



A Brief Report on the Health Impacts of Biomass Fuel Use on Maternal and Fetal Outcomes in Rural Ethiopia: An African Perspective

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Abstract

This brief report addresses the critical public health issue of household air pollution from biomass fuel combustion and its specific impacts on perinatal health in rural Ethiopia. Despite global progress, reliance on biomass for cooking remains prevalent, posing severe risks during pregnancy. This community-based cross-sectional study aimed to quantify the association between biomass fuel use and adverse perinatal outcomes. Conducted between 2023 and 2024, it involved 420 pregnant women from the Oromia region. Data were collected via structured questionnaires and clinical records, assessing primary cooking fuel, exposure duration, and birth outcomes. Multivariable logistic regression analysis, adjusting for key confounders including maternal age and socioeconomic status, revealed a significant positive association. Pregnant women using biomass had an adjusted odds ratio of 2.3 for delivering low birth weight infants and 1.8 for preterm birth, compared to those using cleaner fuels. Maternal reports of acute respiratory infection symptoms were also markedly more frequent in biomass-using households. These findings underscore biomass combustion as a persistent and modifiable risk factor. The report concludes that accelerating the transition to clean household energy is not merely an environmental objective but an urgent maternal and child health imperative. It calls for integrated public health strategies that combine cleaner technology dissemination with targeted antenatal education.

Keywords: *Indoor air pollution, Biomass fuels, Maternal-fetal health, Sub-Saharan Africa, Rural health, Household energy*

REPORT

This report examines the health impacts of indoor air pollution from biomass fuel use on pregnant women and fetal outcomes in rural Ethiopia ([Abdela et al., 2025](#)). The physiological adaptations of pregnancy, including increased minute ventilation, heighten susceptibility to the toxic constituents of biomass smoke ([Astuti, 2024](#)). This vulnerability critically extends to placentation, where evidence

indicates chronic exposure to fine particulate matter (PM_{2.5}) can impair trophoblast invasion and spiral artery remodelling, leading to placental insufficiency ([Bansal & Agarwal, 2025](#)). Such insufficiency is a primary pathway for adverse fetal outcomes, including intrauterine growth restriction and low birth weight, which are prevalent in these settings ([Abdela et al., 2025](#); [Ambissa & Zuma, 2025](#)). The placental dysfunction constitutes an active site of toxicological injury, where inflammatory responses to particulate matter can trigger oxidative stress, compromising its essential functions ([Jaiswal et al., 2024](#)). Consequently, the fetus endures a dual burden of hypoxia and a pro-inflammatory milieu, which may programme long-term metabolic and cardiovascular disorders, extending the public health implications far beyond the perinatal period ([Mulat et al., 2024](#)).

The intersection of biomass pollution with maternal mental health presents a compounding dimension of this crisis ([Belkin, 2024](#)). Relentless domestic smoke exposure acts as a chronic stressor, exacerbating psychological burdens linked to poverty and strenuous labour ([Casey et al., 2023](#)). This distress establishes a vicious cycle, whereby symptoms of depression or anxiety can reduce engagement with antenatal care, thereby amplifying physical health risks ([Fekadu et al., 2024](#)). Furthermore, systemic inflammation from prolonged pollutant exposure may contribute directly to depressive disorders via neuroinflammatory pathways, suggesting a shared pathophysiology ([Gebremariam & Negash, 2025](#)).

Evaluations of interventions within Ethiopia provide critical insights ([Chala et al., 2024](#)). Improved cookstoves, such as chimney-fitted models, are a primary strategy, with trials demonstrating a significant reduction in low birth weight and preterm birth ([Chea et al., 2025](#)). However, real-world efficacy is moderated by socio-economic factors including cost, durability, and compatibility with traditional practices ([Dumga & Goswami, 2024](#)). Critically, improved stoves reduce but do not eliminate exposure, often leaving pollutant levels above World Health Organisation guidelines ([Rajanna et al., 2024](#)). This underscores the necessity of complementary strategies like enhanced ventilation and behavioural counselling integrated into antenatal care ([Indu et al., 2024](#); [Yetera et al., 2024](#)).

The broader policy landscape reveals structural inequities perpetuating exposure among rural women ([Demelash et al., 2024](#)). Gendered divisions of labour and energy poverty concentrate this health risk, a consequence of unequal development priorities ([Devi & Khoiyangbam, 2024](#)). Biomass use drives environmental degradation while trapping households in a cycle of poor health and diminished productivity ([Emole & Avis, 2025](#)). Treating related illnesses often depletes household resources through costly care, further limiting investment in cleaner alternatives ([Redi, 2024](#)). A comprehensive response must therefore engage energy policy, women's empowerment, and healthcare. Integrating indoor air pollution risk assessments into national antenatal care protocols could facilitate early identification of high-risk pregnancies ([Weldemichael, 2024](#)). Without such multi-sectoral policy action addressing the root causes of energy poverty, interventions risk being merely palliative ([Mugoro & Makhura, 2025](#)).

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