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Impact of Pradhan Mantri Ujjwala Yojana on Women's Health in Uttar Pradesh: Evidence from Secondary Data Analysis

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Abstract
Women's health constitutes a fundamental pillar of human development and social progress, particularly in developing regions where gendered roles expose women to disproportionate health risks. In rural India, continued reliance on traditional biomass fuels such as firewood, dung cakes, and coal has contributed to severe indoor air pollution, adversely affecting women's respiratory and overall health. In this context, the Pradhan Mantri Ujjwala Yojana (PMUY), launched in 2016, represents a significant policy intervention aimed at promoting access to clean cooking fuel among economically disadvantaged households.
The present study examines the role of PMUY in improving women's health in Uttar Pradesh through an analytical framework based on secondary data derived from National Family Health Surveys (NFHS-4 and NFHS-5), government reports, and relevant literature. The analysis indicates a significant increase in LPG adoption and a corresponding decline in exposure to smoke-related health risks among rural women. The findings further suggest that the scheme has contributed to improved health conditions and enhanced socio-economic empowerment. However, persistent challenges such as affordability of refills and uneven rural accessibility continue to constrain its long-term effectiveness. The study concludes that PMUY holds transformative potential, provided that policy support is sustained and implementation gaps are effectively addressed.
Keywords: *PMUY, Women's Health, Clean Fuel, Uttar Pradesh, Indoor Air Pollution, LPG*

I. Introduction

Health is a central determinant of human well-being and national development, and within this framework, women's health assumes particular significance. Globally, household air pollution remains one of the leading environmental health risks, particularly in developing countries where reliance on traditional fuels is widespread. In India, especially in rural areas, women are primarily responsible for cooking and household management, which exposes them to hazardous indoor environments when traditional fuels are used. Biomass fuels such as firewood, crop residues, and dung cakes release high levels of particulate matter and toxic gases, contributing significantly to indoor air pollution. Prolonged exposure to such pollutants has been linked to respiratory infections, chronic obstructive pulmonary disease (COPD), eye irritation, cardiovascular issues, and adverse pregnancy outcomes.

Uttar Pradesh, being the most populous state in India, presents a critical case for analyzing the intersection between energy poverty and women's health. A substantial proportion of its population resides in rural areas where access to clean energy has historically been limited. Women in these regions spend considerable time collecting fuel and cooking in poorly ventilated spaces, thereby increasing their exposure to harmful pollutants and reducing their overall well-being. This not only affects their physical health but also contributes to time poverty and limits their participation in economic and social activities.

Recognizing the adverse implications of traditional cooking practices, the Government of India launched the Pradhan Mantri Ujjwala Yojana (PMUY) in 2016 as a major clean energy initiative. The scheme aims to provide subsidized LPG connections to women from economically weaker households, thereby facilitating a transition from polluting fuels to cleaner alternatives. Beyond its primary objective of energy access, PMUY seeks to reduce indoor air pollution, improve health outcomes, minimize physical drudgery, and enhance women's dignity and empowerment. By targeting women as primary beneficiaries, the scheme also incorporates a gender-sensitive approach to development.

Against this backdrop, the present study aims to analyze the extent to which PMUY has contributed to improving women's health in Uttar Pradesh using secondary data sources. The study further seeks to understand whether increased access to clean cooking fuel has translated into measurable improvements in health conditions and overall quality of life among rural women.

II. Research Methodology

The present study adopts a descriptive and analytical research design based entirely on secondary data sources. The analysis is confined to the state of Uttar Pradesh, which has been selected due to its large rural population and historically low access to clean cooking fuel. Data has been collected from reliable and authoritative sources, including the National Family Health Surveys (NFHS-4, 2015–16 and NFHS-5, 2019–21), reports of the Ministry of Petroleum and Natural Gas, government publications, and relevant peer-reviewed academic literature.

The study focuses on key indicators such as the extent of clean cooking fuel usage, prevalence of respiratory and related health issues, women's participation in household decision-making, and broader environmental and living conditions. A comparative approach has been employed to assess changes over time, particularly between NFHS-4 and NFHS-5, in order to evaluate the impact of PMUY on women's health outcomes.

The analysis is primarily based on percentage comparisons and trend evaluation, supported by thematic interpretation to understand the broader socio-economic implications of LPG adoption. This approach enables the study to examine both quantitative changes and qualitative improvements in women's health and living conditions.

