 (16.98)
	Low risk	471 (42.09)
SARS-CoV-2 nucleic acid test		
	Negative	1119 (99.73)
	Positive	3 (0.27)
Flu-like symptoms		
	Symptoms occurred	36 (36/1119, 3.22)
	Healthy	1083 (1083/1119, 96.78)
Flu vaccination		334 (29.77)
The first dose of COVID-19 vaccine		1099 (97.95)
	Beijing Institute of Biological Products	810 (808/1099, 73.52)
	Beijing Sinovac	227 (227/1099, 20.66)
	Wuhan Institute of Biological Products	16 (16/1099, 1.46)
	Sinopharm	7 (7/1099, 0.64)
	CanSinoBIO	7 (7/1099, 0.64)
	Pfizer BioNTech	7 (7/1099, 0.64)
	Anhui Zhifei Longcom Biopharmaceutical	5 (5/1099, 0.45)
	Janssen	2 (2/1099, 0.18)
	Others	18 (18/1099, 1.64)
The second dose of COVID-19 vaccine		1086 (1086/1099, 98.82)
	Beijing Institute of Biological Products	758 (808/1086, 69.80)
	Beijing Sinovac	257 (227/1086, 20.90)
	Wuhan Institute of Biological Products	30 (30/1086, 2.76)

Pfizer BioNTech	9 (9/1086, 0.83)
Anhui Zhifei Longcom Biopharmaceutical	6 (6/1086, 0.55)
Sinopharm	5 (5/1086, 0.46)
Bharat Biotech	2 (2/1086, 0.18)
Others	19 (64/1086, 1.75)
The third/booster dose of COVID-19 vaccine	934 (934/1086, 86.00)
Beijing Institute of Biological Products	334 (334/934, 35.76)
Beijing Sinovac	262 (262/934, 28.05)
Changchun Institute of Biological Products	213 (213/934, 22.81)
Wuhan Institute of Biological Products	41 (41/934, 4.39)
Anhui Zhifei Longcom Biopharmaceutical	10 (10/934, 1.07)
Sinopharm	5 (5/934, 0.54)
Pfizer BioNTech	4 (4/934, 0.43)
Others	65 (65/934, 6.96)
COVID-19 impact on personal development	6.37 ± 2.44 (0–10)
No problems	353 (31.46)
Mild impact	69 (6.15)
Moderate impact	234 (20.86)
Severe impact	278 (24.78)
Not reported	188 (16.76)
Relationship between COVID-19 pandemic and flu-like symptoms	
Higher frequency	57 (5.08)
No change	758 (67.56)
Lower frequency	185 (16.49)
Not applicable	122 (10.87)

Note: BMI, body mass index. a. students indicate medical or nursing students from medical universities. b. medium risk indicates coming in contact with less than 50 COVID-19 patients

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within a 14-day period or coming in contact with more than 50 COVID-19 patients over a long period; high risk indicates coming in contact with more than 50 COVID-19 patients within a 14-day period.

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Table 2. Preventative measures of 1119 participants

Preventative measures	Summary data (number %)
Traditional Chinese Medicine	629 (56.21)
Chinese herbal decoction	544 (86.49)
Xiamen preventative formula	506 (93.01)
Self-prescription	62 (11.40)
Chinese patent medicine	265 (42.13)
Lianhua Qingwen preparation	212 (80.00)
Huoxiang Zhengqi preparations	111 (41.89)
Shuanghuanglian preparation	102 (38.49)
Banlangen (*Isatidis Radix*) granule	98 (36.98)
Shufeng Jiedu preparation	68 (25.66)
Ganmao Qingre granule	61 (23.02)
Jinhua Qinggan granule	58 (21.89)
Qingfei Paidu granule	1 (0.38)
Shengmaiyin liquid	1 (0.38)
Others	15 (5.66)
Moxibustion	234 (37.20)
Tuina	124 (19.71)
Cupping	117 (18.60)
Acupuncture	115 (18.28)
Manual acupuncture	74 (64.35)
Needle warming moxibustion	67 (58.26)
Electroacupuncture	54 (46.96)
Press needle	35 (30.43)
Laser acupuncture	10 (8.70)

