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Quarantine experience of close contacts of COVID-19 patients in China: A qualitative descriptive study

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ABSTRACT

Objective: Close contacts of novel coronavirus disease 2019 (COVID-19) patients may suffer from physical and psychological problems. Few studies have investigated the quarantine experiences of close contacts of COVID-19 patients. The objective of this study was to best capture participants' quarantine experiences during the COVID-19 outbreak in China.

Methods: A descriptive, qualitative design was used. All interviews were recorded and coded using thematic analysis.

Results: Fifteen participants took part in this study. The following five themes emerged: (1) experience in the early stage of quarantine; (2) experience in the middle stage of quarantine; (3) experience in the late stage of quarantine; (4) self-coping persisted throughout the quarantine period; and (5) external support was evident throughout the quarantine period.

Conclusion: Our study highlights the need to assess the psychological state of close contacts in the early stage of quarantine and to provide psychological support for them, especially for the older and the less educated. Although close contacts had physical symptoms and psychological issues, they adopted positive coping strategies, which indicated that they were vulnerable but strong. Furthermore, external support from the Chinese government helped them cope with the quarantine effectively. Learning from the quarantine experience is expected to help the Chinese government and institutions from other parts of the world to better care for close contacts.

1. Introduction

The epidemic of novel coronavirus disease 2019 (COVID-19) has captured intense attention nationwide and globally. This disease has widely and rapidly spread in China and several other countries. COVID-19 pneumonia is highly contagious, spreading mainly through contact and droplets, and the general population is susceptible. Since the middle of December 2019, person-to-person transmission of COVID-19 has occurred among close contacts. According to the official website of the National Health Commission, as of February 23, 2020, 49,824 people have been confirmed to have COVID-19 infections, and 635,531 have come into close contact with confirmed COVID-19 patients in mainland China [1]. A close contact is defined as a person who has not taken effective protection and has close contact (within 1 m) with

confirmed and suspected patients 2 days before symptom onset in suspected and confirmed patients or 2 days before samples of asymptomatic infection are taken [2]. There has been no doubt that close contacts are more likely to contract COVID-19.

China has made unprecedented efforts in identifying and quarantining close contacts of confirmed patients to control the infection and cut off transmission routes [3]. Quarantine refers to separating and restricting the movement of people who are exposed to a contagious disease to see if they become sick, thus reducing their risk of infecting others [4], whereas isolation means separating infected people from those who do not get the infection. Quarantine is considered to be the first principle of infectious disease control. The primary purpose of quarantine is to prevent transmission of an infectious agent from those potentially incubating the disease [5]. There are different types of

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quarantine for preventing infectious diseases. In Singapore, video monitoring of people quarantined at home was common during the severe acute respiratory syndrome (SARS) outbreak [6]. Individuals with exposure to SARS were instructed not to leave their homes or have visitors in Toronto [7]. A prospective cohort study from Korea reported that quarantine types included single-room quarantine, cohort quarantine, and self-imposed quarantine for persons exposed to patients with confirmed Middle East respiratory syndrome (MERS) infections [8]. In China, close contacts of COVID-19 patients were quarantined at home or in medical quarantine centers that were remodeled by small and medium-sized hotels or hostels to temporarily house close contacts of COVID-19 patients or cured COVID-19 patients and to control the spread of COVID-19. Although quarantine measures are designed to protect an individual's physical health from infectious diseases, it is necessary to consider the mental health of those subject to such restrictions.

