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Research Paper

Understanding the pregnant women's experiences during the COVID-19 pandemic in Macao: A qualitative study☆

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ABSTRACT

Objective: To explore and interpret the experiences of pregnant women in Macao during the COVID-19 pandemic.
Methods: Recruitment advertisements were published through multiple social platforms in Macao. A purposive snowball sampling method was adopted to select interviewees. Eighteen women who were confirmed as pregnant from January to May 2020 participated in this qualitative study. Data was collected from November to December 2020 using in-depth personal interviews. One-to-one interviews were conducted by telephone to avoid personal contact. Thematic analysis was used to perform the data analysis and identify emergent themes.
Results: Five themes emerged from the data analysis: changes in daily life, psychological distress, unique experiences of pregnancy follow-up, trying to pay attention to health information but also feeling overwhelmed, and change in hygiene behaviors due to fear of infection. Six sub-themes were identified: being confined at home but understanding the reasons, financial pressures and timely support from the government, perceived risk of catching the infection, retaining optimism with various help and support, adequate personal protections, and obsessive hygiene behaviors.
Conclusion: During a pandemic, there is a risk of greater individual isolation, particularly for vulnerable groups such as women in pregnancy. The humanized attention to and support for the residents from the government buffered the adverse impact on the study participants. Preplanning for such events is needed to focus on psychological distress, financial constraints, and prenatal health services. Alternative service delivery, such as telemedicine, online counseling, and virtual reality (VR) technology, should be applied to offer pregnant women timely support and avoid a crisis.
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What is known?

- The COVID-19 pandemic imposes a significant impact on human beings worldwide.
- Pregnant women are a particularly vulnerable group during epidemics.

What is new?

- Macao has achieved good results in the fight against COVID-19 with various effective measures.
- The humanized attention to and support for the residents from the government buffered the adverse impact on the study participants.
- There are also some aspects that health professionals need to reflect on and improve.

1. Introduction

The COVID-19 has shown the characteristics of rapid spread and quickly led to a global pandemic [1]. In response to COVID-19, many

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countries and regions have adopted various measures, including the isolation of people, the closure of public places, the suspension of major activities, the avoidance of travel, the mandatory wearing of masks, and even the closure of the city [2]. A pandemic outbreak will likely cause significant public panic and psychological distress [3]. According to studies in China [4], Italy [5], and Greece [6], during the early stages of the pandemic, even people in less affected areas reported stress, anxiety, depression, and sleep impairment. Thus, those vulnerable, such as women in pregnancy adapting to physical and mental health changes, are more likely to be at risk of adverse reactions [7].

A study evaluating the mental health of Chinese pregnant women showed that the incidence of depression in pregnant women increased significantly after the emergence of COVID-19 [8]. The researchers also found the increase in depression was unrelated to the number of confirmed cases in the local area, indicating a causal link with the pandemic resulting in a higher incidence of depression in pregnant women than before the pandemic [8].

In another study in the United States, an online survey of 4,451 pregnant women from April to May 2020 revealed that nearly 30% of those surveyed reported increased preparation stress and perinatal infection stress [7]. Similarly, in an online survey conducted in Canada from June to July 2020, 57% of pregnant women reported increased clinical depression, more than 30% reported increased anxiety, and 19% reported insomnia [9]. An Italian study also showed that the confinement caused by the COVID-19 pandemic had a significant negative impact on the individual mental health of pregnant women [10].

Although current research shows that there is no evidence that COVID-19 can be transmitted vertically from mother to child [11,12], the severity and mortality of pregnant women infected with COVID-19 are not higher than those of other coronaviruses [13,14], there remain too many unknowns about COVID-19 causing public panic and a sense of danger, particularly amongst pregnant women who are understandably concerned for the welfare of their unborn child [8].

Similar issues arise in the Macao region, which is the subject of this study. Macauo Special Administrative Region (Macau SAR) is located in China's Greater Bay Area (GBA), adjacent to Hong Kong, Guangzhou and Shenzhen. With a population of 71 million, the Greater Bay Area is the fourth largest bay area in the world. The convenient transportation infrastructure enables residents of the Greater Bay Area to commute from one city to another within tens of minutes [15]. Furthermore, Macao SAR is the most densely populated area globally (population is about 670,000, 21,717 people per square kilometer) [16].

Additionally, Macao is a city famous for gaming and tourism. In 2019, more than 39.4 million visitors were entering Macao, among them Chinese mainlanders numbering 28 million [17]. The pandemic brought back memories of 2003 when Severe Acute Respiratory Syndrome (SARS) broke out. While there was only one case, Macao residents were fearful of the catastrophic impact on neighboring areas (Guangdong, Hong Kong, etc.). They always maintained a high vigilance against potential pandemics.

