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Psychological responses of pregnant women to an infectious outbreak: A case-control study of the 2003 SARS outbreak in Hong Kong

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Abstract

Objective: The aim of the present study was to examine the behavioral and psychological responses of pregnant women during the 2003 severe acute respiratory syndrome (SARS) outbreak in Hong Kong. **Methods:** Ethnographic interviews were first conducted to identify the common psychological and behavioral responses to the outbreak. This was followed by a case-control study of 235 consecutive pregnant women recruited during the SARS epidemic, and a historical cohort of 939 pregnant women recruited a year before the outbreak. Both cohorts completed standardized rating scales on depression, anxiety, and social support. **Results:** Women in the SARS cohort adopted behavioral strategies to mitigate their risk of contracting infection. However, pregnant women tended to overestimate the risk of contracting SARS and nearly a third of the women were homebound. The anxiety level of the SARS cohort was slightly higher than that of the pre-SARS control. No statistical difference was found between the depression levels of the two cohorts. **Conclusion:** The improved social support experienced by pregnant women during SARS might have buffered the stress associated with an outbreak. However, clinicians should monitor for overestimation of infectious risk among pregnant women.

Keywords: Anxiety; Depression; Infectious outbreak; Natural disaster; Pregnancy

Introduction

Emerging infectious diseases pose public health risk across the globe. Outbreaks of Ebola in Africa, West Nile encephalitis in North America, severe acute respiratory syndrome (SARS) in Asia and Canada, and avian flu in Southeast Asia and China show that both developed and developing countries are constantly under the threat of infectious epidemics.

Infectious outbreak naturally causes profound fear and panic in the society [1]. Pregnant women are particularly affected, as they are naturally concerned about the safety of their fetus. Any mortality would be double-fold. For some infections, like SARS, pregnancy seemed to worsen the clinical course and outcomes [2,3]. Also, some therapeutic agents are potentially teratogenic. Ribavirin, for instance, a key treatment for SARS, has documented teratogenicity in animals [4]. Thus, a SARS-infected pregnant mother would face the dilemma of having to choose between rejecting ribavirin treatment or accepting its potential teratogenic effects on the fetus. Mortalities of pregnant women in outbreaks are widely and dramatically publicized in the media, which only escalates the fear and worries of pregnant women further.

Study of pregnant women's psychological well-being during an outbreak has been rare. Indeed, until the SARS outbreak in 2003, empirical studies of the psychological

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responses of general population to epidemics have been limited [5,6]. This is probably because reaching out to a community during an outbreak is dangerous, if not life-threatening. Besides, it is difficult to conceive and implement a study amidst the shock of an acute epidemic. Unsurprisingly, psychosocial studies of epidemic outbreaks tend to be uncontrolled and focus on hospital staff and patients [7–15].

Our research team had a unique opportunity when the SARS epidemic hit Hong Kong in 2003. We were studying the antenatal mental health of Hong Kong women just before the outbreak occurred. Hence, we could apply the established framework and research methods to investigate the psychological impact of SARS on pregnant women.

Methods

We combined qualitative and quantitative methods to examine the experiences of pregnant women during the SARS outbreak. The qualitative ethnographic interviews fathomed the psychological and behavioral responses of pregnant women. The quantitative survey measured the prevalence of the identified psychobehavioral responses, as well as the levels of anxiety and depression using a case-control design. The study protocol was approved by the institutional review board.

Ethnographic investigations

Ethnography is a fieldwork carried out by a trained anthropological observer who describes changes in behavior, collects stories and opinions from key informants, and interviews informants about special topics like health beliefs, informal practices, and social relationships. Overall, ethnography describes what matters most in people's local worlds [16].

We began the ethnographic investigation by reviewing reports of SARS outbreak in local newspapers, magazines, television, and radio programs. We paid close attention to materials related to pregnancy and childbirth. Following the general ethnography, one investigator (DL), who had received training in medical anthropology, purposively recruited pregnant women at a university-affiliated antenatal clinic for ethnographic interviews.

The interviews, which lasted about 1 h, examined the lived experience and socioemotional responses to the SARS crisis. The recruitment continued until data saturation was reached, which meant that further informants did not add new themes or findings to the analysis. A total of 15 women were approached and 12 (80%) agreed with the interview. The ethnographic data were analyzed using a thematic approach [17]. A total of 50 themes were identified, and based on these themes, a 41-item questionnaire was constructed for application in the quantitative survey.