Many studies have investigated the psychological experience of quarantined individuals during major infectious disease outbreaks. A recent review reported that quarantine for preventing infectious diseases had adverse psychological outcomes, such as posttraumatic stress disorder (PTSD), anger and confusion, which can lead to long-term negative psychological effects [9]. Specifically, during the SARS outbreak, Cava et al. [10] adopted a descriptive, qualitative design to explore the experience of home quarantine of individuals affected by SARS in Toronto. The 21 participants described their experience during the quarantine, including feeling stigmatized, feeling rejected and blamed, or feeling bored, and the subtheme of coping ran through the quarantine process. Another study assessed the psychological effects of quarantine among 129 individuals who were self-quarantined during the SARS epidemic. This study found that symptoms of PTSD and depression were observed in 28.9% and 31.2% of participants [7]. The interview results of Cava et al. [6] reported that respondents exposed to someone with suspected SARS were quarantined at home for 10 days, they had feelings of fear or denial about their risk of being infected by SARS, and they showed high compliance with the quarantine order. Wang et al. [11] adopted a cross-sectional study design to investigate whether being quarantined to contain H1N1 flu transmission was correlated with negative psychological effects and found quarantine did not have immediate negative psychological consequences among 176 undergraduate students who were quarantined as close contacts for 7 days. The reason may be the lower morbidity and mortality rate during the H1N1 outbreak than the SARS outbreak. The COVID-19 patients and suspected patients are populations who must be quarantined. Zhou et al. [12] explored the psychological experience and coping strategies of COVID-19 patients during the quarantine period through their comments. Huang et al. [13] introduced psychological self-help methods to suspected patients, such as accepting their own negative emotions and positively changing their perceptions about facing COVID-19. Xiang et al. [14] reported that patients with confirmed or suspected cases expressed fear of the consequences of COVID-19 infection, and others in quarantine felt bored, lonely, and angry. Quarantining close contacts of COVID-19 has been the primary community control measure available. In the initial stage of the COVID-19 outbreak in China, Wang et al. [15] found that more than half of the general public assessed the psychological impact as moderate to severe, and approximately one-third reported moderate to severe anxiety. Therefore, people who had a history of contact with COVID-19 patients may suffer from greater stress. These people are more prone to various psychological and mental problems. However, there is no known information on the quarantine experience of close contacts in the current epidemic situation of COVID-19.

To fill the gaps in the literature, we conducted a qualitative descriptive study to explore the quarantine experiences of close contacts during the quarantine in China. Our findings may help government agencies and healthcare professionals support the physical and mental health of close contacts in the face of the COVID-19 outbreak in China and other parts of the world. They also may help to understand how to provide humanistic quarantine care in the health care delivery system.

2. Methods

2.1. Design

Existing quantitative methods do not sufficiently take into account the perceptions and experiences of close contacts, but a qualitative descriptive design allows for an understanding of their experience [16] and is employed when a research study aims to discover and describe a process, a phenomenon, or the perspectives and views of the participants [17,18]. Moreover, a qualitative descriptive study design offers comprehensive information about an event [16]. Because a qualitative approach would yield a more detailed, in-depth and comprehensive description of the quarantine experience of the participants, a descriptive qualitative method was employed to explore the quarantine experience of close contacts of COVID-19 patients. Qualitative descriptive studies employ the principles of naturalistic enquiry or investigate a phenomenon in its natural state as much as possible [16,19]. In terms of quality assurance, the reporting of this study was consistent with the consolidated criteria for reporting qualitative research [20].

2.2. Objectives

The purpose of this study was to gain a better understanding of the quarantine experiences of close contacts during the quarantine.

Our two main research questions are as follows:

1. How did your emotions change during the quarantine?
2. What strategies did you adopt or what support did you receive to cope with your emotional changes during the quarantine?

2.3. Sampling, setting and participants

During the initial stage of this study, convenience sampling was used to recruit participants. We distributed a recruitment advertisement via WeChat, which is the most frequently used social media platform in China. The close contacts of COVID-19 patients who responded to the recruitment advertisement formed a convenience sample (a total of 102 close contacts). Then a purposive sampling procedure was used to recruit participants with rich information [21] among the 102 close contacts. An email containing a statement of consent was sent to the recruited close contacts. We recruited fifteen participants from Zibo city of Shandong Province. The inclusion criteria were as follows: (1) individuals who have been identified as close contacts of COVID-19 patients; (2) individuals who voluntarily participated in the study; and (3) age ≥ 18 years old. The exclusion criteria included the following: (1) individuals who had severe diseases or (2) were unable to communicate effectively.

2.4. Data collection

Prior to the interview, we sent participants electronic informed consent forms. After they agreed, we began to interview them. The semistructured, one-on-one, in-depth interviews were conducted from February 12, 2020 to March 30, 2020. Researchers used the interview to enter the inner world of the research object and understand the implicit meaning of their psychological activity, emotional response, life experience and behavior. The interview method is more flexible, happens in real-time and has the function of meaning interpretation [22]. The present study aimed to explore the quarantine experience of the close contacts; thus, it was suitable as the interview method. The interviews were conducted by telephone and lasted approximately 60 to 90 min. The first author (CDD) interviewed the participants. The interview environments were quiet, and interruptions were minimal. The expert panel (YZH, SF, CDD, TLW and SJ) created an interview guideline (Supplementary file 1). The questions were open-ended. All interviews were audio-recorded. With the permission of the participants, the interviews were digitally recorded using a handheld recorder to boost

the accuracy of transcription. Within 24 h after the end of the first interview, the digital recording was transcribed verbatim. Simultaneous analysis of the interview transcript was performed with reflections on the content and modification of codes when new data arose. Then we interviewed the next participant. Data saturation was achieved at the 15th interview, because it became clear that there were no new themes transpiring from the interview, which meant that data collection ended.

