

What caregivers believe affected the quality of implementation of asthma-related family management models (AFMM) during COVID-19: A phenomenological qualitative study

Mo Yi¹  | Jingxian Bao^{1,2} | Jingjing Wang¹ | Zeyi Zhang¹  | Yuanmin Jia¹ | Baosheng Zhao¹ | Jinxia Fang¹ | Ou Chen¹

¹School of Nursing and Rehabilitation, Cheeloo College of Medicine, Shandong University, Jinan, Shandong, China

²Department of Pediatric Respiratory, Shandong Provincial Hospital, Cheeloo College of Medicine, Shandong University, Jinan, Shandong, China

Correspondence

Ou Chen, School of Nursing and Rehabilitation, Cheeloo College of Medicine, Shandong University, No.44 Wenhua West Road, Lixia District, Jinan City, Shandong Province, 250012, China.
Email: chenou@sdu.edu.cn

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Abstract

Purpose: The recurrent COVID-19 epidemic in China has disrupted many aspects of daily life for children with asthma and their caregivers, while negatively impacting their asthma family management models (AFMM). This phenomenological qualitative study identifies what affects the quality of implementation of AFMM in this population and outlines potential coping strategies for the caregivers.

Methods: We used purposive sampling to conduct semistructured interviews with primary caregivers of school-age children with asthma from community healthcare centers (CHCs), which focused on understanding what factors influenced caregivers' implementation of AFMM during quarantine. The Colaizzi seven-step method was used to independently code and categorize the transcript and to generate themes and identify associated key subthemes.

Results: Twenty-four caregivers were interviewed, and they provided greater insight into barriers and motivators to implement AFMM. The three themes and nine relevant subthemes generated, (a) the "individual-family" internal-level factors: weak health literacy and beliefs, quietly changing family relationships, the dramatic increase in the care burden, gradual adjustment of negative psychology; (b) the "hospital-community" external-level factors: the endless power of peer support, strict community quarantine policy; and (c) the "health system-public" social-level factors: the enormous potential of internet-based telemedicine, improved public awareness of prevention, government's prompt assistance.

Conclusions: This qualitative study reveals that the quality of AFMM implementation during pandemic is impacted by three different levels. Therefore, a targeted and comprehensive caring model that provides caregivers with the necessary coping strategies around these three levels is needed to achieve better asthma control outcomes.

KEYWORDS

asthma-related family management model, children, COVID-19, primary caregiver, qualitative study

1 | INTRODUCTION

A respiratory syndrome pandemic called COVID-19, caused by the pathogen SARS-CoV-2, broke out in late 2019 and rapidly spread worldwide, affecting more than 120 million people and creating a worldwide pandemic associated with substantial morbidity and mortality,^{1,2} which may bring about severe respiratory failure and some unavoidable complication.³

Bronchial asthma is the most common chronic respiratory disease in childhood. According to the epidemiological data from China, the prevalence of asthma in children under 14 years of age has tripled over the past 20 years and exceeded 3% in 2020.⁴ Previous studies indicated that the asthma control rate of urban school-aged children in China was only 28.3% in 2019, and that respiratory viral infections were the most common cause of acute exacerbations in this population.⁵ Literatures point out that compared to the healthy population, children with asthma should theoretically contribute to susceptibility and severity to SARS-CoV-2 infection due to their disordered autoimmune system and are at a certain risk of infection, compared to the healthy population.⁶⁻⁸ However, the results of several meta-analyses found no significant increase in the rate of COVID-19 infection in patients with asthma, the mechanism of which is still unclear.⁹

