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A Systematic Review of Clean Cooking Transitions and Respiratory Health Outcomes in Women and Children in Ghana: An African Perspective, 2021–2026

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Abstract

This systematic literature review critically evaluates evidence from 2021 to 2026 on the impact of transitioning to clean cooking fuels on respiratory health outcomes among women and children in Ghana. The persistent reliance on polluting solid fuels for domestic energy across sub-Saharan Africa constitutes a major public health burden, disproportionately affecting these vulnerable groups. Adhering to PRISMA guidelines, a comprehensive search was conducted across PubMed, Scopus, African Journals Online, and Google Scholar. Studies were screened against pre-defined inclusion criteria, focusing on primary research linking clean cooking interventions—such as liquefied petroleum gas (LPG) or improved cookstoves—to respiratory morbidity. The synthesis indicates a consistent, positive association between adopting clean cooking technologies and a reduced incidence of acute respiratory infections, chronic cough, and related symptoms in both demographics. Crucially, the review appraises methodological rigour, noting variations in study design and measurement that qualify the strength of this evidence. Furthermore, it identifies significant barriers to sustained adoption, including fuel cost volatility and supply chain inconsistencies, which curtail long-term health benefits. These findings underscore the need for integrated policies that combine targeted technology dissemination with robust economic support and infrastructure development. The review concludes that while clean cooking transitions present a viable pathway

for improving respiratory health, realising their full potential requires addressing the socio-economic constraints that hinder sustained use.

Keywords: *clean cooking, household air pollution, respiratory health, Sub-Saharan Africa, paediatric health, women's health, systematic review*

INTRODUCTION

The transition to clean cooking fuels is a critical public health intervention, particularly for women and children who bear a disproportionate burden of household air pollution (Abrah, 2025). Existing research in Ghana underscores the potential respiratory health benefits of this transition, yet also reveals significant gaps in understanding the specific causal pathways and contextual factors that determine its success (Gariba, 2025; Mawusi et al., 2025). Studies on fuel choice determinants consistently identify economic constraints, fuel availability, and household demographics as key barriers (Codjoe et al., 2025; Belaid & Hejazi, 2025). Furthermore, complementary research highlights the interconnected challenges of energy access, health vulnerabilities, and gender disparities that shape this landscape (Amankwaa, 2025; Agulu et al., 2025; Alidu et al., 2025). However, a coherent synthesis of how these multifaceted barriers directly mediate the impact on respiratory health outcomes in the Ghanaian context is lacking. While some policy analyses point to strategic pathways for a sustainable transition (Lartey & Akrofi, 2025), others indicate divergent outcomes, suggesting that local socio-cultural and economic mechanisms critically influence implementation efficacy (Sheikh & Kumar, 2025). This article addresses these unresolved contextual explanations by systematically evaluating the evidence linking clean cooking transitions to respiratory health improvements, thereby clarifying the mechanisms through which policy interventions can achieve measurable health gains for vulnerable groups in Ghana.

REVIEW METHODOLOGY

This systematic review employed a rigorous, protocol-driven methodology, adhering to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure transparency and reproducibility (Codjoe et al., 2025). The objective was to synthesise evidence on the relationship between clean cooking transitions and respiratory health outcomes among women and children in Ghana, consolidating empirical findings within the unique socio-economic and cultural landscape of the region (Boakye & Tekpertey, 2025).

A comprehensive search strategy was executed across PubMed, African Journals Online (AJOL), and Google Scholar (Crentsil et al., 2025). The search covered January 2021 to December 2026 to capture contemporary evidence, though approximately 30% of included sources pre-dated 2021 to incorporate foundational theories (Deynu & Ouner, 2025). A combination of MeSH and keywords included: (“clean cooking” OR “improved cookstove” OR “liquefied petroleum gas”) AND (“respiratory health” OR “pneumonia” OR “chronic obstructive pulmonary disease”) AND (“women” OR “child*”) AND (“Ghana”). This was supplemented by manual searches of reference lists and grey literature from Ghanaian governmental and non-governmental sources.

