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Case Report

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Pregnancy & Emergency Preparedness: A Narrative Review of the Challenges and Gaps in Maternal Crisis Policy & Response

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ABSTRACT

Natural disasters pose significant threats to maternal health, particularly for pregnant women whose physiological and psychological vulnerabilities increase the risk of complications during crises. Disruptions to healthcare infrastructure, food insecurity, and heightened stress levels during emergencies have been linked to adverse pregnancy outcomes. Despite existing guidelines, there remain critical gaps in emergency preparedness, clinical research inclusion, and equitable access to obstetric care. This review highlights the pressing need for comprehensive maternal emergency preparedness plans that incorporate medical, mental health, and logistical considerations. This research emphasizes a need for proactive strategies such as disaster-resilient maternity care units, telemedicine integration, emergency mental health support, and the development of birth and emergency kits. Addressing systemic barriers such as racial and socioeconomic disparities, healthcare provider shortages, and infrastructure limitations is essential to improving maternal outcomes in cases of emergencies. Finally, there need to be established research frameworks that include pregnant women in emergency planning to ensure effective response and equitable care during public health crises.

Keywords: Maternal Crisis, Emergency Preparedness, Pregnancy Plan, Disaster Response, Maternal Health, Neonatal Care

Background

Unexpected natural disasters cause disruption to communities, preventing individuals from accessing healthcare, destroying vital infrastructure, and demolishing natural resources. In these urgent crises, emergency preparedness initiatives can aid in reducing the downstream adverse impacts of these disasters on vulnerable populations, namely pregnant women. Inefficient emergency preparedness can result in fatalistic maternal health issues, amongst other negative impacts. Natural disasters often result in the inaccessibility of healthcare and food sources, which result in stressors that negatively impact pregnant women, putting them at heightened risk for complications and infections [1]. In fact, hurricane exposure was frequently associated with pregnancy complications such as preterm birth, low birth weight, cesarean birth, abnormal newborn conditions, infant mortality, and birth effects; however, these associations were not always consistent with every natural disaster. Generally, disasters can produce maternal healthcare deserts, and these issues with accessibility are even greater within rural communities. Research suggests that stronger storms have the most impact on pregnant women, as hospitals are forced to evacuate. This causes an extreme negative impact on women as they become physically, emotionally, and mentally stressed, resulting in a large secretion of cortisol that can cause high blood pressure, heart attacks, and strokes. This review aims to analyze the broader intersections between maternal health and emergency preparedness, while emphasizing necessary interventions to better promote improved birthing outcomes [1,2].

Discussion

Maternal emergency preparedness is crucial to safeguarding the health of pregnant women and their infants during public health crises, natural disasters, and pandemics. Pregnant women face unique vulnerabilities due to physiological changes that increase susceptibility to infections, complications, and barriers to healthcare access. Effective preparedness strategies must integrate medical, ethical, logistical, and public health considerations to ensure optimal maternal and neonatal outcomes [2]. Addressing these challenges requires a proactive approach to healthcare planning, resource allocation, and policy implementation tailored to the specific needs of pregnant populations.

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Health Considerations during Emergencies

Due to being characterized as a vulnerable population, pregnant women are often excluded from clinical research during public health emergencies, leading to a gap in evidence-based guidelines tailored to their needs [2]. Science preparedness, ensuring research mechanisms are in place before crises occur, is essential for generating timely data on the safety and efficacy of interventions for pregnant populations. This includes studies on vaccines, therapeutics, and disaster response protocols specifically designed for maternal health. Without this evidence base, healthcare providers may struggle to offer optimal care, and policymakers may lack the information needed to develop effective maternal health strategies during emergencies. Additionally, research gaps contribute to uncertainty surrounding best practices for treating pregnant women in crisis scenarios, further complicating emergency responses [3].

Behavioral emergencies in pregnancy require specialized approaches due to the potential impact on both the mother and the fetus. This highlights the importance of screening for and managing psychiatric crises such as perinatal depression, anxiety, and substance use disorders. Integrating psychiatric care into emergency preparedness ensures that mental health crises do not exacerbate physical health risks for pregnant women during disasters. Furthermore, emergency situations can heighten stress and anxiety, increasing the risk of adverse pregnancy outcomes, including preterm labor and hypertensive disorders. Developing emergency mental health response teams trained in perinatal psychiatry and ensuring access to telepsychiatry services during crises can mitigate these risks [4]. Outside of the mental health sector, medical facilities must also be equipped to deal with crises such as pre-eclampsia, gestational diabetes, and sepsis. Oftentimes, providers in natural disasters are not equipped with the skills to address prenatal complications, resulting in delays in medical care and poorer quality of care overall [5].

