Regional disparities in Preventive measures of COVID-19 pandemic in China. A study from international students' prior knowledge, perception and vulnerabilities

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Abstract

The COVID-19 pandemic needs immediate solution before inflicting more devastation. So far, China has successfully controlled transmission of COVID-19 through implementing stringent preventive measures. In this study, we analyze the effectiveness of preventive measures taken in thirteen regions of China based on the feedback provided by 1135 international students studying in China. The study uses factor analysis combined with varimax rotation of variables. It was found that awareness raising and dispersing actionable knowledge regarding trust and adapting measures remained significantly important. Therefore, recognition of information gaps, improvements in the level of alertness, and development of preventive measures in each sector are imperative. The findings of this study revealed that trust, students' health, waste disposal, and the efforts of the Chinese government/ international institute of education to prevent this pandemic were significantly and positively associated with preventive measures. The results showed that prior knowledge, global pandemics, and food and grocery purchases were firmly related to the preventive measures of COVID-19. Moreover, anxiety, transportation, and economic status were negatively related to the preventive measures. During this epidemic situation, international students suffered various types of mental stresses and anxiety, especially living in most affected regions of China. The study adopted a mixed (qualitative and quantitative) approach where the findings can act as a set of guidelines for governmental authorities in formulating, assisting in the preparation, instructing, and guiding policies to prevent and control the epidemic COVID-19 at national, local, and divisional levels.

Keywords Novel coronavirus pneumonia · Zoonotic diseases · Epidemic · COVID-19

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Introduction

Pandemics are not a phenomena; people have faced them over the centuries (Cunha 2004, Gacel-Ávila 2005, Winter & Winter 2018). For instance, the Black Death, which was the most devastating pandemic in the human history, killed almost one third of the population of the world in the fourteenth century (Cohn Jr & Weaver 2006, Haensch et al. 2010, Wheelis 2002). A common influenza claims thousands of lives every year across the world. For instance, smallpox, tuberculosis, malaria, plague, measles, and cholera have also remained significant killers in the history of mankind. However, owing to the scientific advancements, humanity now possess better expertise to cope with the pandemics (Benatar 2002, Morse et al. 2012, Osterholm 2005). History gives its perspectives and probably also provides solace. The recent outbreak of COVID-19 has made coronavirus species known to the world (Koh 2020, Lai et al. 2020, Rasmussen et al. 2020). The coronavirus was first discovered in the 1960s (Holland 1999, Kahn & McIntosh 2005); however, the scientists are still ambiguous of its source (Cheng et al. 2015, Cheng et al. 2010, Cheng et al. 2012). Because it looks like a corona, it is called a coronavirus. Corona is a Latin word, meaning the "crown." In only a few cases, coronavirus infects humans and animals (Azhar et al. 2014, Corman et al. 2014). There are about thirteen types of coronaviruses discovered so far; however, some of them pose a real threat to human health (Coleman & Frieman 2014). In the history, three coronaviruses were found to be deadly to humans and one to other living beings, namely, Middle East respiratory syndrome (MERS), severe acute respiratory syndrome coronavirus (SARS-CoV) and swine acute diarrhea syndrome coronavirus (SADS) (Ashour et al. 2020, Srivastava & Saxena 2020).

Middle East respiratory syndrome (MERS) was the first deadly coronavirus-related epidemic that started from Saudi Arabia (Ajlan et al. 2014, Hastings et al. 2016) and spread to many countries in Europe, Middle East, Africa, and Asia. MERS killed 858 people; most of them were from the Middle East. In April 2014, the disease reached the USA when two cases were reported, one in Indiana and one in Florida (Maslow & immunotherapeutics 2017). Both MERS-positive patients returned from Saudi Arabia. In May 2015, the disease had spread to South Korea, where it became the largest outbreak outside the Arabian Peninsula. Severe acute respiratory syndrome coronavirus (SARS-CoV) was the second deadly coronavirus-related disease (Khan et al. 2014, Shortridge 2003). SARS started in 2003, claimed lives of 774 people, and infected more than 8000 people across 26 countries. The origin of SARS was tracked to be southeastern China, near Hong Kong from where the disease was transmitted to other countries (Cheng et al. 2007). The last case of SARS was reported in 2004.

Swine acute diarrhea syndrome coronavirus (SADS-CoV) was also a type of coronavirus that only infected animals (Zhou et al. 2019). It was transmitted to pigs through a specific kind of bats known as horseshoe bat. Approximately 90% of piglet died in less than 5 days because of this coronavirus. SADS-CoV originated from Guangdong in 2018. SADS-CoV killed more than 24,000 piglets in four farms (Zhou et al. 2020b).

The outbreak of the recent novel coronavirus pneumonia (COVID-19) was reported from Wuhan at the end of December 2019 (Cheng et al. 2020). The virus spread fast across the various regions in China and the transmitted to other countries (Peng et al. 2020, Singhal 2020). In March 2020, the World Health Organization (WHO) declared it as a pandemic because the COVID-19 cases started to be reported from more than 170 countries (Paez et al. 2020).

China is the most populous country in the world. China has approximately 3000 universities and colleges with over 20 million students. Chinese government is motivating international students by offering them admission to universities in China. So far, more than 500,000 international students from different countries are studying in different Chinese universities. Most of the international students are from Asia. A large number of students from Africa, Europe, America, and Oceana are also studying in China. The number of South Korean students studying in China is 50,000 which is currently the highest from any foreign country. Pakistani students rank second with more than 30,000 students. Beijing has the highest number of international student that is 80,000. Shanghai has 55,000 international students while Jiangsu province has the third largest number (50,000) of international students (Jiani 2017, Wen & Hu 2019, Wu et al. 2019a).

The start of the year 2020 was not fortunate for China (Wu et al. 2019b). The country had to face the deadliest and most contagious virus in the human history (Pan et al. 2020). As of February 29, 2020, the National Health Commission confirmed 79,251 COVID-19 cases in Mainland China. There were 7664 severe cases, a total of 2835 deaths, along with of 39,002 cured and discharged cases, and a total of 7264 suspected cases. The COVID-19 is going to spread in other countries of the world too. So far, people died due to this epidemic in 10 countries of the world. The USA is the most affected country by COVID-19 after China. There are 1,291,337 cases of COVID-19 in the USA with 5000 death tolls.

The COVID-19 outbreak scared most of the people in China which also included international students studying in different regions of China. Students studying in areas which are more affected by the pandemic are more scared than those in other regions. This research conducted a quantitative study in this tense environment to know the perception of international students about COVID-19, reasons of spreading this virus, the efforts made by federal/provincial/local government

to make them aware and protect them in this scenario in different regions of China, and the impact of this epidemic on Chinese economy (Asghari et al. 2019, Grenwald-Mayes 2001, Joseph et al. 2019). The purpose of this study is to know the anxiety of international students about this virus as well as their extent of satisfaction from the efforts made by the federal/provincial/local government to overcome the spreading of COVID-19.