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	Tai Chi	81 (12.88)
Other measures		651 (58.18)
	Physical activities	586 (90.02)
	Walking, hiking	442 (75.43)
	Aerobic exercise	303 (51.71)
	Anaerobic exercise	164 (27.99)
	Yoga	135 (23.04)
	Meditation, mindfulness	98 (16.72)
	Others	48 (8.19)
	Food supplements	302 (46.39)
	Vitamin supplements	225 (74.50)
	Vitamin C	193 (85.78)
	Vitamin D	131 (58.22)
	Vitamin E	110 (48.89)
	Vitamin B_{12}	107 (47.56)
	Vitamin A	104 (46.22)
	Multivitamin	89 (29.47)
	Probiotics	139 (46.03)
	Amino acid, protein	134 (44.37)
	Mineral supplements	96 (31.79)
	Calcium	91 (94.79)
	Zinc	72 (75.00)
	Magnesium	62 (64.58)
	Selenium	57 (59.38)
	Copper	44 (45.83)
	Omega-3 fatty acid	72 (23.84)
	Special food	193 (29.65)

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	Fruits and vegetables	176 (91.19)
	Oranges	169 (96.02)
	Carrots	143 (81.25)
	Celery	119 (67.61)
	Lemons	104 (59.09)
	Onions	99 (56.25)
	Soup	122 (63.21)
	Broth soup	107 (87.70)
	Vegetable soup	105 (84.07)
	Ginger soup	68 (55.74)
	Onion soup	36 (29.51)
	Tea	96 (49.74)
	Black tea	81 (84.38)
	Green tea	74 (77.08)
	Fermented tea	29 (30.21)
	Bee products	64 (33.16)
	Honey	60 (93.75)
	Propolis	32 (50.00)
	Royal jelly	29 (45.31)
	Spices	59 (30.57)
	Ginger (*Zingiberis rhizoma recens*)	56 (94.92)
	Garlic (*Allii sativi bulbus*)	54 (91.53)
	Green Chinese onion (*Allium fistulosum*)	48 (81.36)
	Hot pepper (*Capsici fructus*)	43 (72.88)
	Turmeric (*Curcumae longae rhizoma*)	25 (42.37)
	Special diets	36 (18.56)
Home remedies		192 (29.49)

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	Nasal rinse	142 (73.96)
	Inhalation (steam)	53 (27.60)
	Essential oils	44 (22.92)
	Tea Tree (*Melaleuca alternifolia*)	33 (75.00)
	Savory (*Satureja hortensis*)	28 (63.64)
	Lemon (*Citrus limonum*)	23 (52.27)
	Thyme (*Thymus vulgaris*)	14 (31.82)
	Marjoram (*Origanum majorana*)	13 (29.55)
	Ravensara (*Ravensara aromatica*)	13 (29.55)
	Eucalyptus (*Eucalyptus globulus*)	12 (27.27)
	Gelodurat®	11 (25.00)
	Oregano (*Origanum vulgare*)	10 (22.73)
No special treatments		227 (20.29)

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Declaration of interests

☐The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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We confirm that the manuscript has been read and approved by all named authors and that there are no other persons who satisfied the criteria for authorship but are not listed. We further confirm that the order of authors listed in the manuscript has been approved by all of us.

