Impacts of Environmental Factors on Maternal Health in Low Resource Settings.

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Abstract. The interaction between the environment and maternal health is critical to public health. It impacts the well-being of pregnant women globally. This paper investigates the connections between multiple environmental factors and their impact on maternal health, emphasizing the challenges and potential interventions. In diverse settings, ecological conditions shape maternal health outcomes. Factors such as air and water quality, sanitation, chemical exposure, nutritional food, and climate change play pivotal roles. The disparities in environmental exposures contribute to varying risks for pregnant women, particularly in low- and middle-income countries (LMIC). The detrimental effects of environmental pollution, inadequate sanitation, a rise in temperature, and limited access to healthcare services are explored concerning maternal health outcomes. Additionally, the abstract highlights the interconnectedness of socio-economic factors, cultural influences, and healthcare-seeking behaviour in shaping the impact of the environment on expectant mothers. Recognizing the complexity of these factors is essential for designing targeted interventions to improve maternal health in low-resource settings. The abstract concludes by advocating for comprehensive strategies encompassing healthcare improvements, environmental stewardship, and community empowerment to mitigate adverse environmental impacts on maternal health. Understanding and addressing these dynamics are crucial steps toward ensuring the well-being of mothers and promoting sustainable maternal healthcare practices.

Keywords: Environment, Pollution, Maternal Health, Low Resource, Rural areas.

1 Introduction

Maternal health is a crucial part of public health and is profoundly influenced by numerous factors, such as social, cultural, demographic, economic, and behavioural. Environmental factors also play a pivotal role and make an impact on the health of a pregnant woman during pregnancy and after childbirth. In the context of low-resource areas, where healthcare disparities and socio-economic challenges prevail, the intricate interplay between environmental factors and maternal well-being becomes a critical area of exploration. As per the WHO reports in 2016, 24% of all deaths worldwide were because of the environment. Environmental factors include heat waves, air pollution, water pollution, sanitation, exposure to harmful chemicals, and many more. This

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estimated burden of disease can be reduced and relies on the relationship between exposure and the development of disease [1].

Various research on environmental exposure and its impact on maternal health has focused on adverse effects on newborn babies, and very few studies have focused on the health of mothers [2]. Any pre-existing conditions related to environmental exposure and maternal gestational exposures pose complications to the health of a pregnant woman during pregnancy after childbirth. Besides pregnant women, these climate-sensitive risks are most vulnerable for children, older people, poor communities, and those having some pre-existing health issues [3]. Climate hazards affect maternal health directly and indirectly by increasing the risk of mortality, noncommunicable diseases, infectious diseases, and health emergencies. [3].

These climate hazards relate to a high risk of developing complications during pregnancy that lead to adverse maternal and perinatal outcomes. These are responsible for maternal and child morbidity and mortality, such as low birth weight, stillbirth, pre-birth, hypertensive disorder of pregnancy, and gestational diabetes [4]. Furthermore, the mental well-being of individuals during and after pregnancy can be negatively impacted by the consequences of being exposed to climatic hazards and their subsequent aftermath, which can also contribute to intergenerational trauma. This is in addition to the health risks associated with inadequate nutrition, water, hygiene, and sanitation. These circumstances have the potential to exacerbate stress, anxiety, and depression, which are recognized as risk factors for adverse perinatal outcomes [4]. WHO reported that between 2030 and 2050, climate change is expected to cause approximately 250,000 more fatalities each year. 38,000 deaths attributed to heat exposure in older individuals, 48,000 deaths owing to diarrhea, 60,000 deaths from malaria, and 95,000 deaths caused by childhood undernutrition. [3]. The projected annual direct health harm expenditures are predicted to range from USD 2 to 4 billion by 2030 [5].

Environnemental Factor	Estimated no of deaths	Reference of data Source
Outdoor Pollution (Air)	45,00,000	Global Burden of Disease, 2016 [7]
Indoor Pollution (Air)	28,00,000	Global Burden of Disease, 2016 [7]
Water pollution (Hygine, sanitation effects]	18,00,000	Global Burden of Disease, 2016 [7]
Exposure to lead	5,00,000	Global Burden of Disease, 2016 [7]
Climate change and heat	2,00,000	World Health Organization, 2002 [8]

Table 1: The estimated number of deaths and associated environmental factors.

