

Exploration of Chinese Parental Awareness About COVID-19 Outbreaks

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Abstract

Background: Currently children's COVID-19 case numbers are gradually increased in various countries, and many parents fear for their children's safety after schools reopen. The aim of this research was to investigate Chinese parents' awareness of pediatric COVID-19 in relation to protecting their children.

Methods: A cross-sectional study was conducted in Fujian and Jiangsu provinces in China using a web-based research questionnaire to investigate parents with children aged 6 to 16 years old.

Results: Research samples included 1222 participants. 99.2% of participants were aware of respiratory transmission of COVID-19, and 75.6% also believed fecal-oral transmission to be possible. Although 98.3% of participants reported knowing how to properly wear and remove masks, most parents were unaware of good handwashing technique and answered incorrectly regarding cough etiquette. Research participants seemed uncertain of children's symptoms. Awareness scores of participants significantly differed across parental role, educational attainment levels, and social-economic levels ($P < 0.005$), with fathers, the better educated, and those of higher income showing higher levels of awareness.

Conclusion: Research results suggest an urgent need for parental education regarding COVID-19 in children, especially regarding handwashing techniques and cough etiquette; educational facilities and outreach to parents and schoolchildren are particularly important.

Background

The recent novel coronavirus outbreak was first detected in Wuhan, China in late December 2019. By July 2020, it has spread to 216 countries and territories, resulting in over 12 million confirmed cases and fifty-five thousand deaths [1–2]. This new pandemic was officially determined by World Health Organization (WHO) to be a novel coronavirus disease (abbreviated as COVID-19) caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) [2]. Where infection rate is concerned, young children seem to be less susceptible to COVID-19 infection than adults; additionally, children with COVID-19 became less ill and demonstrated less obvious symptom and classic [3]. Current investigations have confirmed that SARS-CoV-2 enters cells by binding to the angiotensin-converting enzyme 2 (ACE-2) cell receptor and facilitate internalization of the virus into human cells. That may explain this different infection rate between adults and children because of low ACE2 expression in children [3–5].

However, evidence has proved children can get COVID-19 like adults, and pediatric COVID-19 cases are now gradually increasing in different countries.^{6–9} The most common clinical manifestations of pediatric cases are fever, cough, or shortness of breath (over 60%) followed by headache (15% in 0–9 year old pediatric patients, 42% in 10–19 year old pediatric patients) [7–8]. According to clinical characteristics of existing pediatric cases, children with COVID-19 can be divided into five clinical types: asymptomatic infection, mild, common, severe, and critically severe [8–10]. In comparison adult patients, most children diagnosed with the disease experience mild symptoms, faster recovery, shorter detoxification time, and good prognosis [8–9]. However, a rare new serious multisystem inflammatory syndrome, related to

COVID-19 and apparently caused by overactive immune responses in old children and adolescents, can occur, and the number of these atypical cases in pediatric patients has been increasing since the middle of April, 2020 in Europe, Canada, and the United States [11–12].

COVID-19 is highly contagious and transmits mainly from person-to-person contact with respiratory droplets of an infected person and usually through coughing and sneezing [13–16]. Currently, experts believe that SARS-CoV-2 can be transmitted through direct, indirect, or close contact with infected secretions (saliva, respiratory droplets, eye discharge, feces or urine) [17–18]. Infection can occur by multiple routes including contact and droplet transmission, touch contaminated surfaces and objects (Fomite transmission), aerosols transmission, fecal-oral, and waterborne routes [14–17]. WHO has acknowledged that the coronavirus can be spread by tiny particles suspended in the air [16–17]. A South Korea's study found that children, younger than 10, transmit COVID-19 to others much less often than adults do; however, children, between 10–19 years old seemed to transmit the virus as well as adults do [19]. This research, conducted during school closure, also found that the highest COVID-19 rate in school-aged children and the lowest for household contacts of children 0–9 years [19]. In contrast, an investigation in Wuhan and Shanghai, China, found that school closures and social distancing significantly reduced COVID-19 rates among school-age children [16].