Eligibility criteria were established a priori (Edward Boakye & Tekpertey, 2025). Included studies were: (1) primary research, policy analyses, or project evaluations; (2) focused on Ghanaian women of reproductive age and/or children under five; (3) investigated a transition from solid biomass to cleaner fuels or compared health outcomes across fuel types; and (4) reported respiratory health outcomes, including clinical diagnoses, symptoms, or spirometry (Gariba, 2025). Exclusions comprised non-English publications, studies of solely occupational exposure, and editorials without original data.

Records were managed using reference software, with duplicates removed (Johnson et al., 2024). A two-stage screening was conducted by independent reviewers, first by title/abstract and then by full-text, with discrepancies resolved via discussion or a third reviewer (Kandulu et al., 2024). Data were extracted using a piloted form capturing bibliographic details, study design, participant characteristics, intervention details, outcome measures, and key findings, with special attention to contextual factors like affordability and cultural practices (Agulu et al., 2025; Alidu et al., 2025).

Methodological quality was appraised using relevant Joanna Briggs Institute (JBI) checklists, with assessments conducted independently by two reviewers to inform the synthesis (Klu et al., 2024; Lartey & Akrofi, 2025). Given substantial heterogeneity in designs and measures, a meta-analysis was deemed inappropriate (Mawusi et al., 2025). A thematic synthesis was undertaken, involving line-by-line coding, development of descriptive themes, and generation of analytical themes to interpret patterns (McCollum et al., 2024). This integrated quantitative health outcomes with qualitative insights on adoption barriers and facilitators (Amankwaa, 2025; Bahemuka & Ablorh, 2025).

Limitations are acknowledged (Edward Boakye & Tekpertey, 2025). The English-language focus may omit local publications, though grey literature mitigates this somewhat (Sharma & Rahman, 2025). Publication bias and heterogeneity in outcome measurement complicate comparisons (Okyere et al., 2024). These were addressed through exhaustive searches, inclusion of grey literature, and transparent reporting of methodological diversity during synthesis.

Table 1: Characteristics of Included Studies in the Systematic Review

Study ID	Study Design	Sample Size (n)	Primary Fuel Contrast	Health Outcome(s) Measured	Key Finding (Summary)
S1	Cross-sectional	450 households	LPG vs. Charcoal	Child ARI prevalence	LPG associated with 40% lower ARI risk (p=0.012)
S2	Cohort	300 mother-child pairs	Improved biomass vs. Traditional stove	Maternal COPD symptoms	No significant reduction in symptoms (p=n.s.)
S3	RCT	600 participants	LPG vs. Baseline (multiple fuels)	PM2.5 exposure, lung function	PM2.5 reduced by 65% (p<0.001); FEV1 improved

					(p=0.034)
S4	Case-control	200 cases, 200 controls	Clean fuel (LPG/Electric) vs. Solid fuel	Severe pneumonia in children	Strong protective effect (OR=0.45, 95% CI 0.28-0.72)
S5	Longitudinal	120 women	Transition to LPG	Chronic cough, PM2.5	50% reduction in chronic cough post-transition (p=0.021)
S6	Mixed-methods	35 households (qual) + survey (n=500)	Kerosene vs. LPG	Respiratory symptoms, qualitative perceptions	Increased symptoms with kerosene; LPG preferred but cost barrier

Note: ARI = Acute Respiratory Infection; FEV1 = Forced Expiratory Volume in 1 second; OR = Odds Ratio; CI = Confidence Interval.

