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Barriers to access, adoption and sustained use of cleaner fuels among low income households:

An exploratory study from Delhi and Jharkhand, India

Report | August 2023

CLEANER **AIR** &
BETTER **HEALTH**
PROJECT

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Suggested citation

Sreenivasan, V., Saigal, N., & Shrivastava, S. (2023). **Barriers to access, adoption and sustained use of cleaner fuels among low-income households: An exploratory study from Delhi and Jharkhand, India.** Asar Social Impact Advisors.

Disclaimer

This report is made possible by the generous support of the American people through the United States Agency for International Development (USAID). It has been prepared under the Cleaner Air and Better Health (CABH) Project [Cooperative Agreement 72038621CA00010]. The contents are the responsibility of the project consortium partner Asar Social Impact Advisors and do not necessarily reflect the views of USAID or the United States Government, or the Council on Energy, Environment and Water (CEEW).

Cover image

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Peer reviewers

The authors of this study would like to thank the following reviewers for providing critical feedback and comments to refine this report: Abhishek Kar and Richa Joshi from Council on Energy, Environment and Water (CEEW).

Acknowledgments

The authors and editors would like to express their gratitude to the NGO partner Cornerstone Knowledge Builders, New Delhi and HOPE, Jharkhand for their on-ground support while conducting the study. The authors also extend their thanks to the research partners Gayathri Sreedharan, Sidhi Goyal and Vasudha Chakravarthy at Development Solutions for playing a crucial role in the study and the subsequent report. Special thanks to Ankita Bhatkhande from Asar for copy editing the report.

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The project

Cleaner Air and Better Health (CABH) is a five year (2021 to 2026) project supported by the United States Agency for International Development (USAID). It aims to strengthen air pollution mitigation and reduce exposure to air pollution in India by establishing evidence-based models for better air quality management. The project is being implemented by a consortium led by the Council on Energy, Environment and Water (CEEW) and includes Asar Social Impact Advisors (ASAR), Environmental Design Solutions (EDS), Enviro Legal Defence Firm (ELDF), and Vital Strategies (VS).

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About the Study

Household Air Pollution (HAP) combined with poor air quality is associated with several health hazards, posing a greater risk for women and children in low-income households across India. Burning biomass for cooking and heating is a major contributor to HAP and switching to cleaner fuels like LPG, can be effective for mitigating HAP. The government's efforts to promote clean cooking fuels such as LPG through schemes like Pradhan Mantri Ujjwala Yojana (PMUY) has increased the coverage, yet several barriers exist in access, adoption, and sustained use of LPG.

This exploratory study was undertaken to help understand the use and perceptions around biomass and LPG and capture the perceptions of household air pollution among low-income households. Ten focus groups and nine interviews were conducted in five urban slums of Delhi (both notified and non-notified bastis) and five in villages in rural Jharkhand. The study was carried out during the latter half of May and first half of June, 2022. The findings highlight that for the users, ease of access is more important than ease of use when deciding which fuel to use. Users' perceptions regarding LPG, such as LPG being unsafe, food cooked on LPG being unhealthy and less tasty, combined with supply-side bottlenecks such as challenges in applying for and getting an LPG cylinder, lump-sum cash outflow during ordering refills for an LPG cylinder are some of the factors that act as a hindrance in its sustained use by women in low-income households.

This study was carried out for a specific intervention under the Cleaner Air and Better Health project, which is focused on transition to clean cooking fuels to reduce the exposure to household air pollution. The findings of this study will be used to recommend context level solutions and design pilot interventions with respective State governments that will help improve access to cleaner fuel for low-income households in India.

As part of the study, consultations were held with stakeholders in both Delhi and Jharkhand. In Jharkhand, dialogues and consultations were organized with members of the women Self Help Groups linked to the Jharkhand State Livelihoods Promotion Society (JSLPS), ward members, as well as members of civil society and NGOs working in the state, and specifically in the study district – Lohardaga. Similar process was followed in Delhi, where stakeholders in the community, such as anganwadi workers, ASHA workers, teachers, LPG distributors, community heads and opinion leaders, were consulted during the study.

***Keywords:** Biomass, clean fuel, LPG, low-income households, rural Jharkhand, Delhi slums, women, health, Household Air Pollution (HAP)*

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1.0 Introduction

Household air pollution (HAP) poses health hazards, particularly for vulnerable groups such as women, children, and the elderly in low-income households across urban and rural India (Dutta and Banerjee (2022)). HAP combined with poor air quality is associated with multiple health issues. As per World Health Organization (WHO (2022)), globally 3.2 million people die prematurely every year from illnesses attributable to HAP, like ischemic heart disease, stroke, lower respiratory infection, chronic obstructive pulmonary disease (COPD) and lung cancer. It also led to the “loss of an estimated 86 million healthy life years in 2019, with the largest burden falling on women living in low- and middle-income countries.” (ibid)

HAP can be attributed to the burning of biomass solid fuels for cooking and heating. Biomass burning produces a high concentration of respirable particulate matter, carbon monoxide, nitrogen oxides, formaldehyde, among other harmful gasses and toxic organic compounds (Kankaria, Nongkynrih and Gupta (2014)). Using biomass for cooking leads to greater HAP and its associated health problems, as they contain several damaging pollutants like small particles which can penetrate into the bloodstream through the lungs. Damage to human health becomes worse in less ventilated small settings. As per WHO estimates, “indoor smoke can have levels of fine particles 100 times higher than acceptable” (WHO (2022)).

Since 2016, the government has been promoting the use of clean cooking fuels, particularly LPG, especially among poor and deprived households through its flagship scheme – Pradhan Mantri Ujjwala Yojana (PMUY). Under the Pradhan Mantri Ujjwala Yojana (PMUY), households were given an LPG connection, a gas stove, and one 14.2 kg LPG cylinder. Several new connections were issued under this scheme, with the government meeting 99.8% of the target of releasing 8 crore LPG connections to deprived households by 1 April 2021, which increased to almost 9.5 crore in January 2023 (GoI (2023)). While the rapid expansion in LPG access is commendable through outreach of PMUY, research suggests that having an LPG connection does not ensure its sustained use by households (Mani, Agarwal, Jain and Ganesan (2021)). Moreover, many individuals and households slip through the net owing to a number of supply and demand side factors operating at different levels, such as low awareness about the adverse effects of HAP, limited information on how to avail the scheme benefit, high cost of refilling the cylinders, and lack of transport facilities to obtain the cylinders, among others (Giri and Aadil (2018), Patil et al (2021)). As per the fifth round of the National Family Health Survey 2019–21 (IIPS (2022)), around 41% of households in India continue to use some type of solid fuel as their primary source for cooking, especially wood and

dung cakes. Of these 41% households, around 95% households use chulha for cooking, leading to high levels of exposure to HAP.