However, the study is subject to certain limitations. Since it relies on secondary data, it does not capture micro-level variations or individual household experiences. Additionally, health improvements cannot be attributed solely to PMUY, as other welfare schemes and external factors may also influence outcomes. Despite these limitations, the methodology provides a reliable and comprehensive framework for analyzing the broader impact of clean cooking fuel adoption on women's health.

III. Literature Review

Existing literature strongly establishes the relationship between cooking fuel and women's health, with a consistent emphasis on the adverse effects of biomass fuel usage. Studies indicate that reliance on traditional fuels leads to high levels of indoor air pollution, which significantly increases the risk of respiratory and other health-related problems among women.

Mishra et al. (2021) highlight that access to clean cooking fuel plays a crucial role in reducing exposure to harmful pollutants, thereby improving respiratory health outcomes. Similarly, **Sharma and McDonough (2020)** argue that prolonged exposure to smoke from traditional fuels contributes to chronic respiratory diseases, eye irritation, and long-term health complications, ultimately affecting women's overall well-being. **Ghosh et al. (2024)** extend this discussion by examining the socio-economic implications of clean fuel adoption. Their study suggests that the use of LPG not only improves health conditions but also reduces the time spent on fuel collection, thereby enhancing productivity and enabling women to participate more actively in economic and social activities. **Akter and Pratap (2022)** further emphasize the environmental dimension, linking clean energy adoption with reduced emissions and improved public health outcomes. From an international perspective, **Suzuki et al. (2023)** demonstrate that clean cooking initiatives across developing countries have contributed significantly to both health improvements and gender empowerment. These findings underline the broader developmental significance of transitioning to clean energy sources.

Overall, the literature clearly indicates that access to clean cooking fuel is not merely an energy-related concern but a critical factor influencing health, gender equality, and socio-economic development. However, there remains a need for region-specific studies, particularly in the context of Uttar Pradesh, to better understand the localized impact of PMUY on women's health, which the present study seeks to address.

IV. Results and Discussion

Increase in Clean Fuel Adoption

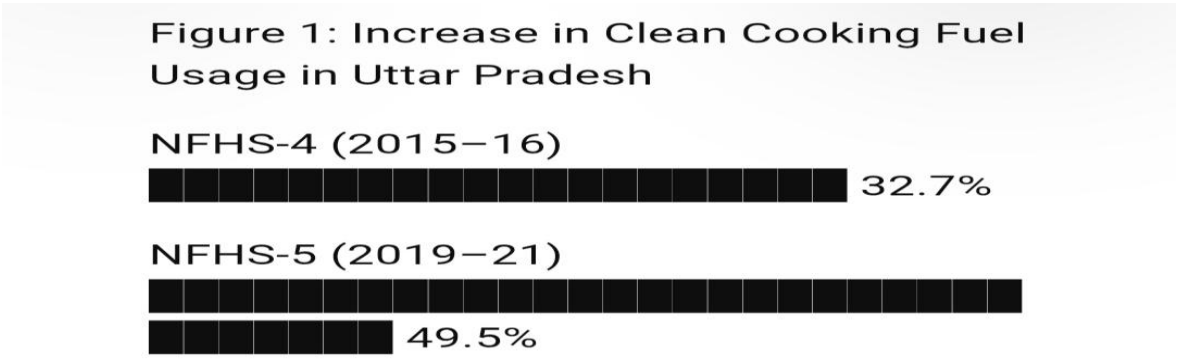
The introduction of the Pradhan Mantri Ujjwala Yojana (PMUY) has led to a significant increase in the adoption of clean cooking fuel in Uttar Pradesh. The scheme has played a crucial role in facilitating access to LPG, particularly among rural and economically weaker households that were previously dependent on traditional biomass fuels.

Table 1: Clean Cooking Fuel Usage in Uttar Pradesh

Indicator	NFHS-4 (2015-16)	NFHS-5 (2019-21)	Change
Households using clean fuel (%)	32.7 %	49.5 %	+16.8%

The data presented in Table 1 clearly indicates a substantial increase of 16.8 percentage points in the use of clean cooking fuel over the period between NFHS-4 and NFHS-5. This rise reflects the growing penetration of LPG connections under PMUY. The increase is particularly significant in rural areas, where dependence on traditional fuels such as firewood and dung cakes was historically high. The shift toward clean fuel not only represents an improvement in energy access but also marks a transition toward healthier and more

sustainable living conditions.
To further illustrate this transition, the following pie chart presents the distribution of clean fuel usage before and after the implementation of PMUY.