Since the outbreak of the COVID-19 pandemic in 2020, the SAR government has undertaken strict measures such as quarantine, wearing masks, cancellation of public events, and school closures. In February 2020, the government announced the suspension of all gambling, including casinos and related entertainment facilities, for 15 days, which was the first time in Macao's history [15]. From the first case of COVID-19 in Macao on January 22, 2020, to September 24, 2021, there have been 64 cases, 58 brought in from outside Macao, and six local infections, with no community transmission, no medical staff infection, and zero death [18]. However, many studies indicated that the strict measures inevitably caused a significant and tangible impact (inadequate supplies, financial loss, and economic downturn) on the whole society, alongside the intangible effect, such as boredom, stress, frustration, anxiety, depression, etc. [19]. As a consequence of this type of impact, we determined to investigate the reality from the perspective of pregnant women in Macao to learn and share our findings.

The literature review indicates some helpful studies on pregnancy outcomes and the mental health of pregnant women during COVID-19. Still, most are quantitative, with very few qualitative studies exploring and reporting pregnant women's true feelings and experiences. Sahin and Kabakci [20] conducted related research in Turkey and found that the COVID-19 pandemic has a great potential to cause anxiety, adversity and fear among pregnant women. At the same time, Atmuri and colleagues did a similar study in Australia. They found that the pandemic has affected the lives of pregnant women and has the potential to damage their psychosocial well-being [21]. Macao has its special population structure, geography, and epidemic features that this study sought to elucidate to further our understanding of the impact of the pandemic.

Some have argued that qualitative research on the COVID-19 pandemic is necessary to understand people's emotional responses to the pandemic, so as to better support the assumptions of quantitative epidemiological models for the purpose of improving pandemic management [22]. One such study of pregnant women found that about 35% of participants reported self-isolating to avoid exposure to COVID-19 [23]. Such findings help build a picture of the COVID-19 impact during pregnancy and were also the impetus for this study focused on the population of Macao, where there were issues arising for pregnant women.

To achieve this, a qualitative design was employed to explore and interpret the lived experiences of pregnant women in Macao during the COVID-19 epidemic. Qualitative research is particularly useful for obtaining direct and unadorned answers to questions of particular relevance to practitioners and policymakers [24]. Semi-structured interviews were conducted to capture, understand, and describe pregnant women's behavioral characteristics and feelings during this challenging time. It is anticipated that the findings will be the reference for government and service providers in their efforts to respond to this kind of public health emergency. In addition, we believe that the study can also have wider utility for others seeking to support pregnant women during a global pandemic.

2. Methods

This is a descriptive, qualitative study conducted in Macao SAR, using thematic content analysis to explore, interpret and present the data obtained through the semi-structured interviews of 18 participants.

2.1. Participants

The study was conducted from November to December 2020 using purposeful snowball sampling. The principle of selecting study participants is to maximize the variability of demographic characteristics such as age, employment, family income, and maternal history. We published recruitment advertisements through multiple social platforms in Macao (Macao Breastfeeding Mothers Group, Macao Mothers Exchange Group, etc.), clarifying the research purpose, method, inclusion and exclusion criteria, and privacy considerations. Inclusion criteria include: adult Macao residents, confirmed pregnancy from January 2020 to May 2020, can speak Chinese, and agree to participate in this study. Exclusion

criteria were those with comorbidities or complications during pregnancy, where this study may increase the burden on the woman, and those diagnosed with a serious mental problem who may have difficulty providing informed consent. The size of the sample size is determined by data saturation.

2.2. Ethical considerations

The Ethics Committee approved the study of Macao Polytechnic University. One-on-one interviews were conducted by telephone to avoid personal contact during the pandemic. Informed consent forms were read verbally, and each participant was asked to approve the form. Before obtaining consent, participants were fully informed of the study's purpose and procedures and voluntary participation in the study. As such, they could refuse to participate or withdraw from the study. To ensure participant safety during the interviews, participants were also able to request that the interviewer turn off the recorder if there was content they did not want to be recorded. Participants' identities were replaced by numbers and letters and would not be revealed in research reports and publications to ensure anonymity.

2.3. Data collection

For the data collection, six semi-structured interview questions were formulated from a review of the literature and expert consultation. Pilot interviews were conducted with two pregnant women prior to the formal interviews to ensure the clarity of the interview outline questions and to identify any problems. After some minor modifications, the final interview questions are as follows. 1) What precautions or actions you took during the COVID-19 outbreak? 2) How did you feel during the epidemic? 3) What has been the biggest impact of COVID-19 on your life? 4) How concerned are you with information about COVID-19? 5) What are your expectations/views about perinatal care services during the pandemic? 6) What kind of health/social support would you like to receive during the pandemic? Each one-on-one phone interview is approximately 30–40 min. To ensure that participants can be interviewed at a convenient time and in a quiet place without interruption, a separate appointment was made with each interviewee prior to the formal interview. The researchers introduced the purpose and procedures of this study, and obtained oral informed consent from the participants. The interviewer strives to remain neutral throughout the interview process and to develop a good relationship with the participants. Interviewing techniques include active listening, unconditional positive attention, and clarification to ensure the veracity of information and avoid bias. Interviews were recorded with a tape recorder and kept strictly confidential.