2.5. Data analysis

After fifteen interviews, categories were tentatively established. When theoretical saturation was reached, sampling was stopped. Thematic analysis was used to identify themes from the interview transcripts [23]. Thematic analysis is the methodical inductive examination of text by detecting and assembling themes and coding, classifying, and refining categories [19]. The themes and subthemes were derived from the data rather than from existing theoretical or conceptual frameworks [24]. We read some articles on the quarantine experience of infectious disease patients and implemented bracketing by writing a reflective note to keep calm and objective and thus reduce the effects caused by any pre-existing notions when analyzing data. YZH, CDD, and SF independently read and reread the transcripts and interview notes to develop detailed notes. Broad codes were inductively developed from these transcripts and refined and synthesized to produce categories. This multicoding approach was used to reduce the risk of researcher bias [25]. A continuous analysis of the data and frequent discussions among the authors were done to refine and define the themes and subthemes. Discussions with the co-researchers (QRL, ZH, TLW, SJ, and WXY) continued until a consensus was reached on the final themes and subthemes that emerged from the data [23]. In the process of data analysis, the criteria for trustworthiness (credibility, transferability, dependability and confirmability) were adhered to [26]. To ensure the credibility of all the transcripts, they were checked for accuracy by two researchers (CDD and ZH). To augment the data consistency, two independent qualitative researchers (YZH and SF) verified the findings of the interview data analysis. Information was repeated and clarified with the participants after the interview. This article described the participants' characteristics, contexts and verbatim quotes to enable the reader to make judgments about the generalizability of the results. To maintain dependability and confirmability, the transcripts were cross-checked by people who did not participate in the transcription process. Moreover, a total of 8 researchers participated in the present study. Most of them were PhD candidates in nursing in the qualitative research. All members of our research team have participated in qualitative research workshops several times, which has improved their understanding of descriptive qualitative research methods, helped to clarify the characteristics of different qualitative research methods, and taught them the skills of collating, coding and analyzing text data, helping make this research more rigorous.

2.6. Ethical consideration

The study received ethics approval from Yunnan College of Business Management (2020048). Electronic informed consent was obtained, and the oral permission was audio-taped from each enrolled participant before the interview began. The participants were informed about the confidentiality of their data. The obtained electronic data were stored on the first author's personal computer in password-protected computer files, and the paper data were stored in a locked drawer.

3. Results

3.1. Participant characteristics

Demographics and quarantine-related information are presented in Table 1. Fifteen close contacts of COVID-19 patients opted in to the study. The participants' ages ranged from 25–59 years. A total of 46.67% were female, and 53.33% were male. Six participants were

Table 1
Characteristics of the study population.

Characteristics	N	%
Age (years)		
18–30	8	53.33
31–40	2	13.33
41–50	1	6.67
51–60	4	26.67
Gender		
Female	7	46.67
Male	8	53.33
Marital status		
Single	6	40.00
Married	7	46.67
Divorced	1	6.67
Widowed	1	6.67
Religion		
Yes	1	6.67
No	14	93.33
Education		
Graduate degree	4	26.67
Undergraduate degree	2	13.33
Pre-university/junior college	2	13.33
Secondary education	3	20.00
Primary education	4	26.67
Type of quarantine		
Self quarantine	6	40.00
Institutional quarantine	9	60.00
Duration of quarantine		
14 days	11	73.33
21 days	4	26.67
The relationships with COVID-19 patients		
Parent	4	26.67
Neighbor	5	33.33
Sibling	3	20.00
Uncle	2	13.33
Grandfather	1	6.67

single, and seven were married. Among the fifteen volunteers, only one had religious beliefs. The education degree ranged from primary schooling to a graduate degree. Sixty percent of the participants were arranged to stay in quarantine at collective medical observation centers. A total of 73.33% were quarantined for 14 days. A total of 33.33% of participants and COVID-19 patients were neighbors, and the parents of 26.67% of participants were COVID-19 patients.