Like most of the coronaviruses, COVID-19 spread was similar to the viruses causing common cold, for instance, through sneezing and coughing and coming in contact with infected person. Most of the types of coronaviruses are not dangerous for living species (Xu 2020). Almost everyone is infected by coronavirus at least once in his or her life. Coronaviruses are commonly spread in fall and winter in the USA. A Reuters survey of economists showed that China's economic growth is expected to slow to 4.5% in the first quarter of 2020, the slowest growth rate since the financial crisis. Factory shutdowns are impeding the flow of products from China, affecting global companies. As China is fighting with coronavirus, global economic losses are increasing. China is the world's second-largest economy and a major trading nation, so the economic impact of coronavirus also threatens global growth. Economists surveyed by Reuters from February 7th to 13th said they expected China's economic growth to fall to 4.5% in the first quarter of 2020, down from 6% in the previous quarter, which is the lowest growth rate since the financial crisis. However, economists are optimistic that if the virus can be controlled, China's economy will recover rapidly.

The objective of this study is to know the views of international students studying in Chinese institutions especially students studying in the thirteen provinces and autonomous regions of China about COVID-19, prior knowledge about coronavirus, reasons of spreading this virus, the efforts made by federal/regional/local government to make them aware and protect them in this scenario, and kinds of mental stress experienced by international students during this epidemic.

The Chinese nation is among those nations in the world with highly diverse food consumption trends from different origins of vegetable, animal, and sea-based products. Their favorite food is vegetables, meat of many animals, and even reptiles like rats, snakes, and bats. This research would also be focusing on the spreading of this virus from animals (Alqahtani 2017, Khan & Naushad 2020, Munster et al. 2020, Zhu et al. 2020), because it is already found that coronavirus is a zoonotic disease which is caused by bacteria or viruses that can easily be spread between animals and humans (Khan & Naushad 2020, Turner 1993, Ullah 2020). It is also found that COVID-19 is originated from animals too. So far different researches conducted on COVID-19, with a typical assumption that it is originated from the bat and two specific types of snakes including Chinese krait and Chinese cobra

(Chan et al. 2020, Gralinski & Menachery 2020, Tang et al. 2006, Xu et al. 2004, Yang et al. 2007). Moreover, this study is also to know the fear of international students about this virus and then how much they are satisfied with authentic information and treating the scenario very well or not by federal/provincial/local government to overcome the spreading of COVID-19. This research is focused on the following questions which arise during this epidemic, such as (1) prior knowledge about coronavirus, (2) reasons of spreading this virus, (3) the efforts made by federal/provincial/local government to make them aware and protect them in this scenario, (4) and kinds of mental stress experienced by international students during this epidemic and the typical satisfaction level from the efforts made by federal/regional/local government to overcome the dissemination of COVID-19. During the outbreak of any disease, the most important thing is to avoid rumors (Paek & Hove 2019). Because rumors can demoralize the passion of people living in the affected areas and hence create more and more problems (Jakovljevic et al. 2020, Siemaszko 2019); the frequent availability of authentic information and the trust of people on the efforts made by the government in any outbreak can vanish these rumors and hence increase the morale of people living there. This feeling boosts the morale of any nation. For example, if international students have no authentic information and confidence with the efforts made by the Chinese government, they would try their best to go back to their own countries. This virus can reside in someone's body for 15 days without showing any symptoms (Guo et al. 2020, Repici et al. 2020). If they went back to their home countries, they could spread it in their countries too, and it could make the situation even worse (Gabutti et al. 2020, Tameris et al. 2019).

Materials and methodology

This investigation study was conducted in the 13 provinces/autonomous regions of China by developing a survey that has a maximum number of international students. The purpose of this survey is to know from international students about their prior knowledge of coronavirus, causes of the spread of this virus, quick awareness provided by federal/regional/local Chinese government to educate them about safety measures and the way of treating infected or suspected cases by Chinese government, the trust of international students on government/international offices during the epidemic, and the different kinds of mental stresses experienced by international students. These regions/provinces were Beijing (16.56%), Jiangsu (13.04%), Hubei (12.07%), Shanghai (11.37%), Zhejiang (8.02%), Liaoning (8.02%), Guangdong (6.96%), Tianjin (5.02%), Shandong (4.93%), Fujian (3.96%), Heilongjiang (3.96%), Guangxi (3.08%), and Sichuan (3.01%). This study targeted 1500 students' responses, but we were able to get

1135 filled questionnaire by international students from 13 provinces and regions of China. The international students of South Korea (16.67%), Pakistan (13.06%), Thailand (10.24%), America (8.99%), India (7.34%), Russian Federation (6.69%), Japan (5.24%), Indonesia (5.14%), Kazakhstan (4.96%), Laos (4.96%), Vietnam (3.99%), Magnolia (3.62%), France (3.53%), Malaysia (2.83%), and Germany (2.74%) participated in this investigation study.

Data collection

Two sources were used to attain the data, i.e., the primary and secondary. Online resources (Ministry of Education, People Republic of China (http://en.moe.gov.cn/), Google Scholar, Science Direct, Web of Science, NJUST's online library) were used to collect the secondary data, whereas a survey-based questionnaire was used to collect the primary data. They were enrolled in degree or language courses in Chinese universities or institutions. This questionnaire was circulated in hard form as well as digital in selected 13 provinces. The items in the questionnaire are used to obtain previous knowledge of coronavirus and perception of international students about vulnerabilities, trust, anxiety, waste disposal, and policy implications on the preventive measures of novel coronavirus pneumonia (COVID-19) in different regions of China. The survey also focused on their attitude and morale in such difficult circumstances. Trained scholars conducted the survey at the Nanjing University of Technology through face-to-face meetings or online links sent through their social networks to submit electronic versions of the questionnaire. The questionnaire consists of two different parts. Survey questioners were circulated using an appropriate specimen method. The poll was created by using the function of Google Forms (https://forms.gle/ggc2W5qE9YitMuWC7) and was published on social networking forums like Facebook, WhatsApp, WeChat, and emails. It was made sure that some questionnaires could be included in the survey results by personally visiting and asking them questionnaire-based queries. In this online interview process, the questions were explained to the participants in their local languages and were asked to respond. A total of 1500 online questionnaires were distributed among the international students, and 1135 responded. The questionnaires were divided into three parts.

The first part contained questions regarding the name, university, home country name, continent, kind of study, duration of stay in China, program of study, source of finance, monthly expenditure, basic knowledge of Chinese language, religious beliefs, residential status, and marital status.

In the second section of the questionnaire, respondents were asked what they knew about coronaviruses before. Questions were asked about coronaviruses. They must give answers based on their previous knowledge about coronavirus before this outbreak, such as what a coronavirus is, from where you heard it, and the source of the coronavirus

transmission. Respondents were also asked in this section about the knowledge of preemptive measures to save themselves from this epidemic (Figs. 1, 2, and 3).

It is the final section of this questionnaire. In this section, the confidence and anxiety of respondents in different regions of China were tried to be measured on the efforts made by federal/regional/local Chinese government and specifically their institutions' administration to prevent and control COVID-19 in different regions of China and secondly tried to know their self-morale in this epidemic and finally tried to understand the different types of mental stresses experienced by international students during this epidemic in different regions of China. Various questions were asked to know the perception of respondents on the efforts made by the Chinese government to prevent and control this virus. This section also focuses on the confidence of international students about the provision of precautionary information to save oneself from this virus, the provision of authentic daily report information so that they could get rid of rumors and to know respondents' morale in this situation. The final sample size was 1135, and the authors guaranteed the confidentiality and privacy of responses. The estimated time of completion of the questionnaire was approximately 30–35 min per response.