2.4. Data analysis

Data analysis and coding data were performed concurrently with data collection to determine data saturation. All recorded data were transcribed by two research assistants within 24 h of the interview. The thematic content analysis technique was employed to perform the analysis [25]. The procedures included: 1) the same transcript was carefully read by two principle researchers independently; 2) the repeated words or sentences were highlighted, and meaningful units were extracted; 3) after generating the initial themes, the two research team members discussed and compared their respective findings, and finally reached a consensus on each theme and sub-theme.

2.5. Rigor

Tong and colleagues' consolidated criteria for reporting qualitative research (COREQ) were employed to ensure the study's rigor [26]. 1) Diverse background of team members. Each author has rich experience in clinical obstetrics and gynecology nursing or qualitative research. Diversity within the research team supports a more rigorous interpretation of the data, and team members providing their own different perspectives and understandings for data analysis and reporting. 2) Verbatim text of interviews was accurately and truthfully transcribed by two assistants separately. 3) Individual transcripts were returned to each participant via email for confirmation. 4) Researchers constantly compared, discussed, and reached a consensus on each theme and sub-theme to maximize the credibility of the analysis.

3. Results

Eighteen participants were interviewed individually, and general characteristics are shown in Table 1. Eighteen participants aged 21 to 45, 5 multiparous and 13 primiparous, and four were unemployed. Five distinct but related themes emerged through the data analysis.

3.1. Theme1: changes in daily life

All study participants ($n = 18$) reported that during the early outbreak of COVID-19, they changed their daily life patterns, particularly their lifestyle ($n = 16$), way of working ($n = 5$), social life ($n = 6$), and family financial situation ($n = 6$). The multiple measures, such as eating at home, and working from home, were implemented to stop the virus from spreading. Participants generally agreed that the measures were necessary, effective, and demonstrated cooperation.

3.1.1. Being confined at home but understanding the reasons

Being confined at home was a popular measure during the early pandemic of COVID-19, particularly in the early to mid-2020. This study showed that most of the participants experienced confinement but expressed understanding.

> *"Because of lockdown, we can only eat at home for almost half a year."* (A3)

> *"Since Macao commenced lockdown on February 20th, the whole city and neighboring cities were frozen."*(A1)

> *"I feel (Macao) government responds very quickly and starts implementing various*
> *and strict curbing measures since early."*(A5)
> *"Almost all those things that need to be handled outside are suspended."(* A6)

> *"There are only videos between relatives and friends; even in the Chinese lunar new year, we can only send greetings via WeChat."* (A6)

> *"The measures indeed carry out a lot of inconveniences, but I feel it is necessary. Otherwise, our city could be collapsed like other places."*(A17)

3.1.2. Financial pressures and timely support from the government

Undoubtedly, COVID-19 has had a massive and devastating effect on economies everywhere. Some of our participants work in casinos or casino-related industries, which is a fragile occupation

Table 1
Socio-demographic characteristics of the participants ($n = 18$).

Numbers	Age (years)	Education level	Occupation	Pregnancy and stage[a]	Parity
A1	31–35	Undergraduate	Office worker	Second trimester	Multiparious
A2	36–40	Undergraduate	Engineer	Second trimester	Primiparious
A3	21–25	Undergraduate	Unemployed	Second trimester	Primiparious
A4	25–30	Undergraduate	Office worker	Third trimester	Primiparious
A5	31–35	Undergraduate	Casino attendant	Third trimester	Multiparious
A6	31–35	Undergraduate	Nurse	Third trimester	Primiparious
A7	41–45	Undergraduate	Office worker	First trimester	Multiparious
A8	31–35	Junior college	Accountant	Third trimester	Primiparious
A9	36–40	Postgraduate	Office worker	Second trimester	Primiparious
A10	31–35	Postgraduate	Doctor	Second trimester	Primiparious
A11	31–35	Undergraduate	Clerk	Third trimester	Primiparious
A12	31–35	Undergraduate	Office worker	Third trimester	Primiparious
A13	31–35	Undergraduate	Unemployed	Third trimester	Primiparious
A14	25–30	Undergraduate	Unemployed	Third trimester	Primiparious
A15	31–35	Undergraduate	Sales	Third trimester	Primiparious
A16	36–40	Junior college	Merchant	Third trimester	Primiparious
A17	25–30	Undergraduate	Casino attendant	First trimester	Multiparious
A18	31–35	Undergraduate	Unemployed	Third trimester	Multiparious

[a] *Note*: Calculated at the end of January 2020.

influenced by pandemics. Consequently, financial pressures were imposed on them and their family, as evidenced by the following quotes.