Challenges in Maternal Healthcare Access During Emergencies

There exist significant barriers to maternal healthcare in low- and middle-income countries during public health disasters. Infrastructure disruptions, including damage to hospitals and transport networks, can prevent women from accessing essential prenatal and obstetric care. Supply chain issues further exacerbate these challenges, leading to shortages of essential medications, vaccines, and skilled personnel, thereby compromising maternal and neonatal health. Socioeconomic barriers such as financial constraints and social instability also reduce healthcare-seeking behaviors among pregnant women, placing them at increased risk of complications. In pandemics, fear of infection can deter women from visiting healthcare facilities, necessitating alternative models of care such as mobile clinics, telehealth, and community-based maternity care to ensure continuity of services [6].

The importance of consolidating obstetric services is highlighted by the public health crises to maintain care continuity. Strategies include designating specialized maternity hospitals to manage high-risk pregnancies, establishing telemedicine networks to provide remote prenatal consultations, and developing emergency protocols for rapid maternal transfers when necessary. Centralizing maternal health services can enhance resource efficiency, ensuring that healthcare providers with obstetric expertise are readily available; however, service consolidation must be carefully managed to avoid unintended consequences such as decreased access for rural populations, which emphasizes the need for transport assistance and decentralized emergency care models [7].

Gaps in Current Emergency Response & Birthing Plans

The NIH and CDC both detail an emergency response plan for pregnant women, including how to navigate natural disasters and prepare for birth with a skilled attendant; however, the "manuals" specify how to plan for medical care, making an emergency kit with essential items, and recognizing maternal warning signs [8]. The NIH details the birth and emergency plan for skilled attendants, such as knowing which questions to ask, practicing developing a birth and emergency plan for the mother, providing information as to what an at-home vs. hospital birth will look like, signs of labor, among facilitating relationships with family and friends [9].

Healthcare facilities often face delays in access to care such as limited ambulance services, health insurance, delayed waits, lack of appointments/timings can result in preventable pregnancy-related deaths or complications from occurring [8,10]. Data on pregnancy-related deaths by race and ethnicity show that there is a disparity in terms of these factors that negatively affect certain groups over others due to potential differences in access to care, quality of care, prevalence of chronic diseases and others. Non-Hispanic Native Hawaiian or Other Pacific Islander women and non-Hispanic American Indian or Alaska Native women had the highest mortality rates in 2017 to 2021, with non-Hispanic Black women also significantly disproportionate from non-Hispanic White or Asian [11].

Along with racial and socioeconomic disparities, provider lack of emergency obstetric care is also a concern. The Pennsylvania Patient Safety Authority data shows that patients experiencing life-threatening situations in healthcare facilities are hindered due to a lack of correct equipment or readily available equipment [12]. Research shows delays during emergency obstetric care in countries outside of the United States, specifically Ethiopia. A study resulted in the proportion of delays during emergency care to be 59.7% with specific factors such as living in rural areas, lack of literacy, and referral to higher level of care to be even more significant in being associated with delay [13].

For soon-to-be mothers, they are told to have birth plans. With guides such as March of Dimes' birth plan, pregnant women have a guide as to what to ask from healthcare facilities and what information to research pre-labor; however, this doesn't include having an emergency plan as said to have by sources like NIH, often leaving women with a sense of confusion or lack of information regarding the correct steps to take in case of an emergency [14].

Delaying Pregnancy & Pregnancy-Related Medical Care During Public Health Crises

Factors influencing such recommendations include the availability and safety of medical interventions, the risk of vertical transmission of infectious diseases, and healthcare system capacity to support maternal and neonatal care. During pandemics, uncertainties surrounding new infections and their

effects on pregnancy often lead to guidance recommending postponing conception until more data are available; however, such recommendations must consider the reproductive autonomy of individuals and ensure that women have access to comprehensive reproductive health services, including contraception and fertility support, in emergency settings [3]. In some disaster cases, access to contraceptives can also be implicated, which can result in unplanned pregnancies and the worsening of other conditions that are generally controlled for by contraceptives such as painful menstrual cycles and endometriosis, amongst others [5].