For analysis of statistical data package, SPSS 19 was used. The results of this research are reduced using Factor Analysis using SPSS 19. It does this by finding potentially unobservable (latent) variables that are reflected in observed variables (manifest variables). Various approaches can be used to accomplish factor analysis, such as principal axis factors, maximum likelihood, generalized least squares, and unweighted least squares. After the initial extraction of the coordinates, various types of rotation can be accomplished. It includes factors such as orthogonal rotations (varimax and equimax), which impose restrictions that are not related to these factors, while tilt rotations (such as Promax) correlate these factors. Considering the different factor analysis techniques and options, it is not surprising that various analysts may get very different results when analyzing the same dataset. However, analysts tried to consider simple structures. A simple structure is a pattern of results, so each variable places a heavy burden on a factor. Factor analysis is a technique based on the correlation matrix of the variables involved, and the correlation usually requires a large sample size to stabilize (Comrey & Lee 1992, 2013, Tabachnick & Fidell 2001). This study provides a hybrid approach, which includes quantitative and qualitative data. The purpose of this hybrid approach is to obtain the maximum amount of information to deepen the understanding of the research area. It was observed that the principles of designing questionnaires were strictly adhered to; for example, the logical relevance of the patterns was continuous and focused on the research area. In order to determine whether the query of the questionnaire was related to the nature of the information required to meet
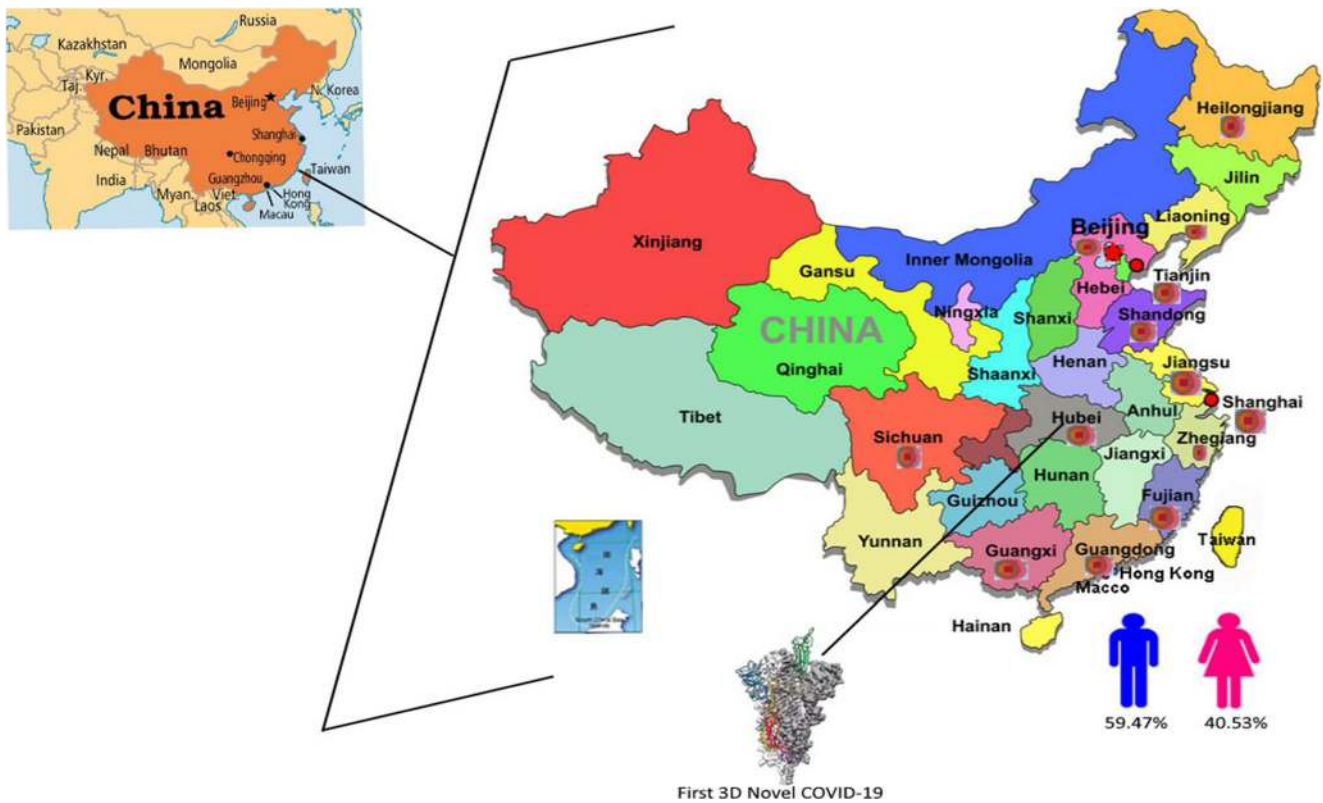
Fig. 1 Classification of sample from various regions on P.R. China

the research purpose, a pilot study was conducted on January 25, 2020. The research conference consisted of nearly 250 highly educated intellectuals (including professors, assistant professors, doctoral students, and graduate students). Participants appreciated this and expressed satisfaction with the questionnaire.