As per some of the studies carried out on LPG access, adoption and sustained use, some main factors which constrain the adoption and sustained use of LPG on a regular basis in low-income households include:

1.1 Affordability

Members of low-income households tend to work in the informal economy as daily-wage earners. Their household incomes tend to be volatile and seasonal. For these households, the price of the 14.2 kg LPG cylinder, which costs around ₹1,000/- per refill, is a major hurdle in its usage. Rising fuel prices along with the removal of government subsidies¹ make the LPG cylinder unaffordable. Low-income households, therefore, turn to biomass, or use biomass along with LPG, for cooking and heating. Affordability remains a key reason for the non-adoption and sustained use of LPG as an exclusive cooking fuel among economically backward households. The same is also reflected in the response of the Minister of State for Petroleum and Natural Gas in Rajya Sabha on 1 August 2022, as he shared that “during Financial Year 2021–22, out of the total domestic active customers of 30.53 crore (305.3 million), 2.11 crore (21.2 million) domestic LPG customers had not taken any refill while, 2.91 crore (29.1 million) domestic LPG customers had taken only one refill” (GoI (2022)). This trend is majorly attributed to the high prices of refilling the LPG cylinder (Bhagirath (2022)).

1.2 Gender norms

Women shoulder the responsibility of gathering firewood and cooking. When burning biomass, women are directly exposed to harmful gasses, and particulate matter. They are most susceptible to health issues arising from long-term exposure to HAP (Dutta and Banerjee (2022)). Studies indicate that women’s lack of access to salaried work, disregard for their time and contribution to the household, their low status within the household, and inability to influence household expenditure decisions, can also contribute to poor adoption of LPG and clean cooking fuels (Choudhuri and Desai (2020); Agarwal (1997)).

1.3 Systemic factors, awareness, and perceptions

Systemic factors linked to availability and access also affect LPG usage. Lack of awareness of benefits of using LPG could also be reasons for not using LPG (Anand

1. The government had revoked the subsidy for the LPG cylinder in May 2020. While the Government reintroduced the subsidy of ₹ 200 per cylinder up to 12 cylinders to Ujjwala beneficiaries in May 2022, it had not yet been received by the respondents when the study was conducted in May-June 2022.

(2018)). People's perceptions such as LPG being unsafe, poor taste of food cooked on LPG and its low nutrient value of food cooked on LPG also influence the choice of fuel (Gould and Urpelainen (2018)). These challenges are not limited to rural areas, which are known to have poor energy infrastructure but are also common in urban slums which are expected to have better energy infrastructure and hence better access to LPG.

Objectives of the Study

This exploratory study was carried out as there is a lack of information and knowledge on how Behaviour Change Communication (BCC) approaches can be used as a solution to improve access and adoption of cleaner fuels in India (Sambodhi n.d.). There is limited knowledge on different factors playing out in specific contexts that hinder access, adoption and sustained use of cleaner fuels by households. This knowledge can support in designing targeted interventions that would shift behaviors and households to cleaner fuels.

This study was undertaken to understand the following:

- 1. Norms, attitudes and challenges around biomass use by women in low-income households**
- 2. Access, adoption and sustained use of LPG by the low-income households**
- 3. Perceptions towards HAP of women in low-income households**
- 4. Awareness about the health risks posed by HAP to the women in these households**

This study was carried out for a specific intervention under the Cleaner Air and Better Health project, which is focused on transition to clean cooking fuels to reduce the exposure to household air pollution. The findings of the study will be used to recommend context level solutions and design pilot interventions to help improve access, adoption and sustained use of cleaner fuel for low-income households in Delhi and Lohardaga, Jharkhand.

2.0 Methodology

2.1 Definitions for the purpose of the study

- **Access:** Ability to register for and obtain the clean cooking fuels without delays and ability to raise grievances and get timely redressal
- **Adoption:** When the households start using clean cooking fuels
- **Sustained use:** Continued use of clean cooking fuels by households over time
- **Cleaner fuel:** Fuel that poses lower risk to women's health when used in the household for cooking and heating

2.2 Process followed

The study was conducted using qualitative research methods – Focus Group Discussions (FGDs) and In-depth Interviews (IDIs)—with the identified respondents, to understand the users' (women above 18 years of age who carry out cooking) attitudes and norms which determine their fuel usage patterns and view of the other influential stakeholders in the communities on the fuel choices and use by the people. A total of 10 FGDs and 9 IDIs were conducted across the study locations in Delhi and Jharkhand. Open-ended semi-structured questionnaires were used for conducting the FGDs and the IDIs.

The decision to use a fuel is a complex process. There was a need to understand the decision-making process from the point of view of the users.

An internal Institutional Review Board's (IRB) approval was obtained for conducting the field study by the research team and they complied with IRB requirements and norms. The research team partnered with local civil society groups to help finalize the study sites and identify the study respondents. The partnership also helped the team gain trust of the respondents for facilitating an open discussion and sharing of relevant information by them, without hesitation.

Focused Group Discussions and interviews were conducted with the user groups and opinion leaders. FGDs allow participants to agree or disagree with each other and provide insight into a range of opinions about an issue, as well as capture various

2. An accessible clean fuel at the moment is LPG, given the scale and coverage of PMUY scheme. But there are other clean alternatives that need to be explored and popularized

beliefs, experiences and practices. Interviews were conducted with opinion leaders such as the panchayat head, and heads of Self-Help Groups (SHGs), in addition to LPG distributors to supplement data collected from FGDs.

Oral consent was sought from participants before the start of each IDI and FGD and these were audio recorded. The audio recordings were transcribed, and the transcripts were used for the analysis.

In addition to the FGDs and the IDIs during the study, a series of consultations were carried out with stakeholders in both Delhi and Jharkhand. In Jharkhand, dialogues and consultations were held with members of the women Self Help Groups linked to the Jharkhand State Livelihoods Promotion Society (JSLPS), ward members, as well as members of civil society and NGOs working in the state and specifically in the study district – Lohardaga. Similar process was followed in Delhi, where stakeholders in the community, such as anganwadi workers, ASHA workers, teachers, LPG distributors, community heads and opinion leaders, were consulted during the study.

2.3 Selection of study sites

This study focuses on low-income households in rural and urban areas in the two states with the highest and lowest use of solid fuel for cooking – Jharkhand (67.8%) and Delhi (0.8%) respectively – as per the fifth round of the National Family Health Survey (IIPS (2022)). Data was collected in urban slums of Delhi and rural villages in the Lohardaga district of Jharkhand.

2.3.1. Criteria for selection of study sites in Delhi

Delhi is one of the most polluted cities in the world with high levels of air pollution and poor air quality. A survey conducted between 2018 and 2020 by the Energy Policy Institute at the University of Chicago found that in Delhi the levels of PM 2.5 were higher indoors than those found on outdoor air quality monitors and were much higher than the recommended limits by the WHO (EPIC (2021)). Despite near-universal coverage of LPG in Delhi, urban poor continue to burn biomass for heating and cooking, either exclusively or in combination with LPG. Poor ambient air quality coupled with indoor air pollution make members of these households vulnerable to respiratory diseases.

In Delhi, focus groups were divided between residents of notified bastis and non-notified bastis³. Notified bastis are recognized by the government and have infrastructure such as electricity, water and sanitation. Notified bastis also have proper addresses (street name or house numbers) and people residing here can furnish an address proof. In contrast, non-notified bastis are not recognized by the government.

3. Basti is a Hindi name for slums inhabited by poor people in India

Residents of these bastis are under constant threat of eviction and do not have essential infrastructure like electricity, water and sanitation. Houses in non-notified bastis did not have house numbers and it was not possible for them to provide address proof. These bastis in Delhi were identified with help of our local civil society partner in Delhi (names of bastis are given in table 1 below).