Based on above research, personal protective measures, personal hygiene, and appropriate social distance remain the most viable options for prevention among children [6, 19, 21–26]. In recent months schools around the world have gradually begun to reopen, including in most provinces in China, causing many parents to fear for their children's safety in the midst of a pandemic. To keep students safe, self-protection measures and educational facilities and outreach are particularly important, and parental awareness regarding COVID-19 must first be evaluated. As schools reopen in China and around the world, such studies will be essential to a safe reopening process. The aim of this research was to investigate the awareness of parents regarding pediatric COVID-19 in relation to protecting their children.

Methods

Study design and setting

A cross-sectional research was conducted in Fujian province provinces from 25th. May. through 25th. June. 2020, as most schools in China reopened after COVID-19 outbreak.

Study population and participant selection

Because literature found that school-age children may transmit the COVID-19 virus more easily than younger children or adults [19–20], the criteria of inclusive sampling for this study were parents of children aged 6 to 16 years old who could read Chinese. The criteria of exclusive sampling were the parents of younger (< 6 y/o) or older (> 16 y/o), or parents unable to read Chinese.

Sample size calculation

To estimate the sample size needed for this study, we used the “Multiple Linear Regression: Fixed model, R^2 deviation from zero” in the G-Power 3.1 [27–28] with small effect size (0.01), power = 0.8, type I error = 0.05, and number of predictors = 5. The total sample size was 1289. The estimated incomplete data was 10%, the final sample sized we needed were 1428.

Instrument and measurement

The questionnaire was constructed and developed based on literature [8–9, 18–21]. It comprised 8 demographic questions and 25 questions assess parental awareness regarding COVID-19 in children, with Sect. 1 (7 questions) covering transmission routes, Sect. 2 (4 questions) covering preventive measures, and Sect. 3 (14 questions) covering symptoms of COVID-19 in children. For each question of Sect. 1 and 2, the response options were on a 5- point Likert-type scale (1 = strong disagreement, 2 = disagreement, 3 = unsure, 4 = agreement, 5 = strong agreement). For each question of in Sect. 3, the response options were no (1) and yes (2). Two questions in Sect. 2 were negatively worded (Question 9 and Question 11). In Sect. 3, the correct answer to five questions was false (yes) (S9, S11-S14). In this research, dependent variable was total score of awareness and independent variables were parental role, educational attainment, and socio-economic status.

Reliability and Validity

The content validity Index (CVI) of research questionnaire was 0.85 to evaluate by a panel of five experts including three clinical experts (two doctors and one nursing manager) and two pediatric scholars. Internal consistency reliability evaluated with overall Cronbach’s alpha coefficient was 0.8, 0.858 for questions of transmission routes (Sect. 1), 0.794 for questions on preventive measurements (Sect. 2), and 0.746 for questions on symptoms of COVID-19 (Sect. 3).

Data Collection

The study was reviewed and approved by the Institutional Review Board of Putain University (approval number: 2020-33). Research data was collected via an online survey. Participants were recruited via the snowball sampling techniques and a consent form was including a link to the web survey platform. All participants had to answer a yes or no question to voluntarily confirm their willingness to participate before data were collected.

Statistical Analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS) software version 26. The research data were described by number and frequency for categorical data and mean, standard deviations and range were used for continuous variables. Multiple linear regression models were used to explore the possible factors affecting participants' awareness regarding children COVID-19. A p value of less than 0.05 was considered as statistically significant.

Research Results

Participants' demographic data

A total of 1360 participants completed the online questionnaire. After detailed review of the responses 138 questionnaires were excluded to missing data or duplications, for the final total of 1222 responses from Fujian province. The average age of participants was 39.3 y/o (range: 23–58, standard deviation: 5.161). The educational attainment of the majority of participants was junior high school (55.6%) and 53.3% were farmers. Most reported middle-class household social-economic status. Table 1 summarizes the demographic profile of participants in this study.