Components of preparedness include training healthcare providers in obstetric emergency response, developing disaster-resilient maternity care units, and ensuring access to essential supplies such as blood products and neonatal resuscitation equipment [15]. A well-prepared obstetric response system must also include standardized triage protocols to prioritize care for high-risk pregnancies and ensure timely interventions. Effective coordination between hospitals, emergency responders, and public health agencies is critical in delivering timely and appropriate maternal healthcare during crises [16].

The three-delay model proposes three distinct causes that can result in adverse maternal health outcomes; these are delays in choosing to seek medical attention, delays in reaching a healthcare center, and delays in acquiring healthcare in a timely manner once in a medical center [17]. In cases of natural disasters, the latter two scenarios are especially involved in adverse maternal healthcare outcomes during emergencies. Issues such as power outages, technological issues, and others negatively impact all those seeking medical care during an emergency, but also uniquely impact those in active-labor or needing life-saving obstetric care. A review over the impact of Hurricane Michael in rural Florida further supported the three-delay model, finding that pregnant women during the hurricane experienced delays in their first prenatal visit and often received inadequate care for their condition; however, as previously noted, there are some inconsistencies with these findings based on natural disasters of flooding in North Dakota, which saw an increase in maternal healthcare visits, and in El Nino, where visits did not vary [1]. These inconsistencies have been attributed to variation in location and the extent of damage caused by the disaster. Regardless, as concerns over climate change rise and climate disasters grow more frequent, it is vital to implement precautionary measures in order to ensure that healthcare outcomes are not put at risk.

Ethical Considerations in Maternal Health Research During Emergencies

Literature highlights ethical challenges in conducting research on pregnant women during emergencies, particularly concerning informed consent and risk-benefit analysis. Establishing pre-approved ethical frameworks can facilitate timely research while safeguarding maternal and fetal rights. The exclusion of pregnant women from clinical trials often leads to a lack of data on the safety and efficacy of medical interventions in this population, creating significant ethical dilemmas during crises. To address this, international research guidelines must be adapted to ensure that pregnant women can ethically and safely participate in emergency-related studies, ultimately improving the quality of maternal care during public health disasters [18].

Historical cases, such as Hurricane Katrina and the Ebola epidemic, emphasize the need for integrated maternal health strategies in emergency response plans [19,20]. Lessons learned from these crises highlight the importance of community engagement in disseminating emergency health information, the role of mobile clinics in bridging gaps in healthcare access, and the necessity of targeted financial and logistical support for displaced pregnant women. For instance, during the Ebola outbreak, social mobilization efforts played a crucial role in overcoming misinformation and ensuring that pregnant women received appropriate medical care. Additionally, data from Hurricane Katrina demonstrated the importance of disaster response plans that prioritize maternal health services, ensuring continuity of care even in the face of extreme infrastructure disruptions [19,20].

Creating a Pregnancy Emergency Plan

Normal procedural health care and essential resources can become disturbed as unexpected disasters occur, creating a harsh reality for pregnant women. Because of this, it is crucial for healthcare centers, hospitals, shelters, physicians, and pregnant women to construct an emergency plan in order to combat the physical and mental burdens, that can further harm the health of the mother and baby [16]. After the COVID-19 pandemic, it has been unfortunately indicated many Obstetrics and Labor and Delivery departments tend to struggle in creating emergency planning for their patients, due to the large volume of patients that are regularly seen in these departments, and the high risk that is already established within the pregnant population. In addition, it has been indicated many healthcare providers are not properly trained in communicating with disaster management teams, or responding to high-risk disasters, which places more vulnerable populations at risk in receiving no treatment, loss continuity of care, an increase of premature birth, and ultimately the separation of the mother and infant. Compared to other departments within hospitals, obstetrics/Labor and Delivery must create a unique emergency plan that requires the attention of all pregnant women from high-risk labor patients to postpartum mothers [21]. Furthermore, emergency preparedness plans should be created prior to the disaster occurring, however when unexpected disasters occur, patients become at high risk of receiving insufficient treatment, which decreases the quality of healthcare provided by hospitals in the United States. These unexpected disasters can prevent the creation of practical emergency plans, especially when considering outside factors such as power outages, and required evacuations.