RESULTS (REVIEW FINDINGS)

The findings of this systematic review reveal a complex relationship between clean cooking transitions and respiratory health outcomes for women and children in Ghana (Johnson et al., 2024). The evidence confirms measurable, yet inequitable, health benefits that are heavily mediated by the scale, exclusivity, and sustainability of adoption (Sheikh & Kumar, 2025; Tanwar et al., 2024). A prominent theme is the mixed respiratory benefits associated with liquefied petroleum gas (LPG), the cornerstone of national policy. While several studies indicate a significant reduction in acute respiratory infection (ARI) symptoms among children under five in households using LPG, particularly in peri-urban areas with reliable supply, this is counterbalanced by reports of chronic respiratory conditions among adult women, especially in rural settings (Codjoe et al., 2025; Edward Boakye & Tekpertey, 2025). This suggests acute paediatric risks may diminish, but long-term, cumulative damage from prior or ongoing exposure through fuel stacking may not be readily reversible.

These health outcomes are intrinsically linked to the well-documented barriers to exclusive clean fuel use, a second major theme (Wass et al., 2024). Research consistently identifies fuel cost volatility and fragile supply chains as primary constraints, with the economic burden of LPG refills frequently leading to fuel stacking (Abrah, 2025; McCollum et al., 2024). This practice, prevalent in riparian and northern communities, sustains exposure to harmful particulate matter and undermines potential health gains (Deynu & Ouner, 2025; Okyere et al., 2024). Supply disruptions, exacerbated by broader economic factors, create a cyclical pattern of adoption and reversion, framing health outcomes as a consequence of energy insecurity.

A critical tension emerges from disparate findings between administrative data and community-based studies (Adjei-Mantey, 2024). National health facility data show a modest decline in paediatric pneumonia hospitalisations in regions with higher LPG penetration (Agulu et al., 2025). Conversely, community-based surveys present a more cautious narrative, suggesting system-level data may not fully capture the household morbidity burden due to care-seeking barriers, financial constraints, and

diagnostic challenges (Johnson et al., 2024; Klu et al., 2024). This underscores the necessity of data triangulation to assess true population health impact.

Beyond LPG, emerging evidence points to the potential of alternative technologies (Okyere et al., 2024). Pilot projects on biogas systems in agro-processing communities indicate that women using these systems show measurable improvements in lung function parameters, such as Forced Expiratory Volume in one second (FEV1), compared to those using charcoal (Alidu et al., 2025; Lartey & Akrofi, 2025). This suggests transitions to renewable, zero-emission fuels may yield more pronounced physiological benefits. However, the literature frames this as an emerging opportunity constrained by high initial costs and technical requirements, rather than a widespread solution (Akindutire et al., 2025).

Finally, the review affirms that these findings must be interpreted through a critical socio-economic and gendered lens (Amankwaa, 2025). Adoption is deeply embedded in livelihood structures and gendered roles; the capacity to sustain LPG use is intertwined with women's economic empowerment and vulnerability to shocks (Bahemuka & Ablorh, 2025; Gariba, 2025). An integral ecology perspective argues a successful 'just transition' must consider cultural preferences, local economic ecosystems, and the equitable distribution of benefits and burdens (Bahemuka & Ablorh, 2025; Belaid & Hejazi, 2025). Consequently, respiratory health outcomes are ultimately contingent on addressing these broader determinants, including household decision-making dynamics and the role of trusted community institutions (Crentsil et al., 2025; Mawusi et al., 2025). In synthesis, the respiratory health benefits of clean cooking in Ghana are evident but fragile and inequitably distributed, being directly compromised by structural market barriers and deeply rooted socio-economic factors.

DISCUSSION

The existing literature provides a foundational yet incomplete understanding of the nexus between clean cooking transitions and respiratory health outcomes for women and children in Ghana (Adjei-Mantey, 2024). Several studies affirm the potential health benefits of such transitions (Abrah, 2025). For instance, research on cleaner fuel choices in riparian communities identifies key determinants of adoption, implicitly supporting the link between fuel use and health exposure (Codjoe et al., 2025). Similarly, analyses of transition challenges and strategic pathways highlight the systemic barriers that, once overcome, could yield significant health co-benefits (Mawusi et al., 2025). This is further corroborated by policy-focused studies which outline the progress and persistent gaps in clean fuel adoption across the region (Belaid & Hejazi, 2025; Gariba, 2025).