Quantitative samples

We recruited participants at the antenatal booking clinics of the Prince of Wales Hospital and the Tai Po Nethersole Hospital. The two clinics functioned as a single university-affiliated public obstetric unit that provided services to a population of one million with diverse socioeconomic background. A cohort of 235 consecutive women was recruited for a 2-month period from April 2003, which corresponded to the peak of the Hong Kong outbreak (SARS cohort). Women were only excluded if they were not Chinese, did not provide consent, or were leaving Hong Kong before delivery. A historical cohort of 939 consecutive women—recruited between October 2001 and September 2002 using the same sampling frame, selection criteria, and study protocol—was used for control comparison (pre-SARS cohort).

Survey method

The participants were interviewed by two research nurses in a semistructured manner for sociodemographic, medical, and psychiatric data. After then, the participants completed the Beck Depression Inventory (BDI), the Spielberger State-Trait Anxiety Inventory (STAI), and the Medical Outcomes Study Social Support Survey (SSS). These three rating scales measure the levels of depression, anxiety, and social support, respectively. The SARS cohort was also interviewed on their psychological and behavioral responses to the outbreak with the 41-item questionnaire derived from the ethnographic investigations. The questionnaire asked about the worries, perceived risk, and behavioral responses toward the SARS outbreak. The internal consistency of the questionnaire was good (Cronbach α coefficient, .90), and the content validity was supported by the ethnographic inquiry, from which the questionnaire items were drawn.

The BDI is a 21-item self-report rating scale commonly used to measure the severity of depression. Its validity and reliability have been thoroughly documented [18]. The Chinese version has also been shown to have good reliability and concurrent validity [19]. Based on previous data and informed clinical experience, we used a cutoff of 14.5 to identify depression of clinical significance [20]. The cutoff was determined before the study began.

The STAI is a 40-item self-report rating scale for state and trait anxiety. It is the most commonly used rating scale for anxiety. Its validity and reliability have been carefully evaluated [21]. The Chinese version has been shown to possess comparable psychometric properties [22]. Because the STAI is used to measure intensity of anxiety (rather than to identify probable clinical cases), no cutoff score has ever been recommended.

The SSS is a 20-item self-administered questionnaire developed by the Rand and Medical Outcomes Study teams to measure social support. The scale measures positive

social interaction, as well as tangible, affectionate, and emotional/informational support. It has good reliability and validity [23]. The Chinese SSS has been validated, showing satisfactory psychometric properties [24].

Statistical analysis

The participants' characteristics were summarized with descriptive statistics. The sociodemographic and clinical characteristics of the two cohorts were compared using Student's t test and χ^2 test for continuous and categorical variables. The BDI, STAI, and SSS scores of the two cohorts were compared using Mann–Whitney tests. The rates of probable depression of the two cohorts were compared using χ^2 test. Statistical significance was defined as $P<.05$ (two-way). Data were analyzed using Statistical Package for Social Sciences (SPSS) for Windows 11.0.

Results

Participants characteristics

In recruiting the SARS cohort, we approached 408 women and 235 (58%) consented to participate in the study. The sociodemographic and clinical characteristics of the participants are summarized in Table 1. Compared with the pre-SARS cohort, the SARS cohort was more likely to be single (3.4% vs. 1%, $P=.01$) and housewife (42.6% vs. 34.2%, $P=.04$).

Antenatal depression, anxiety, and social support

The BDI scores of the SARS cohort and the pre-SARS cohort (8.7±7.3 vs. 7.8±6.1) were not statistically different (Table 1). Likewise, the rates of probable depression between the SARS and pre-SARS cohort (12.3% vs. 11.9%) were not different. However, the SARS cohort had significantly higher anxiety state scores than the pre-SARS cohort (37.2±9.7 vs. 35.5±9.3, $P=.02$). The trait anxiety scores were not different between the two cohorts (39.5±8.3 vs. 38.9±7.9).