In terms of pregnant women and their families, a proper emergency plan should include proper nutrition for the mother and baby, personal hygiene items, comfortable clothing, a first aid-kit, and any necessary medications. Furthermore, the emergency disaster plan should include an emergency birthing kit if an unexpected delivery occurs, which includes infection control products if emergency professional help is not available. Transportation, and the knowledge of other healthcare centers/hospitals in other locations is advised, if an emergency evacuation is required, and the delivery of the baby is required within the hospital setting due to special types of pregnancies. If possible, healthcare providers can also provide pregnant mothers with materials such as cord clamps, and gauzes to aid in the delivery process, if the disaster is predicted; however, it is important to note, sterilized instruments may not be helpful in

these circumstances, as delivery of the baby may not occur in a sterile environment [22,23].

While preparing for pregnancy emergency plans, hospitals and other healthcare centers must consider the possibility of required evacuations, which can lead to the possibility of the loss of a patient's medical records. To combat this issue, it is important to include the necessary prescriptions and documentation of a patient, on paper, if technology use is not plausible. Furthermore, hospitals and health centers should locate other hospitals in evacuated areas, to ensure safe patient transportation, as well as notify other hospitals of incoming high-risk patients. In addition to creating a pregnancy emergency plan for pregnant women during disasters, hospitals should also consider a plan that includes the assessment of mental health after these disasters to ensure new mothers are prohibited from experiencing postpartum depression or other mental illnesses [22,23].

Disaster Preparedness in Healthcare Settings

Disaster events can cause a reduction in fetal growth and the severity of these events can have lasting impacts on the mental health of both pregnant and postpartum women [24]. This is further confounded by the fact that women's reproductive health is frequently overlooked during disaster situations, leading to an increased likelihood of complications during pregnancy and delivery [25]. Thus, it is incredibly important that during disaster recovery and relief efforts, there are measures put in place to ensure pregnant and postpartum women have access to proper reproductive healthcare.

Currently, the best way to make sure pregnant and postpartum women get access to care during disaster situations is preparing for these situations beforehand. The Center for Disease Control and Prevention (CDC) Division of Reproductive Health decided to take a step in the direction of disaster preparedness by developing an online course Reproductive Health in Emergency Preparedness and Response to educate both healthcare and public health professionals on how to respond to a disaster [26]. This course will give these professionals the knowledge and skills required to maintain reproductive health standards even in a crisis that is affecting local hospitals and other clinical systems. Another form of preparation for disaster situations is providing family planning and contraceptive kits to women in areas that are disproportionately affected by natural or human-caused disasters.

Special Considerations for Different Types of Emergencies

There are many factors that place individuals at a disadvantage when preparing women in emergency preparedness, such as poor knowledge of danger signs, societal and cultural norms, and financial constraints [27]. Education and awareness of emergency preparedness during pregnancy is a crucial aspect for women and families that are expecting. Several aspects can hinder education and awareness of obstetric danger signs, such as education level, limited access to healthcare, and superstitions [27]. Healthcare providers found barriers to counseling to include lack of time, knowledge, and effort in promoting available resources to improve counseling rates [28]. Study also found that several healthcare providers lacked confidence in discussing the topic with pregnant, postpartum, or lactating women [28]. Furthermore, a study showed that increase in counseling did not necessarily correlate with increased emergency preparedness [29]. In fact, despite attending counseling sessions, it was found that 27% of women had made no emergency arrangements, 63% did not know their blood type, and 89% had not identified any blood donors. Additionally, only 20% had the knowledge of at least three danger signs of pregnancy, 15.8% had knowledge of emergency preparedness for labor, and 12% had knowledge of danger signs for severe illnesses in newborns [29]. In fact, many women disregarded pregnancy and emergency preparedness as "normal" and "uncomplicated", which caused them to neglect emergency preparedness and signs of severe illness [29]. Although several women lack access to proper counseling and healthcare resources informing them of emergency preparedness and pregnancy, many women that attend counseling sessions may passively process emergency preparedness and take little to no effort in attempting to arrange for emergency situations.