3.2. Qualitative findings

The thematic analysis identified five themes related to the quarantine experience of close contacts of COVID-19 patients: (1) experience in the early stage of quarantine; (2) experience in the middle stage of quarantine; (3) experience in the late stage of quarantine; (4) self-coping persisted throughout the quarantine period; and (5) external support was evident throughout the quarantine period. Each theme was supported by some subthemes that further exemplified the study participants' quarantine experience (Table 2).

3.2.1. Theme 1: experience in the early stage of quarantine

3.2.1.1. Compliance with quarantine

3.2.1.1.1. *High compliance with quarantine.* Some participants thought that quarantine was necessary to prevent the spread of COVID-19. If the close contacts were subsequently confirmed to have COVID-19, they would infect more people. Owing to this perception, they showed high compliance with quarantine. One person commented:

Fortunately, I was quarantined. If I was diagnosed with COVID-19, it would affect my family and friends. (Participant 3).

Some participants actively cooperated with the relevant departments. Feeling that they were doing their duty, they answered the relevant department's questions honestly. They knew if they lied or hid

Table 2
Themes and subthemes.

Themes	Subthemes
Experience in the early stage of quarantine	Compliance with quarantine: 1. high compliance with quarantine; 2. initial resistance to quarantine, but accept it Feeling of fear: 1. fear about being quarantined; 2. fear about contracting COVID-19 Feeling of being stigmatized Multiple physical symptoms
Experience in the middle stage of quarantine	Feeling impatient Feeling nervous
Experience in the late stage of quarantine	Feeling of calmness Looking forward to ending the quarantine soon
Self-coping persisted throughout the quarantine period	Distraction strategies Keeping optimistic Boosting their own immunity
External support was evident throughout the quarantine period	Support from family and friends Psychological support from health professionals Care from the staff Comfortable living environment

something, the consequences would be severe. One person said the following:

The policemen asked us about our whereabouts and who we had contacted. We had to report it truthfully because we didn't know if we had been confirmed to have COVID-19. Knowing my duty, I gave the names of the people we had been in contact with. (Participant 11).

3.2.1.1.2. Initial resistance to quarantine, but acceptance it. In the early stage of quarantine, several participants resisted being quarantined because they did not want to be confined and in close quarters. However, they still accepted the quarantine order. One participant said:

At first, I could not stand being quarantined. My heart was resisting being quarantined. Because I didn't like to be confined and in close quarters. Although I resisted being quarantined, I accepted. (Participant 7).

3.2.1.2. Feeling of fear

3.2.1.2.1. Fear about being quarantined. In our study, nine participants were taken from their homes and placed into quarantine sites. Six participants were quarantined at home. All interviewed participants felt fear in the initial stage of quarantine. They were all being quarantined for the first time, had insufficient knowledge about the quarantine and knew little about what would happen in quarantine. As one participant stated:

At midnight, many policemen wearing gowns and masks came to my home and took us to the quarantine site, which was the first time in the history of our village. I didn't know how to describe that feeling of fear. (Participant 11).

One participant said:

We were very scared about the quarantine. The main reason was that we didn't know much about the quarantine at the beginning. (Participant 9).

Another one said:

When I was quarantined, I cried. I was thunderstruck and speechless. At first, I was quite afraid and nervous. I didn't know what would happen in quarantine. (Participant 8).

On the other hand, one participant related that he was scared about being lonely and lacking company in the quarantine. This participant reflected:

I was especially afraid of being locked up alone because I was lonely and had no company. I was the only one on the Earth. (Participant 7).

Some close contacts quarantined at home also feared being quarantined, but they had lower levels of fear than close contacts quarantined in institutions. Being quarantined at home gave them a sense of belonging. A participant said:

I was so afraid of being quarantined for the first time, but other close contacts might be more afraid who were at the quarantine site. I had a sense of belonging at home that made me less afraid. (Participant 5).

3.2.1.2.2. Fear about contracting COVID-19. Over half of the participants were worried about being diagnosed with COVID-19. Aside from their close contact history with COVID-19 cases, a longer incubation period over 14 days, asymptomatic infection, and misconceptions about COVID-19 were also causes for concern. One participant said:

I had been in contact with four patients diagnosed with COVID-19. Actually, I was really worried. The rate of being diagnosed with COVID-19 was too high for me. (Participant 12).

Others said:

I was worried that I would be diagnosed because of the existence of a very long incubation period in news reports. (Participant 5).

