Journal of Health and Environmental Research
2026, Vol. 12, No. 4, pp. 90–93
https://doi.org/10.11648/j.jher.20261204.13

Communication

Why Firewood Persist: Socioeconomic, Gendered and Community Determinants of Clean-cooking Transition in Rural Abaji, Federal Capital Territory, Nigeria

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Abstract

The persistence of polluting cooking fuels in rural Nigeria is shaped by more than knowledge of health risks. Economic constraints, energy access, infrastructure, gender roles and community norms can reinforce dependence on firewood. This mixed-methods cross-sectional study was conducted in rural communities of Abaji Area Council between November 2025 and April 2026. Household questionnaires characterized cooking practices and socioeconomic conditions, while focus group discussions and key-informant interviews explored perceptions, barriers and coping strategies. The detailed results dataset included 652 households, 420 women and 579 children under five years. Households reported prolonged firewood use, with a median of 12 years of use by the primary cook and a median of 4.5 hours of daily cooking. Only 24.8% used a separate cooking building, and 7.8% cooked inside the main living/sleeping room. Firewood was commonly collected by women and older girls. Children were present during cooking in 87.2% of households with under-five children, and 31% of these households reported carrying a child on the mother's back while cooking. Qualitative analysis identified five themes: normalization of smoke, limited understanding of specific health consequences, cost and availability barriers to cleaner fuels, gendered time poverty, and delayed formal care-seeking for childhood respiratory illness. The clean-cooking gap in rural Abaji is best understood as a structural access problem rather than a simple knowledge deficit. Effective policy should combine affordability measures, last-mile fuel distribution, locally appropriate lower-emission technologies, community engagement, gender-responsive programming and stronger accountability for implementation.

Keywords

Clean Cooking, Firewood, Gender, Energy Poverty, Household Air Pollution, Rural Nigeria, Abaji, Energy Transition

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Received: 3 September 2026; **Accepted:** 27 September 2026; **Published:** 13 November 2026

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1. Introduction

Household energy choices sit at the intersection of health, poverty, gender, infrastructure and environmental sustainability. Globally, an estimated 2.6 billion people still rely on these biomass fuels, with women and children being disproportionately affected due to their increased proximity to cooking activities. The World Health Organization (WHO) attributes over 3.8 million premature deaths annually to exposure to indoor air pollution, primarily from inefficient burning of solid fuels [1, 2].

The combustion of firewood releases harmful pollutants such as fine particulate matter ($PM_{2.5}$), carbon monoxide (CO), volatile organic compounds (VOCs), and polycyclic aromatic hydrocarbons (PAHs) [3]. Prolonged exposure to these pollutants has been linked to a wide range of adverse health outcomes, including respiratory infections, chronic obstructive pulmonary disease (COPD), asthma, low birth weight, impaired cognitive development in children, and even cardiovascular diseases [4].

Although cleaner cooking technologies are increasingly available in Nigeria, rural households may remain dependent on firewood because it is locally accessible, familiar and, in many settings, collected rather than purchased [5, 6]. In Abaji, these structural conditions are compounded by limited electricity access and long distances to health and energy services. Women carry a disproportionate share of cooking and firewood collection. This can create a cycle in which women and children experience greater smoke exposure while also bearing time, physical and opportunity costs associated with biomass collection [7]. Understanding these determinants is therefore essential for designing interventions that are feasible as well as technically sound.

2. Methods

2.1. Design and Setting

The study used a mixed-methods cross-sectional design in rural communities of Abaji Area Council, Federal Capital Territory. The detailed study documentation identifies Yaba, Gurdi, Mawogi, Adagba and Alu as the named communities included in the results.

2.2. Quantitative Component

Household questionnaires captured demographic characteristics, household income, cooking fuel, duration of firewood use, meals cooked per day, cooking duration, kitchen location, ventilation and child proximity to cooking. The detailed results dataset included 652 households and 420 women, with 579 children under five years living in the participating households.

2.3. Qualitative Component

Ten focus group discussions involving 98 women and 20 key-informant interviews were conducted. Key informants included primary-health-care nurses, community health extension workers, village heads and traditional birth attendants. Thematic analysis followed Braun and Clarke's six-phase framework. Two coders independently coded 20% of transcripts, with reported intercoder reliability above 85%.

2.4. Integration

Quantitative and qualitative findings were integrated through triangulation. The approach compared measured exposure and reported health outcomes with community narratives about smoke, cooking practices, affordability and health-seeking behaviour.

3. Results

The socioeconomic profile indicates substantial economic constraint. Most women had little or no formal education, household incomes were low, and crowding was common. Electricity access was also low across the communities described in the study.

Table 1. Socioeconomic and infrastructure context.

Indicator	Finding from detailed study results
Women with no formal education	74.7%
Women with secondary education or higher	2.3%
Households earning <NGN 50,000/month	88.5%
Median persons sleeping in main room	5 (IQR 4-7)
Households with ≥7 persons in main room	23.0%
Households with electricity across named communities	3.9-22.1%
Separate cooking building	24.8%

Table 2. Cooking practices and gendered exposure.

