CENTER FOR GLOBAL DEVELOPMENT

Decreasing Domestic Drudgery

Why it Matters and What We Know About What Works in Low- and Middle-Income Countries

ALBA LOUREIRO · KEHINDE AJAYI

Abstract

The COVID-19 pandemic highlighted gender disparities in time spent on unpaid work, but most responses have focused narrowly on unpaid care work, overlooking other unpaid domestic activities that impact women's economic inclusion and related outcomes. To address this gap, we review evidence from 25 studies on interventions aimed at decreasing domestic drudgery—defined as unpaid, arduous domestic work—and examine their impact on women's wellbeing in low- and middle-income countries. Our findings emphasize the need for increased research and broader policy attention to decrease domestic drudgery.

POLICY PAPER 375 • DECEMBER 2025

Decreasing Domestic Drudgery: Why it Matters and What We Know About What Works in Low- and Middle-Income Countries

Alba Loureiro
The Fletcher School, Tufts University

Kehinde Ajayi
Center for Global Development

Alba Loureiro and Kehinde Ajayi. 2025. "Decreasing Domestic Drudgery: Why it Matters and What We Know About What Works in Low- and Middle-Income Countries." CGD Policy Paper 375. Washington, DC: Center for Global Development. https://www.cgdev.org/publication/decreasing-domestic-drudgery-why-it-matters-and-what-we-know-about-what-works-low-and

CENTER FOR GLOBAL DEVELOPMENT
2055 L Street, NW Fifth Floor
Washington, DC 20036

1 Abbey Gardens
Great College Street
London
SW1P 3SE

www.cgdev.org

Contents

Figures

Tables

Introduction

Globally, it is well recognized that there are systematic differences in how men and women tend to spend their time—women typically spend more time than men do on unpaid work and relatively less of their time than men do on paid work. The COVID-19 pandemic substantially increased awareness about the gender imbalance in time spent on unpaid work. However, much of the subsequent research and policy attention has narrowly focused on addressing unpaid care work, leaving a gap in understanding other forms of unpaid domestic work that impact women's wellbeing. To address this gap, we conducted an evidence review to examine what we know about how to decrease domestic drudgery—defined as unpaid arduous domestic work. Our review synthesizes existing evidence on the effectiveness of drudgery-reducing interventions and highlights implications for policies to enhance women's wellbeing in low- and middle-income countries (LMICs).

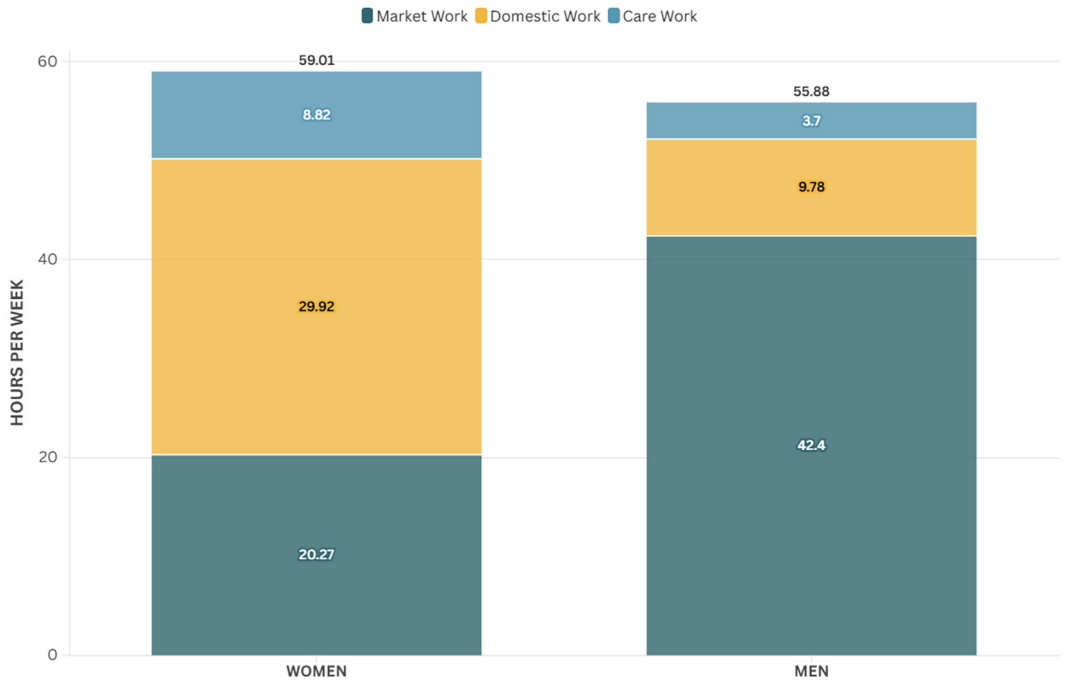
We find strong evidence that switching to liquified petroleum gas (LPG) from biomass cooking fuel, improving electricity infrastructure, and strengthening water access are effective approaches to decrease domestic drudgery. These approaches also show promise as avenues to improve women's wellbeing more broadly. However, significant gaps remain in the measurement and reporting of their impacts on women's outcomes (particularly in the domains of economic participation, health, and empowerment), highlighting the need for additional research.