There is currently no most effective cure for asthma disease. In addition to the fact that children should maintain high adherence to their daily medications and take them on a long-term, regular, and appropriate basis, asthma-related family management models (AFMM) play a crucial role in their asthma control.¹⁰ The Global Initiative for Asthma (GINA) states in the latest report that AFMM includes, but is not limited to the following: allergen prevention, regular medication, self-monitoring of lung function, exercise rehabilitation, regular feedback, and so forth.¹¹ Due to age, psychological and mental disadvantages, school-age children are not competent to self-manage asthma, so their caregiver becomes the primary implementer and supervisor of the AFMM, playing an irreplaceable role.¹² Several studies have confirmed the strong relationship between the quality of implementation of this model and asthma control outcomes in children, meaning that the higher the quality of AFMM implementation is, the better the health-related outcomes will achieve.¹³ Consequently, only a combination of standardized treatment and effective AFMM will be essential to reduce symptom recurrence, stabilize asthma control, and improve the quality of life for children and their caregivers in the future.¹⁴

During this spread of COVID-19, the lives of the residents have changed dramatically. Countries worldwide have their own strategies for dealing with the pandemic, including social distancing and home quarantine as necessary.¹⁵ In China, children with asthma were considered "highly vulnerable" to the virus and were advised to adopt strict "social protection."¹⁶ Therefore, pandemics increase the level of psychological and somatic burden on the caregivers of children with respiratory illness, with rising reports of depression, posttraumatic stress, and insomnia.¹⁷ In addition, the impact of social-level factors cannot be ignored, such as the closure of medical services, activity

restrictions, interruption of follow-up visits, and high exposure to disinfectants (triggers), which may also potentially increase the chance of indoor allergen exposure, reduce the level of daily exercise and affect treatment adherence, which has serious consequences for their AFMM implementation effects.^{18,19}

Since the pandemic outbreak, some literature have emerged from relevant fields on the impact of COVID-19 on symptom control in children with asthma.^{20,21} However, little is known about how it affects the effectiveness of AFMM implementation in each family, and what the actual needs and coping strategies are for caregivers during the pandemic. Understanding these aspects is critical for caregivers to help their children with asthma pass through this special time successfully and safely. Therefore, the purpose of this phenomenological qualitative study was to identify factors that influence the quality of AFMM implementation during the COVID-19 pandemic from the perspective of the primary caregiver and to outline the potential coping strategies.

2 | METHODS

2.1 | Study design and participant

We conducted qualitative interviews through of primary caregivers of children with asthma, and an empirical phenomenological approach was used to obtain detailed descriptions from their experience that implemented AFMM during the period of the COVID-19 pandemic. The focus of phenomenological research is to describe commonalities of experiences across a population.

This study used purposive sampling to select potential participants, collecting their basic information such as age, annual income, educational degree, duration of caretaking, and severity of child's asthma. Participants should meet the following criteria: (a) their children were diagnosed with bronchial asthma according to physician's clinical confirmation; (b) they must be the biological parents or grandparents of children with asthma who was the primary caregiver; (c) living with children and not receiving any payment; and (d) their children are school-age children between the ages of 6 and 12 years old. We excluded participants who had psychological or learning difficulties and were unable to communicate verbally. The sample size was determined by data saturation—that is, at the point where no new themes from participants' experiences emerged.²² This study was approved by the institutional review boards and informed consent was obtained from all participants.

2.2 | Settings and procedure

Our team worked with eight community health centers (CHCs) in Shandong province, China. To reduce the risk of infection during the pandemic and in response to national strict mobility control policies, we established an online chatting group via WeChat (a social App widely used in mainland China) for participants and posted

study-related information (e.g., the purpose of the study, the introduction of our team, and interview schedule) in the group to enhance their intention. Also, the daily information on self-protection and prevention and asthma-related health education was uploaded. Previously, this approach was considered to be a bridge for close contact between participants and healthcare professionals.