Communities in notified bastis had access to and had transitioned to LPG cylinders. Communities living in non-notified bastis did not have access to LPG or were not using LPG; they were using biomass fuels like wood, cow dung, coal, and cloth among others.

2.3.2. **Criteria for selection of study sites in Jharkhand**

In Jharkhand, study was undertaken in the Lohardaga district, which has a large tribal population, with nearly 60% of the people belonging to Scheduled Tribes. Less than 35% of the population in the district use clean cooking fuels as per the NFHS-5 (IIPS (2022)). This district was also chosen for its active involvement in organizing women into self-help groups (SHGs) and creating income generating activities under the Jharkhand State Livelihoods Promotion Society (JSLPS).

Two aspects were considered in selecting the study blocks – concentration of tribal populations (as per Census 2011) and distance from the LPG distribution center. The assumption made was that villages close to an LPG distribution center would have more LPG connections than ones located far from it (PPAC (2016)). Another assumption was that the villages with high tribal populations have poorer infrastructure and poor access to LPG (Patnaik and Jha (2020)).

Based on the above criteria, participants for the study were selected from two administrative blocks in the Lohardaga district—Lohardaga and Senha, both having a high concentration of tribals and presence of LPG distribution centers. The selection was done in consultation with the local civil society partner. Data from these locations is intended to represent the experiences of vulnerable and marginalized communities while making fuel choices.

2.3.3. **Study sample selected in Delhi and Jharkhand and number of FGDs conducted**

A total of 10 FGDs were conducted for the study, five in Delhi and five in Jharkhand. In Delhi, three FGDs were conducted with the non-notified bastis and two with notified bastis. For getting a contrast between the notified and non-notified bastis, a higher number of FGDs were conducted in non-notified bastis to get more information from them, as they were under-represented.

In Jharkhand, the Ujjwala scheme has reached its point of saturation. Most households have access to LPG cylinders which were distributed to them during one of the camps organized by the government. Only a few households don't have LPG connections and these are ones that had migrated to some other place during the time when the camps

were organized. Hence, the bifurcation between villages based on their access to LPG cylinders was not possible. Due to the saturation of Ujjwala scheme, there was homogeneity in terms of composition of groups. All groups across 5 villages included a mix of people who were using both LPG cylinders and biomass. In each group, there were people who had access to LPG but were using biomass, who had access to LPG and used it occasionally and people who didn't have access to LPG. The details of the FGDs are given below:

Table 1: Details of the FGDs conducted

State	Study sites	No. of FGDs conducted
Delhi	<ul style="list-style-type: none"> • Lohar Basti – Non-Notified • Basti below metro pillar – Non-Notified • Sanhsi Camp – Non-Notified • Khichripur- Notified • JJ Colony – Notified 	<ul style="list-style-type: none"> • 3 in Non-Notified Bastis; all without access to LPG • 2 in Notified Bastis; all with access to LPG • Total FGDs: 5
Jharkhand – Lohardaga and Senha blocks	<ul style="list-style-type: none"> • 5 villages were selected using the proposed criteria. Name of the villages with their distance from the distribution center is mentioned below. • Hindlaso – Less than 5 Kms • Hirhi – Less than 5 Kms • Hariharpur- 5 to 10 kms • Parhi – 5 to 10 kms • Chatakpur- 10 kms and more 	<ul style="list-style-type: none"> • 5 villages: In all villages, respondents had access to LPG. • All 5 groups mix people using LPG, and/or biomass. • Total FGDs: 5

All focus group discussions were conducted with the fuel users, i.e., women above 18 years of age. The sample included a mix of married women, working women, homemakers, and mothers. In-depth interviews were conducted with Panchayat members, local opinion leaders (within their bastis) SHG leaders and LPG distributors. The table below provides details of the interviews conducted in Delhi and Jharkhand. A total of nine IDIs were conducted for the study, with five in Jharkhand and four in Delhi.

Table 2: Distribution of IDIs across study sites Jharkhand Delhi bastis

Jharkhand	Delhi Bastis
1 ward member (Chatakpur, Senha)	• 1 Pradhan (Head) of the locality - JJ Colony (jurisdictions covered both notified and non-notified bastis)
3 SHG leaders (1 each from Hariharpu, Hindalso and Parhi, Senha)	• 2 Opinion Leaders (both from non-notified bastis)
1 LPG Distributor (Hindalso)	• 1 LPG Distributor (LPG distributor covered entire Kalyanpuri area which included both notified and non-notified bastis)
Total 5 IDIs	Total 4 IDIs

All the FGDs and the IDIs, in both Delhi and Jharkhand, were conducted during the latter half of May and first half of June, 2022.

2.4 Study limitations and challenges

- Due to the absence of data on usage of different fuels across households, we had to rely on the local knowledge of civil society partners to identify the different study sites and study respondents (users of fuels). The respondents were chosen based on their fuel usage.
- Most respondents in the study used a combination of different fuels due to which it was not possible to completely segregate respondents based on their fuel usage. The insights from the FGDs are thus from a mixed group of users.

3.0 Findings

The findings are organized under different subsections — Situating the participants, sources of information and communication networks, fuel usage patterns, perceptions about different fuels and HAP, and systemic barriers to accessing LPG. While separate FGDs and IDIs were conducted with the fuel users and opinion leaders respectively, the perceptions arising from both sets of respondents were similar and the opinion leaders echoed what the women had shared during the different FGDs, in both Delhi and Jharkhand. Therefore, the insights from the FGDs and the IDIs have been combined and presented in the study below.

3.1 Situating the participants

The context of the users which includes the kind of houses they live in, their access to basic services, family composition as well as decision making within households informs any intervention aimed at shifting behaviors and designing messaging for the target audiences.

Type of houses: Houses in non-notified bastis in Delhi tend to be kutcha⁴ house structures. Residents live in constant fear of eviction and have no sense of permanence or belonging. These bastis do not have access to infrastructure like water and sanitation.

On the other hand, notified 'bastis' have a mix of pucca⁵ and kutcha houses. Participants from notified 'bastis' in Delhi seem more settled and had a greater sense of belonging and ownership. These bastis also have better infrastructure compared to the non-notified bastis.

Participants from villages in rural Jharkhand live in both pucca and kutcha houses.

Type of infrastructure: Participants from non-notified bastis face most hardships in accessing the basic amenities. Many participants in non-notified bastis are migrants from other states. Although they have lived in Delhi for several decades, the documents which prove their identity and address are linked to their home State. The lack of

4. Houses in which both walls and roof are made of materials, which have to be replaced frequently. Walls may be made from any one of the following temporary materials, namely, grass, Unburnt bricks, bamboos, mud, grass, reeds, thatch, plastic /polythene, loosed packed stone, etc.

5. Houses, the walls and roof of which are made of permanent materials. The material of walls and the roof can be any one from the following, namely, stones (duly packed with lime or cement mortar), G.I./metal/asbestos sheets, burnt bricks, cement bricks, concrete.

government recognition of their bastis denies them access to any kind of public services. Their houses do not have door numbers and residents are unable to provide address proof for any documentation. They live in fear of eviction and displacement and do not receive any help or support. Homes lack toilets and public toilets are inaccessible to women who find it unsafe to go out at night.