> *"Since the second quarter of this year (2020), we have had no income, and we have to rely on the government's financial aid …. "* (A11)

> *"My husband (who used to work in Hong Kong) has not returned to work since Hong Kong has been lockdown in May (2020), especially grateful to our government's financial support."*(A7)

> *"I applied for an unpaid leave since the outbreak of COVID-19. However, our government is very nice, waiving our water and electricity fees, and offering electronic consumer cards with ten thousand Macao Pataca (1Pataca = 0.84 USD) for each resident."* (A13)

3.2. Theme 2: psychological distress

The most worrying aspect for pregnant women was catching the coronavirus and transmitting it to their fetuses or babies. Consequently, the participants ($n = 13$) tried to avoid any potential risk and were anxious much of the time. Some even avoided speaking with others or refused to stay with their husbands when they returned from their workplaces.

3.2.1. Perceived risk of catching the infection

The study revealed that a couple of participants perceived family members or colleagues are potential means of transmission of COVID-19, which caused them nervousness. Some of them shared their experiences as:

> *"One family member has been to another risky place during a severe pandemic, and I worried he would infect our whole family when he returned."* (A9)

> *"… I was scared that colleagues were potential means of transmission; I kept worrying that I might be infected as we are sitting in the same space and working."*(A7)

> *"My husband is a firefighter, and he has the chance to contact potential cases. We are afraid the baby in my belly would be very dangerous, so he must sleep in a separate room."*(A6)

> *"My husband works in a casino, a relatively dangerous environment. My children and I moved to my mother's place to separate from him."*(A11)

3.2.2. Retaining optimism with various help and support

Though the pandemic indeed causes psychological distress to all residents, particularly to the vulnerable groups like pregnant women, the government, health professionals, and social workers offer timely and precise help, which greatly retains participants' optimism. Some participants shared that:

> *"I stay at home; the social workers always send something to my room. I feel being concerned."* (A4)

> *"I have confidence in our government since they have tried their best to curb the pandemic and concern citizen's life."* (A9)

> *"The government is very thoughtful amid the pandemic. They offer free disinfectants, even tissues anywhere, such as all entrances of buildings, elevators, supermarkets, etc."*(A12)

3.3. Theme 3: unique experiences of pregnancy follow-up

More than half the participants ($n = 9$) reported changing their routine pregnancy follow-up visits. In order to effectively control the pandemic, all public places need to go through necessary but very tedious procedures, such as mask-wearing, monitoring body temperature, wiping hands with alcohol, lining up while keeping your distance, and scanning health QR codes, filling forms, etc.

> *"They (primary health workers) were calling me to follow-up visit through telephone."* (A15)

> *"Face-to-face pregnancy education was replaced by the virtual way, the QR code was offered to me and let me learn the relevant information or knowledge about antenatal care by myself."* (A2)

"Community health center intentionally reduced the number of visitors in each time lot to decrease the aggregation." (A6)

3.4. Theme 4: trying to pay attention to health information but also feeling overwhelmed

During this unique period, most women ($n = 16$) said they could not help but pay attention to the news, such as reports on local, nearby or global new cases, the death rate, or the innovative prevention and treatment regimens claimed by the government or experts. However, they also reported feeling overwhelmed by the variety of information, especially when there was too much "negative" news from various media (mass media or social media).

"I can't prevent myself from watching TV, Facebook, or the mobile reports on the pandemic news …. to know how many cases and any new cases have emerged locally."(A16)

"Too much uncertainty and predictive reports about the pandemic upset me." (A18)

"I watched TV and got to know the confirmed cases and death numbers continuously surge. I feel very sad and scared."(A5)

"I got to know from the internet that animals (dogs or cats) are also possible sources of infection. I am very nervous; too much news, don't know which one is true." (A17)

3.5. Theme 5: change of hygiene behaviors due to fear of infection

All participants ($n = 18$) reported that due to the fear of infection from COVID-19 and the government emergency working group advice, alongside health professional's promotion of healthy behaviors, led to them change their hygiene behaviors, including properly washing hands, wearing the mask, disinfecting the home floor, door handles or using some small tools to touch public buttons. While these could be deemed good habits (healthy behaviors), they intensified the fear and anxiety experienced throughout their pregnancy to the point where the behavior became obsessive in some cases.

3.5.1. Adequate personal protections

Many participants shared that they were reminded to protect themselves in the very early stage of the COVID-19 pandemic. Almost all public areas are indeed equipped with disinfectants, even facial masks.