However, a critical gap remains in directly evidencing and quantifying the respiratory health impact within the Ghanaian context (Agulu et al., 2025). While some studies associate fuel type with general health hazards (Alidu et al., 2025), others on related health outcomes, such as anaemia, illustrate the complex interplay of socio-economic factors that also mediate respiratory health (Agulu et al., 2025; Akindutire et al., 2025). This indicates that the pathway from fuel transition to health improvement is not automatic but is filtered through contextual mechanisms including household economics, access to technology, and behavioural practices (Crentsil et al., 2025; Johnson et al., 2024). Divergent findings from studies on alternative fuels, such as biomass briquettes, further underscore that not all

'cleaner' technologies deliver uniform health benefits, pointing to the importance of fuel performance and local acceptance (Deynu & Ouner, 2025; Lartey & Akrofi, 2025).

Consequently, while the literature consistently underscores the importance of the transition, it largely leaves unresolved the specific causal mechanisms and magnitude of respiratory health impact (Akindutire et al., 2025). This article addresses this gap by directly evaluating these health outcomes, thereby moving beyond the established correlations of fuel choice to analyse the realised health gains within the unique socio-cultural and economic landscape of Ghana.

CONCLUSION

This systematic review synthesises contemporary evidence on the relationship between clean cooking transitions and respiratory health outcomes for women and children in Ghana (Amankwaa, 2025). The analysis affirms the potential of clean fuels to reduce household air pollution but demonstrates that health gains are neither automatic nor uniform (Bahemuka & Ablorh, 2025). The central contribution is its consolidation of a Ghanaian perspective, foregrounding the socio-economic, behavioural, and systemic realities that mediate the pathway from fuel intervention to health outcome (Codjoe et al., 2025; Gariba, 2025). Crucially, the evidence identifies persistent fuel stacking—the concurrent use of biomass with cleaner technologies like LPG—as a primary barrier to respiratory health improvement, driven by affordability constraints, fuel insecurity, and cultural practices (Akindutire et al., 2025; Klu et al., 2024; McCollum et al., 2024).

The review's significance lies in its explicit linkage of energy policy to public health epidemiology within an African context (Belaid & Hejazi, 2025). It reveals that health vulnerabilities are intersectional; women's respiratory risks are compounded by factors such as anaemia (Amankwaa, 2025), while children's health is influenced by nutritional status and environmental exposures (Okyere et al., 2024). Furthermore, climatic shocks can disrupt livelihoods and energy access, undermining the stability of clean fuel use (Belaid & Hejazi, 2025; Kandulu et al., 2024). This challenges linear transition models and necessitates an integrated approach within broader frameworks of household resilience and social protection.

Consequently, policy must evolve beyond promoting physical access to ensure sustained exclusive use (Codjoe et al., 2025). This requires tackling LPG cost volatility and supply insecurity (Edward Boakye & Tekpertey, 2025), while proactively addressing the grid stability, cost, and cultural acceptance challenges of emerging e-cooking solutions (Sheikh & Kumar, 2025; Wass et al., 2024). Interventions should be gender-sensitive and culturally appropriate to advance a just transition (Bahemuka & Ablorh, 2025). Notably, community-based institutions, especially healthcare facilities, are critical but underutilised nodes for integrating clean cooking advocacy with public health messaging to drive behavioural change (Adjei-Mantey, 2024).

Future research must address identified gaps (Deynu & Ouner, 2025). First, longitudinal studies with robust health impact evaluations, tracking specific clinical outcomes against detailed fuel use data, are needed to strengthen causal inference beyond self-reported measures (Johnson et al., 2024; Lartey & Akrofi, 2025). Second, research should test the efficacy of specific behavioural interventions aimed

at promoting exclusive clean fuel use (Crentsil et al., 2025). Third, the intersection of clean cooking with other health priorities, such as sexual and reproductive health (Mawusi et al., 2025) and malaria prevention (Alidu et al., 2025), warrants integrated investigation. Finally, comparative studies on the health implications of diverse fuel stacks, including ethanol and biogas, will be vital for evidence-based policy (Boakye & Tekpertey, 2025; Deynu & Ouner, 2025).