Cooking characteristic	Finding
Meals cooked per day	76.2% cooked three meals

Cooking characteristic	Finding
	daily
Daily cooking time	Median 4.5 hours (IQR 3.5-5.5)
Firewood use duration	Median 12 years (IQR 7-20)
Separate cooking building	24.8%
Indoor separate room	30.4%
Open veranda/eaves	37.0%
Main living/sleeping room	7.8%
Window present	47.8%
Chimney/smoke outlet	0%
Door kept open during cooking	91.7%

Firewood was collected from nearby forests by women and older girls in 86% of households and purchased in 14%. The source estimates typical consumption at approximately 25-35 kg per week. These activities impose a substantial time burden on women and girls.

Children were present in the cooking area during at least part of cooking in 87.2% of households with children under five. In 31% of these households, the child was carried on the mother's back while she cooked, illustrating how caregiving responsibilities can increase direct exposure.

3.1. Community Perceptions and Barriers

Theme 1: Smoke as normal

Participants commonly described smoke as an unavoidable part of traditional cooking. This normalization reduced the likelihood that routine symptoms would be interpreted as warning signs requiring environmental change.

Theme 2: Awareness without disease-specific knowledge

Most FGD participants recognized that smoke was harmful to the lungs, but few could identify specific diseases or link smoke directly with childhood pneumonia. Health workers reported limited training on household air pollution.

Theme 3: Cost and availability barriers

Participants repeatedly described cleaner fuels as unaffordable or difficult to obtain. The nearest source of cooking gas was reported to be in Abaji town, creating both financial and logistical barriers.

Theme 4: Gendered burden and time poverty

Firewood collection was described as women's and girls' work. Long collection journeys reduced time for income-generating activities, education and rest, while exhaustion could increase children's proximity to cooking.

Theme 5: Delayed care seeking

Formal care was often sought only after respiratory illness became severe. Community narratives described reliance on home treatment and herbal remedies before presentation to health facilities.

3.2. Illustrative Community Narratives

"Since the time of our grandmothers, we have cooked with firewood. Smoke has always been there."

"Gas is for the rich."

"Every three days I walk two hours to the forest, carry a bundle of wood that weighs more than my child, and walk back."

"Only when the child turns blue or stops eating do they go to the clinic."

4. Discussion

The findings challenge explanations of firewood dependence that rely primarily on cultural preference or inadequate awareness. In Abaji, households face a combination of low income, limited energy infrastructure, restricted access to cleaner fuels and entrenched gender roles as indicated in our finding. Where firewood is available locally at little or no cash cost, cleaner fuels may remain economically inaccessible even when households understand that smoke is harmful [8, 9].

The gender dimension is central. Women undertake cooking and much of the firewood collection, while girls may also participate in collection. This creates a triple burden: direct smoke exposure, physical labour and opportunity costs. The fact that young children are frequently present during cooking further extends the exposure pathway from women to children. Similar finding has been previously reported [10, 11].

The study also demonstrates why health education alone is unlikely to produce rapid behaviour change. Participants may recognize that smoke is irritating or harmful but still have no realistic alternative. Interventions therefore need to combine risk communication with actual access to affordable technologies, reliable fuel supply and practical household-level exposure reduction [12, 13].

The qualitative findings support a layered policy response. In the immediate term, moving cooking away from sleeping areas and improving ventilation are feasible exposure-reduction strategies [14, 15]. In the medium term, improved biomass stoves and passive heat-retention devices may reduce fuel demand where LPG access is not yet realistic. In the longer term, last-mile LPG distribution, financing mechanisms and accountable clean-cooking programmes are needed to shift households toward cleaner technologies [9].

In this perspective, the principal strength of the present study is the integration of quantitative household information with detailed community narratives, allowing structural barriers to be interpreted alongside measured exposure and health findings. The study also provides community-specific information useful for programme design. However, limitations of the include the cross-sectional design, possible recall and social-desirability bias in reported practices, and the absence of

longitudinal evidence on whether proposed interventions would produce sustained changes.

5. Conclusion

Firewood dependence in rural Abaji is sustained by interacting economic, infrastructural, gendered and social factors. The evidence suggests that the clean-cooking transition cannot be achieved through awareness campaigns alone. Policies must reduce the practical and financial barriers to cleaner cooking while providing immediate exposure-reduction options for households that cannot transition immediately.

Abbreviations

$PM_{2.5}$	Particulate Matter and
CO	Carbon Monoxide
COPD	Chronic Obstructive Pulmonary Disease
PAHs	Polycyclic Aromatic Hydrocarbons
VOCs	Volatile Organic Compounds
WHO	World Health Organization

Acknowledgments

The authors thank and acknowledged the cooperation of Abaji community chieftaincy and Global Health and Infectious Disease Control Institute, Nasarawa State University, Keffi, Nasarawa State for enabling the conduct of the research.

Author Contributions

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Data Availability Statement

Available on reasonable request from the corresponding author.

Conflicts of Interest

The authors declare no conflicts of interest.

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