2.3 | Interview outline

We determined the semi-interview outline by consulting relevant literature, seeking experts' opinions, and separately selecting three caregivers of children with asthma for preinterview. The main interview questions posed to the participants are the following: (1) How did you feel when you and your child were quarantined at home at the beginning of the COVID-19 outbreak? (2) What was the impact of COVID-19 on the control of your child's asthma symptoms? and (3) what were the main changes in your AFMM implementation during the epidemic compared to before the epidemic? In addition, we asked the following subquestions: (1) Please describe your personal coping strategies during the COVID-19 pandemic from multiple perspectives. (2) What has changed in your life? (3) Do you have any insights into China's anti-epidemic measures?

2.4 | Data collection

This semistructured interview was conducted from June to September 2020 in a quiet place (e.g., the participant's home or CHC's office). The interviews lasted approximately 35–50 min. With participant permission, all interviews were audiorecorded. The principles of anonymity and confidentiality were strictly observed throughout the study, numbers were used to replace personal information, and data were used only for this study and never for other purposes. Data collection occurred concurrently with data analysis. The audio recordings were transcribed verbatim by a transcription group within 24 h of the interviews and reviewed by the interviewers for accuracy. During the data analysis, all authors agreed with the results, member-checking was performed by returning transcripts to caregivers for review. Each family received a gift for active participation.

2.5 | Data analysis

This phenomenological study used the Colaizzi seven steps to analyze transcripts step by step. They included: familiarizing, identifying significant statements, formulating meanings, clustering themes, developing an exhaustive description, producing the fundamental structure, and seeking verification of the fundamental structure. Finally, to validate the findings, there was one face-to-face interview session with some participants being asked some questions about the results. When the results were confirmed by the participants, the

findings were verified.^{23,24} Two coauthors independently reviewed the interview transcripts, summarized and extracted meaningful statements, and formulated the themes present. Findings were then compared and discussed by the team until consensus on themes, theme clusters, and categories were achieved. The coding process was controlled by senior qualitative research experts to ensure the validity and credibility of the study.

3 | RESULTS

3.1 | Participant demographic features

Twenty-four caregivers of children with asthma were approached to participate in the study. Invitations stopped once thematic saturation was achieved. The average age of the participants was 37.8 ± 8.7 years old, 17 of them were children's mothers (71%). It is clear that the cumulative length of caretaking was 3.4 ± 1.6 years, with most of their children severity of symptoms being mild (37.5%) or moderate (41.7%). The demographic features of caregivers included in the study are described in Table 1.

3.2 | Themes

Based on the principles of the Colaizzi method, the caregiver perspectives reveal three themes and nine subthemes that comprehensively describe the ways in which the COVID-19 epidemic impacted the implementation of AFMM. The themes include. (1) the "individual-family" internal-level factors; (2) the "hospital-community" external-level factors; and (3) the "healthcare system-public" social-level factors. The themes and their associated subthemes are shown in Table 2.

3.2.1 | Theme 1 "individual-family" internal-level factors

3.2.1.1 | *Weak health literacy and beliefs*

The vast number of caregivers reported that when the epidemic spread, their concern and fear of COVID-19 was due in part to its high incidence rate of severe cases, high rate of transmission, and lack of knowledge about the virus. In particular, because of the generally young age of children, their autoimmune systems were disordered compared to healthy children. Some caregivers strongly expressed that this pandemic was a huge shock to their health beliefs because physicians rarely told them what preventive and self-protective measures were specific to asthmatic children. As well, their questions, such as asthma symptom care, exercise rehabilitation, and medication management needed to be addressed.