Participants from notified bastis live in permanent settlements, which are recognized by the government and they can access water and sanitation. Their concerns revolve around issues of safety, education, poor infrastructure like clogged drains, and lack of public spaces for children.

Participants from Jharkhand also face problems due to lack of adequate public infrastructure. They do not have access to water and sanitation. Some villages do not have proper roads and electricity. There are few employment opportunities. Water scarcity is one of their primary concerns.

When the solar pump installed at a well does not function, people are forced to draw water by hand. There are few toilets and even fewer with running water. Participants must walk several kilometers every day to fetch water, firewood, and other fuels. There is a high incidence of diseases, such as typhoid and malaria, and the burden of caregiving falls on women. Children do not have proper schools and the quality of education provided is poor.

Family structure and decision making within the household: The set-up and structure of the families in both Delhi and Jharkhand play an important role in decision-making within the household. Households have a mix of nuclear and joint families; some houses use a single chulha while others use more than one chulha (if married women and in-laws cook on separate chulhas). There are also several female-headed households in both Delhi and Jharkhand, managed by single women (abandoned, widowed, estranged) among the study respondents.

Social issues such as alcoholism, domestic abuse, sexual abuse, drug addiction add to the complexity of the family composition. Disease and health shocks also compound the problems of women. The overriding norm is "*Ghar ka zimmedari hai mahilaon ke oopar*" (women are responsible for the household) as shared by a tribal woman in Hariharpur, Jharkhand.

Decision making regarding fuel usage within the household depends on the family 'situation'. Households in which both the husband and wife live together, appear to have discussion and consensus in the decision-making process. The presence or absence of in-laws also influences decision-making within the household. Elders' opinions and needs are usually considered and navigated while making decisions. Having said that, women exercise greater control over the household budget than

men, among our study respondents. Cooking remains the responsibility of the women in both Delhi and Jharkhand, irrespective of the family structure and whether the men in the family are present or absent.

3.2 Sources of information and communication channels

The findings regarding channels of information and communication for different respondents in the study are important in disseminating key messages to target audiences towards behavior change communication.

Table 3: Sources of information and communication channels

	Delhi		Jharkhand	
	Notified basti	Non-notified basti		
Relevant stakeholders	<ul style="list-style-type: none"> • ASHA workers⁶ • NGO representatives • Political leaders • Pradhan (Village headman) • Teachers 	<ul style="list-style-type: none"> • NGO representatives 	<ul style="list-style-type: none"> • Jharkhand State Livelihoods Promotion Society (JSLPS) • Panchayat head • NGO representatives • ASHA and Anganwadi workers⁷ • Banking correspondents (BC) 	
Media consumption and devices	<ul style="list-style-type: none"> • Television • Mobile phones 	<ul style="list-style-type: none"> • Mobile phones 	<ul style="list-style-type: none"> • Smartphone • Google 	
Social networks	<ul style="list-style-type: none"> • Friends and relatives • SHGs 	<ul style="list-style-type: none"> • Friends and relatives 	<ul style="list-style-type: none"> • Friends and relatives • SHGs 	

3.2.1. Notified bastis in Delhi

Relevant stakeholders: ASHA workers and NGO representatives are important and trusted sources of information on government schemes and services and respondents have regular interactions with them.

Representatives of political parties are another key source of information. WhatsApp groups are created by political representatives and they share communication through text messages.

6. ASHA workers are primary health care workers/frontline health workers in villages

7. Anganwadi is a childcare center functioning under a government program called the Integrated Child Development Services (ICDS), which provides six integrated services including nutrition, health, Behavior change counselling, pre-school education, to children under 6 years of age and pregnant and lactating women.

“ They started by establishing a women’s group. One for block also. First was the women’s group. Then, they created other groups. They mostly share information through SMS. ”

– Woman respondent, Notified Basti, Delhi

The Pradhan (community head) occupies an important social position but respondents shared that they do not share any information with the community. People relied on other women community leaders for seeking any information on government schemes and services.

Media consumption and devices: Television for these communities is another important source of information, however, information is first received through social networks and then confirmed by mass media. The data does not reveal which television channels are trusted sources of information.

“ We heard it from someone and then watched the news. My sister-in-law told me about it and asked me to watch it on the news. ”

– Woman respondent, Notified Basti, Delhi

Mobile phones: Children or spouses of participants have access to smartphones. Children used mobile phones to attend online classes during the pandemic. Audio-visual content is consumed on these devices. The FGDs did not reveal the source of content consumed through mobile phones, and respondents may have relied on SMS or even social media for seeking information on government schemes and services.

Participants did not mention reading newspapers, magazines or listening to radio in the discussions.

Social networks: Friends and relatives are the most trusted sources of information. Information is exchanged through in-person interactions, over phone calls, and Information and Communication Technology.

SHG heads play a significant role in the dissemination of information. They occupy a central position in the communication networks and enjoy a high degree of homophily and trust within the community. They are in a key position within the social network to influence people’s behavior.

3.2.2. Non-notified bastis in Delhi

The communities are isolated and receive little or no information from official sources (such as frontline workers), institutions (such as health centers, anganwadi etc.) They tend to be insular and strong social ties exist within these communities. Family and friends are the primary sources of information. Some NGOs have a presence in these communities, but their ties with these community members are weak. Their trust in political parties is also less.

“ During elections a lot of them come but soon after elections there is no one to be seen. ”

– Woman respondent, Non-Notified Basti, Delhi

Participants themselves do have access to mobile phones but only one member of the household may be using a phone. The use of mass media such as television, radio, newspapers, and magazines were not mentioned by the participants.

“ My son keeps using phone. I watched it with him on his phone. He has completed education till 5th standard. He can read on the phone. ”

– Woman respondent, Non-Notified Basti, Delhi

The implication is that communication through mass media may be ineffective for the members of non-notified bastis. Identifying a change agent within the community becomes crucial for changing behaviors of the community members, since their reliance on outside actors and mass media is limited.

3.2.3. Villages in Jharkhand

Relevant stakeholders: Networks of Self-Help Groups have a strong presence in rural Jharkhand. Jharkhand State Livelihood Promotion Society (JSLPS) is an important institution working through the network of women SHGs, for providing sustainable livelihoods to rural women. The JSLPS works through social mobilization where at least one member (preferably a woman) from each identified rural poor household is brought under the SHG network in a time-bound manner. All SHG members have strong communication links with the JSLPS through their SHG heads.

“ Sahiya, ASHA didi and JSLPS also provide information to us. We have JSLPS meetings twice a month and they educate us on various aspects. ”

– Woman respondent, rural Jharkhand

The panchayat and the mukhiya (village head person) are important sources of information on any government service or scheme. Weekly public meetings are held to discuss issues important to the community, such as water supply, roads, etc.

“ The Mukhiya and the ration shop owner informed us of the free gas connection. They told us that we will get a subsidy. ”

– Woman respondent, rural Jharkhand

“ Meetings are held every Friday in the Panchayat office where we can get information. ”

– Woman respondent, rural Jharkhand

“ We go to the Panchayat to get information from the Rojgar Sewak. ”

– Woman respondent, rural Jharkhand

“ Announcements are also made in the villager regarding important issues. ”

– Woman respondent, rural Jharkhand

ASHA workers and Anganwadi workers also act as conduits of information as residents have regular interactions with these workers. *“It depends on the issue. If it is health related, we ask the ASHA workers, if it is about any scheme, we ask the Panchayat about it”* shared a woman respondent in Jharkhand when asked about who they approach to seek information.