We understand that the Corresponding Author is the sole contact for the Editorial process. He/she is responsible for communicating with the other authors about progress, submissions of revisions and final approval of proofs

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Graphical abstract

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Certificate of English language editing

STROBE Statement—checklist of items that should be included in reports of observational studies

Item No		Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	P1-3
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	P2-3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	P4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	P5
Methods			
Study design	4	Present key elements of study design early in the paper	P5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	P5-7
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	P6
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	NA
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	P8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	P7-8
Bias	9	Describe any efforts to address potential sources of bias	P6-8
Study size	10	Explain how the study size was arrived at	P7-8
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	P9
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	P9
		(*b*) Describe any methods used to examine subgroups and interactions	P9
		(*c*) Explain how missing data were addressed	P9
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy	NA
		(*e*) Describe any sensitivity analyses	P9

Continued on next page

Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	P9-10
		(b) Give reasons for non-participation at each stage	NA
		(c) Consider use of a flow diagram	NA
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	P10, P26-30
		(b) Indicate number of participants with missing data for each variable of interest	NA
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	NA
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	NA
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	NA
		Cross-sectional study—Report numbers of outcome events or summary measures	P9-13, P26-34
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	P9-13, P26-34
		(*b*) Report category boundaries when continuous variables were categorized	P9-13, P26-34
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	P13
Discussion			
Key results	18	Summarise key results with reference to study objectives	P13-16
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	P16-17
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	P17
Generalisability	21	Discuss the generalisability (external validity) of the study results	P17
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	P18

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

Checklist for Reporting Results of Internet E- surveys checklist (CHERRIES)

Item Category	Checklist Item	Explanation	Page
Design	Describe survey design	Describe target population, sample frame. Is the sample a convenience sample? (In "open" surveys this is most likely.)	P5-6
IRB (Institutional Review Board) approval and informed consent process	IRB approval	Mention whether the study has been approved by an IRB.	P6
	Informed consent	Describe the informed consent process. Where were the participants told the length of time of the survey, which data were stored and where and for how long, who the investigator was, and the purpose of the study?	P6
	Data protection	If any personal information was collected or stored, describe what mechanisms were used to protect unauthorized access.	P8-9
Development and pre-testing	Development and testing	State how the survey was developed, including whether the usability and technical functionality of the electronic questionnaire had been tested before fielding the questionnaire.	P6-7
Recruitment process and description of the sample having access to the questionnaire	Open survey versus closed survey	An "open survey" is a survey open for each visitor of a site, while a closed survey is only open to a sample which the investigator knows (password-protected survey).	P7
	Contact mode	Indicate whether or not the initial contact with the potential participants was made on the Internet. (Investigators may also send out questionnaires by mail and allow for Web-based data entry.)	P7
	Advertising the survey	How/where was the survey announced or advertised? Some examples are offline media (newspapers), or online (mailing lists – If yes, which ones?) or banner ads (Where were these banner ads posted and what did they look like?). It is important to know the wording of the announcement as it will heavily influence who chooses to participate. Ideally the survey announcement should be published as an appendix.	P7
Survey administration	Web/E-mail	State the type of e-survey (eg, one posted on a Web site, or one sent out through e-mail). If it is an e-mail survey, were the responses entered manually into a database, or was there an automatic method for capturing responses?	P7
	Context	Describe the Web site (for mailing list/newsgroup) in which the survey was posted. What is the Web site about, who is visiting it, what are visitors normally looking for? Discuss to what degree the content of the Web site could pre-select the sample or influence the results. For example, a survey about vaccination on a anti-immunization Web site will have different results from a Web survey conducted on a government Web site	P5-7