Demographic characteristics of respondents

There were a total of 1135 respondents. The respondents are comprised of both male and female. Males were 59.47%, while females were 40.53%, as shown in Table 1. The age of respondents was between 20 and 41 years.
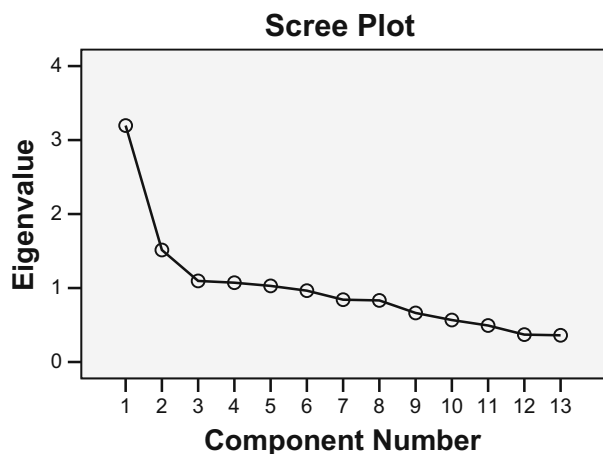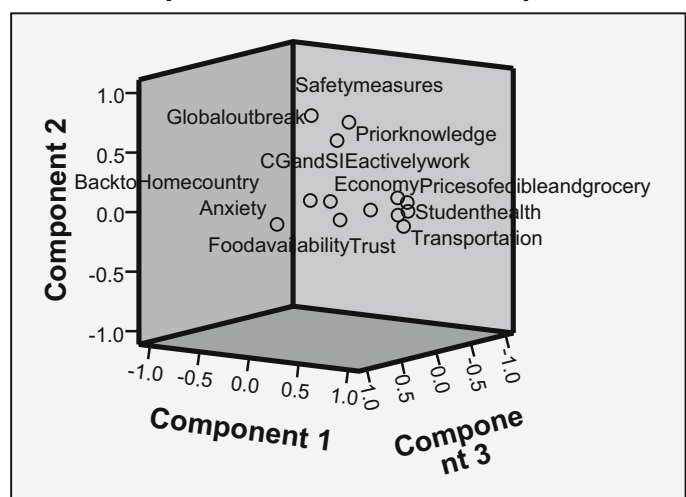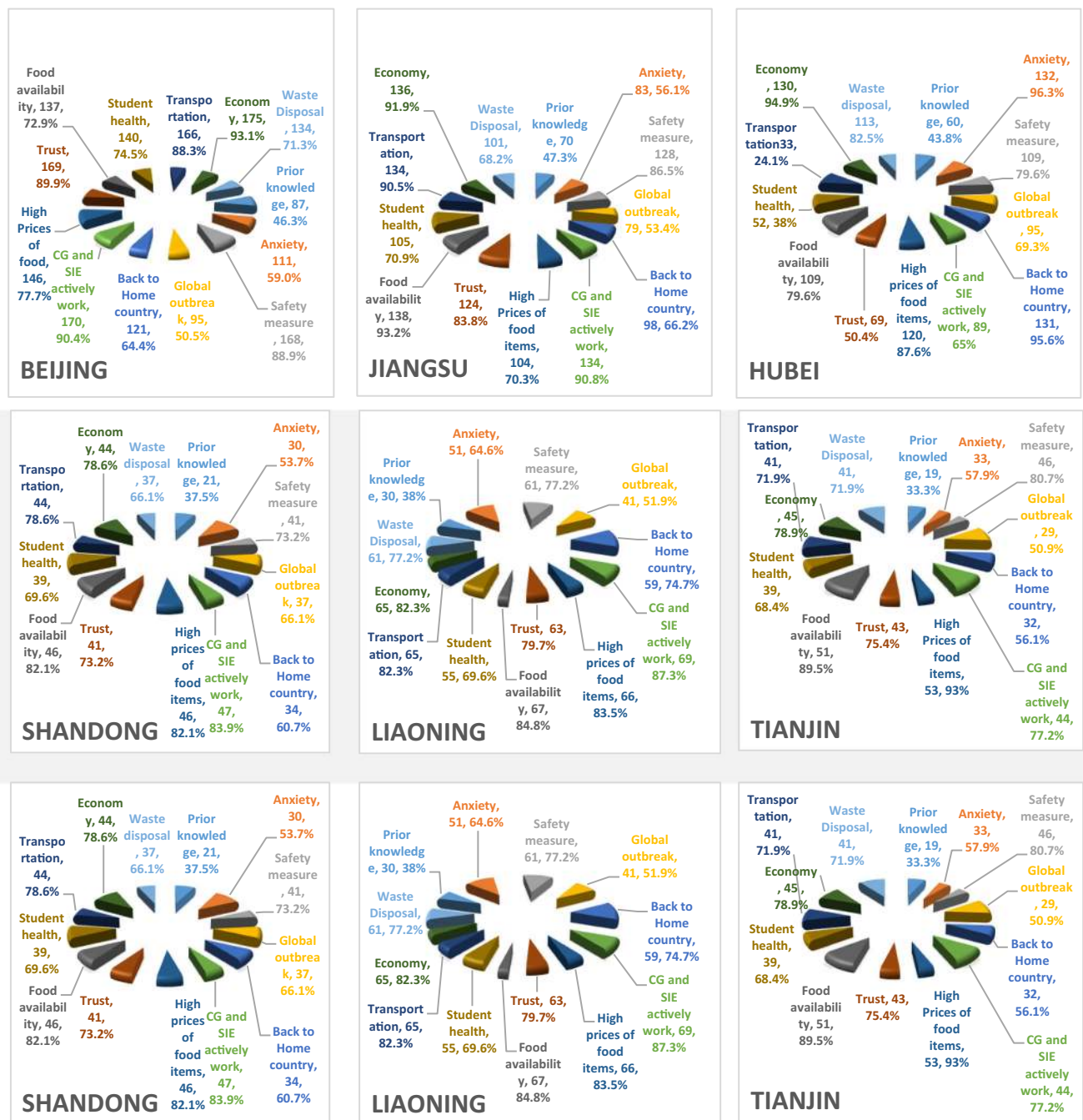

Fig. 2 Scree plot and box plot

Fig. 3 International student's perspectives; preventive measures of COVID-19 impact age-wise, gender-wise and educational-wise across the thirteen provinces of China

Survey showed that the majority of the participants were from Asia (42.47%), followed by Africa (30.84%), America (12.69%), and Europe (10.84%). Marital status showed that the majority of the respondents were single (68.28%), living on campus mostly as bachelors. The majority of the students could understand basic simplified Chinese language. A good majority of students (88.93%) were affiliated with a religion and had some religious beliefs, while 12.07% did not have any kind of religious belief. Most of the students had been staying

in China for about more than 2.5 years, followed by a duration of 1–2.5 years' period. The percentage of survey participants is categorized as master's students, with 35.16% of the whole participants. Bachelor's students followed the tally with 28.19%, and Ph.D. students were 24.67% of the total sample. Majority of the survey participants were with major in engineering (29.34%), followed by social science (15.15%), arts (13.48%), mathematics (9.25%), physics (8.9%), language course (8.81%), chemistry (7.84%), and biology (7.22%).
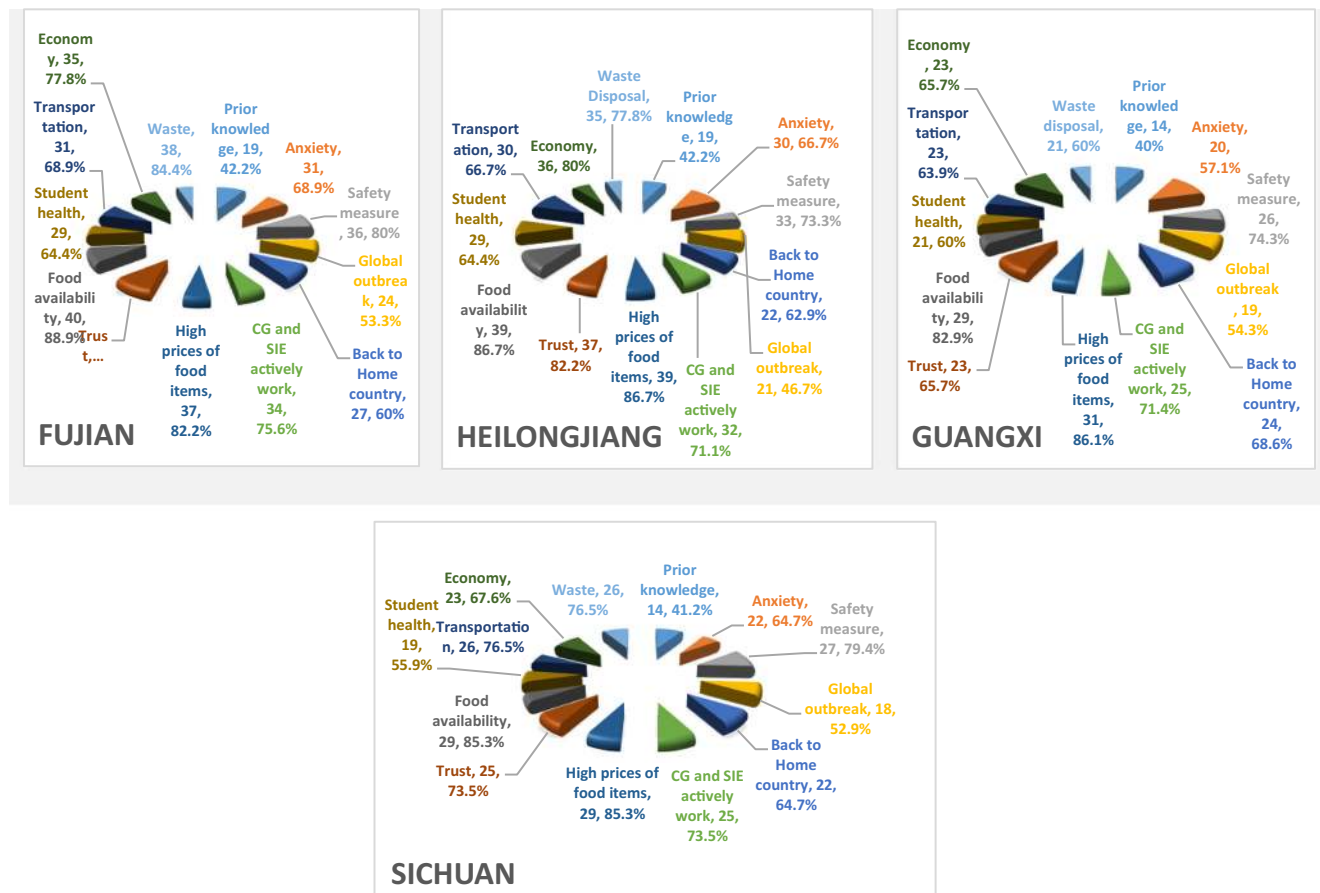
Fig. 3 continued.