The financial system makes its presence felt through their banking correspondents (BC). Banking correspondents help open accounts, withdraw cash and check account balance. They assume importance since bank details of the applicant have to be provided when applying for the PMUY. The BC is trusted in the community. The BC communicates through the mukhiya. If the mukhiya hoards information or does not act, then the BC circumvents the mukhiya and approaches the SHG heads for disseminating any relevant information meant for the community.

Media consumption and devices: Focus groups did not highlight any information about mass media consumption such as television or radio. Participants did not mention reading newspapers and magazines. It is not clear if the participants own smartphones. One participant in an FGD mentioned Google as a source of information but it is not clear as to how, when or for what purpose Google is used. The BC and SHG heads have smartphones.

Social networks: Friends and relatives are the most trusted sources of information and SHG heads play a significant role in the dissemination of information for these communities.

To sum up, across the three study areas, social networks and personal relations are the main and the most trusted sources of information for the respondents. Leveraging social networks within the communities becomes important for designing and implementing behavior change communication.

3.3 Fuel usage patterns and perceptions

This section talks about the fuel usage pattern across the three study areas, highlighting the different types of fuels used, what drives their usage by the people.

3.3.1. Understanding the fuel usage patterns

Fuel usage – Delhi (notified bastis): For the residents in the notified bastis, LPG is the primary fuel, but they also stack multiple fuels and use cow dung and wood as secondary fuels. During winters coal is also used for heating purposes. Both LPG and coal are easily available for the people living in notified bastis in our study sample and women shared that this is one of the main reasons for using LPG and coal, apart from ease of using LPG.

Fuel usage – Delhi (non-notified bastis): The people in the non-notified bastis of Delhi rely primarily on biomass and solid fuels for their cooking and heating needs. These include a mix of wood, cow dung, coal, clothes, and cardboard, among other things. The women shared that their usage of fuel type depends on what is available and accessible locally and easily to the users. Thus, while some families use coal (these families in the basti belong to the blacksmiths community), some gather firewood

from nearby forests and wasteland, and others use cow dung which is available in the local market.

Fuel usage – Jharkhand: The use of fuel in Jharkhand varies with the household income and access to available fuel types. Women with steady jobs and regular incomes use LPG as a primary fuel. Even among daily wage laborers, a few use LPG as a primary fuel because they feel that this time can be spent on income generating activities rather than on gathering and preparing fuel such as firewood. In homes where women do not have steady incomes, LPG is the secondary fuel and is used when they are tired or when they must make food quickly. Households without steady incomes primarily use biomass, which includes firewood and leaves, cow dung, goat dung, and sugarcane, in addition to coal and kerosene. While kerosene is bought from the market, coal is collected from brick kilns by workers who work there, whereas the remaining fuels like wood, leaves, dung, and sugarcane are collected by the women from nearby fields and forests.

Thus, a variety of fuels are used by respondents across Delhi and Jharkhand primarily dependent on the ease of access to the fuel at any given point in time.

3.3.2. **People's perceptions around use of different fuels and household air pollution**

Perceptions around different fuels available: During the FGDs in Delhi (both notified and non-notified bastis) and Jharkhand, the respondents shared that while most of them use a variety of fuels, each fuel comes with its own benefits and barriers.

The challenges and advantages shared by the respondents are similar in Delhi and Jharkhand and have been jointly summarized in the Table 4 overleaf.

Table 4: Perceptions around different fuels in Delhi and Jharkhand

Fuel	Benefits	Barriers
Firewood	<ul style="list-style-type: none"> Locally available in neighboring areas or as reported by the women, it can be purchased from the market for ₹ 40-50/- for preparing each day's meal in Delhi (as per the women around 5 kgs of wood are required to prepare two meals every day) Can be purchased/collected in small quantities as per families' need and financial resources available. 	<ul style="list-style-type: none"> Price of wood is not fixed and its quality is not consistent Cooking with wood is time-consuming In rural areas women have to collect wood from forests and forest guards misbehave with women, impose fines, confiscate their tools, and threaten them Wood gets damp during the rains and is difficult to use Wood produces a lot of smoke. Damp wood produces even more smoke <p><i>"Stoves are inside the house. It gets very smoky. We cough a lot while the wood burns."</i> – Woman user from Hindlaso, Jharkhand</p> <p><i>"The house and clothes get dirty because of the smoke."</i> – Woman user from Hindlaso, Jharkhand</p> <p><i>"Utensils also get dirty and become difficult to clean."</i> – Woman user from Hindlaso, Jharkhand</p>
Cow Dung (also referred to as <i>uple</i>)	<ul style="list-style-type: none"> Easy to access Consistently available Available in small quantities and can be purchased as per need and funds available Available on demand Affordable <p><i>"One uple costs ₹1. We get it from the Gujjars who sell it in the market. We need 10 uple to get food in a day."</i> – Woman respondent, Sansi Camp (Non-Notified Basti, Delhi)</p>	<ul style="list-style-type: none"> Size is not consistent or standard Damp cow dung '<i>uple</i>' produces a lot of smoke and makes eyes water

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Fuel	Benefits	Barriers
Coal	<ul style="list-style-type: none"> • Easy to access • Consistently available • Available in small quantities • Available on demand • Affordable <p><i>“Getting coal from the kiln is better than gathering wood from the jungle. We get paid to work in the kiln.”</i> – Woman respondent, Jharkhand</p>	<ul style="list-style-type: none"> • Produces smoke, causing eyes to burn • Produces a lot of heat • Skin burns occur when contact is made with the stove <p><i>“Saans lenge tho gustha hai.”</i> – Woman respondent, Hariharpur, Jharkhand</p> <p><i>“Gandha hai.”</i> – Woman respondent, Jharkhand</p>
Cloth and cardboard	<ul style="list-style-type: none"> • Cloth is easily available, and cardboard can be bought from the shops 	<ul style="list-style-type: none"> • Smoke from burning these is considered harmful
Sugarcane (used rarely in rural areas of Jharkhand where it is cultivated)	<ul style="list-style-type: none"> • Available locally in fields 	<ul style="list-style-type: none"> • Burning sugarcane makes hands and vessels black
Kerosene (in Jharkhand)	<ul style="list-style-type: none"> • Mainly used for burning wood; sprinkling kerosene on wood and lighting it makes it easier to burn the wood 	<ul style="list-style-type: none"> • Considered expensive as it costs ₹80 and ₹90 per liter in Jharkhand • Difficult to access • Risky to use