The above figure clearly illustrates the increase in the adoption of clean cooking fuel in Uttar Pradesh between NFHS-4 and NFHS-5. The visual comparison shows a noticeable rise in LPG usage from 32.7 percent to 49.5 percent. This increase reflects the growing impact of the Pradhan Mantri Ujjwala Yojana in promoting clean energy adoption among rural households. The expansion in clean fuel usage indicates a gradual shift away from traditional biomass fuels, contributing to improved household environments and better health outcomes for women.

The increase in clean fuel adoption can also be understood in the context of targeted policy implementation and subsidy support under PMUY. The scheme specifically focused on economically weaker households, ensuring that women from below poverty line families received LPG connections in their own names. This approach not only improved access but also encouraged adoption by reducing initial financial barriers. However, it is important to note that while access has increased significantly, sustained usage depends on affordability and consistent availability. In many cases, households continue to use traditional fuels alongside LPG, indicating that adoption does not always translate into exclusive usage. Nevertheless, the observed increase reflects a structural shift in rural energy consumption patterns.

Impact on Women's Health
The transition from biomass fuels to LPG has had a direct and positive impact on women's health. Women in households using clean fuel are exposed to significantly lower levels of indoor air pollution, which reduces the risk of respiratory illnesses, eye irritation, and other health complications. The reduction in smoke inside the kitchen environment has improved overall comfort and reduced physical strain associated with cooking.
Indoor air pollution has long been identified as a major contributor to respiratory diseases among rural women. The use of LPG minimizes the emission of harmful pollutants such as carbon monoxide and particulate matter, thereby lowering the incidence of chronic respiratory conditions. In addition to physical health improvements, women also experience psychological relief, as cooking becomes less stressful and more convenient. This transition contributes to improved well-being and enhances the overall quality of life.

Figure 2: Impact of LPG Usage on Women's Health
Use of LPG
↓
Reduction in Indoor Smoke
↓
Lower Exposure to Harmful Pollutants
↓
Decrease in Respiratory Problems and Eye Irritation
↓
Improved Physical Comfort and Reduced Drudgery
↓
Better Mental Well-being and Quality of Life
The above figure illustrates the pathway through which the adoption of LPG contributes to improved health outcomes among rural women. The use of clean cooking fuel reduces indoor smoke and exposure to harmful pollutants, which in turn lowers the incidence of respiratory diseases and eye-related problems. These

improvements enhance physical comfort and reduce the burden of cooking, ultimately leading to better mental well-being and an improved quality of life.

In addition to physical health improvements, the adoption of LPG has also contributed to reducing long-term health risks that often go unnoticed. Continuous exposure to biomass smoke is associated with chronic conditions that develop gradually over time. By minimizing such exposure, LPG usage helps in preventing the cumulative health burden faced by rural women. Furthermore, cleaner cooking environments improve indoor air quality for all household members, including children and the elderly, thereby creating a healthier living environment overall.

Improvement in Broader Health Indicators

The improvement in access to clean cooking fuel has coincided with positive changes in broader health indicators in Uttar Pradesh. For instance, the Infant Mortality Rate declined from 63.5 in NFHS-4 to 50.4 in NFHS-5, reflecting improvements in maternal and child health conditions. While these changes cannot be attributed solely to PMUY, the reduction in indoor air pollution plays an important supporting role.

Improved cooking conditions contribute to better maternal health, as women are less exposed to harmful smoke during pregnancy. Additionally, increased awareness of hygiene and health practices, supported by various government initiatives, has further strengthened health outcomes. The combined effect of improved environmental conditions and enhanced health awareness has contributed to a gradual improvement in overall public health indicators in the state. It is also important to recognize that improvements in health indicators are the result of multiple interrelated factors. Government initiatives related to healthcare, sanitation, and nutrition have collectively contributed to better outcomes. However, the role of clean cooking fuel remains significant, as it directly addresses environmental health risks within households. The reduction in indoor pollution complements these initiatives by creating safer and healthier living conditions.