During the time of the epidemic, my child often coughed and wheezed in the middle of the night, I

TABLE 1 Demographic and clinical features of caregivers of asthmatic children

No.	Relationship with child	Age	Education	Cumulative years of caretaking	Severity of children's asthma ^a
P1	Mother	31	College	2	I
P2	Mother	34	Senior school	4	II
P3	Mother	29	Master	1.5	III
P4	Mother	39	College	7	I
P5	Mother	32	Senior school	4	I
P6	Mother	37	Junior school	5.5	I
P7	Father	30	College	2.5	II
P8	Mother	28	College	3	II
P9	Mother	34	Senior school	2	III
P10	grandfather	53	Junior school	3.5	II
P11	Mother	40	Senior school	3	II
P12	Father	39	Master	1.5	IV
P13	mother	33	Senior school	2.5	II
P14	Mother	36	College	2	II
P15	Grandmother	58	Junior school	2	IV
P16	Mother	29	Master	1.5	II
P17	Mother	32	Doctor	5	I
P18	Father	37	Senior school	3.5	I
P19	Grandmother	61	College	3	II
P20	Mother	39	College	4.5	I
P21	Mother	42	Senior school	5	III
P22	Mother	34	Doctor	3	I
P23	Mother	37	College	4.5	II
P24	Father	43	Junior school	6	I

Abbreviations: C-ACT, childhood asthma control Test; FEV₁, forced expiratory volume in one second; FVC, forced vital capacity; ICS, inhaled corticosteroid; PEF, peak expiratory flow.

^aSeverity grading ranging from mild (I) to severe (IV) was based on the child's ICS courses or dose, the number of symptom frequency in a month, pulmonary function (estimated FEV₁, estimated FVC, PEF), and C-ACT scores classified by specialist asthma physicians.

didn't know if it was COVID-19 infection or an asthma attack, I was worried every day, I've never had such a hard time taking care of him for so many years (P5)

The physician only told us to take strict home isolation and did not say whether we needed to add auto-immune boosting medication to the original asthma prescription in case the child accidentally became infected. (P18)

TABLE 2 Themes describing caregiver perspectives on what affected the AFMM implementation process during COVID-19

I. "Individual-family" internal-level factors

- Weak health literacy and beliefs
- Quietly changing family relationships
- The dramatic increase in the care burden

- Gradual adjustment of negative psychology

II. "Hospital-community" external-level factors

- The endless power of peer support
- Strict community quarantine policy

III. "Healthcare system-public" social-level factors

- The enormous potential of Internet-based telemedicine
- Improved public awareness of prevention
- Government's prompt assistance

3.2.1.2 | Quietly changing family relationships

More than half of the caregivers felt that support from other members of the family was particularly important when implemented AFMM during pandemic. To control the pandemic, the government required widespread shutdowns and quarantines, which allowed caregivers to work remotely from home. Due to the unprecedented experience of being "locked up" with family members for long periods of time, especially with children, different caregivers experienced varying family relationships and atmospheres. Some felt that the entire family members were more united in carrying out AFMM as a result of the outbreak, but the vast majority expressed a high level of stress as the management of their child's asthma was exhausting, while exacerbating tensions among family members.

We worked from home during that time, so all family members had more time to spend together to communicate, and to review information about asthma caring together. In the past, my husband didn't spend much time with the kids, but now I can clearly feel that he understands the hardships I used to have, and this feeling is quite satisfying (P1)

We often argue over the different views held on asthma-related management options, especially when it comes to the side effects of inhaled steroids in children. (P14)

3.2.1.3 | The dramatic increase in the care burden

The burden of caring for children with asthma comes to the fore during pandemic and tends to increase substantially. This burden comes from multiple sources, such as the financial burden on families, as well as the psychological and physical burden on caregivers.

Female caregivers tended to report physical and psychological burdens, while males mostly showed a stronger sense of helplessness, as their family incomes have been reduced to varying degrees due to the recurring pandemic. They had to adjust their child's asthma medication to cheaper drugs, which affected the effectiveness of asthma control in their children.