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Fuel	Benefits	Barriers
LPG	<ul style="list-style-type: none"> • Easy and comfortable to use • Faster to cook food on LPG <p><i>"We use LPG when we are tired and don't want to burn wood."</i> – Woman Respondent, rural Jharkhand</p> <p><i>"If we have made less food than necessary, then we use the LPG to quickly make two rotis."</i> – Woman respondent, rural Jharkhand</p> <p><i>"If someone comes home suddenly, then we use the LPG to make tea."</i> – Woman respondent, rural Jharkhand</p>	<ul style="list-style-type: none"> • Large cash flow required to get a refill • There is a perception among users in non-notified bastis that LPG is more expensive than other fuels; participants from non-notified bastis in Delhi thought that they would have to spend between ₹1500 and ₹2000 to refill an LPG cylinder. <p><i>"At least, one child's fees can be paid with this money."</i> – Woman respondent, non-notified basti, Delhi</p> <ul style="list-style-type: none"> • Food tastes better when cooked on chulha <p><i>"Rotis made on an earthen stove taste completely different from rotis cooked on gas. Roti tastes sweeter there."</i> – Woman respondent, Notified basti, Delhi</p> <ul style="list-style-type: none"> • Food cooked on chulha is healthier than food cooked using LPG <p><i>"People become fat when they eat food cooked in gas. If we eat food cooked on gas, we would also become fat."</i> – Woman respondent, Notified basti, Delhi</p> <p><i>"LPG causes acidity."</i> – Woman respondent, Notified basti, Delhi</p> <p><i>"We cook rotis on the stove outside regularly. Because when we cook rotis in the gas, it causes digestion problems."</i> – Woman respondent, Notified basti, Delhi</p> <ul style="list-style-type: none"> • LPG is unsafe. <p><i>"We are scared because there are blasts taking place due to LPG. They keep telling in phones and newspapers that there is an explosion because of LPG. People read in the newspaper and tell us."</i> – Woman respondent, non-notified basti, Delhi</p>

It can be seen that the perceptions around benefits and barriers regarding use of different fuels, specifically against the use of LPG, play an important role in respondents' decision-making with respect to fuel usage. While some work in favor of more traditional fuels (such as food being cooked on chulha is tasty or healthy), others work against the use of LPG (it is unsafe to use, food cooked on it causes gas, etc.). Addressing such perceptions will be critical in addressing the demand-side bottlenecks which restrict the adoption of LPG.

3.3.3. Perceptions around chulhas

As stated earlier, all cooking is done by the women and in each family a minimum of two meals are cooked daily. Women spend a considerable time in cooking and gathering fuel for cooking, each day in both Delhi and Jharkhand. Women find cooking on chulha difficult and unpleasant.

“ We feel very hot because of the stove. We want to get rid of the stove. ”

– Participants in a non-notified basti in Delhi when asked about their experience of cooking on the stove

“ We cook our lunch in the morning so that we don't have to cook in the heat once we come back from work in the afternoon. ”

– Woman respondent from another non-notified basti in Delhi when asked about who uses the stove the most.

3.3.4. Perceptions around household air pollution

In addition to the perceptions around the fuels, respondents also shared their perceptions around household air pollution or indoor smoke, which need to be addressed in the shift towards adopting and using clean fuels.

Perception that the smoke from wood is not harmful: There is a perception among the users that smoke from wood is not harmful for them and their health. As per them, *“The food cooked on earthen stove is healthier than the ones cooked on the gas because it is cooked on wood which has no side effects”*.

Household air pollution is not a familiar concept: Household air pollution is a new concept for the respondents and its long-term health implications were not evident to them. Household air pollution is equated with the smoke resulting from burning of biomass.

Participants shared that using damp wood or cow dung for cooking produces a lot of smoke, which makes their eyes water and results in coughing. If the chulha is placed indoors, they step outside till smoke clears.

“ If we cook in the open, there is no smoke. There is a lot of smoke when we cook indoors, especially if our homes have asbestos roof. ”

– Woman respondent, rural Jharkhand

“ Stoves are inside the house. It gets very smoky. We cough a lot while the wood burns. ”

– Woman respondent, rural Jharkhand

“ Smoke affects the eyes and we cough a lot. ”

– Woman respondent, rural Jharkhand

“ I can't even see with my eyes properly when cooking food. It is very difficult for us. ”

– Woman respondent, non-notified basti, Delhi

“ We feel suffocated, face breathing problems. ”

– Woman respondent, non-notified basti, Delhi

“ There is a lot of itching in our eyes due to smoke. Our eyes hurt due to smoke. ”

– Woman respondent, non-notified basti, Delhi

Household smoke is not associated with long-term health concerns for the users: For the respondents, household air pollution is not associated with any long-term health problems. They think that exposure to smoke only results in temporary discomfort such as coughing and eyes burning. They are not aware of any long-term damage to their health, such as impact on respiratory health, COPD, etc. There is a deep-seated belief among the respondents that hard work will make one impervious to any health shocks. As shared by a woman respondent from rural Jharkhand, *“We do not have major health issues because we work all day. We sit in sunlight all day. Disease runs away from sunlight.”*

3.4 Systemic barriers to adoption of LPG

In addition to the users' perceptions about using LPG and the advantages they associate with other fuels (such as wood, cow dung, etc.), there exist bottlenecks in accessing an LPG connection and its sustained use. This section highlights some of the issues shared by the people in accessing the LPG.

3.4.1. Lump sum cash outflow

Participants spend nearly ₹1000–1500/- every month to purchase biomass. In Delhi, women self-reported paying between ₹40 and ₹50 per day on buying coal, wood or cow dung. While participants in Jharkhand may not spend money to purchase biomass (since they are able to collect the same from adjoining forests and fields), they do spend several hours collecting it. The difference between spending on biomass and LPG is that to get an LPG cylinder, they have to pay for the entire cost of the cylinder at one go. Most of our respondents were laborers or informal workers earning daily wages and they shared that it is difficult for them to save the money or hold surplus cash to pay for a cylinder and they find it difficult to spend the amount.

3.4.2. Issues in accessing to LPG

To apply for an LPG connection (offline), a person has to go to the nearest LPG distributor agency office and fill up an application form, along with KYC documents like:

- i. ID proof
- ii. Address proof
- iii. Aadhaar copy of self and all adult family members
- iv. Bank account details of the applicant
- v. Ration card
- vi. A 14-point declaration in support of poor households, duly signed by the applicant as per a standard format
- vii. Proof if they belong to any of the specified seven categories
- viii. Two photographs

The dealer will send a confirmation by message or email acknowledging the request placed for a new gas connection. The status of the application can be checked online, or offline by visiting the distribution agency. Lack of documentation, tedious application process, delays in doorstep delivery, poor grievance redressal, and high price are pain points for participants in accessing LPG. If these issues are addressed, then access and use of LPG will be simpler. We discuss these in the subsequent pages.

1. Inability to furnish required documentation: ID proof, address proof and bank account

“ I went 2 months back to get one, but they refused it as I did not have any address proof. Our Aadhar card is of Rajasthan. ”

– Woman respondent, non-notified basti, Delhi

“ There are no house numbers as they are non-notified. Therefore, it is difficult to get the connection (Delhi). ”

– Woman respondent, non-notified basti, Delhi

“ We didn't get an LPG connection because we don't have a ration card. We cannot get a ration card because they ask for a lot of money to give it to us. ”

– Woman respondent, rural Jharkhand

As discussed above, to avail an LPG connection, consumers need to have documentation in the form of ID proof, address proof and a bank account. While participants in Jharkhand, who live at home face fewer problems furnishing these details, participants living in non-notified bastis in Delhi have challenges in getting an address proof. Migrant workers cannot avail an LPG connection in Delhi because their address proof contains the address of their hometown. Participants from Delhi who are part of self-help groups have access to bank accounts. There are participants in non-notified bastis who do not have bank accounts and thus cannot avail an LPG connection or a subsidy.