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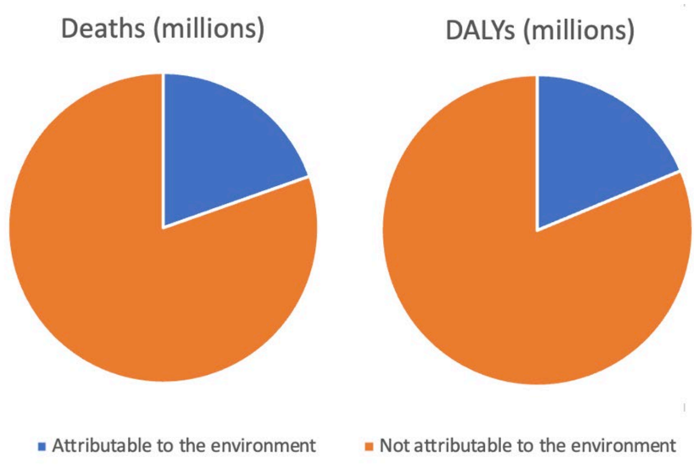

Figure 1: The proportion of fatalities and Disability-Adjusted Life Years (DALYs) caused by environmental factors worldwide in 2016
*source- Preventing disease through healthy environment :a globan assesment of the burden of disesse from environmental risks, WHO 2012, updates 2016.

2 Environmental-related common risks associated with pregnancy.

2.1 Air pollution

Air pollution creates various complications in terms of pregnancy outcomes, especially in the case of women with an already compromised respiratory system or with any underlying health condition like asthma [9]. A systematic analysis conducted by Pederson et al., and Shah et al., found that exposure to air pollutants, including particulate matter and traffic exhaust, can lead to restricted growth of the unborn child, low birth weight (LBW), preterm (PTM), and small gestational age (SGA) [9-10]. According to a study conducted in Zimbabwe, infants born to mothers who cooked with wood, dung, or straw were 175 g lighter (95% CI 50–300) than those born to mothers who used healthier and cleaner fuels. Consequently, maternal biomass smoke exposure may significantly contribute to respiratory morbidity and mortality in infants [15]. Multiple studies and extensive documentation are available regarding the adverse effects of air pollution on hypertension during pregnancy, polycystic ovarian disease, reduced fertility, and miscarriage [22] [23].

2.2 Environmental chemical contaminants

Several environmental chemical contaminants, such as methylmercury (CH3Hg), polychlorinated biphenyls (PCBs), polychlorinated dibenzofurans (PCDFs), environmental tobacco smoke (ETS), 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) (chloracne), etc. adversely affect pregnancy and child health. There is a significant amount of epidemiological evidence that links chemical contaminants to adverse effects on pregnant women and the health of their children. These effects include fetal growth deficits, motor, cognitive, auditory, and visual deficits, sudden infant death syndrome, and delayed or retarded development [11]

2.3 Water pollution

Access to clean drinking water is also one of the major problems faced by people in many parts of the world and, especially in low-resource areas. Water contamination can have severe negative health impacts on pregnant women and their unborn children. Drinking water contaminated with heavy metals like lead and mercury can cause significant health problems, such as delays in cognitive and motor development, growth retardation, gut-related issues, fertility complications, hormonal imbalances, and more. Additionally, exposure to chemicals such as polyaromatic hydrocarbons (PAHs), chlorinated compounds like trihalomethanes, tetrachloride, tetrachloroethylene, and dichloroethylene, and benzenes in water can lead to reduced birth weight, preterm births, central nervous system anomalies, neural tube anomalies,, cardiac defects, oral cleft defects, and other serious complications that pose significant risks to both the mother and child [12]. These substances might impact hormone synthesis and negatively affect maternal and child health [24]. Various studies show that these substances might impair hormone synthesis or function negatively, affecting infants [24]. Research has indicated that infants who consume water contaminated with tetrachloroethylene (PCE) may experience enduring neurological consequences.