The sample of this study showed that 87.67% of students were not living with their families in China.

Survey showed that the majority of participants were from Beijing (16.56%), followed by Jiangsu (13.04%), Hubei (12.07%), Shanghai (11.37%), Zhejiang (8.02%), Guangdong (8.02%), Liaoning (6.96%), Tianjin (5.02%), Shandong (4.96%), Fujian (3.93%), Heilongjiang (3.93%), Guangxi (3.08%), and Sichuan (3.01%). Most of the students were from South Korea (16.67%), followed by Pakistan (13.06%), Thailand (10.24%), America (8.99%), India (7.34%), Russian Federation (6.69%), Japan (5.24%), Indonesia (5.14%), Kazakhstan (4.96%), Laos (4.96%), Vietnam (3.99%), Mongolia (3.62%), France (3.53%), Malaysia (2.83%), and Germany (2.74%).

Factor analysis and hypothesis validation

The response of this indicator is measured on a 5-point Likert scale, with a variable ratio of 5:1. The development phase of the scale has been completed based on a previous study (Hinkin 1995). Besides, the purpose of creating this scale is to obtain more accurate measurements, a higher chance of finding changes, and a better interpretation of the viewpoint

(Gunderman & Chan 2013). The dependability is a significant factor in understanding the quality of a measuring instrument because it helps to identify the impact of inconsistencies on the measurement results. Bryman and Cramer stated that if there are multiple measurement items in the structure, then internal reliability is very crucial (Bryman & Cramer 2004). The study included numerous measurements. Therefore, evaluate the authenticity of the project to align it with the respondents' answers (Nunally & Bernstein 1978). To measure internal consistency, Cronbach's alpha reliability factor was used. Reliability coefficients are considered to be less than 0.6; acceptable coefficients are between 0.6 and 0.7, and all coefficients greater than 0.8 are considered good (Comrey & Lee 1992). According to Nunally, all Cronbach's alpha reliability coefficients (0.7 or higher) can be regarded as sufficient (Tabachnick & Fidell 2001) (Hair et al.) It means that all internal consistency of 0.7 or higher is adequate (Comrey & Lee 2013). According to these recommendations, the minimum cut-off value of Cronbach's α reliability coefficient is 0.7, which is the critical value used to determine the reliability of various indicators to find the total reliability of each potential structure used in this study.

Table 1 Demographic characteristics of the respondent

	Frequency (*n*)	Percentage (%)
Province/autonomous region		
Beijing	188	16.56
Jiangsu	148	13.04
Hubei	137	12.07
Shanghai	129	11.37
Zhejiang	91	8.02
Guangdong	91	8.02
Liaoning	79	6.96
Tianjin	57	5.02
Shandong	56	4.93
Fujian	45	3.96
Heilongjiang	45	3.96
Guangxi	35	3.08
Sichuan	34	3.01
Country		
South Korea	189	16.67
Pakistan	148	13.06
Thailand	116	10.24
America	102	8.99
India	83	7.34
Russian Federation	79	6.69
Japan	59	5.24
Indonesia	58	5.14
Kazakhstan	56	4.96
Laos	56	4.96
Vietnam	45	3.99
Mongolia	41	3.62
France	40	3.53
Malaysia	32	2.83
Germany	31	2.74
Continent		
Asia	482	42.47
America	144	12.69
Europe	123	10.84
Africa	350	30.84
Oceania	36	3.16
Age		
18–25	512	45.11
26–34	543	47.84
35–41	80	7.05
Education		
Short training course	56	4.93
Diploma course	72	6.34
Bachelor degree course	320	28.19
Master degree course	399	35.16
PhD degree course	280	24.67
Post-doctoral	8	0.71
Marital status		
Single	775	68.28

Table 1 (continued)

	Frequency (*n*)	Percentage (%)
Married	320	28.19
Divorced	4	0.35
Widowed	5	0.44
Others	31	2.74
Gender		
Male	675	59.47
Female	460	40.53

Data was converted into an interpretable format (Hinkin 1995); all potential constituents were scored on a 5-point Likert scale: 5 means strongly agreed, and 1 means strongly disagreed with each question in the questionnaire. The primary purpose of cross-loading is to check all items loaded into its structure with high or low scores. Usually, recommend using a new development scale where the measurement model should be kept at 0.50 or higher. Hulland (1999) recommended removing items with loads of less than 0.40 from the model. EFA is used to analyze the research results to confirm the authenticity of the model. A variable correlation matrix was used to discover the multicollinearity of data. Multicollinearity is not a problem because all correlations are more significant than 0.05, and the determinant of the matrix is 0.01 (> 0.00001). Kaiser-Meyer-Olkin (KMO) test is used to check if the samples shown in Table 2 are sufficient. Analysis of data composed for international student's prior knowledge and perception about vulnerabilities, trust, anxiety, waste disposal, and policy implications of different regions of China during this epidemic was measured along with those factor principle that is showing EV (eigenvalues) higher than 1 was sorted using SPSS.19. The data were analyzed by compiling a questionnaire on international students' prior knowledge, vulnerabilities, and perception about preventive measures of epidemic novel coronavirus pneumonia (COVID-19) in different regions of China for 1500 students, but only 1135 respondents were surveyed. Numerous aspects were measured during the study. The principle component showing EV (eigenvalue) greater than 1 was sorted using SPSS.19.

The results of KMO always lie between 0 and 1. Values closer to 1 are better than closer to 0. A value of 0.6 is a suggested minimum. The result indicates that the Kaiser-

Table 2 Kaiser-Meyer-Olkin (KMO) statistics and Bartlett's test of sphericity

Kaiser-Meyer-Olkin measure of sampling adequacy		0.811
Bartlett's test of sphericity	Approx. chi-square	2621.693
	df	78
	Sig.	0.000

Table 3 Factor analysis results with VARIMAX rotation of total variance

Components	Initial eigenvalues			Extraction sums of squared loadings			Rotation sums of squared loadings
	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %	Total
1	3.196	24.582	24.582	3.196	24.582	24.582	3.138
2	1.514	11.646	36.229	1.514	11.646	36.229	1.504
3	1.096	8.430	44.658	1.096	8.430	44.658	1.104
4	1.072	8.246	52.904	1.072	8.246	52.904	1.089
5	1.029	7.914	60.818	1.029	7.914	60.818	1.071
6	0.964	7.417	68.235				
7	0.842	6.480	74.714				
8	0.832	6.402	81.117				
9	0.663	5.099	86.216				
10	0.567	4.365	90.580				
11	0.493	3.794	94.374				
12	0.370	2.848	97.223				
13	0.361	2.777	100.000				

Meyer-Olkin measure of sampling adequacy is 0.873. Bartlett's test of sphericity checks the null hypothesis that the correlation matrix is an identity matrix. The identity matrix is a matrix where all diagonal elements are 1 and all non-diagonal items are 0. In Bartlett's test of sphericity, approx. chi-square and df are 2621.693 and 78, respectively, at the significance level (< 0.000).