Women in the SARS cohort had significantly better social support in all except the domain of tangible support. Only 10.8% of women felt lonely and the lack of support during the SARS outbreak (Table 2). A post hoc correlation analysis was performed to examine the relationship between the level of social support and depression among the SARS cohort. The results showed that there was a significant negative correlation between the BDI score and the total social support score [$r=-.41$, $P<.0001$ (two-tailed)].

Table 1
Sociodemographics and psychological well-being of pre-SARS vs. SARS cohorts

Assessment characteristics	Pre-SARS cohort (n=939)	SARS cohort (n=235)	Test value[a]	P value[a]
Age (mean±S.D.)	29.9±5.1	29.6±5.4	0.87	.39
Parity				
Nulliparous	596 (63.5%)	138 (58.7%)	1.81	.18
Marital status			7.88	.01*
Single	9 (1.0%)	8 (3.4%)		
Married/ cohabiting	930 (99.0%)	227 (96.6%)		
Education level			0.89	.63
<7 years	36 (3·8%)	9 (3.8%)		
7–13 years	739 (78.7%)	191 (81.3%)		
≥13 years	164 (17.5%)	35 (14.9%)		
Employment status			6.14	.04*
Unemployed/student	15 (1.6%)	2 (0.8%)		
Housewife	321 (34.2%)	100 (42.6%)		
Full/part-time	603 (64.3%)	133 (56.6%)		
Past depression	18 (1.9%)	7 (3.0%)	0.52	.47
Trimester at recruitment			2.32	.15
First trimester	219 (23.3%)	66 (28.1%)		
Second and third trimester	720 (76.7%)	169 (71.9%)		
BDI (mean±S.D.)	7.8±6.1	8.7±7.3	−1.4	.16
BDI>14.5	112 (11.9%)	29 (12.3%)	2.39	.12
STAI anxiety state (mean±S.D.)	35.5±9.3	37.2±9.7	−2.32	.02*
STAI anxiety trait (mean±S.D.)	38.9±7.9	39.5±8.3	−0.82	.42
SSS subscores (mean±S.D.)				
Tangible support	73.6±18.0	75.6±18.3	−1.65	.10
Affectionate support	74.6±17.8	77.7±17.9	−2.2	.03*
Positive social interaction	74.5±15.6	77.1±16.0	−2.55	.01*
Informational support	72.9±16.8	75.5±16.2	−2.13	.03*

[a] The test value and P value are determined by Student's t test, χ^2 test, or Mann–Whitney test as appropriate.
* $P<.05$ (two-tailed).

Table 2
Psychological and behavioral responses to SARS outbreak [n (%)]

SARS infection in	Yes	No		
Family members	0 (0)	234 (100)		
Friends	6 (2.6)	228 (97.4)		
Neighborhood	130 (55.6)	104 (44.4)		
Psychological responses to SARS				
Worried about contracting SARS	*Worried or very worried*	*Slightly worried*	*Not worried at all*	
Herself	116 (49.6)	107 (45.7)	11 (4.7)	
Newborn (pregnancy and postdelivery)	136 (58.1)	80 (34.2)	18 (7.7)	
Spouse	148 (63.2)	75 (32.1)	11 (4.7)	
Relatives/friends	134 (57.3)	88 (37.6)	12 (5.1)	
Likelihood of contracting SARS	*Likely or very likely*	*Unlikely or very unlikely*		
Herself	51 (21.9)	182 (78.1)		
Newborn	50 (21.5)	183 (78.5)		
Pregnancy-related worries	*Worried or very worried*	*Slightly worried*	*Not worried or not considered*	
Fetal malformation if antiviral drugs are needed for SARS infection	161 (68.8)	53 (22.6)	17 (7.3)	
SARS infection leading to miscarriage	109 (46.6)	92 (39.3)	33 (14.1)	
SARS infection leading to preterm delivery	108 (46.2)	97 (41.5)	27 (11.5)	
Newborn contracting SARS postdelivery	93 (39.7)	101 (43.2)	40 (17.1)	
	Yes	*No*	*Need to discuss with family/doctor*	
Opt for abortion if infected with SARS	51 (25.4)	47 (23.4)	100 (49.8)	
Inner experience	*Agree or very agree*	*No comment*	*Disagree or very disagree*	
Uneasy even at home because of SARS	43(18.4)	66(28.2)	125 (53.4)	
Lack of security because of SARS	128 (54.7)	56 (23.9)	50 (21.4)	
Loss of freedom because of SARS	113 (48.3)	72 (30.8)	49 (20.9)	
Lonely and lack of support because of SARS	21 (10.8)	49 (25.1)	125 (64.1)	
Behavioral responses to SARS				
Mitigating infection risk	*More or much more*	*No change*	*Less*	
Washing hands	214 (91.5)	20 (8.5)	0 (0)	
	Most of or all the time	*Sometimes*	*Rarely or never*	
Wearing masks	164 (70.1)	57 (24.4)	13 (5.6)	
Wearing gloves	4 (1.7)	16 (6.8)	214 (91.5)	
	Nearly or totally homebound	*Less than usual*	*Same as usual*	*More than usual*
Going out	87 (37.2)	128 (54.7)	19 (8.1)	0 (0)
Hospital visits	*Yes*	*Neutral*	*No*	
Fear of going for antenatal visit in the hospital	156 (66.7)	70 (29.9)	7 (3.0)	
Fear of any consultations in the hospital	187 (79.9)	45 (19.2)	2 (0.9)	
	Yes	*Considered*	*No*	
Cancelled appointments in the hospital	28 (12.0)	91 (38.9)	111 (47.4)	
Postponed appointments in the hospital	49 (20.9)	68 (29.1)	117 (50)	