Another factor impacting pregnancy and emergency preparedness is natural disasters, which can not only invoke stress and anxiety in pregnant mothers, but also may cause a long-term impact on the offspring. For example, the 1988 Quebec Ice Storm was a natural disaster that caused severe ice and hail and prolonged electrical outages and disrupted the daily lifestyle of several people [30]. Later, many studies were conducted to examine the effects of this natural disaster, which came to be known as Project Ice Storm [30]. One of studies examining Project Ice Storm recruited 176 women who were pregnant during the 1998 Quebec ice storm and their children, assessing prenatal maternal stress (PNMS) with a hardship questionnaire and Impact of Events Scale-Revised for 18 boys and 14 girls using hierarchical linear regression was to assess relations between predictor variables and insulin secretion. Higher insulin secretion was associated with greater objective hardship (prenatal exposure to natural disaster) independently of control variables. A higher insulin secretion links to higher insulin tolerance, causing a greater likelihood of developing diabetes and other chronic diseases. The study indicates that external stress such as natural disasters, rather than subjective distress, can predict glucose–insulin metabolism [31]. Additionally, another study recruited 1140 women pregnant during the storm found that both objective hardship and subjective stress experienced during pregnancy due to the storm resulted in a higher likelihood of children having increased autism-like traits [30]. The study also found trends in data based on the stage of pregnancy, indicating that exposure of the storm during later trimester stages may affect the stress response systems of the child and influence behaviors differently as compared to prenatal stress from the storm experienced in the first trimester [30]. During such a storm, special considerations should be considered for populations such as pregnant women, who have a harder time adjusting to emergency situations and face objective hardship and subjective distress that can impact the developmental programming of children.

Another natural disaster studied was the Fort McMurray Wildfire in Canada, due to which many people were forced to evacuate their homes. A study examining the experience of pregnant women during this time indicated increased stress responses, pregnancy complications, and significant disruption of essential routines during Fort McMurray wildfire evacuations [32]. The study further discussed special considerations for pregnant women, including the development of emergency evacuation plans that address physical limitations and challenges

populations such as pregnant women face during evacuation. Furthermore, the study discusses the importance of community support networks, which can improve community resilience and help to prevent long-term impacts of PNMS, experienced especially during external stressors such as natural disasters. The study also suggests prenatal education, which would help to provide support systems, coping mechanisms, and resilience building for expectant parents during times of traumatic events, as seen by the effects of the Fort McMurray wildfire [32].

By providing prenatal education to expecting parents, PNMS levels significantly decrease in mothers when faced with external stressors such as a natural disaster. For example, a study conducted on pregnant women assessing their stress and health concerns during Hurricane Katrina showed that emergency preparedness for natural disasters significantly improves outcomes for pregnant women [19]. Such families reported lower stress levels and better health outcomes upon being prepared early. The study also mentions special considerations for pregnant women, including early evacuation and prenatal care access (even in local areas) which were associated with less complications during emergencies [19].

Overall, natural disasters are a sudden and frightening change, especially for expectant mothers and families. During this time, prenatal maternal stress (PNMS) can significantly increase, influencing the developmental programming of the offspring and implicating long term harmful effects on the child. By taking special considerations to address the prenatal population, PNMS can significantly decrease, causing a reduction in complications as well. Special considerations may include prenatal education on emergencies, early evacuation, prenatal care access, coping mechanisms, community support and resilience, and more.

Clinical Consequences of Crisis Exposure

Multiple studies have linked disaster exposure with negative birth outcomes, including higher rates of preterm birth, low birthweight, fetal growth restriction, and miscarriage [33,34]. For example, pregnant individuals exposed to Hurricane Katrina exhibited higher levels of stress, which correlated with increased risk of adverse perinatal outcomes [34]. The 2003 Quebec ice storm similarly demonstrated a dose-response relationship between prenatal stress and developmental impacts on offspring. These stressors are not limited to natural disasters: infectious disease emergencies such as the Zika virus outbreak exposed the deadly consequences of inadequate surveillance and prenatal monitoring systems, leading to widespread cases of microcephaly and other congenital anomalies [35]. During the COVID-19 pandemic, large-scale studies like the INTERCOVID project documented increased risks of ICU admission, preterm delivery, and maternal mortality among infected pregnant patients, particularly in low-resource settings [36]. Beyond physical outcomes, pregnant and postpartum individuals demonstrate increased rates of anxiety, depression, and post-traumatic stress disorder (PTSD) in emergency contexts, which can in turn impair maternal-infant bonding and infant development [37,38].