"The Government (Macao government) warned citizens very early and reminded us to fully protect ourselves what seemed like every minute of the day." (A5)

"I wash my hands frequently and carry alcohol with me all of the time. I disinfect my hands before touching my eyes, ears, nose, and mouth or before eating. Once going out, I wear the mask all the time." (A9)

"I wipe the mobile phone with alcohol pads every day; disinfect bags, and the outer packaging of food or items were taken home." (A15)

"When shopping in supermarkets, I wear disposable gloves. I only use my mobile to pay. I rarely use cash because cash contains a lot of germs." (A10)

3.5.2. Obsessive hygiene behaviors

Personal hygiene is considered one of the best safety measures to prevent COVID-19 infection. However, some of our study participants demonstrate highly alerted hygiene behaviors. It is evidenced by:

"We use disinfectant to mop the floor, clean door handles and furniture surfaces three times a day ….. all worn shoes must be put outside the door. My friends said that I am crazy and have become overactive." (A5)

"I don't use my hands to touch public facilities, such as elevator buttons and door handles. If I need to pull the door, I immediately disinfect my hands with alcohol. During the most painful period (of the pandemic), I wear two masks when I have to go out." (A6)

"… I choose not to use public transportation (public buses, taxis) …" (A3)

4. Discussion

This study describes the experiences of pregnant women in Macao during the COVID-19 pandemic, drawing on data obtained from one-to-one semi-structured interviews, which illustrate the unusual circumstances created by the pandemic and the women's efforts to adapt. The findings paint a picture of pregnant women's coping to overcome challenging obstacles to receiving appropriate support during this global public health emergency. It is perhaps somewhat trite to state that a pandemic has a significant impact on daily life, as, by their very nature, pandemics are disruptive to the normal routines of life. Similarly, this study shows that during this pandemic, the daily life, the social connections, and the leisure of pregnant women have changed. One of the key requirements for a woman experiencing pregnancy is psychological, social, and spiritual support. Still, the response to the pandemic meant many of the typical sources of support were changed. Of course, this is not unique to Macao but is consistent with Brook's study into the psychological impact of infectious disease [27]. In fact, many countries and regions have put in place various restrictions to prevent the rapid spread of the pandemic, including Italy [10], Turkey [20], Spain [28], and Belgium [29]. The common measures include quarantining travelers from any risk area, suspending all schools, and ensuring people worked from home and stayed at home as much as possible. For pregnant women, the "stay at home" may cause weight gain and potentially adversely influence the health of the fetus [30,31]. This is illustrated by a study in Spain showing the daily exercise of pregnant women during the COVID-19 pandemic was significantly reduced, and recommending that a specific and user-friendly online program that prioritizes pregnant women should be rapidly developed to help ensure pregnant women maintain a healthy lifestyle and improve their health and wellbeing, while at home [28].

During pregnancy, it is well documented that there is a need for emotional support from family, friends, and health professionals to help with the adjustments required for childbirth [25]. What should be avoided is any further significant psychological distress. However, this is exactly what the participants in this study experienced, with the sudden outbreak of COVID-19 leaving them and their families feeling anxious and frightened. This was magnified by the many uncertainties and unanswered questions surrounding the virus [27]. What was the risk of infection for themselves and their fetus? What were the risks during pregnancy and childbirth? What might be the risks to their newborn child? As Rettie et al. point out, even in non-pandemic settings, pregnant women often feel

uncertainty and anxiety about issues related to childbirth and the arrival and care of a newborn baby [32]. So, in this case, the pandemic increased the magnitude of the uncertainty, further compounded by reduced family income. This is consistent with the findings of a study in the mainland of China which pointed out that pregnant women with lower monthly household income during the epidemic had a higher incidence of anxiety during pregnancy [33]. One of the determinants of antenatal mental health problems in pregnant women is considered to be low socioeconomic income [34].

Another cause of psychological distress was related to a family member's job(s) and the perceived risk of infection. Police officers, firefighters, casino attendants, and health professionals were perceived as high-risk jobs. The participants all felt under tremendous psychological pressure because their family members, particularly their husbands, worked in high-risk positions and often felt powerless to address them.

From these findings, it would appear necessary for maternity service providers to understand women's postpartum experiences and their particular needs during the pandemic to be better prepared for similar outbreaks. As the WHO's guidelines indicate, women should be guaranteed certain basic rights and enabled to access services that ensure the best possible childbirth experiences, even though a global pandemic [35]. During the pandemic, the health services for pregnant women were altered which also happened in other places around the world, such as the mainland of China [36], Turkey [20], Japan [37], and Italy [10]. These alternatives also follow the guidelines provided by many countries in response to this sudden epidemic [38,39]. Some countries and regions quickly provided online medical services. One example is a medical center in New York, United States, which rapidly added telemedicine to its prenatal care during the pandemic [36]. The enabling technology and applications have quickly developed in response to the pandemic. So it would be relatively straightforward for health services and governments to look at best practices and invest in technical and population-wide solutions. This benefits preparing for a future pandemic and providing greater flexibility in accessing existing healthcare services.