The initial number of factors is the same as the number of variables used in factor analysis. However, not all elements are retained. This research considers five factors only from all 13 factors. The eigenvalue is the variance of the consideration. Because a factor analysis on the correlation matrix is performed, the variables were normalized, which means that the variance of each variable is 1, and the total variance is equal to the number of variables used in the analysis, which is 13 in this case (Table 3).

The name with total is a column that contains characteristic values. The first factor would always be considered the largest variance; the second factor would resolve as much residual variance as possible, and so on. Therefore, each continuous factor would account for less and less variance. It reduces from 3.196 to 0.361 in all 13 cases. % of variance in this column comprises each factor as a percentage of the total variance. The percentage of cumulative variance is explained by the current factor and all previous factors. For example, the third line displays a value of 44.658. It means that the first three factors together account for 44.658% of the total variance.

In extraction sums of squared loadings, the number of rows in this table corresponds to the number of factors retained. As per the results, this research is asking to keep five factors, so there are six rows, one for each retention factor. Values in this panel of the table are calculated the same way as in the left panel, except that the values here are based on common variance. The values in this panel of the table will always be lower than the values in the left panel of the table because they are based on a common variance, which is always less than the total variance. Additionally, the values of rotation sums of squared loadings in this table represent the distribution of the maximum backlash of rotation. Varimax rotation attempts to maximize the variance of each factor, so the total amount of variance considered will be redistributed among the three extracted factors.

A scree plot is a line plot of the eigenvalues of factors or principal components in the analysis (PCA). The scree diagram is used to determine the number of factors to be retained in the exploratory factor analysis (FA) or the principal components to be employed in the principal component analysis (PCA). Scree plot always shows eigenvalues in a downward curve, sorting eigenvalues from largest to smallest. According to the scree test, it is found that the characteristic value seems to stabilize the graphic "elbow," and the factor or component to the left of this point should be kept significant. Its name is scree because of the resemblance after the elbow.

The component plot in rotated space displays the substances (variables) in the rotated factor space.

Varimax rotation is also known as Kaiser-Varimax rotation. It is a statistical technique used in first-level factor analysis to clarify the relationship between factors. This process involves adjusting the coordinates of the data derived from the principal component analysis. It maximizes the sum of squares of loading variance, where "loading" represents the correlation between variables and factors. For a small number of variables, this usually results in a high factor load, and for the remaining variables, it often results in a low factor load. All other components have eigenvalues greater than 1 (Kluijtmans et al. 1996).

According to the results given in Table 4, 5 variables have a more significant correlation in the first factor. In other words,

Table 4 Component matrix—exploratory factor analysis

Indicators	Components				
	PCA_1	PCA_2	PCA_3	PCA_4	PCA_5
Prior knowledge	0.121	0.236	0.323	0.153	0.135
Anxiety	0.083	0.111	0.476	0.654	0.206
Safety measures	0.066	0.719	− 0.184	0.298	− 0.011
Global outbreak	0.094	0.741	− 0.199	0.155	0.100
Back to Home country	− 0.042	0.123	0.0389	− 0.226	0.702
CG and SIE actively work	0.036	0.252	0.477	− 0.205	− 0.626
Prices of edible and grocery	− 0.028	− 0.388	− 0.027	0.0637	0.217
Trust	0.766	− 0.216	0.034	− 0.061	0.003
Food availability	− 0.027	− 0.071	0.595	− 0.060	0.146
Student health	0.814	− 0.104	0.049	− 0.007	0.000
Transportation	0.759	− 0.117	− 0.054	− 0.047	− 0.043
Economy	0.840	− 0.035	0.014	0.004	0.041
Disposal of Waste	0.718	0.010	0.074	0.029	0.027

there are five kinds of factors that have the most explanatory power in PCA_1. These factors are economy (0.840), transportation (0.759), student health (0.814), waste disposal (0.718), and trust (0.766). In PCA_2, the significant factors were safety measures (0.719) and global outbreak (0.741). In PCA_3, the essential factors consist of students' anxiety (0.476), and the Chinese government (CG) and school of international education (SIE) actively work (0.477). In PCA4, the significant factors consist of anxiety (0.654) and prices of edible and grocery (0.637).

Vulnerabilities and impacts of preventive measures of epidemic COVID-19

The findings of preventive measures of epidemic COVIR-2019 and its impacts (i.e., prior knowledge, trust, students' health, waste disposal, anxiety, global outbreak, back to home country, CG and SIE actively work, prices of edible and grocery, food availability, transportation, economy) revealed that over 33% of the respondents across Jiangsu believed that international students studying in Jiangsu have the most prior knowledge about coronavirus (47.3%) and students from Tianjin had the lowest knowledge of coronavirus (33.3%). Most students were satisfied with the safety measure adopted by the government and international offices. Students in Beijing (88.9%) were most satisfied with the security measures taken by their government and international offices, while students in Guangdong

(71.4%) were least satisfied with it. The majority of students who were dissatisfied with the administration of the government or related institutions come from short courses; most of them were women. For most international students, food and groceries were easily available during this epidemic. The highest positive response came from Shanghai (93.8%) and the smallest positive response came from Beijing (72.9%). During the epidemic, food and grocery prices rose. The majority of students (93%) from Tianjin and at least 75.8% of students from Guangdong supported this statement. Most students were satisfied with the waste disposal arrangements (especially masks) arranged by government departments and their related departments. In this regard, the largest percentage of satisfied students came from Fujian (84.4%) and the smallest came from Guangxi (60%). This is a precautionary measure against this epidemic to avoid unnecessary travel. Among all regions, the highest positive rate was in Jiangsu province (90.5%). In this regard, due to the lockdown, Hubei Province had the lowest positive rate (24.1%). Due to the lockdown, most areas of Hubei Province could not be transported. Most students were satisfied and trust the steps taken by the administration of government and related agencies. The highest positive rate from all regions came from Jiangsu (90.8%), and the lowest positive rate came from Hubei (65%). More than 50% of students believed that COVID-19 would become a global epidemic. The number of students from Tianjin

was the largest (66.1%), and at least 50.5% of Guangdong students supported this statement. In this epidemic, international students studying in different regions and provinces of China were under various stresses such as family pressure, high food prices, and fear of coronavirus. Of the students in Hubei Province, 96.3% were suffering from anxiety, while 95.5% of students in Hubei Province wanted to return home because Hubei is the epicenter of the epidemic. It has been locked for about a month and a half. The level of anxiety was lowest in Shandong Province (53.7%). The least number of international students who wanted to return home (56.1%) is Tianjin. Tianjin is a developed city near Beijing. As China battled the coronavirus, global economic losses were increasing, some cities were being blocked, and businesses were responding to lost revenue and supply chain disruptions and increased travel restrictions. Among all students from 13 provinces and regions, Hubei Province students were most (94.9%), while Guangxi students were at least 65.7% to support this statement.