2.4 Climatic conditions

The relationship between climatic conditions and maternal health is intricate and can result in adverse pregnancy outcomes. Pregnant women are at high risk during high temperature or heat waves because of hormonal changes during the pregnancy [25]. This increases the risks for the mother and fetus's health. Newborn children are more sensitive to too-high and too-low temperatures because of their limited temperature regulation capacity [26]. Climate change-induced high temperatures can lead to various health issues like difficulties in regulating body temperature, which can cause premature birth, underweight at birth, fetal death, and birth defects. Extreme weather conditions such as floods, hurricanes, tsunamis, droughts, etc. can displace people, especially in rural areas, making pregnant women in these regions more vulnerable [13].

2.5 Exposure to Lead

In India, lead exposure may happen in the cosmetic and traditional medicine industries and various jobs in the unorganized sector [27.] Lead has been shown to have a hazardous and poisonous effect on the human reproductive system [28]. In addition to occupational risks, children's polyvinyl chloride (PVC) toys and paints in a typical home can expose them to lead [29]. Continuous lead exposure has been linked to behavioural and executive function impairments in children [30]. Lead exposure at high levels (>40 μg/dl) for short or long periods (>25 μg/dl for more than a year) and lead levels in maternal blood (>10 μg/dl) increase the risk of spontaneous abortion, preterm delivery, low birth weight, and impaired neurological development of the fetus [31].

2.6 Exposure to Microplastics

Although the impact of microplastics on human health is an area that is still underexplored, potential health impacts have been reported, including maternal health. The wide use of plastic products in the environment led to the ubiquitous presence of microplastics. In a study by Ragusa et al., 2021, the first evidence of microplastic was reported in the human placenta. MPs can alter the placenta's cellular regulating pathway, growth factors, and communication factors between mother and child. In addition, MPs can accumulate various other pollutants on their surface, such as EDCs, PFAs, heavy metals, and various organic and inorganic pollutants, synergistically increasing the harmful impacts of microplastics [32].

Environmental Factors	Impact on Maternal Health
Air pollution	Restricted growth of child [9], Low birth weight [14-15], Hypertensive disorders of pregnancy [16-17], Miscarriage [20], ART failure [21], Polycystic ovarian syndrome [18] [22], low fertility [23]

Water Pollution	Fertility complications, low birth weight, preterm births [12], neurological consequences, hormonal imbalances [24]
Environmental chemical contaminants	Fetal growth deficits, visual deficits, sudden infant death syndrome, delayed or retarded development [11]
Climatic conditions (High Temperature)	Preterm birth, low birth weight, stillbirth, and congenital anomalies [25] [26]
Lead	Miscarriage, premature birth, underweight at birth, and compromised brain growth of the unborn child [31]
Metals and other substances	Pregnancy-induced hypertension [32] [33],, uterine fibroids [34], reduced fertility[35], and miscarriage[36-37] Cardiometabolic health [38]
Pesticides and Pollutants such as DDT, DDE and dioxin/PCBs	Impaired lactation [39], risk of breast cancer in mothers [40] Development of breasts and milk production [41]

Table 2: Environmental factors and their impact on maternal health.

3 Conclusion:

Dynamic environmental factors influence maternal health and give rise to numerous risks for expectant mothers throughout their pregnancy and in the postpartum period. This review aims to elucidate the distinct peril to reproductive health that arises from exposure to environmental factors. This review paper outlines the specific risks associated with various environmental factors, including air pollution, water pollution, and exposure to environmental chemical contaminants, lead, and metals. These risks include premature birth, underweight at birth, fetal death, and birth defects, miscarriage, spontaneous abortion, neurological consequences, hormonal imbalances, breast cancer, and polycystic ovarian syndrome.

To mitigate the adverse effects of environmental factors on maternal health, policymakers, healthcare professionals, and communities must work together to implement effective strategies. This could entail regulating chemical exposures, boosting access to nutrient-dense foods, strengthening sanitation systems, promoting access to air and water quality, and creating resilience plans to deal with the effects of climate change. In the end, preserving maternal health demands an all-encompassing strategy that acknowledges the intricate network of environmental factors and addresses the social, economic, and cultural factors that compound these difficulties. We can work to ensure better outcomes for pregnant women globally by promoting a deeper understanding of the relationships between the environment and maternal health and by putting targeted interventions into practice. By providing information that can guide evidence-based policies and interventions targeted at building a healthier and more equitable future for expectant mothers worldwide, this research adds to the continuing conversation on maternal health.

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