People will always need information and guidance in great change and uncertainty. However, constant exposure to too much, especially negative news, is known to lead to psychological distress and irritability [23]. Advanced technology provides people with a variety of ways to obtain information, such as Facebook, WeChat, Weibo, etc., receiving massive amounts of information every day, but it will lead to excessive information. In addition, the authenticity and reliability of the data are not necessarily guaranteed. Some information is exaggerated or biased and may mislead the public, thereby causing unnecessary anxiety and panic [40].As the results of one study showed, during COVID-19, the more daily attention pregnant women were to information about the pandemic, the higher the chance of developing anxiety during pregnancy [36]. Reducing information overload and managing the sources of information and disinformation are significant challenges for individuals and health providers, and governments around the world. The most useful intervention is to help individuals discern, evaluate, and critique the information they receive at a personal level. Understanding the origins of the source, the legitimacy of the evidence presented, and guiding people to more trusted, evidence-based sources are likely to be the most useful skills. It may also be a case of helping individuals limit the time engaged in watching the news and social media to allow some 'me-time' and the development of some simple relaxation techniques. Again, this can be provided online through appropriately prepared pre-natal and post-natal resources.

The hygiene behaviors mandated by governments in response to the pandemic might be one of the rare positive effects of the pandemic. Almost all participants reported that they and their family members had to change their hygiene behaviors to protect themselves and their family members during the pandemic. The behaviors included frequently and correctly washing their hands, wearing masks when going out, and disinfecting clothes, shoes, and belongings after returning home from outside. According to the health belief model, if people perceive susceptibility and seriousness, this encourages them to take action [41]; the Perceived benefit is people's assessment of the value of taking the advised effort to reduce the risks of diseases [42]. However, the compulsive-like health behaviors demonstrated by participants were essentially due to the pandemic threats they perceived and the government's promotions and related mandatory policies. At the very beginning of the pandemic, the Macao SAR government immediately implemented preventive measures and maintained a high degree of responsiveness to the pandemic. This was because of their previous experiences with the SARS outbreak in 2003 and is why Macao SAR has been comparatively successful in fighting the pandemic.

5. Limitations

While rigorous research procedures were followed, it is acknowledged that some limitations exist. Firstly, although the study used the principle of maximum differentiation in selecting participants, the respondents this time are not necessarily representative of all pregnant women who experienced the first wave of the epidemic in Macao. Secondly, the snowball sampling method is prone to deviation, there will be certain similar situations between samples. If the sample is not willing to continue to provide personnel for the survey, it will be terminated. So we used several social platforms to recruit participants to avoid this limitation. Thirdly, by using telephone interviews which were more convenient for participants, the interviewer could not observe and record the facial expressions of the participants, so there are some non-verbal information might be ignored. In addition, the phone interviews were conducted six to ten months after the first wave of the epidemic in Macao. This may inevitably lead to some recall bias.

6. Conclusions

The study sought to understand the real-life experiences of Macao pregnant women who experienced the first wave of COVID-19. The findings illustrate the pandemic and the related restrictions had on the participants in the study, but the humanized attention to and supports for the residents from the government buffered the adverse impact on the study participants. It is hoped that the findings will provide useful insights for health professionals into the challenges faced by pregnant women during the COVID-19 pandemic. With some pre-planning, greater investment in enabling technologies (telemedicine, online counseling, and virtual reality (VR) technology) to help connect and advise women experiencing pregnancy, and some targeted financial support, the challenges could be alleviated. While it seems inevitable that further global pandemics are likely, this study provides important experiences for responding to similar public health emergencies to support the pregnant women in society.

Credit authorship contribution statement

Xin Wang: Conceptualization, Methodology, Data collection, Formal analysis, Writing - original draft. **Ming Liu**: Formal analysis, Writing - original draft, Writing - Review & editing. **Ka Ian Ho**: Data collection. **Stephen Tee**: Writing - Review & editing.

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Data availability statement

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Declaration of competing interest

The authors have declared no conflict of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijnss.2022.06.006.