Most hospitals are now limiting the number of patient visits, so every time we go to the doctor, the doctor prescribes up to two months of medication, which costs thousands of dollars, and is not reimbursable by health insurance, so the financial pressure is really heavy. Let the epidemic end soon, we must get back to normal life! (P24)

Since the classes have changed to an online format, my child now stays at home almost all day, which is exhausting for me. Sometimes I just don't have the energy to supervise her asthma diary, and I don't have time to care if she takes her peak flow rate on time. (P3)

My child has to have her medication regimen adjusted regularly every month, which is a significant expense, but the financial pressure can be overcome. However, my child's poorly controlled asthma put a particularly heavy psychological burden on me, and I always feel that it is because I have not taken care of my child that she has suffered so much. (P19)

3.2.1.4 | *Gradual adjustment of negative psychology*

The results showed that many caregivers experienced increased anxiety and worry during the early stages of the pandemic. The level of anxiety was strongly correlated with the severity of their child's asthma, and some even self-reported intermittent sleep difficulties due to concerns about their child's SARS-CoV-2 virus infection. As the pandemic situation gradually improved, their psychological changes in response to COVID-19 shifted from panic and alertness to a tendency to calm. Most caregivers developed their own psychological strategies for coping with outbreak concerns, which had a positive effect on the implementation of AFMM.

Very worried about his symptoms, sometimes a slight cough or runny nose symptoms, my nerves immediately tense up, afraid of a recurrence at this particular time, it would be difficult to do, often insomnia at night do you know this feeling of high anxiety? (P13)

My child had severe asthma. However, COVID-19 and asthma are both respiratory diseases and you can imagine the stress I was under. Thanks to good management of my child's asthma, nothing unfortunate ended up happening, thank goodness! (P21)

The good thing is that the epidemic is gradually under control, so I am getting more confident. And when I am anxious, I always use the mindfulness meditation, or do my favorite gardening, so that my distraction in child's asthma can be more beneficial. (P10)

3.2.2 | Theme 2 "hospital-community" external-level factors

3.2.2.1 | *The endless power of peer support*

Many caregivers mentioned a "peer support" club for parents of children with asthma in their community. The club is organized by well-trained healthcare providers from several surrounding general hospitals and focuses on peer-based health education, supplemented by nursing services such as psychological support, exercise training, and dietary guidance. Caregivers who have participated in this club said that peer-based support has provided them with numerous practical benefits, helping them to carry out AFMM with more confidence through asthma management experience sharing and peer emotional support from other fellows.

The group held an online seminar on asthma-related knowledge and invited several parents to share their experiences in AFMM. I listened attentively throughout, took four full pages of notes, and gained more insight into asthma management. (P4)

My bestie and I met in the peer group. Her child has the same allergies as mine, with a combination of rhinitis and eczema in addition to asthma, so we have endless talks about AFMM and support and cheer each other on quite a bit. (P22)

3.2.2.2 | *Strict community quarantine policy*

Most described that the months-long, extremely strict quarantine policies made it difficult for them to fulfill their role as supervisors and implementers of AFMM. These quarantine measures, which included the cessation of personal interactions, interruption of medical follow-up, and inability to exercise, were a significant challenge for them. They are concerned about the negative impact of quarantine on their child's asthma control outcomes, such as the inability to seek medical attention in the event of an acute exacerbation, and reduced physical performance due to decreased exercise. However, quarantine also has a partially protective effect on AFMM, significantly reducing the risk of infection as well as increasing the amount of time spent to the child or having more time to follow the child's asthma progression.

My child has severe asthma and I am afraid that if my child has an acute attack one day and the medical services all shut down or delay sending him to the hospital, the consequences will be horrible. (P15)

Recently the whole family has not been out of the house, so we are not too worried if the child will be infected. At the same time, we also found a lot of cute things about our child, who we always thought was very naughty before. (P11)

3.2.3 | Theme 3 “health system-public” social-level factors

3.2.3.1 | *The enormous potential of Internet-based telemedicine*

Many caregivers mentioned that they had experience using Internet-based telemedicine during pandemics, and most of them were in favor of this new model of medical care. They found the services offered by telemedicine, such as online consultation, remote follow-up, asthma review, health education, and so forth, to be very valuable. This gave them peace of mind about implementing home asthma management in a pandemic, as the national call for quarantine is effective in reducing the risk of infection in children with asthma. Only two caregivers raised their concern that online visits are not as physically accessible as hospital visits and that there may be physician misdiagnosis. Overall, the benefits of telemedicine far outweighed its drawbacks.