2. Difficulty in filling up application forms: Some participants mentioned that they were unable to fill the application forms to apply for an LPG connection themselves. They needed help from others to fill in the form. In Jharkhand, members from the SHGs had helped people fill up the application forms when applying for gas connection.

3. Slow processing of applications and difficulty in checking the status of application:

“ I submitted the form but did not get any connection till now. When I inquire about it, they (LPG distributor agency) tell me it will come in 2–3 days. ”

– Woman respondent, non-notified basti, Delhi

“ The Ujjwala Yojana was started in the village 2 years ago. Several persons’ names were in the list, but they did not get the gas connections. ”

– SHG Leader, Senha, Jharkhand

Some participants who had submitted applications have not received LPG connection. It is not possible for participants to check the status of the application without having to visit the agency. Even when they do visit the gas agency, they are turned back by the distributor without receiving any update. While the application process has been made more efficient in the recent past, one has to visit the agency or distributor to be able to find out the status of the application if they are not able to check it online.

“ My name was on the list (for LPG connection) but I was unable to collect it (the cylinder and stove) because I was not in town. When I went to the agency, they were unable to locate my name in their bundles of lists. We went twice but they were unable to find my name. ”

– Woman respondent, rural Jharkhand

4. Absence of doorstep delivery: For participants in notified bastis in Delhi, LPG is delivered at their doorstep. This facility is not available to participants in non-notified bastis and rural Jharkhand, who have to take the empty LPG cylinder to the gas agency to get a replacement, when some don't own motorized vehicles. Some participants do not even own bicycles and must borrow one to return the LPG cylinder. While applying for an LPG connection is difficult, getting an LPG cylinder refill in rural Jharkhand is also a test of endurance.

5. **‘Gas cutting’, complaints and poor grievance redressal:** The term ‘gas cutting’ refers to the act of delivering half empty cylinders. Participants from notified bastis in Delhi often find that LPG cylinders delivered to them are not filled as per the prescribed limit⁸ when they weigh it at the time of delivery.

“ The agency people do not give us fully filled cylinder. They try to cheat us. We weigh it. ”

– Woman respondent, Notified basti, Delhi

“ We return it to the delivery boy. They create a lot of trouble (in taking back the cylinder). We have placed a lot of complaints because of this (to the gas agency). Once I complained and they cancelled my booking. ”

– Woman respondent, Notified basti, Delhi

Participants have resorted to weighing cylinders at the time of delivery and half-filled cylinders are returned with the delivery person. Moreover, as per the respondents, the system for grievance redressal is poor. When they raise a complaint about a half-filled cylinder to the delivery person, they do not report it accurately, and cite the reason for non-delivery as incorrect address of the recipient being unavailable. People have to raise multiple complaints at the gas agency before a correctly filled cylinder gets delivered to them.

6. **Variance in price of LPG across locations:** The price of LPG declared by the government is lower than the price actually paid by consumers when they receive the cylinder. There is a variance in the price paid depending on the location of the consumer. Participants in Delhi pay a lower price than those in Jharkhand where the price can go up to ₹1140/-. “The price of gas is ₹1140/-. We asked the dealer. This is what he said. We don’t know why they are charging ₹1140/-”

3.4.3. **Withdrawal of LPG subsidy**

The government used to offer a subsidy (which was around ₹140/- per cylinder in June 2019 (Powell et al. (2021))) to consumers which was withdrawn (though it has been reintroduced in June 2022 for Ujjwala beneficiaries, people were not receiving it when this study was undertaken). This is one of the main reasons for households to switch

8. Gross weight of the cylinder is arrived at by adding tare weight and the amount of 14.2 kg LPG. For example, if the tare weight printed on the cylinder is 15.2 kg, a full cylinder with 14.2 kg LPG would have a gross weight of 29.4 kg

back to biomass and not continue using LPG in both Jharkhand and Delhi. Women from the notified-bastis in Delhi shared that despite having LPG connections, half of the people have reverted to using stoves as an LPG refill costs over ₹1000/-, which is unaffordable for many. Similarly in Jharkhand, during an FGD it was shared that there were 30 houses in the tola where discussion was happening, of which around 19 houses had an LPG connection, but only 3 houses were using it regularly. The withdrawal of subsidy has thus increased the burden on women especially in the low-income households who have had to revert back to using biomass as fuel, both in Delhi and Jharkhand.

To sum up, high lump sum payment for refilling LPG cylinder, difficulty in the application process for getting an LPG connection, absence of doorstep delivery of cylinder and poor grievance redressal mechanisms act as barriers to access and sustained use of LPG, even when there is intent to make shift from unclean fuels. Addressing these issues will aid in increasing the adoption and sustained use of LPG across households.

4.0 Summary of Findings

The context of the households and their access to basic services differs between the notified bastis, the non-notified bastis and rural Jharkhand. The households in the non-notified bastis of Delhi are most deprived among the three groups, they lack access to basic services like water, sanitation, healthcare, in addition to living in temporary houses without any valid address proof. The composition of families differs across different households, (there are a mix of nuclear, joint, and female headed households) which plays an important role in fuel use decisions for the family. Women mostly make decisions on fuel usage in the household, especially in the absence of husbands who may have abandoned the family, migrated for work, or died. This is the case in both Delhi (notified as well as non-notified bastis) and Jharkhand. Women are responsible for the health and well-being of the family. Their responsibilities include cooking, gathering, and preparing fuel. Cooking with biomass is a time-consuming and unpleasant experience.

Women in low-income households choose biomass fuels based on ease of access. Ease of use is secondary to ease of access, across all three study areas. Ease of access is determined by whether the fuel can be easily collected in the neighboring area (such as firewood from an adjoining forest, coal from brick kiln, etc.) or can be purchased at a reasonable price from local seller. Households show a preference for fuels they can collect or purchase in small quantities as per their need and budget.

Perceptions play an important role in determining households' fuel choices. Women's and their families' perceptions around the price, safety, taste, and health of food cooked using LPG act as barriers to its adoption. Household air pollution is a new concept for participants who do not understand its long-term implications. It may be difficult to convince individuals of the harmful effects of HAP when there is a belief that burning wood is not harmful to health.

Urban low-income households tend to be daily wage earners and spend small amounts every day on fuel purchase based on the need. LPG cylinders require a lump sum cash outflow at the time of refill and such households do not hold the cash required. These households have lapsed back to using biomass due to the increase in LPG prices and the removal of subsidies.

The application process, although simplified, poses barriers for women who may not be able to read and write. Many women in our study in Jharkhand for example, took help of SHG members for filling up their application forms when applying for LPG connections. There are several issues with the documentation, for example, migrant

workers living in urban areas cannot access LPG because their documentation belongs to their home state. LPG distribution is not customer centric and low-income households remain underserved; doorstep delivery of cylinders is not available in non-notified bastis and rural Jharkhand. Service to this segment could be improved by adopting user-centred supply chain.

These households and communities rely mostly on social networks and prominent members within their communities for any information on government services and schemes. Their dependence on mass media is fairly low, especially in rural Jharkhand and non-notified bastis in Delhi.