I was definitely worried that I was an asymptomatic COVID-19 patient (Participant 8).

I didn't know much about the disease. I thought it was a terminal illness. Additionally, I had a cough. I was so worried about being diagnosed. (Participant 15).

3.2.1.2.3. Feeling of being stigmatized. In addition to fear, close contacts also cared about what others might think. They worried that other people would see close contacts as carriers of the COVID-19, would stay away from them and would look at them differently than before. For instance:

When I was in quarantine, I was panicking and scared. My freedom was restricted. I was afraid that people in our village would talk about me. (...) They may think that I was a carrier of COVID-19. (Participant 5).

At the beginning of the quarantine, the opinions of people in the village and the work unit had a great impact on me. At that time, because of myself (a close contact), many colleagues in the unit were also quarantined, and many people looked at me with weird eyes. (Participant 13).

3.2.1.2.4. Multiple physical symptoms. In the early stage of quarantine, many participants had fever, sore throat, cough sputum production, chills, high blood pressure, muscle aches or sleep difficulties. The psychological factors or different living environments between home and medical quarantine centers may have been related to the occurrence of physical symptoms.

When I took my temperature, I had a slight fever, probably due to psychological reasons or environmental changes. At that time, I was worrying too much, such as if I would be diagnosed, I would be discriminated against and so on. Besides, I was not used to living here. (Participant 6).

I had too much psychological pressure. (...) I couldn't sleep, and my blood pressure went up in (early) quarantine. (Participant 4).

3.2.2. Theme 2: experience in the middle stage of quarantine

3.2.2.1. Feeling impatient. In the middle of the quarantine, it was evident that some close contacts felt impatient. Participants stated that they were questioned about their contact history many times by the

public security bureau, the centers for disease control, and other relevant government agencies, which made them impatient. They believed that it was enough for one department to ask about their contact history, and the sharing of information among different departments could avoid making close contacts answer the same question many times. This indicated a need for effective collaboration among agencies.

What influenced me most was the police station, the centers for disease control and prevention and government departments. This is the age of the Internet, resources could be shared, but the reality was different. I had to answer the same question (about contact history with COVID-19 patients from these departments) again and again. I actively cooperated with them at the beginning. I didn't feel tired because I knew they were responsible. After five days, some institutions called me to ask the same question, and I got irritable. (Participant 12).

3.2.2.2. Feeling nervous. Some participants were nervous when they underwent nucleic acid tests, and they were nervous when waiting for the results. In addition, tensions were exacerbated by the need to do it twice.

In the middle of quarantine, we did nucleic acid tests. At that time, we were nervous. Later, the test results were negative. I suddenly became relaxed. After that, I heard that it was necessary to undergo two nucleic acid tests considering the accuracy of the results. At that time, I got nervous again. (Participant 9).

3.2.3. Theme 3: experience in the late stage of quarantine

3.2.3.1. Feeling of calmness. The emotions during the quarantine period were not always full of fear, impatience or tension. It was obvious that some participants were calm and peaceful in the late stage of the quarantine. At that time, they knew more about COVID-19, more and more COVID-19 cases had been cured, their nucleic acid test results were negative, and others they contacted were in good health, which made them calm. For instance:

I always read the news, and the school provided a platform for students to learn about COVID-19, which deepened my understanding of COVID-19, and I was not afraid of this disease. In addition, I and others who contacted me didn't have any symptoms. Therefore, I was peaceful. (Participant 5).

When I did the nucleic acid test, I was nervous. (...) My test results were negative for COVID-19 infection, which made me clam. (Participant 9).

My classmate was the first COVID-19 patient in our city, and he was cured, and many COVID-19 patients were discharged from the hospital. Thus, I was relatively calm at that moment. (Participant12).

3.2.3.2. Looking forward to ending the quarantine soon. At this stage, some participants wanted to end the quarantine as soon as possible. Being quarantined made them temporarily unable to work, so they were anticipating coming back to work.

In the late stage of quarantine, I wanted to be immediately released from quarantine to work. I couldn't wait anymore (laugh). (Participant 13).

I often wondered why the quarantine wasn't over yet. I had a lot of work to do. (Participant 12).

3.2.4. Theme 4: self-coping persisted throughout the quarantine period

Participants experienced emotional changes and had some physical symptoms during the quarantine period. The importance of coping strategies in the face of this extreme situation deserves to be underlined. In our study, active and positive coping strategies were present in nearly all patients, which was conducive to helping them ease their

emotions.