Table 1
 Characteristics of Participants (N = 1222)

Characteristic	Numbers of Participants	Percentage
Gender		
Male	419	34.3%
Female	803	65.7%
Parental Role		
Father	419	34.3%
Mother	803	65.7%
Marital status		
Single	54	4.4%
Married	1168	95.6%
Numbers of Children		
One	142	11.6%
Two	683	55.9%
Three or more	397	32.5%
Occupation		
Civil Servant, Teacher	48	3.9%
Farmer	651	53.3%
Labor	259	21.2%
Businessman	124	10.1%
Clinician	72	5.9%
Other	68	5.6%
Educational Attainment		
Primary School or Under	245	20%
Junior High School	679	55.6%
High School	140	11.5%
Undergraduate	139	11.4%
Postgraduate	19	1.6%
Residential Status		

Characteristic	Numbers of Participants	Percentage
Houseowner	1081	87.3%
Renter	155	12.7%
Socio-Economic Status		
Poor	85	7%
Middle-class	908	74.3%
Well-off	227	18.6%
Rich	2	0.2%

Descriptive data and outcome data

In Sect. 1, Transmission Routes, the majority of participants believed that “COVID-19 virus transmits via respiratory droplets of infected patients” (99.2%) and most (94.3%) believed that uncovered sneezing or cough could spread COVID-19 virus. 75.6% believed that virus may be transmitted by patients’ feces, urine and excrements. Additionally, only 853 participants (69.8%) believed that COVID-19 virus may spread by eating contaminated food.

In Sect. 2, regarding the personal preventive measures, the majority of participants (95.7%) strongly agreed or agreed with the statement “a good handwashing should last for at least 10 seconds”. Additionally, most (92.2%) strongly agreed or agreed with the statement “people should cover their mouth while sneezing and coughing by hands”. Unfortunately, based on the WHO and CDC recommendations to people for the prevention of COVID-19, these responses were incorrect (Table 2).

Table 2
Distributions of Participants' Awareness (number/ percentage, N = 1222)

Questions	Strongly/ agree	Unsure	Strongly /Disagree
Section 1: How is COVID-19 transmitted?			
Q1. Respiratory Droplets of Patients Mean: 4.78, SD:0.435	1212/ 99.2%	10/ 0.8%	0/0
Q2. Feces, Urine and Excrement Mean:4.13, SD: 0.954	924/75.6%	231/ 18.9%	67/ 5.5%
Q3. Eye Discharge of Patients Mean:4.13, SD: 0.959	930/ 76.3%	206/ 16.9%	83/ 6.8%
Q4. Uncovered Sneeze, or Cough Mean:4.55, SD:0.71	1153/ 94.3%	42/3.4%	27/ 2.2%
Q5. Direct Hand Contact with an Infected Person's Respiratory Droplets Mean:4.24, SD:0.925	1005/ 82.3%	137/ 11.2%	80/ 6.5%
Q6. Eating Contaminated Food Mean: 3.98, SD:1.028	853/ 69.8%	254/ 20.8%	115/ 9.4%
Q7. Touching Other's Clothes and Shoes; Mean: 4.02, SD:1.00	880/ 72%	234/ 19.1%	108/ 8.8%
Section 2: Knowledge of COVID-19 Preventive Measures			
Q8. I understand how to properly wear and remove masks. Mean: 4.64, SD:0.528	1201/98.3%	18/1.5%	3/ 0.3%
Q9. A good handwashing should last for at least 10 seconds; Mean: 4.58, SD: 0.683 (Reverse question)	1190/ 95.7%	25/ 2%	27/ 2.2%
Q10. I separate outdoor clothes and indoor clothes. Mean: 4.59, SD: 0.564	1185/96.9%	34/ 2.8%	3/0.3%
Q11. In order to prevent spreading the virus, we should cover our mouth with our hands when coughing or sneezing. Mean: 4.47, SD:0814 (Reverse question)	1126/ 92.2%	33/ 2.7%	63/ 5.1%
Q12, Sect. 3: What are the symptoms of COVID-19 in children? (Number/Percentage of "Yes")			
S1. Fever: 1196/ 97.9%; S2. Stuffy Nose & Cough: 746/ 61%; S3. Sneezing: 594/ 48.6%			
S4. Nausea & Vomiting : 611/ 50%; S5. Diarrhea: 426/ 34.9%; S6. Myalgia: 323/ 26.4%			