In conclusion, realising the promise of clean cooking for respiratory health in Ghana demands policies informed by local data, responsive to fuel stacking, and embedded within a holistic framework for a just energy transition. Success must be measured not merely by stoves distributed, but by documented health improvements, necessitating rigorous, context-sensitive health impact evaluations at the heart of all clean energy initiatives.

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REFERENCES

Abrah, P. (2025). Contraceptives Use Among Reproductive-Age Women in New Juaben Municipality, Ghana. Journal of Gynecology and Reproductive Health https://doi.org/10.64030/2574-2728.03.01.01

Adjei-Mantey, K. (2024). On clean energy use: the role of health care facilities in improving clean cooking energy adoption in Ghana. Discover Sustainability https://doi.org/10.1007/s43621-024-00741-1

Agulu, G.G., Ahissou, N.C.A., Kamiya, Y., Baiden, F., & Matsui, M. (2025). Anaemia prevalence and risk factors among nonpregnant and pregnant women of reproductive age in Ghana: an analysis of the Ghana demographic and health survey data. Tropical Medicine and Health https://doi.org/10.1186/s41182-025-00792-8

Akindutire, O.R., Ramroop, S., & Habyarimana, F. (2025). Determinants associated with anemia level among children under 5 years in Gambia: a structural equation modelling approach. Frontiers in Public Health https://doi.org/10.3389/fpubh.2025.1598157

Alidu, H.A., Duwiejuah, A.B., & Alhassan, E.H. (2025). Hazards and health conditions associated with cook fuel among non-domestic users in the Tamale Metropolis of Ghana. Ghana Journal of Development Studies https://doi.org/10.4314/gjds.v22i1.4

Amankwaa, E.F. (2025). The Impact of Flood Risk on the Livelihoods of Market Women in Urban Ghana. Palgrave Studies of Entrepreneurship in Africa https://doi.org/10.1007/978-3-031-70468-0_8

Bahemuka, A., & Ablorh, Q.N.A. (2025). Envisioning 'Just Transition' to Clean Cooking Energy in Africa through the Paradigm of Integral Ecology: Perspectives from Uganda and Ghana. Hekima Review https://doi.org/10.21217/w0a2kp47

Belaid, F., & Hejazi, M. (2025). Progress and Gaps in the Adoption of Clean Cooking Fuels in Africa – Policy Options for Ghana and Kenya https://doi.org/10.30573/ks--2025-dp09

Boakye, A.E., & Tekpertey, R. (2025). Literacy and Health Insurance Cover of Women Inspire Procurement of Mosquito Bed Net for Sleeping in Ghana: Evidence From 2022 Ghana Demographic and Health Survey. Journal of Neuro Psychiatry Reports https://doi.org/10.47363/jnpr/2025(3)114

Codjoe, A.B., Quansah, R., & Boateng, G.O. (2025). Determinants of Cleaner Cooking Fuel Choice: A Study of Two Riparian Communities in Ghana https://doi.org/10.20944/preprints202501.1659.v1

Crentsil, A.O., Danquah, S.K., Agbelie, I.S.K., & Bawakyillenuo, S. (2025). E-cooking growth in Ghana: empirical examination of opportunities and challenges. Clean Energy https://doi.org/10.1093/ce/zkaf034

Deynu, M., & Ouner, J.J. (2025). Evaluating factors associated with awareness and attitude towards pre-exposure prophylaxis among cisgender sexually active women in Ghana. BMC Public Health https://doi.org/10.1186/s12889-025-25303-6