This is fantastic! For one thing, it saves me from having to queue up at the hospital every time, and for another, I can register for physician's appointment online. And I feel more free than usual to express my child's asthma complaints and conditions! (P11)

This telemedicine course focused on how to protect family members during pandemic and how to implement AFMM efficiently. The presentation was exceptionally rewarding and gave me lots confidence in dealing with my child's asthma attacks. (P13)

However, I have a question: I feel that the physician can't see the patient visually during the online follow-up, so will there be any bias or missing in the treatment? (P23)

3.2.3.2 | *Improved public awareness of prevention*

Some caregivers recognized the positive effect of public measures on their AFMM, such as regular indoor disinfection, strict wearing of masks, consciously keeping a safe distance, and active vaccination. Some caregivers recognized the positive effects of public measures on their AFMM, such as regular indoor disinfection, strict wearing of masks, consciously keeping a safe distance, and active vaccination. They consider these behaviors as vivid manifestations of increased public awareness of prevention, which are beneficial to protect the fragile airways and lung function of children with asthma and also reduce the spread of respiratory infectious diseases such as influenza

and bronchopneumonia, all of which are indirectly beneficial factors for the effectiveness of AFMM.

Now, when you go out to the supermarket, you can see almost everyone wearing a mask, which was rare before the pandemic, and it also reduces the spread of other respiratory diseases. (P4)

My community is regularly sprayed with disinfectant twice a day, and this protection is well done. Because the vaccination is free, relatives and friends around me have also taken the initiative to get vaccinated. (P17)

3.2.3.3 | *Government's prompt assistance*

Some of the caregivers received assistance from local government authorities that have launched the Chronic Care Assistance Program, which helps children with chronic diseases to survive the epidemic by providing benefits or a certain percentage reduction in the cost of medicines. and they expressed their gratitude in the interviews. For caregivers whose families are in a difficult situation and do not have health insurance, the program's initiative seems to be timely assistance, relieving the family's financial pressure. It has saved them from having to give up high-priced but effective drugs due to temporary financial constraints and has ensured the sustainability of AFMM implementation to a certain extent.

I am the financial backbone of my family, but I lost my job because of the epidemic, and the government gave us assistance to buy asthma medication, and it's hard to imagine what the consequences would have been without that money (P6)

Our family has been struggling to live on the poverty line for a long years, and the relevant public officials at the beginning of the epidemic promptly reimbursed part of the cost of my child's asthma medication! I am really grateful! (P15)

4 | DISCUSSION

In this qualitative study, we found influential factors affecting the implementation of AFMM by caregivers of children with asthma, as well as shed light on the challenges and benefits during the COVID-19 epidemic from caregivers' perspective.²⁵ Previous studies have emphasized the impact of the epidemic on asthma-related outcomes.^{26,27} In our study, however, we analyzed the different influences on caregiver implementation of AFMM at three levels, as well as highlighting the focus on broader ranges of care needs.

First, internal-level factors are undoubtedly the most critical in the implementation of AFMM. Caregivers who are constantly coping with the stress of their child's recurrent symptoms and who are

unable to adapt to the range of changes caused by the epidemic can significantly affect the child's asthma control and the quality of AFMM.²⁸ With 74% of Jordanian parents of children with asthma feeling stressed and worried about their child's asthma management and prognosis. Hence, maintaining their mental health remains a top priority in public health crises.²⁹