To summarize the outcomes of 13 region into age groups (18–25, 26–34, and 35–41) with relative percentage, the findings revealed that anxiety, global outbreak, back to home country, and Chinese government (CG)/school of international education (SIE) actively work were the key factors in extreme levels of preventive measures of epidemic COVID-19 with an effect range of 26 to 30%, 24 to 29%, 23 to 28%, and 22 to 27%; trailed by trust, prices of edible grocery, and food availability with a range of 21 to 25%, 20 to 24%, and 20 to 23%, respectively; consequently waste disposal with an effect range of 19 to 23%, followed by transportation and economy with effect range 18 to 21% and 15 to 18%, respectively, whereas prior knowledge and students' health had nearly identical effect range to 9 to 16% and 8 to 14%, respectively.

On the basis of educational background, the findings of short training course, diploma course sample showed that preventive measures of COVID-19 are the largest contributor to rising anxiety, back to home country, prices of edible and grocery, and food availability in China followed by Chinese government (CG) and school of international education (SIE) actively work, and prior knowledge and students' health, subsequently trust, with marginal difference to global outbreak, waste disposable, transportation, and economic growth. The sample with bachelor's degree education displayed that anxiety and back to home country were the most important concern with same impact, followed by prices of edible and grocery and food availability with marginally difference, subsequently prior knowledge and students' health, subsequently trust, with

slight difference global outbreak, followed by economy and transportation. The sample of master's students indicated that trust and anxiety's and prior knowledge's shares were fractionally higher than students' health, waste disposable, followed by back to home country, prices of edible and grocery, food availability, and Chinese government (CG) and school of international education (SIE) actively work with marginal difference to transportation, subsequently economic growth. The sample with Ph.D. degree and post-doctoral identified that trust and anxiety, Chinese government (CG) and school of international education (SIE) actively work, and prior knowledge were a much higher concern than back to home country, prices of edible and grocery, and food availability, followed by waste disposable, transportation, and economic growth with marginally differences.

As per the gender-based demographic findings, it demonstrated that the primary reason behind increasing (i.e., prior knowledge, trust, students' health, waste disposal, anxiety, global outbreak, back to Home country, Chinese government (CG) and school of international education (SIE) actively work, prior knowledge, prices of edible and grocery, food availability) and decreasing (i.e., transportation, economy) in China is the preventive measures on COVID-19. According to the male population of the sample trust, anxiety and Chinese government (CG) and school of international education (SIE) actively work were determined at an extensive scale, comparatively more than prices of edible and grocery and food availability, entailed by waste disposable with nominal difference. Additionally, students' health followed by prior knowledge, global outbreak, and back to home country, with nominal difference to transportation and economy. The sample of female population identified nearly indistinguishable outcomes to that of males.

Discussion on hypothesis validation

To meet the primary research objectives and to fully understand the relationship holistically, it is also important to explore the prior knowledge of coronaviruses, their sources, and preventive measures for international students to avoid the epidemic by considering these things. In the second part, try to find out what the Chinese government/local government/university/SIE has done to raise awareness to save the public, especially international students, to save from this epidemic. It is also trying to find that masks, edibles, and groceries are in the access of international students during this epidemic, are

they ready to fight the plague with the government, or they are too much nervous with the situation and want to go back to their own country to save themselves from it at their earliest.

Our findings revealed that international students do not have too much prior knowledge about coronavirus and its origin. Most of the international students were unaware of it before the breakout. The Chinese government and international schools have provided them with sufficient material to understand this and to avoid the epidemic. Most international students were satisfied with the efforts of the Chinese Government and international schools to provide them with sufficient information about the coronavirus.

Coronaviruses are very common in different animals, including camels, snakes, and bats. Rarely, these can evolve and infect humans and then spread between humans. In the past, SARS-CoV and MERS were coronaviruses which affected human. Most coronaviruses infect animals only (Xu 2020). It is transmitted to pigs through a specific kind of bats known as horseshoe bat. Ninety percent of piglet died for less than 5 days because of this coronavirus. Novel coronavirus pneumonia (COVID-19) is also originated from the bat and then transferred to humans (Cheng et al. 2020). Bats are recognized as natural reservoirs of several viruses (Zhou et al. 2020a). As the potential vectors, bats received particular attention as three new coronaviruses in the twenty-first century caused an unexpected outbreak of human disease, COVID-19 in China, severe acute respiratory syndrome coronavirus (SARS-CoV), and MERS-CoV, recommended originated in bats. In China, various horseshoe bats have been found to contain genetically different SARS-like coronaviruses.

On the other hand, a wide range of coronaviruses associated with MERS-related viruses have been found worldwide, some of which can be classified as the same as MERS coronaviruses. Scientific communities are striving to understand the patterns of virus origin and transmittance to particular species and mainly human beings. Due to this reason, international students are instructed by the Chinese government (CG)/school of international education (SIE) not to come close to any wild animals. They were told not to eat meat, but if someone wants to eat meat, he or she must cook it properly. The majority of international students were satisfied with the efforts made by the government to isolate the infected or suspected people and the people who were in close contact with those people to protect others from this virus. They were also satisfied by the lockdown of the epicenter of this outbreak, Wuhan. Most of the students were also satisfied with other measures taken by the government, such as restricting the gathering, providing awareness about precautions, making it compulsory to wear face masks at public places, and declaring public health emergencies.

The students also supported the preemptive measures taken by their institution or international school within the boundary of their institutions. Most international students said that their institution had taken the following steps during this epidemic such as they shared daily epidemic report containing authentic facts and figures, providing awareness and training to students to save themselves from this disease, making restriction on traveling, taking measures to make sure check and balance on institution's entrance and dormitory entrance, making sure of provision of edible and groceries, and taking measures to make environment clean by properly dumping garbage and used face masked.

This investigation study found that most international students agreed with the institutions' instructions to stay inside for the prevention of this epidemic. They tried to live in their room. There were found 4 types of people during this outbreak.

1- People belong to Wuhan or other affected areas by an epidemic.
2- People who were in close contact with Wuhan and affected areas' people.
3- People who encountered by Wuhan people or affected areas' people in public places and they never met before.
4- People who did not travel since this outbreak.

Chinese government identified as suspected cases of first category people and contacted them. It is effortless to find people with close contact with them. The third category is the hidden danger. They are tough to be found. Even they do not know that they are affected or suspected. So, the best way to prevent and control the epidemic is by staying at home. The majority of the international students were agreed on the availability of food and grocery. There was no shortage of food within the institution or outside institution, but the prices were increased due to the epidemic. After a meal, face masks are becoming the 2nd highest demanding item in this scenario. As per the majority, there was a shortage of masks at pharmacies due to too much demand. They are experiencing a problem in getting face masks. Prices of masks have also been increased since the beginning of this epidemic.

As per scientists, coronavirus can live in the human body for 14 days without showing any symptoms. If a single student carried a virus to another country, it could be awful for his or her family and that country. Some of the students were paying attention to daily exercise to make their body and brain relaxed. But most of the students were in a state of nervousness. They were unable to decide anything. They wanted to go back

to their home without knowing the threat that they could be very harmful to their own family and area.

As per investigation study results, most of the students were cooperating and paying gratitude to medical staff, service personnel, sanitation workers, and police during this epidemic. They were aware that those restrictions were in their interests. They were obeying the new rule set by the Chinese government or their institution/international school administrations.