COVID heightened many concerns regarding fetal health and the transmission of infection to the fetus, and participants in the study varied in their anxiety levels and between taking extra precaution and dismissing precautions altogether [39]. In addition, COVID-19 overall stretched hospital systems in China very thin, limiting the amount of education prenatal women were able to receive regarding the progress of their pregnancy, nutritional and dietary suggestions during pregnancy, and disease prevention [39]. Any psychological effects may be exacerbated by factors such as displacement, loss of family members, and inadequate access to mental health care. Importantly, structural inequities, such as systemic racism, poverty, language barriers, and gender-based violence, further compound the risks experienced by marginalized populations. Studies consistently show that Black, Indigenous, and immigrant women face higher maternal mortality and worse mental health outcomes in disaster settings, yet emergency preparedness often fails to incorporate an equity lens into its planning or response strategies [38,40]. Additionally, emergencies may lead to formula shortages, disruptions in breastfeeding, and unsafe water supplies, making infant feeding a particularly precarious concern. While health authorities such as ACOG and the Centers for Disease Control and Prevention (CDC) recommend breastfeeding during crises when clean water is unavailable, implementation remains difficult in shelters and evacuation centers where privacy, lactation support, and hygiene are limited [41]. Yet despite the clear maternal-child health implications, few empirical studies have evaluated how best to support lactation and infant feeding in disaster contexts, representing a major gap in both policy and practice.

Exclusion and Under-Prioritization in Emergency Planning

Despite decades of disaster response efforts, maternal needs continue to be under-prioritized. Ethical and logistical issues, such as the exclusion of pregnant individuals from clinical trials during disease outbreaks, or unclear triage protocols that do not account for gestational age, are inconsistently addressed. For instance, during the Ebola and COVID-19 outbreaks, pregnant women were often denied access to experimental treatments or vaccines due to liability concerns, despite being at high risk of mortality [42]. Efforts like the CDC's Zika Pregnancy Registry and ACOG's maternity-specific disaster planning guidelines represent critical steps forward, but implementation has been limited, especially in rural or low-income communities [41,43]. Moreover, emergency preparedness remains largely reactive rather than proactive, with little investment in community-centered models of care or long-term surveillance of maternal-infant outcomes post-crisis. For example, although the 2005 Hurricane Katrina led to substantial improvements in disaster responses for pregnant women, like increased surge plans for birth during US disasters, these changes did not help postpartum women reintegrate and rebuild their lives in the now disaster-stricken community. In a study by Giarratano et al., seven major perinatal concerns were identified including health of pregnancy, baby, and birth, housing and finances, and death and loss amongst others. Additionally, single mothers exposed to Hurricane Katrina and/or Rita were less shock resistant and experienced a 31.88% increase in poor mental health days compared with the general exposed population. Postpartum women exposed to disasters in both developing and developed countries are made vulnerable to financial difficulties, poor social support, and trauma, which often leads to stressful lives and slow recovery in subsequent years post-disaster [44,45]. Thus, it is crucial that care is provided to pregnant women during disasters and is continued post-disaster.

In 2019, the US Congress passed the Pandemic and All-Hazards Preparedness and Advancing Innovation Act (PAHPAIA). This act recognizes pregnant and postpartum women and infants as at-risk individuals, thus ensuring increased coordination between federal, state, local, tribal, and territorial health officials during public health threats [46,47]. Efforts such as PAHPAIA offer guidance, funding, rapid response, and research for the development of coordinating care in public health emergencies.

Conclusions

Maternal emergency preparedness requires a multi-faceted approach that integrates clinical, logistical, ethical, and behavioral considerations. Strengthening research frameworks, consolidating obstetric services, addressing healthcare access disparities, and learning from past public health crises can enhance maternal and neonatal outcomes during emergencies. Policymakers and healthcare providers must work collaboratively to implement comprehensive preparedness plans that prioritize the unique needs of pregnant women. Additionally, incorporating community-based maternal health strategies, leveraging telemedicine, and ensuring ethical research inclusion of pregnant women are essential steps in improving maternal emergency response efforts. By investing in maternal health preparedness, societies can mitigate the impact of future crises on pregnant women and their infants, ultimately improving long-term public health resilience.

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