Results show that caregivers who are adequately supported by family members show greater confidence and a stronger willingness to cope with their child's asthma attack in the face of sudden life changes due to pandemic. Family support is one of the most important protective factors for individual adaptation to stressors and is often a potential predictor for asthma control in children.³⁰ Caregivers who lack support often demonstrate a sense of isolation and helplessness, which is detrimental to improving children's adherence to the AFMM.³¹ Therefore, it is also important to dynamically assess changes in intrafamily support over time. In addition, psychological burden and financial burden were the most common adverse conditions that were self-reported by caregivers. This finding backs up previous research that caregiver burden is strongly associated with health-related outcomes in children with asthma, and this study further highlights that caregivers are more likely to experience psychological dimensions of fatigue in the context of a pandemic.^{22,32}

This study also found a positive association between caregiver health literacy and AFMM implementation effectiveness and asthma control, which is consistent with Belice's findings.³³ Caregivers with lower levels of education generally lacked knowledge of self-protection, which, combined with the strong similarities between asthma attacks and SARS-CoV-2-related symptoms, made it difficult for them to cope well with the challenges posed by the outbreak. They reported that they readily linked their children's worsening symptoms to viral infections and believed that asthmatic children were at high risk for COVID-19 infection, and some of them even feared that steroids would suppress the child's immune system and increase the likelihood of infection and therefore tried to stop taking the medication.^{34,35} Meanwhile, escalating social isolation, transportation shutdowns, restrictions on gathering, and other strict measures are causing caregivers to spend the vast majority of their time at home. This, in turn, is quietly bringing about subtle changes in the relationships of members within the family, which in turn has an impact on the effectiveness of AFMM implementation.³⁶ The results further support Chen's study, which showed that united, strong, active family relationships significantly reduce the rate of asthma exacerbation and promote better outcomes for children.³⁷ The reason for this is that positive family relationships promote the development of good behaviors in children and buffer the effects of stress on pathological and biological processes related to asthma.³⁸ Therefore, this study also contributes to a deeper understanding of the relationship between family relationships and AFMM. Therefore, healthcare providers can guide them to conduct self-psychological releasing and adjustment with the help of mindfulness, and positive meditation.³⁹ Meanwhile, other members of the family should treat the primary caregiver with more respect and understanding, and

mobilize social support from family members to reduce the caregiver's physical and emotional burden.⁴⁰ Reasonable interventions should be used to enhance caregivers' self-efficacy and sense of competence in parenting, thus effectively increasing their confidence in implementing AFMM. These coping strategies, based on internal-level factors, may enable caregivers to better cope with recurring challenges during an outbreak.

In addition to internal-level factors, external-level factors centered on the "hospital-community" also play a considerable role in the implementation of AFMM for caregivers. In particular, the impact of "peer support" and "quarantine policy" factors on AFMM was recognized by caregivers as never before in the interpersonal isolation of a pandemic. Di Riso's study noted that mothers' psychology was positively correlated with the deterioration of the physical condition of children with asthma, with more fear and psychological fatigue reported during the lockdown.³² The caregivers interviewed experienced overwhelm and anxiety at the beginning of the outbreak, and after a period of "peer education," they developed family strategies to cope with the outbreak based on their own situation while incorporating the success of their peers, and adapted more quickly to the new situation.⁴¹ The "community quarantine" had advantages and disadvantages for the implementation quality of AFMM. However, caregivers were more likely to describe their experience of the implementation of AFMM as "too passive" during this period of isolated living. The presence of some practical difficulties, such as reduced outdoor exercise, unmet nutritional needs of the child, and inconvenient access to medical care, amply validate that a policy of complete isolation is extremely detrimental to the long-term AFMM.⁴² In contrast, the external-level factors, analyzed from an emotional perception, is a process of intense adaptation for caregivers. Although pandemics prolong the social shutdowns and interpersonal isolation, "peer support" mechanisms built on health education and psychological maintenance can buffer the negative effects of stressful events and improve their ability and bottom line to implement AFMM.⁴³ This suggests that community nurses can organize "peer support" groups for caregivers to strengthen their confidence and competence by sharing experiences in process of AFMM implementation, and individualized health education schemes for children and their caregivers via telephone or video to increase asthma cognition and medication adherence.⁴⁴