3.2.4.1. Distraction strategies. Indeed, many patients reported using strategies such as watching TV, listening to music and so on to distract themselves from their situation. They made a conscious effort not to think about it.

I was nervous during quarantine. I watched variety shows, movies, sleep, listen to music, which would take me away from the situation for a while. (Participant 5).

3.2.4.2. Keeping optimistic. It was noteworthy that some patients expressed that keeping optimistic was conducive to helping them overcome the difficult and critical situation. For example:

I regulated my emotions by myself. I constantly reminded myself to see the positive side, so the psychological pressure gradually eased. (Participant 4).

3.2.4.3. Boosting their own immunity. Some participants took a variety of measures to support their immune systems during quarantine, such as drinking water, eating food, and doing exercise, in order not to be infected by COVID-19, which eased their emotions.

My appetite was not good, but to improve my immunity, I always tried to eat food. I also forced myself to drink water until I couldn't drink more. (Participant 11).

When I was quarantined, I drank a lot of hot water every day. I also did a lot of exercise, such as walking slowly and doing yoga. (Participant 8).

3.2.5. Theme 5: external support was evident throughout the quarantine period

This theme included four subthemes. Whether close contacts were quarantined at home or in institutions, they all received support from family and friends. Additionally, for close contacts quarantined in institutions, they expressed that they had access to professional psychological support, the staff were very concerned about them, and the living environment at the quarantine site was good.

3.2.5.1. Support from family and friends. During the interview, all participants reported that they received social support from their family and friends, which allayed their negative moods. As a participant said:

I like to make friends, and have many friends. I like to chat with others. My friend called me to care about me and comfort me, which relieved my fear. (Participant 11).

3.2.5.2. Psychological support from health professionals. Participants older than 50 years with a primary education level had limited knowledge about COVID-19 and were psychologically vulnerable. Thus, mental support was necessary. In the quarantine area, health professionals provided psychological support for people with psychological needs.

I didn't know much about the disease. I thought it was a terminal illness. Once people got this disease, they would die. I was very frightened, and fortunately, there were professional psychologists to comfort me. (Participant 15).

3.2.5.3. Care from the staff. Some participants thought the staff members at the quarantine site were friendly and considerate, and the staff met the reasonable needs of the close contacts. Moreover, the staff in the quarantine area gave patients traditional Chinese medicine, which contributed to boosting the body's immunity.

I didn't have a cell phone. The staff at the quarantine point bought me a mobile phone to facilitate communication with my family. For the old and the uneducated, a mobile phone was very important, because it was the only way for us to communicate with the others. (Participant 15).

They provided us with the necessities of life. They tried to meet our reasonable needs. For example, if something did not work, the staff would repair it right away. If I needed something, they provided it for me. The staff in the quarantine area also gave me traditional Chinese medicine to boost my immunity, which helped reduce the risk of infection with COVID-19. (Participant 8).

3.2.5.4. Comfortable living environment. Most of the quarantine sites were converted from hotels. The respondents were satisfied with the living environment and thought it comfortable.

The environment was comfortable. They provided a double bedroom, air conditioning, water, food, fruit, milk and so on. (Participant 12).

4. Discussion

To date, this is the first qualitative study in China to explore close contacts' quarantine experience during the COVID-19 epidemic. Under the COVID-19 threat, quarantine is a public health tool to prevent the spread of this infectious disease. Based on clinical investigations, the incubation period is generally 1–14 days, and most are 3–7 days [27]. The close contacts were quarantined for 14 days in accordance with the incubation period of COVID-19. In view of the existence of COVID-19 patients with a longer incubation period (> 14 days), some close contacts were quarantined for 21 days. In the present study, we found that the quarantine experience of the participants was different at different times of the quarantine.

In the early stage of quarantine, most of the participants strongly complied with the quarantine. Although some participants showed resistance at first, they accepted the quarantine order, which was in line with Lin et al., who reported that even though half of participants accepted the quarantine order, they showed reluctance to be quarantined during the SARS period [28]. One study found that quarantine compliance was related to the perception of disease risk, in particular to the person's assessment of their own risk and, to some degree, that of others [6]. Given that some close contacts in our study did not have a good understanding of quarantine, health professionals should explain that the quarantine policy is imperative and important for COVID-19 prevention and control. Quarantining close contacts can screen for high-risk groups and protect the uninfected, thereby reducing the prevalence of COVID-19.