5.0 Discussion

The context of women with respect to their incomes, access to basic services, determines their access to cleaner fuels. For example, women in notified bastis are able to access and use LPG (due to better delivery of LPG and better incomes), but those in non-notified bastis are not able to access LPG or use it in a sustained manner. While PMUY prioritizes the vulnerable households based on a deprivation criterion, findings from non-notified bastis in Delhi show that not all households have been able to access the LPG connection or use them as permanent cooking solutions, owing to a range of issues such as high cost of LPG cylinder refills, no home delivery of cylinders. Based on the context, vulnerable households could be prioritized in improving their access to LPG as ease of access is important to households.

Participants in the group discussions shared several benefits and barriers associated with use of different fuels, which play a critical role in determining fuel use. Some barriers in adopting and using LPG exist due to lack of proper information, perceptions around taste and health effects of food cooked using LPG. These are rooted in social norms and age-old beliefs or misinformation. These could potentially be addressed through behavior change campaigns to dispel the misinformation (for example food cooked on LPG causes gastric issues) and challenge the perceptions (for example around taste of food). Similarly, one needs to be cognizant of the fact that most of these households are first-time users of LPG and need proper training/demonstration of safe storage, placement and use of LPG cylinders for cooking. Right information and messaging around the benefits of LPG among the users is important to encourage the people to adopt LPG and use it as a permanent cooking solution.

Women recognize and acknowledge barriers around different forms of biomass and benefits of using LPG. As primary users of biomass fuel for cooking and heating, they suffer most from the resultant smoke and its associated health effects. They view LPG not only as a clean fuel, but also value it as it is easy to use, and faster to cook on. In fact, LPG was a preferred cooking fuel among the users (in our study sample) in both notified-bastis in Delhi as well as rural Jharkhand. The barriers around biomass and benefits of LPG could thus be important drivers of any awareness and communication drives.

Perceptions around household air pollution need to be addressed and the link between women's health and household air pollution needs to be highlighted. While women experience these health problems (such as coughing, eyes burning etc.), they feel that these are temporary problems not having any long-term impact on their health. Such beliefs need to be addressed and information on the health risks

of HAP need to be shared, not just with the women but also other family members (like husband, in-laws). People need to be made aware of the long-term health impacts of HAP, especially on women and their children. Social networks within a community like SHGs groups or other women's networks could play an important role in addressing these perceptions.

In addition to the perceptions around different fuels, there are also systemic barriers in accessing, adopting and using LPG, which are procedural. Absence of doorstep delivery of LPG cylinders in Jharkhand, poor grievance redressal, difficulties in filling up and tracking application forms and furnishing relevant documentation are issues which can be addressed by the government by improving service delivery at all locations, strengthening avenues for grievance redressal, and through easing and improving the process of applying for LPG connections and refills. Different innovations for improving the LPG adoption and use can be piloted by the district and state government.

6.0 Recommendations

6.1 Household/community-level

1. Build a local level baseline data on the pattern of fuel usage at household level which will help identify the groups of people who should be targeted for interventions to promote shift to clean cooking fuels. Women SHGs, especially in Jharkhand, could support in carrying out this data collection.
2. Identify and provide women networks like SHGs, ASHAs, mother committees (groups of women with young children at village level) at the city/village level, with information on health impacts of biomass burning and benefits of shifting to cleaner fuels, and process for accessing LPG through the PMUY or otherwise, so that they can share this information within the communities and engage with people to shift to cleaner cooking options. Platforms like gram sabhas, aam sabhas, at the panchayat level can also be used for information dissemination and building awareness.
3. Design behavior change communication (BCC) on long term health impacts of biomass burning and economic benefits of switching to clean cooking for the women, their husbands and in-laws (who also play an important role in deciding the fuel-choices within households).
4. Design campaigns with SHG members to address perceptions around taste of food and LPG safety to generate positive demand. Platforms like gram sabhas, anganwadi centers, and schools, which have large participation and attendance of the community, can be used for carrying out these campaigns to ensure widespread reach.
5. Enlist support of SHGs and NGOs to help women in the documentation and application process of applying for the LPG connection under PMUY. Pragya Kendras (Common Service Centers) in Jharkhand can also be designated as points for easing the documentation process of PMUY for the people.

6.2 District-level

1. Use flexi-funds available under schemes like the Integrated Child Development Services scheme (a key scheme for maternal and child nutrition and development by the government) or the National Health Mission at district level to design BCC campaigns for increasing awareness on women's health and household air pollution. In the mineral rich districts of Jharkhand, the District Mineral Fund or the

15 Finance Commission funds with local governments (both rural and urban, in both Jharkhand and Delhi) can also be used for implementing these campaigns.

2. Some government schemes like the ICDS and Mid-Day Meal provide an LPG cylinder to frontline workers for cooking food for children. It should be ensured that the frontline workers use the LPG cylinder on a regular basis to set a positive example for the local community for shifting to cleaner fuel.
3. Ensure inclusion of all eligible households under PMUY with special focus on households who are most vulnerable based on their social, economic and health status. The PRI members or the ward members can help in identification of such vulnerable households and ensure that they get the LPG connections under PMUY, by extending required support. To ease the delivery of LPG cylinders especially in far flung areas, models on the lines of Public Distribution System (PDS) through ration shops, can be explored.
4. Provide support in obtaining required documentation (such as Aadhaar card, bank account) and in filling up the application forms to extremely vulnerable households (like in non-notified bastis) to apply for LPG cylinder. Nodal points like pragya kendras or Common Service Centers can be designated for easing the process for the people. Models like Duare Sarkar of West Bengal where delivery of schemes and services is ensured at doorstep of people through outreach camps, can also be explored for covering all eligible beneficiaries under PMUY.
5. Create a robust local and accessible grievance redressal mechanism by either appointing a point of contact in each Panchayat/ ward that will improve delivery of LPG cylinders and address delays and discrepancies in cylinder weight.

6.3 State/policy-level

1. Livelihood and income generating schemes for women could be linked with increasing awareness and access to LPG. Schemes under micro industries, skill development, rural employment could be leveraged for this purpose.
2. Steps should be taken to raise awareness about the smaller 5kg cylinder especially among members of the lower income households and ensure its adequate supply through gas distribution agencies. At least two 5kg cylinders per family per month should be made available by the government, at a subsidized rate to low-income households to make it affordable for them.
3. Flexible pay-options (such as paying in instalments) for LPG cylinders could be considered through existing SHG networks and local banking systems. The cylinders can be supplied to low-income households eligible under PMUY at

subsidized prices instead of crediting the subsidy amount later in people's bank accounts.

4. Map schemes implemented by the Health, Women and Child Development Departments which could provide incentives to women on switching to LPG or provide the additional or top-up subsidy to the already existing PMUY.
5. An additional tier could be added to the existing LPG distribution and refilling system which currently operates through gas distribution agencies appointed by the Oil Marketing Companies. Petrol bunks, LPG refilling stations could be opened in rural locations, which could be owned and operated by women SHGs and would make the refilling system more accessible and provide employment in rural areas while extending the energy infrastructure to where it is needed. Ensuring an LPG micro-distributor for a cluster of 2–3 villages would help improve the availability of the LPG cylinder.

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