Item Category	Checklist Item	Explanation	Page
	Mandatory/voluntary	Was it a mandatory survey to be filled in by every visitor who wanted to enter the Web site, or was it a voluntary survey?	P6-7
	Incentives	Were any incentives offered (eg, monetary, prizes, or non-monetary incentives such as an offer to provide the survey results)?	P7
	Time/Date	In what time frame were the data collected?	P9
	Randomization of items or questionnaires	To prevent biases items can be randomized or alternated.	P7
	Adaptive questioning	Use adaptive questioning (certain items, or only conditionally displayed based on responses to other items) to reduce number and complexity of the questions.	P7
	Number of Items	What was the number of questionnaire items per page? The number of items is an important factor for the completion rate.	P7
	Number of screens (pages)	Over how many pages was the questionnaire distributed? The number of items is an important factor for the completion rate.	P7
	Completeness check	It is technically possible to do consistency or completeness checks before the questionnaire is submitted. Was this done, and if "yes", how (usually JAVAScript)? An alternative is to check for completeness after the questionnaire has been submitted (and highlight mandatory items). If this has been done, it should be reported. All items should provide a non-response option such as "not applicable" or "rather not say", and selection of one response option should be enforced.	P7
	Review step	State whether respondents were able to review and change their answers (eg, through a Back button or a Review step which displays a summary of the responses and asks the respondents if they are correct).	P7
Response rates	Unique site visitor	If you provide view rates or participation rates, you need to define how you determined a unique visitor. There are different techniques available, based on IP addresses or cookies or both.	P8
	View rate (Ratio of unique survey visitors/unique site visitors)	Requires counting unique visitors to the first page of the survey, divided by the number of unique site visitors (not page views!). It is not unusual to have view rates of less than 0.1 % if the survey is voluntary.	NA
	Participation rate (Ratio of unique visitors who agreed to participate/unique first survey page visitors)	Count the unique number of people who filled in the first survey page (or agreed to participate, for example by checking a checkbox), divided by visitors who visit the first page of the survey (or the informed consents page, if present). This can also be called "recruitment" rate.	P9-10

Item Category	Checklist Item	Explanation	Page
	Completion rate (Ratio of users who finished the survey/users who agreed to participate)	The number of people submitting the last questionnaire page, divided by the number of people who agreed to participate (or submitted the first survey page). This is only relevant if there is a separate "informed consent" page or if the survey goes over several pages. This is a measure for attrition. Note that "completion" can involve leaving questionnaire items blank. This is not a measure for how completely questionnaires were filled in. (If you need a measure for this, use the word "completeness rate".)	P9-10
Preventing multiple entries from the same individual	Cookies used	Indicate whether cookies were used to assign a unique user identifier to each client computer. If so, mention the page on which the cookie was set and read, and how long the cookie was valid. Were duplicate entries avoided by preventing users access to the survey twice; or were duplicate database entries having the same user ID eliminated before analysis? In the latter case, which entries were kept for analysis (eg, the first entry or the most recent)?	P7
	IP check	Indicate whether the IP address of the client computer was used to identify potential duplicate entries from the same user. If so, mention the period of time for which no two entries from the same IP address were allowed (eg, 24 hours). Were duplicate entries avoided by preventing users with the same IP address access to the survey twice; or were duplicate database entries having the same IP address within a given period of time eliminated before analysis? If the latter, which entries were kept for analysis (eg, the first entry or the most recent)?	P7
	Log file analysis	Indicate whether other techniques to analyze the log file for identification of multiple entries were used. If so, please describe.	NA
	Registration	In "closed" (non-open) surveys, users need to login first and it is easier to prevent duplicate entries from the same user. Describe how this was done. For example, was the survey never displayed a second time once the user had filled it in, or was the username stored together with the survey results and later eliminated? If the latter, which entries were kept for analysis (eg, the first entry or the most recent)?	P7
Analysis	Handling of incomplete questionnaires	Were only completed questionnaires analyzed? Were questionnaires which terminated early (where, for example, users did not go through all questionnaire pages) also analyzed?	NA
	Questionnaires submitted with an atypical timestamp	Some investigators may measure the time people needed to fill in a questionnaire and exclude questionnaires that were submitted too soon. Specify the timeframe that was used as a cut-off point, and describe how this point was determined.	NA
	Statistical correction	Indicate whether any methods such as weighting of items or propensity scores have been used to adjust for the non-representative sample; if so,	P9

Item Category	Checklist Item	Explanation	Page
		please describe the methods.	