Women's Empowerment

PMUY has also contributed significantly to women's empowerment through multiple pathways. One of the most notable aspects of the scheme is that LPG connections are issued in the name of women, which enhances their visibility and role within the household. This recognition strengthens women's position as primary decision-makers in matters related to household energy use. The data indicates an increase in women's participation in household decision-making, rising from 81.7 percent to 87.6 percent. This improvement reflects a gradual shift toward greater gender equality and empowerment. Furthermore, the adoption of LPG has reduced the physical burden associated with fuel collection and traditional cooking practices. Women no longer need to spend long hours collecting firewood, which allows them to utilize their time more productively. Time savings have enabled women to engage in childcare, household management, and in some cases, income-generating activities. This improved time utilization enhances their economic and social participation, thereby contributing to overall empowerment. The scheme, therefore, not only improves health but also strengthens women's socio-economic position.

Impact Pathway of PMUY on Women's Health

The impact of PMUY on women's health can be understood through a structured pathway:

PMUY Implementation
↓
Access to LPG
↓
Reduction in Biomass Fuel Use
↓
Lower Indoor Air Pollution
↓
Improved Women's Health
↓
Enhanced Productivity and Empowerment

This pathway highlights the interconnected nature of the scheme's impact. Improved access to clean fuel leads to environmental improvements within households, which in turn result in better health outcomes. These improvements further enhance women's productivity and contribute to their empowerment.

V. Challenges and Limitations

Despite the positive outcomes, several challenges continue to affect the long-term effectiveness of PMUY. One of the primary issues is the affordability of LPG refills. While the initial connection is subsidized, the recurring cost of refills can be a burden for economically weaker households. As a result, some households revert to traditional fuels or adopt a mixed usage pattern known as fuel stacking.

Accessibility also remains a concern in remote rural areas, where LPG distribution networks are limited or irregular. Delays in cylinder delivery and lack of nearby distribution centers discourage consistent usage. Additionally, awareness regarding the long-term health benefits of LPG remains uneven, which affects behavioral change.

These challenges indicate that while PMUY has successfully improved access to clean cooking fuel, sustained usage requires continued policy support, improved infrastructure, and targeted awareness programs.
Another critical challenge is the issue of behavioral adaptation. Even after receiving LPG connections, some households continue to rely on traditional fuels due to long-standing habits and perceived cost advantages. This practice of fuel stacking reduces the overall effectiveness of the scheme. Additionally, lack of awareness regarding the long-term health benefits of clean fuel further limits sustained adoption. Addressing these behavioral and informational barriers is essential for ensuring that the benefits of PMUY are fully realized over time.

VI. Suggestions and Policy Recommendations

To enhance the effectiveness and sustainability of PMUY, several policy measures are necessary. Ensuring the affordability of LPG refills is critical for sustained adoption, and this can be achieved through targeted subsidies and flexible payment options. Strengthening distribution infrastructure in rural areas will improve accessibility and ensure timely availability of LPG cylinders.

Awareness campaigns should be intensified to educate beneficiaries about the health and environmental benefits of clean cooking fuel. Integrating PMUY with other welfare schemes related to health, nutrition, and women's empowerment can create a more comprehensive development framework. Furthermore, strengthening monitoring and evaluation mechanisms will help identify implementation gaps and improve scheme performance. Encouraging regular usage of LPG through incentives and behavioral interventions can also reduce dependence on traditional fuels and ensure long-term benefits.

VII. Conclusion

The findings of the study demonstrate that the Pradhan Mantri Ujjwala Yojana has played a significant role in improving women's health in Uttar Pradesh by facilitating a transition to clean cooking fuel. The increase in LPG adoption has reduced exposure to indoor air pollution and contributed to improved health outcomes, enhanced quality of life, and greater empowerment of women.

However, challenges related to affordability, accessibility, and sustained usage remain critical concerns. Addressing these issues through continued policy support and effective implementation strategies is essential for maximizing the long-term impact of the scheme. With sustained efforts, PMUY has the potential to serve as a transformative intervention for promoting public health, environmental sustainability, and gender equality in rural India. From a long-term perspective, the success of PMUY depends on its ability to ensure sustained and exclusive usage of clean cooking fuel. While the scheme has made significant progress in improving access, future policy efforts must focus on affordability, behavioral change, and infrastructure development. A comprehensive approach that integrates energy access with health and social policies will be essential for achieving lasting improvements in women's health and overall well-being.

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