Our analysis of the interviews found that the respondents experienced fear, stigma and some physical symptoms in the early days of quarantine. Xiao et al. also found that quarantined people distanced themselves from each other and were more likely to experience negative emotions in the absence of interpersonal communication [29]. Moreover, our findings are consistent with the psychologic impacts of quarantine on individuals with fever during the SARS period, such as fear [28], and are similar to Cava et al.'s results [6]. In our study, all participants expressed feelings of fear in the initial stage in quarantine. This feeling can likely be ascribed to the unknown about COVID-19 infection on the one hand and the lack of freedom and the company of others on the other hand. Xiang et al. [14] recommended that regular and accurate updates about COVID-19 be provided to allay feelings of fear. Therefore, close contacts need sufficient information related to quarantine, such as the reasons for being quarantined, its effectiveness for public infection control, the quarantine length, the procedures they may experience, the basic clinical facts about COVID-19, and updates on the COVID-19 outbreak, in the early stage of quarantine. Furthermore, during quarantine, over half of the participants expressed

concerns that they would be diagnosed with COVID-19. Even the general public was worried about contracting the virus during one influenza outbreak [30]. Moreover, under the SARS threat, each participant with fever was afraid of being confirmed with SARS in the quarantine period [28]. Furthermore, given the presence of asymptomatic infected patients and the extra-long incubation period of 14 days, the worry of the participants is understandable. Specifically, those who are older, live in the countryside and are less educated thought that patients with COVID-19 could not be cured, and they were fairly worried about being diagnosed with COVID-19. This was a misconception. Therefore, it is necessary for healthcare professionals to convey basic clinical knowledge about COVID-19 to close contacts to correct their misconceptions. Additionally, one study reported that particular psychological support must be directed to the infected patients and their close contacts who belong to vulnerable populations [31]. Therefore, healthcare professionals should conduct psychological assessments and interventions for these individuals if necessary. Moreover, given the high infection rate and high death rate in the elderly [32], it was necessary to pay more attention to the health status of older close contacts during the quarantine period.

Cava et al. [10] and Lin et al. [28] reported that individuals affected by SARS felt stigmatized when quarantined, which was in line with our findings. The stigma stems from discrimination by others against close contacts. In addition, self-stigma occurs when members of devalued groups are aware of prejudice, discrimination, and stereotypes, which can lead to their internalization of these beliefs [33]. Given that stigma surrounds individuals who have been quarantined, health education about the disease and the rationale for quarantine and public health information provided to the general public can be conducive to reducing stigmatization [39]. Furthermore, in the early stage of quarantine, many participants had some physical symptoms, such as cough, fever, headache, sore throat and sleep difficulties. On the one hand, their physiological changes, such as fear, worry, and tension, contributed to these; on the other hand, changes in the living environment caused physical discomfort. Physical symptoms may occur without timely psychological support, which may exacerbate fears and concerns about COVID-19. Therefore, it is a key for health professionals to provide psychological counseling for close contacts at an early stage. Healthcare providers should also pay attention to the physical condition of close contacts and perform medical treatment if necessary.

In the middle of quarantine, participants clearly expressed their impatience and tension. We found that participants' feeling of impatience was especially related to their experience of answering the same questions from different departments many times, which actually reflected that they did not want to be reminded of their status as a close contact anymore. That experience was full of unpleasant memories. Therefore, it is necessary to strengthen cooperation among departments and realize information sharing to reduce the frequency of inquiries about contact history and to relieve the psychological burden of close contacts. In the late stage of quarantine, the participants' fears and tensions were greatly reduced, and they appeared calm. The change may have arisen mainly from the fact that they tested negative for COVID-19 and people who had contacted them were in good health, which ensured them that they were free of COVID-19.