References

[1] Center for systems science and engineering (CSSE) at Johns Hopkins, University.Coronavirus COVID-19 Global Cases.[Accessed 2021-09-25]. https://coronavirus.jhu.edu/.
[2] Usher K, Bhullar N, Jackson D. Life in the pandemic: social isolation and mental health. J Clin Nurs 2020;29(15–16):2756–7. https://doi.org/10.1111/jocn.15290.
[3] Shorey S, Chan V. Lessons from past epidemics and pandemics and a way forward for pregnant women, midwives and nurses during COVID-19 and beyond: a meta-synthesis. Midwifery 2020;90:102821. https://doi.org/10.1016/j.midw.2020.102821.
[4] Huang YE, Zhao N. Generalized anxiety disorder, depressive symptoms and sleep quality during COVID-19 outbreak in China: a web-based cross-sectional survey. Psychiatr Res 2020;288:112954. https://doi.org/10.1016/j.psychres.2020.112954.
[5] Moccia L, Janiri D, Pepe M, Dattoli L, Molinaro M, De Martin V, et al. Affective temperament, attachment style, and the psychological impact of the COVID-19 outbreak: an early report on the Italian general population. Brain Behav Immun 2020;87:75–9. https://doi.org/10.1016/j.bbi.2020.04.048.
[6] Voitsidis P, Gliatas I, Bairachtari V, Papadopoulou K, Papageorgiou G, Parlapani E, et al. Insomnia during the COVID-19 pandemic in a Greek population. Psychiatr Res 2020;289:113076. https://doi.org/10.1016/j.psychres.2020.113076.
[7] Mappa I, Distefano FA, Rizzo G. Effects of coronavirus 19 pandemic on maternal anxiety during pregnancy: a prospectic observational study. J Perinat Med 2020;48(6):545–50. https://doi.org/10.1515/jpm-2020-0182.
[8] Wu YT, Zhang C, Liu H, Duan CC, Li C, Fan JX, et al. Perinatal depressive and anxiety symptoms of pregnant women during the coronavirus disease 2019 outbreak in China. Am J Obstet Gynecol 2020;223(2):240. https://doi.org/10.1016/j.ajog.2020.05.009. e1-240.e9.
[9] Khoury JE, Atkinson L, Bennett T, Jack SM, Gonzalez A. COVID-19 and mental health during pregnancy: the importance of cognitive appraisal and social support. J Affect Disord 2021;282:1161–9. https://doi.org/10.1016/j.jad.2021.01.027.
[10] Ravaldi C, Wilson A, Ricca V, Homer C, Vannacci A. Pregnant women voice their concerns and birth expectations during the COVID-19 pandemic in Italy. Women Birth 2021;34(4):335–43. https://doi.org/10.1016/j.wombi.2020.07.002.
[11] Chen HJ, Guo JJ, Wang C, Luo F, Yu XC, Zhang W, et al. Clinical characteristics and intrauterine vertical transmission potential of COVID-19 infection in nine pregnant women: a retrospective review of medical records. Lancet 2020;395(10226):809–15. https://doi.org/10.1016/S0140-6736(20)30360-3.
[12] Rasmussen SA, Smulian JC, Lednicky JA, Wen TS, Jamieson DJ. Coronavirus disease 2019 (COVID-19) and pregnancy: what obstetricians need to know. Am J Obstet Gynecol 2020;222(5):415–26. https://doi.org/10.1016/j.ajog.2020.02.017.
[13] Wong SF, Chow KM, de Swiet M. Severe acute respiratory syndrome and pregnancy. BJOG 2003;110(7):641–2. https://doi.org/10.1046/j.1471-0528.2003.03008.x.
[14] Alfaraj SH, Al-Tawfiq JA, Memish ZA. Middle East Respiratory Syndrome Coronavirus (MERS-CoV) infection during pregnancy: report of two cases & review of the literature. J Microbiol Immunol Infect 2019;52(3):501–3. https://doi.org/10.1016/j.jmii.2018.04.005.
[15] Ieng SM, Cheong IH. An overview of epidemiology of COVID-19 in Macao S.A.R. Front Public Health 2020;8:550057. https://doi.org/10.3389/fpubh.2020.550057.
[16] United Nations. Department of economic and social affairs, population dynamics. World Population Prospects 2020. https://population.un.org/wpp/Download/Standard/Population/. [Accessed 25 September 2021].
[17] Government of Macau special administrative region, statistics and census service. Tourism Statistics 2020. http://dsec.gov.mo. [Accessed 25 September 2021].
[18] Wikipedia. COVID-19 pandemic in Macau. https://en.wikipedia.org/wiki/COVID-19_pandemic_in_Macau. [Accessed 25 September 2021].
[19] Brooks SK, Webster RK, Smith LE, Woodland L, Wessely S, Greenberg N, et al. The psychological impact of quarantine and how to reduce it: rapid review of the evidence. Lancet 2020;395(10227):912–20. https://doi.org/10.1016/S0140-6736(20)30460-8.
[20] Mizrak Sahin B, Kabakci EN. The experiences of pregnant women during the COVID-19 pandemic in Turkey: a qualitative study. Women Birth 2021;34(2):162–9. https://doi.org/10.1016/j.wombi.2020.09.022.
[21] Atmuri K, Sarkar M, Obudu E, Kumar A. Perspectives of pregnant women during the COVID-19 pandemic: a qualitative study. Women Birth 2022;35(3):280–8. https://doi.org/10.1016/j.wombi.2021.03.008.