Behavioral and psychological responses to outbreak

None of the participants were (or were living with) health care workers, who were at high risk of contracting SARS. However, about half of the women (55%) in the SARS cohort were living in buildings or residential estates where SARS cases had been identified. The psychological and behavioral responses of the SARS cohort are summarized in Table 2.

More than half of the women worried about their spouses, newborns, or themselves contracting SARS. One fifth of the women considered it likely or very likely that they or their babies to contract SARS. About 70% of the women worried about teratogenicity should they need to take ribavirin, and nearly half worried about SARS infection leading to miscarriage or preterm deliveries. A quarter of the women indicated that they would opt for termination of pregnancy should they contract SARS.

To mitigate risk of infection, about 70% of the SARS cohort wore a mask all or most of the times, and 40% washed their hands much more frequently than before. About 92% refrained from leaving home, and a third were homebound. Still, nearly a fifth of women felt uneasy even when they were staying at home. Two thirds of the women were scared of going to hospital for antenatal visits, and about a third had cancelled or postponed antenatal appointments. About 45% considered delivering in hospitals with fewer SARS cases, and a further 13% had already decided to do so.

Discussion

To the best of our knowledge, this is the first study on the psychobehavioral responses of pregnant women to an infectious outbreak. We were able to conduct the study amidst the chaos of SARS because we were by chance completing a study of antenatal mood disorders when the outbreak began. We could thus swiftly respond by applying the same sampling frame and study protocol to the SARS cohort. Hence, in contrast to most reports on the psychological impact of outbreaks, our study has a well-matched control group for comparison. The combined use of qualitative and quantitative methods also enabled a contextualized understanding of the lived experience of being pregnant during a frightful epidemic [25].

Our findings showed that protective apparels and "reverse isolation" were commonly used by pregnant women to mitigate the risk of infection. Anticipatory worries were common. These included worries of contracting infection, transmitting infection to the fetus, acquiring infection during delivery, and risking teratogenicity if drug treatment is required. Unsurprisingly, about two thirds of pregnant women were scared of going to hospital, and a third cancelled or postponed the antenatal checkup appointments. Studies in Hong Kong showed that 70% of general population would stay away from hospitals to avoid contracting SARS [26]. In Taiwan, a 24% reduction of ambulatory care was also recorded during the 2003 SARS epidemic [27].

Although the behavioral responses of pregnant women to SARS outbreak were comparable to those of general population, we found that substantial portion of pregnant women overestimated their risk of infection. As many as 20% of pregnant women reckoned that they were likely to contract SARS. This compared with 9% of the general population surveyed around the same time [28]. In reality, none of the 235 participants eventually acquired the infection. In fact, once the public was aware of the outbreak and took precautionary measures, there was no new SARS infection among local pregnant women.