Although the psychological burden of the close contacts was heavy, these respondents stayed particularly strong during the quarantine. Many participants used strategies to cope with their stressful situation, including distraction, staying optimistic, and boosting their own immunity, which was consistent with Cava et al.'s finding that participants applied coping strategies throughout the quarantine process [10]. The distraction aims to distract the person from some thoughts relating to the stressful event. Some close contacts often chose to watch TV and listen to music to distract themselves from negative emotions. In addition, some close contacts chose to see the positive side of COVID-19, which indicated that they had an optimistic attitude toward COVID-19. A previous study showed that most people believed that good things

would happen rather than bad things; this trait was defined as dispositional optimism [34]. According to Seligman [35], the general measure of optimism is positive thinking. It has been proven that positive thinking can improve life satisfaction [36]. In our study, some participants eased their negative emotions by thinking about the benefits of quarantine. The benefits of quarantine mainly included preventing the spread of COVID-19, making the close contacts stronger and cherishing life more. Moreover, during the quarantine period, most participants kept up a healthy lifestyle to enhance their immune function. People with strong immunity are less likely to be infected with COVID-19. Most respondents said they were more concerned about their physical and mental health and spent more time relaxing, resting and exercising during quarantine. These positive impacts on physical health may have helped the participants cope with the negative impacts on mental health [37]. During the quarantine period, each individual was strong; they were not overwhelmed by negative emotions but actively coped with them and did not give up on their will to survive. This is a positive attitude that people in quarantine should have, which may come from the desire to survive. In summary, these coping strategies or adaptive defense mechanisms can be important to better understand the impacts of quarantine; they are a means to promote homeostasis and control in an individual subjected to stressors [38].

Apart from the self-coping strategies of close contacts, the Chinese Government has implemented a series of strategies to prevent mental health problems that might arise in close contacts who are quarantined during the COVID-19 pandemic. We define these strategies as external support for close contacts. In our analysis, external support included a professional psychological counseling team, comfortable living environment, and access to social support from family, friends and staff. During the quarantine period, participants experienced several intertwined emotions. Young people, especially those highly educated, expressed that they did not need professional psychological support. They could manage their emotions in a variety of ways. Based on our findings, healthcare professionals regularly should visit close contacts who are older, have a low level of education, or live in rural areas in collective medical observation centers and should provide support accordingly. Furthermore, the Chinese government guaranteed food, water, fruit, milk, and daily living necessities to the quarantined people and treated COVID-19-related symptoms as well as non-COVID-19-related symptoms. In addition, the staff members in quarantine areas were very friendly to them, and they were guaranteed to be available 24 h per day. They tried to meet the reasonable needs of the informants to reduce fear and other psychological discomforts. For example, the staff bought mobile phones for participants, which helped the close contacts communicate with others and get information and emotional support from family members and friends. In the SARS threat, one study reported that quarantined respondents were dissatisfied with the physical environment and found it difficult to tolerate [28]. During the COVID-19 epidemic, healthcare professionals in quarantine areas provided high-quality care and met specific needs related to the environment, emotional support, and physical health of quarantined persons. Social support deserves special attention: patients with a better recovery emphasized the importance of family support in helping them recover successfully. Studies in a range of countries have presented the positive effects of social support, and poor social support has been associated with an over 2-fold increase in the risk of death [39,40]. In our analysis, most participants received social support from family and friends. Through interviews, we also found that none of the fifteen close contacts were diagnosed with COVID-19.

Our study has several limitations. First, all the participants were from Zibo city, Shandong Province. Although data saturation was reached, the applicability of this study to other settings is limited because the opinions reflected by the context and living environment, as well as the psychological statuses, cannot be generalized to other Chinese people. Future research could explore the quarantine experience of people in different districts. In addition, the interviews were

conducted by telephone, which may have led us to miss the participants' expression changes and not capture some details which could be caught in face-to-face interviews.

5. Conclusions

Quarantine is a public health measure imposed to minimize transmission. Based on our research findings, most quarantined close contacts experienced heavy emotional turmoil and had some physical symptoms during the quarantine period. In this situation, they adopted emotional regulation strategies and received external support to cope with their negative emotions. Our study highlights the need to provide a clear rationale to quarantined individuals, assess the close contacts' psychological state early in quarantine and provide psychological support for them, especially for older people and the less educated. Moreover, there is a need to strengthen cooperation among various departments and to achieve resource sharing. The self-coping strategy of close contacts and the external support from the Chinese government enabled close contacts to better cope with the quarantine. Learning from the quarantine experience is expected to help the Chinese government and other institutions across the world to better care for close contacts.

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Authors' contributions

YZH, CDD and SF were responsible for the design of this study. CDD, SF, and TLW collected and analyzed the data. All authors contributed equally to the interpretation of the findings and the writing of the manuscript. All authors approved the final version of the manuscript for publication.

Data sharing statement

The risk of breaking anonymity is too high to share this data.

Declaration of competing interest

All authors report no competing interests.

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