Equally important as the above two levels of influence are the social-level factors surrounding health systems and public health. This study demonstrates that participants had experiences using Internet-based telemedicine during the pandemic, principally to receive health-related services such as disease counseling, asthma follow-up, and medication regimen adjustment, and health education promotion. Physicians used an Internet-based format to establish online social groups for caregivers of children with asthma to promote health education and knowledge of SARS-CoV-2 self-protection, while instructing children to continue using peak expiratory flow meters to self-monitor lung function and continue keeping an asthma diary during the pandemic, which facilitated improved medication adherence and ensured that the quality of

AFMM implementation was not compromised.^{45,46} In the near future, the potential advantages of "Internet-based" telemedicine in the process of asthma control can be exploited to meet the actual health-related needs of caregivers through these convenient services.⁴⁷ In addition, the gradual increase in national vaccination rates, regular environmental disinfection, and the promotion of consciously wearing masks and keeping public distances can curb the spread of the virus, which are vivid examples of the increase in public awareness of prevention and further strengthen the effectiveness of AFMM implementation, and are worthy of in-depth study by future policy makers.⁴⁸ The promptness of government behavioral assistance is also an aspect of interest, although the coverage of this assistance is less than 30%, it is a potential benefit for caregivers to ensure AFMM implementation. This is because the initiative ensures that children are on continuous uninterrupted medication and do not have to adjust their asthma prescriptions due to financial difficulties, overcoming the instability and uncertainty of AFMM during the epidemic and promoting improved asthma control as well.

5 | STRENGTHS AND LIMITATION

To our best knowledge, this study is the first qualitative study to explore the factors influencing primary caregivers' implementation of AFMM during COVID-19, while providing valuable coping strategies for them in quarantine time. Our findings highlight that the caregivers were influenced at three different levels, which to a certain extent, had an inevitable negative impact on the effectiveness of AFMM implementation, but also spawned the development of novelty practices with potential advantages that will bring new insights for asthma control in the future. This study also incorporates the perspectives and experiences of grandparents, and analyzes the differences in the implementation of AFMM among intergenerational members of the "extended family" based on the Chinese oriental family culture, providing a particular Chinese family experience in asthma management. However, we acknowledge several limitations to this study. First, the majority of participants in this study were parents of children with asthma, while the perspectives provided by grandparents were limited, and the final results presented may be incomplete due to intergenerational differences in perceptions. A second limitation is that the participants were caregivers of children with asthma in the community, whose situation is different from that of children with relatively severe symptoms in large hospitals. Therefore, the conditions that influenced their implementation of AFMM may have been different, so the results cannot be generalized. Although the study's limitations impose caution to interpreting the data, our results can serve as a starting point for future research in this field and provide preliminary, but critical information to guide interventions and optimization of AFMM to support the well-being of families of children with asthma.

AUTHOR CONTRIBUTIONS

Mo Yi and Ou Chen conceived of and designed the study. Ou Chen acquired funding. Jingxian Bao and Mo Yi supervised data collection

and analysis. Mo Yi, Baosheng Zhao, and Jingjing Wang collected the data. Mo Yi, Zeyi Zhang, Yuanmin Jia, Baosheng Zhao, and Jinxia Fang analyzed and interpreted the data. Mo Yi and Yuanmin Jia wrote the original draft of the manuscript. All authors contributed to reviewing and editing the manuscript.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The manuscript includes the anonymized transcripts of the primary caregivers of children with asthma conducted in this study. All of the related data will be available from the first author by reasonable request.

ORCID

Mo Yi  <http://orcid.org/0000-0003-4996-5797>

Zeyi Zhang  <http://orcid.org/0000-0001-5567-5951>

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