Questions	Strongly/ agree	Unsure	Strongly /Disagree
S7. Fatigue: 354/ 28.7%; S8. Itchy Eyes & Watery Eyes: 204/ 16.7%; S9. Itchy & Red Rash: 141/11.5%			
S10. Loss of smell or taste: 163/13.3%; S11. Swollen Joints:81/6.6%;			
S12.Flushed Face, Sweaty: 227/ 18.6%; S13. Chapped lips:143/ 11.7%; S14. Stomatitis: 273/ 22.3%			

In Sect. 3, Symptoms of COVID-19 In Children, the majority of participants (97.9%) responded that fever was one of the symptoms of COVID-19 in children, and 61% believed that stuffy nose and coughing were also symptoms. Few participants believed that the symptoms of “nausea & vomit” (50%) and “diarrhea” (34%) were related to pediatric COVID-19. Literature did not suggest that swollen joints, flushed face, sweaty, chapped lips may not relate to COVID-19, and indeed few participants considered those symptoms related to COVID-19. Table 2 displays distribution and comparison of participants’ awareness levels.

Factors associated with awareness score toward COVID-19 prevention

Awareness scores significantly differed by parental relationship (mother or father), educational attainment, and social - economic Status ($p < 0.05$; Table 3), after adjusting for the age effect. More specially, the results of multiple liner regression analysis exhibited that mothers had, on average, 0.779 units significantly lower score of awareness regarding pediatric COVID-19 than did fathers (estimate= -0.779; $p = 0.026$; Table 3), after adjusting for other factors. Participants with higher academic attainment had higher awareness scores. After adjusting of other factors’ effects, those participants with a high school diploma (estimate: 1.588, $p = 0.007$; Table 3), an undergraduate degree (estimate: 2.224, $p < 0.001$; Table 3), or a graduated degree (estimate: 2.554, $p = 0.046$; Table 3) had higher awareness score than those with the lowest educational attainment (primary school or less). Participants in the highest socio-economic class had higher awareness scores than those in the lowest class (estimate: 1.504, $p = 0.031$).

Table 3
Multiple Linear Regression Models of Significant Impact Factors on Awareness (N = 1222)

Variables	Estimate	SE	95% CI	P
Intercept	62.962	1.589	59.846,66.077	< 0.001*
Parental Role				
Mother versus Father ^a	-0.779	0.349	-1.465, -0.093	0.026*
Educational Attainment				
Postgraduate	2.554	1.282	0.04, 5.068	0.046*
Undergraduate	2.224	0.584	1.079, 3.37	< 0.001*
High School	1.588	0.589	0.432, 2.743	0.007*
Junior High School	0.721	0.424	-0.11, 1.552	0.089
Primary school or Under	0 ^a			
Socio-Economic Status				
Rich	1.885	3.843	-5.648, 9.417	0.624
Well-off	1.504	0.696	0.139,2.869	0.031*
Middle-class	0.905	0.612	-0.296, 2.106	0.140
Poor	0 ^a			
Age	-0.059	0.032	-0.123, 0.006	0.074
Note: Dependent variable: Total Score of Awareness; Model: (Intercept), Parental Role, Educational Attainment, Socio-Economic Status. a. Set to zero because this parameter is redundant. * p < 0.05				

Discussion

To our Knowledge, this is the first investigation of Chinese parents' awareness regarding pediatric COVID-19. Research was conducted as most schools reopened after the COVID-19 outbreak, while China was no longer at the epidemic stage but still a dangerously affected area, especially with many imported confirmed cases. In contrast to a previous study in Wuhan city [10], most participants in this study were farmers with low educational attainment (55% junior high school). In Fujian province, almost 50% residents are farmers. To this point, Fujian has recorded 367 COVID-19 patients including 71 patients recently came from abroad or from other provinces, and no confirmed infections in children. Therefore, this research data may be considered and accurate picture of the Fujian population.