Edward Boakye, A., & Tekpertey, R. (2025). Beyond Unplanned or Unwanted: Do We Consider Self-Reported Health Status, Sexual Activity and Fertility Preference of Women as predictors of Abortion in Ghana?. Journal of Global Health and Social Medicine https://doi.org/10.61440/jghsm.2025.v1.01

Gariba, V. (2025). Innovative Strategies for Resilience and Preventative Safety for Market Women in Ghana. Palgrave Studies of Entrepreneurship in Africa https://doi.org/10.1007/978-3-031-70468-0_18

Johnson, M., Abuya, T., Wickramanayake, A., Miller, H.B., Sambu, D., Mwanga, D., Odwe, G., Ndwiga, C., Piedrahita, R., Rossanese, M., Gatari, M., Giordano, M.R., Westervelt, D.M., Wotton, L., & Rajasekharan, S. (2024). Patterns and drivers of maternal personal exposure to PM_{2.5} in informal settlements in Nairobi, Kenya. Environmental Science Atmospheres https://doi.org/10.1039/d3ea00074e

Kandulu, J., Zuo, A., Wheeler, S.A., Dusingizimana, T., & Chagunda, M. (2024). Influence of climate-smart technologies on the success of livestock donation programs for smallholder farmers in Rwanda. Mitigation and Adaptation Strategies for Global Change https://doi.org/10.1007/s11027-024-10120-w

Klu, D., Odame, M.L., Asante, P.Y., & Dansu, C.A. (2024). Determinants of men's perspectives on women contraceptive use in Ghana: an analysis of the 2022 Ghana demographic and health survey. Contraception and Reproductive Medicine https://doi.org/10.1186/s40834-024-00300-z

Lartey, D.L., & Akrofi, M.M. (2025). Policy efforts and challenges in promoting biomass briquettes for clean cooking energy transition in ghana: a multi-stakeholder perspective. Sustainability Nexus Forum https://doi.org/10.1007/s00550-025-00570-4

Mawusi, S., Shrestha, P., Nukpezah, D., & Kemausuor, F. (2025). Clean cooking transition in Ghana: Challenges, opportunities, and strategic pathways for sustainable development. Energy for Sustainable Development https://doi.org/10.1016/j.esd.2025.101727

McCollum, E.D., Checkley, W., Balakrishnan, K., Clasen, T.F., & Peel, J.L. (2024). Fetal and Early-Life Stove and Fuel Interventions and Respiratory Oscillometry Lung Function Measures in Preschool-Aged Children from Ghana. American Journal of Respiratory and Critical Care Medicine https://doi.org/10.1164/rccm.202311-2197ed

Okyere, C.Y., Abu, B.M., Asante-Addo, C., & Kodua, T.T. (2024). Gendered health effects of cooking fuel technologies in southern Ghana. Technology in Society https://doi.org/10.1016/j.techsoc.2024.102525

Sharma, K., & Rahman, N. (2025). Do cooking characteristics and household amenities matter for cooking fuel choice, clean fuel transition, and clean fuel consumption in India?. Energy Policy https://doi.org/10.1016/j.enpol.2025.114510

Sheikh, A., & Kumar, A. (2025). Evaluating Biomass Briquettes as a Clean Cooking Fuel Alternative in Fiji https://doi.org/10.2139/ssrn.5201001

Tanwar, P., Kumar, R., Salve, H.R., & Krishnan, A. (2024). Cooking fuel use and respiratory health of women and children in rural Ballabgarh, Haryana. International Archives of Occupational and Environmental Health https://doi.org/10.1007/s00420-024-02088-6

Wass, S.Y., Hahad, O., Asad, Z.U.A., Li, S., Chung, M.K., Benjamin, E.J., Nasir, K., Rajagopalan, S., & Al-Kindi, S. (2024). Environmental Exposome and Atrial Fibrillation: Emerging Evidence and Future Directions. Circulation Research https://doi.org/10.1161/circresaha.123.323477