[22] Teti M, Schatz E, Liebenberg L. Methods in the time of COVID-19:the vital role of qualitative inquiries. Int J Qual Methods 2020;19:1–5. https://doi.org/10.1177/1609406920920962.
[23] Begum MR, Ehsan N, Ehsan M, Sharif AB. Pregnancy and childbirth in COVID-19 positive/probable and suspected patients:A comprehensive review. J Bangladesh Coll Phys 2020;38:91–108. https://doi.org/10.3329/jbcps.v38i0.47443.
[24] Sandelowski M. Whatever happened to qualitative description? Res Nurs Health 2000;23(4):334–40. https://doi.org/10.1002/1098-240X(200008)23:4<334:AID-NUR9>3.0.CO;2-G.
[25] Braun V, Clarke V. Using thematic analysis in psychology. Qual Res Psychol 2006;3:101–77. https://doi.org/10.1191/1478088706qp063oa.
[26] Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ):A 32-item checklist for interviews and focus groups. Int J Qual Health Care 2007;19(6):349–57. https://doi.org/10.1093/intqhc/mzm042.
[27] Brooks SK, Weston D, Greenberg N. Psychological impact of infectious disease outbreaks on pregnant women: rapid evidence review. Publ Health 2020;189:26–36. https://doi.org/10.1016/j.puhe.2020.09.006.
[28] Biviá-Roig G, La Rosa VL, Gómez-Tébar M, Serrano-Raya L, Amer-Cuenca JJ, Caruso S, et al. Analysis of the impact of the confinement resulting from COVID-19 on the lifestyle and psychological wellbeing of Spanish pregnant women: an Internet-based cross-sectional survey. Int J Environ Res Publ Health 2020;17(16):5933. https://doi.org/10.3390/ijerph17165933.
[29] Constandt B, Thibaut E, De Bosscher V, Scheerder J, Ricour M, Willem A. Exercising in times of lockdown: an analysis of the impact of COVID-19 on levels and patterns of exercise among adults in Belgium. Int J Environ Res Publ Health 2020;17(11):4144. https://doi.org/10.3390/ijerph17114144.
[30] Young DR, Hivert MF, Alhassan S, Camhi SM, Ferguson JF, Katzmarzyk PT, et al. Sedentary behavior and cardiovascular morbidity and mortality:A science advisory from the American heart association. Circulation 2016;134(13). https://doi.org/10.1161/CIR.0000000000000440. e262-e279.
[31] Fazzi C, Saunders DH, Linton K, Norman JE, Reynolds RM. Sedentary behaviours during pregnancy:A systematic review. Int J Behav Nutr Phys Activ 2017;14(1):32. https://doi.org/10.1186/s12966-017-0485-z.
[32] Rettie H, Daniels J. Coping and tolerance of uncertainty: predictors and mediators of mental health during the COVID-19 pandemic. Am Psychol 2021;76(3):427–37. https://doi.org/10.1037/amp0000710.
[33] Yan D, Yuan J, Yan H, Liu T, Wang F, Tian M. Effect of COVID-19 epidemic on pregnant women's anxiety during pregnancy. Int J Gynaecol Obstet 2021;48(1):110. https://doi.org/10.12280/gjfckx.20200651 [in Chinese].
[34] Fellenzer JL, Cibula DA. Intendedness of pregnancy and other predictive factors for symptoms of prenatal depression in a population-based study. Matern Child Health J 2014;18(10):2426–36. https://doi.org/10.1007/s10995-014-1481-4.
[35] World Health Organization. WHO recommendations on intrapartum care for a positive childbirth experience. World Health Organization 2018. https://apps.who.int/iris/bitstream/handle/10665/260178/9789241550215-eng.pdf. [Accessed 25 September 2021].
[36] Aziz A, Zork N, Aubey JJ, Baptiste CD, D'Alton ME, Emeruwa UN, et al. Telehealth for high-risk pregnancies in the setting of the COVID-19 pandemic. Am J Perinatol 2020;37(8):800–8. https://doi.org/10.1055/s-0040-1712121.
[37] Furuta M. International year of midwifery-in the midst of a pandemic. Midwifery 2020;87:102739. https://doi.org/10.1016/j.midw.2020.102739. 2020.
[38] Ortiz EI, Herrera E, De La Torre A. Coronavirus (COVID 19) infection in pregnancy. Colomb Méd 2020;51(2):e4271. https://doi.org/10.25100/cm.v51i2.4271.
[39] Qi HB, Chen MM, Luo X, Liu XY, Shi Y, Liu TJ, et al. Management of a delivery

suite during the COVID-19 epidemic. Eur J Obstet Gynecol Reprod Biol 2020;250:250–2. https://doi.org/10.1016/j.ejogrb.2020.05.031.
[40] Taylor S, Asmundson GJ, Hyprochondria. Treating health anxiety: a cognitive-behavioral approach. New York: Guilford Press; 2004.
[41] World Health Organization. Health education: theoretical concepts, effective strategies and core competencies: a foundation document to guide capacity development of health educators. WHO Regional Office for the Eastern Mediterranean 2012. https://apps.who.int/iris/handle/10665/119953. [Accessed 25 September 2021].
[42] Glanz K, Rimer BK, Viswanath K. Health behavior and health education: theory, research, and practice. San Francisco, CA: Jossey-Bass; 2008.