This is an unfortunate fact about this epidemic that it is on the path of a global outbreak. The Chinese government is leaving no stone unturned to overcome this problem. Even then, it is on the path of a global outbreak. As new deadly strains of the virus continue to spread in China and around the world, the United Nations health agency has taken extraordinary measures. The virus has spread to nearly 185 countries like Italy, Iran, South Korea, Hong Kong, USA, Australia, and Nepal. World Bank Group was issued a statement on the outbreak of novel coronavirus in China:

> "As the novel coronavirus spreads, the World Bank Group is reviewing financial and technical resources that can be mobilized quickly to support affected countries and assist the life-saving work underway to stop the transmission and mitigate the impact of this virus. All countries to strengthen their health surveillance and response systems, which is essential to contain the spread of this and any future outbreaks. We are monitoring the wider economic and social impacts of this crisis. Support China's efforts to respond including its efforts to maintain resilience in its economy. World Bank Group recognize that it is the poorest countries and most vulnerable populations."

Recommendations and policy implementations

The epidemic of new coronavirus pneumonia (COVID-19) has drawn increasing attention worldwide. Our research provides a deep insight into the preventive measures of the epidemic of new coronavirus pneumonia (COVID-19) outbreak in China. The results of this study can be used as stepping stones for further research. Carrying out comprehensive research will greatly help us innovate and improve major epidemic preventive measures and improve the national public health emergency management system from the perspective of systems and mechanisms. The respondent of this study emphasized that ensuring the safety and health of the

people is an important task for any party to manage the country and government. According to the current situation, not only must we succeed in the scientific and accurate fight against epidemics, we must also take a long-term perspective, sum up experience, learn lessons, and find out shortcomings and deficiencies. The prerequisite of integration of biosafety into the national security system, systematically planning national biosafety risk preventive measures, establishing a governance system, and comprehensively improving national biosafety governance capabilities.

The participant of this study suggested that the Chinese government should pay close attention to making up for shortcomings, making up for loopholes and strengths and weaknesses, adhere to principles, and implement and improve professional systems and mechanisms. Prevent epidemics and improve the national public health emergency management system. Some other important results in the preventive measures are major tests of national governance systems, capabilities, innovate and improve the national public health emergency management system, and improve the ability to respond to major public health emergencies.

The penury in strengthen the rule of law in public health, comprehensively strengthen and improve relevant laws and regulations in the field of public health, and seriously evaluate the improvement of infectious disease prevention and animal protection regulations. From the perspectives of protecting public health, maintaining national security, and maintaining long-term national stability, biosafety should be integrated into the national security system. The construction of a national biosafety risk preventive measures system should be systematically planned and national biosafety standards should be formulated. The risk preventive measures system must be comprehensively improved. It is necessary to promote the promulgation of the "Biosafety Law" as soon as possible and speed up the construction of national biosafety laws and regulations and the system guarantee system.

Maintaining the concept of 24/7 preventive measures and implementing health and care policies are the most important preventive measures. It is necessary to improve the public health service system, optimize the investment structure of medical and health resources, strengthen the preventive measures capacity building of rural and community grassroots units, and strengthen the front line of defense. It is necessary to strengthen the construction of public health teams, improve the training, acquisition, use, treatment guarantee, evaluation, and incentive mechanism of practitioners. In short, the behavior of the population has been deeply rooted in their level of knowledge, thereby continuing to strengthen the system construction of general practitioner training and graded diagnosis

and treatment, and promotes effective coordination and public health services and medical services. It is needed to strengthen risk awareness and improve working mechanisms of preventive measures, enhance risk awareness, and improve coordination mechanisms for research, assessment, decision-making, and preventive measures of major public health risks.

This study focuses on understanding of perception reforms of people; improves the major epidemic preventive measures system; improves the major epidemic emergency mechanism, establishes a centralized, unified, and efficient leadership and command system to achieve clear, orderly, smooth, and effective implementation of the command system; addresses the frontiers of the epidemic; improves the effective coordination mechanism of scientific research, disease control, and clinical treatment; timely summarizes the practical experience of various regions; forms institutionalized results; and improves the preventive measures of major epidemics and emergencies. These measures include updating government policies to build awareness among the population and reduce the impact of transmitted COVID-19. This can be accomplished by creating training manuals tailored to meet the needs of different groups of knowledge levels, regions, and industries.

These training manuals should be established to focus on varying the behavior of populations by raising awareness about the impact of preventing and controlling the COVID-19 epidemic, which is addressed by specific demographics, procedures, and actions to address and reduce these diseases. Strategies must be developed at all levels, including national, provincial, departmental, and local levels, and the strategy must be continuously evaluated to ensure accountability and effectiveness. As China is a populous country, decision-making should follow top-down procedures; local and regional governments should implement the "COVID-19 Epidemic Preventive Measures Policy" and the government should regularly evaluate these regulations.

The primary objective of the COVID-19 epidemic preventive measures policy should be to help people to improve their comprehensive social science skills and knowledge. These policies should aim to reduce the spread of epidemic like COVID-19 and procedures by delegating responsibilities to provincial officials to establish an effective chain of command. Transparency in the decision-making process and the development of formal policies with clear objectives, resource allocation, and strategic objectives can improve the long-term implementation period of the regulations. The implications

of these policies will become apparent through strong public support, longer policy horizons, and a comprehensive shift in the country's population to sustainable behavior.

Conclusion

After the outbreak of the novel coronavirus pneumonia (COVID-19) in China which is the deadliest type of coronavirus, so far discovered, the lives of international students studying all over the China were affected a lot, although international students were satisfied by the government and institution's administrations to prevent this epidemic in different regions of China. No doubt, they are standing firm with Chinese nation to defeat this epidemic. All of the international students of different regions of China are cooperating and paying gratitude to medical staff, service personnel, sanitation workers, and police during this epidemic and appreciated the decision taken by government to overcome this problem such as they shared daily epidemic report containing authentic facts and figures, providing awareness and training to students to save themselves from this disease, making restriction on traveling, taking measures to make sure check and balance on institution's entrance and dormitory entrance, making sure of provision of edible and groceries for international students, and taking measures to make environment clean by properly dumping garbage and used face masked.

During this epidemic, international students faced many types of mental stresses. Their family and friends living in their home countries were too much worried about their health and safety. One of the most mental stresses is to spend most of their time in rooms and apartments alone. Humans are social animals. They want to interact with others to live a good life. Because of this epidemic, they cannot interact with too many people and cannot go out to visit somewhere.

The results showed that the perception, safety measure, trust, student health, waste, and Chinese government/school of international education got high appreciations and positively significant association with preventive measures of epidemic novel COVID-19. They were also satisfied with the efforts of the government/administration to prevent and control the epidemic. The Chinese government/school of international education provided them training with enough information to protect themselves from the epidemic. Moreover, anxiety, food and grocery availability, transportation, and economy of China were negatively

related with preventive measures of epidemic COVID-19. A Reuters survey of economists showed that China's economic growth is expected to slow to 4.5% in the first quarter of 2020, the slowest growth rate since the financial crisis. Factory shutdowns are slowing the flow of products and parts from China, affecting global companies. The economists are optimistic that if the virus can be controlled, China's economy will recover rapidly.

Compliance with ethical standards

Conflicts of Interest The authors declare that there is no conflicts of interest.

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