In our research, although most participating parents knew that respiratory transmission (patients' droplets) was the main transmitted route of COVID-19; few recognized contact transmission as another

transmitted route for the virus (Question 4, 5, & 7; Table 2). In this study, 69.8% of participants believed that contaminated food may be a transmission route, but 20.8% participants doubted this theory. Although one hypothesis proposes that the COVID-19 virus may be transmitted via respiratory droplets on the surface of food or food package, currently no evidence proves this hypothesis. Good handwashing, personal hygiene practices, and choice of grocery stores are more important [18].

Personal preventive measures towards COVID-19, including proper handwashing, appropriate facemask use, and respiratory hygiene practices (cough etiquette), are particularly important [18–19]. Clinical experts recommend that proper handwashing technique involve 7 steps and last at 20 seconds [23–25], and it is recommended to cover nose and mouth with tissue or an elbow rather than hands when coughing or sneezing [17, 21–26]. However, our research revealed that the majority of participants had incorrect information on handwashing technique and respiratory hygiene practice (Table 2, q11 and q12). These parents urgently need accurate and appropriate information to correct these misunderstandings.

Additionally, evidence has found differences between the COVID-19 symptoms of children and those of adults [8–9]. In this research, most participants knew that fever and cough are symptoms of COVID-19 in children, but few knew that sneezing is also a symptom. Unlikely adult patients, children with COVID-19 have digestive symptoms (nausea, vomiting, diarrhea) [6–8, 20]. Our research found that participants lack knowledge regarding the symptoms of COVID-19 in children (Table 2).

Parental role, educational attainment and socio-economic condition were significant factors affecting COVID-19 awareness scores. Research participants who were fathers, more highly educated, and of a higher socio-economic status showed better awareness than did others. We assure that more educated, and prosperous parents may possess more resources and access to information on COVID-19, and accordingly better hygiene practices, than parents of lower education and income. These results are likely consistent with a previous study [10, 16]. Investigations in other countries have also revealed that educational attainment, poverty level on awareness regarding COVID-19 [19, 29].

Limitation

One important limitation of this study was that it is not representativeness of the Chinese population as a whole due to use of a snowball sampling method to recruited participants. Additionally, since research setting was limited to two provinces in China, data may not represent the conditions in other provinces which suffered many COVID-19 cases during the outbreak.

Conclusion

Because the COVID-19 is a new disease which infected only few children in China during outbreak, and due to the prevalence of myths and misinformation about this virus, parents lacked clear protective information on protecting children during the critical outbreak in China. However, evidence has found that children of all age can be infected and develop COVID-19. Our research results suggest an urgent need to

improve parental knowledge regarding the transmission routes, symptoms in children, and preventive measures for children, especially handwashing techniques. cough etiquette and recognition of children's COVID-19 symptoms. Moreover, we also suggest an urgent push to develop educational outreaches to parents and schoolchildren to promote personal hygiene knowledge and practice to protect both children and their families. Further studies are needed to develop and evaluate the effectiveness of these programs.

Abbreviations

WHO: World Health Organization;

COVID-19: Novel Coronavirus Disease;

SARS-CoV-2: Severe Acute Respiratory Syndrome Coronavirus 2

ACE-2 : Angiotensin-Converting Enzyme 2

CDC: Centers for Disease Control and Prevention

Declarations

- Ethics approval and consent to participate:

The study was reviewed and approved by the Institutional Review Board of Putain University (approval number: 2020-33). Written informed consent was posted on web-based questionnaire and all participants had to log into web-based questionnaire and answer a yes or no question to voluntarily confirm their willingness to participate before data were collected.

- Consent to publish:

Not applicable.

- Availability of data and materials:

This research datasets generated and analyzed during this study are not publicly available due to the sensitive nature of the data and ethics restrictions on data sharing. Respondents did not consent to have their data publicly shared.

- Competing interests:

The authors declare that they have no competing interests.

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- Authors' Contributions:

N-H Peng, JF Zhou conceived and designed the study. H Meng, ZZ Li, BR Wei, MX Huang contributed research data collection, Y-C Chang was responsible for data analysis. All authors have read and approved the manuscript.

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