The overestimation of risk may explain the slightly higher level of anxiety observed among the SARS cohort. We could not estimate the rate of anxiety, as the STAI was not designed to detect probable cases. Nonetheless, previous studies have shown that antenatal stress and anxiety are associated with increased uterine artery resistance and reduced uterine blood flow, and prematurity and smaller babies are more common among women who are stressed during pregnancy [29]. A study also showed that lower Manhattan women who were exposed to the stress of the World Trade Center event in the first trimester of pregnancy delivered infants with significantly shorter gestation and a smaller head circumference [30]. It would hence be worthwhile to examine if the SARS newborns were more likely to be preterm or small for gestation, and whether there are longer-term health consequences.

There was no substantial increase in depression among the SARS cohort. The levels and rates of depression were similar between the SARS and pre-SARS cohorts. These findings were unexpected, given the worries and stresses the SARS women reported. On the other hand, our data showed that, compared with the pre-SARS control, the SARS cohort received more social support during the outbreak. Only 10% of women in SARS cohort reported lonely or unsupported. It is well established that social support protects women from antepartum and postpartum depression [31,32]. Our post-hoc analysis also showed that participants who received more social support were less depressed. The buffering effect of social support may explain why not more depression was observed in the SARS cohort.

It is of note that pregnant women who were most depressed or anxious during the SARS outbreak might not have returned to the hospitals at all. Besides, about 40% of eligible women declined to participate in the study. This was slightly higher than the average refusal rates (33%) we encountered in local obstetric population. Even so, the selection bias is unlikely to be the full explanation for the differential responses of anxiety and depression observed among the SARS cohort.

There are other limitations that deserve discussion. First, we measured the psychological and behavioral responses with a newly developed questionnaire. It was not possible to evaluate the psychometric performance (such as sensitivity, specificity, predictive values) of the questionnaire because the questionnaire is merely a collection of questions on how pregnant women react to the outbreak. No specific constructs are measured by the questionnaire. The internal consistency of the questionnaire, however, is good, and the ethnographic inquiry lends support to the content validity.

Second, the 2003 SARS outbreak lasted only about 6 months in Hong Kong. Hence, most women were not exposed to the threat of SARS for the full pregnancy. Most participants had only been exposed to the SARS threat for 2–3 months when they were interviewed. Thus, only acute psychological responses were examined in the present study. Longer longitudinal follow-up is needed to examine the sub-acute and long-term psychological complications, such as posttraumatic stress disorder. In addition, it is important to appreciate that a more prolonged epidemic could have happened had the disease become more widespread. Many historical outbreaks were of years. Caution is needed in generalizing our findings to more prolonged crisis.

It is also important to note that there might be a cohort bias in a historical comparison. Besides SARS outbreak, certain factors that differed between pre-SARS and SARS period may contribute to the difference of psychological or behavioral measures. In this study, the demographic difference, like marital status and employment status, was the possible resource of cohort bias. Last, we were not able to estimate the rates of anxiety disorders and the observed difference in anxiety level between the SARS and control

cohorts was a small one. Hence, studies are needed to ascertain if the difference in anxiety between the two cohorts is of clinical significance (for instance, higher rates of anxiety disorders in the SARS cohort).

Conducting research in a hazardous environment was challenging. We found formulating research questions amidst the chaos and confusions of an outbreak required concentration and some degree of detachment. The tremendous impact of SARS outbreak on the obstetrics service has been summarized by Haines et al [33]. The demand from maintaining clinical services in a crisis could easily distract research efforts. We largely avoided that by assigning specific staff to overlook the research needs of the society. We were initially concerned about the safety of our research assistants and study participants, but they justly reminded us that it was also important to document the crisis and continue scientific inquiry in extreme situations. Nevertheless, conducting research in a public disaster was emotionally draining. Maintaining some meanings in life amidst a catastrophe empowered us and braved us through the storm.

We hope this report will stimulate more research on the psychological impact of outbreaks and catastrophes on pregnancy. Emerging infectious diseases such as avian flu, structured violence, terrorism, and natural disasters are regularly threatening humankind in many parts of the world. However, so little is known about the impact of such on mothers and newborns. Without good-quality empirical data, it is hard for health care providers and decision-makers to devise policy and disaster plan that are informed and evidence-based.

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