Why decreasing domestic drudgery matters

Women tend to spend significantly more of their time dealing with domestic drudgery than men do worldwide. Recent estimates based on nationally representative time-use data from 50 countries indicate that women spend an average of 29.92 hours weekly on domestic work as a primary activity, while men spend only 9.78 (Figure 1) (Gottlieb et al. 2024). Although there are also stark gender differences in the average time spent on care work as a primary activity (8.82 hours for women versus 3.70 hours for men), domestic work constitutes the largest component of women's work in most countries, taking up an average of three times as many weekly hours as time spent on care work.[1] Meanwhile, men spend most of their time on market work (42.40 hours weekly, compared to 20.27 hours weekly for women). These time allocations indicate that reducing the time women spend on care work is insufficient to fully address gender differential constraints on women's time, because many women would still be spending a disproportionate amount of time on unpaid domestic work (including activities like fetching water and wood, cooking, cleaning, doing laundry, and household shopping). Women's "time poverty" (limited time available for paid market work) results from their substantial amounts of time spent on unpaid domestic work and unpaid care work.

1 The authors note that the harmonized data they use only include the primary activity of individuals, due to variations in reporting on secondary activities across surveys. This could lead to an underestimate of the total amount of time women spend on domestic work and care work, because care work is often undertaken as a secondary activity.

FIGURE 1. Women spend more time on average than men do on domestic work



Source: Figure created by authors using data from Gottlieb et al. (2024) on average weekly hours worked by married working-age adults, based on "high-quality time-use data from 77 nationally representative surveys covering 7.4 million individual diaries across 50 countries".

These differences in time use have direct implications for women's outcomes. Domestic drudgery has been associated with several negative outcomes for women, potentially compromising their physical and mental health, decision-making power, educational attainment, and livelihood opportunities (Crow and Mcpike 2009). Thus, identifying approaches to effectively decrease domestic drudgery is crucial to enhance women's economic empowerment and wellbeing. Several studies have examined the impacts of drudgery-reducing interventions on women's wellbeing in high-income countries (including Cowan 1983 and Aguiar and Hurst 2007), providing a historical perspective on this question. We complement this work with a focus on impacts in low- and middle-income countries.

We outline a comprehensive conceptual framework linking drudgery-reducing interventions to women's wellbeing in the appendix. In brief, by reducing women's time spent on unpaid arduous domestic tasks (such as cooking, fuel collection, water collection, shopping, laundry, cleaning, and food preparation), drudgery-reducing interventions can free up women's time for other activities (including paid work, education and learning, unpaid market or care work, volunteer work, self-care and leisure). Each of these alternative activities, in turn, impacts women's wellbeing. For example, if women increase their time spent on paid work, they can subsequently increase their earnings. Higher earnings could improve women's health and empowerment, by allowing women to increase their health-related expenditures and by increasing women's intrahousehold bargaining power. Similarly, women could increase their time spent acquiring education and skills, which could also

increase their productivity, agency, and health-seeking behaviors, leading to positive effects on earnings, empowerment, and health.

What we do

We use a two-step search strategy, beginning with an initial set of anchor studies and then screening papers that cite or were cited in these anchor studies to identify papers that meet the following criteria: (i) published in English between 2010 and 2025; (ii) focused on low- or middle-income countries; (iii) evaluate interventions that could reduce domestic drudgery; (iv) employ experimental or quasi-experimental research designs to estimate causal impacts on women's time spent on unpaid domestic work.

We included studies that employed causal identification strategies and addressed domestic drudgery's effects on women's wellbeing. We excluded studies using hypothetical simulations, and those lacking causal identification strategies. We also excluded studies on agricultural drudgery because it differs in nature by being market work and therefore has different determinants and different potential impacts on women's wellbeing.

We define domestic drudgery as a subset of unpaid domestic labor that is physically demanding, repetitive, and time-consuming, often performed with little autonomy—drawing on feminist economics, time-use research, and the definition proposed by CARE India (2016). Key tasks linked to drudgery include cooking, fuel collection, accessing water, shopping, doing laundry, and cleaning. Contextual factors like infrastructure and social norms shape how these tasks are experienced.

Given the growing literature on care work, we focus on identifying the impacts of unpaid domestic work as another constraint that remains even when the amount of time spent on unpaid care work is reduced. (Recent reviews on the impacts of changes in unpaid care work on women's wellbeing in low- and middle-income countries include Halim, Perova, and Reynolds (2023) and Evans et al. (2021)). While excluding studies on care work clarifies our scope, we recognize the overlap between care and domestic drudgery. Tasks like cooking or fetching water often serve both care and non-care roles. Additionally, care work is often conducted as a secondary activity at the same time as domestic work. Nonetheless, separately examining evidence on interventions to reduce domestic drudgery highlights the need for policies that address the full complexity of women's unpaid work.

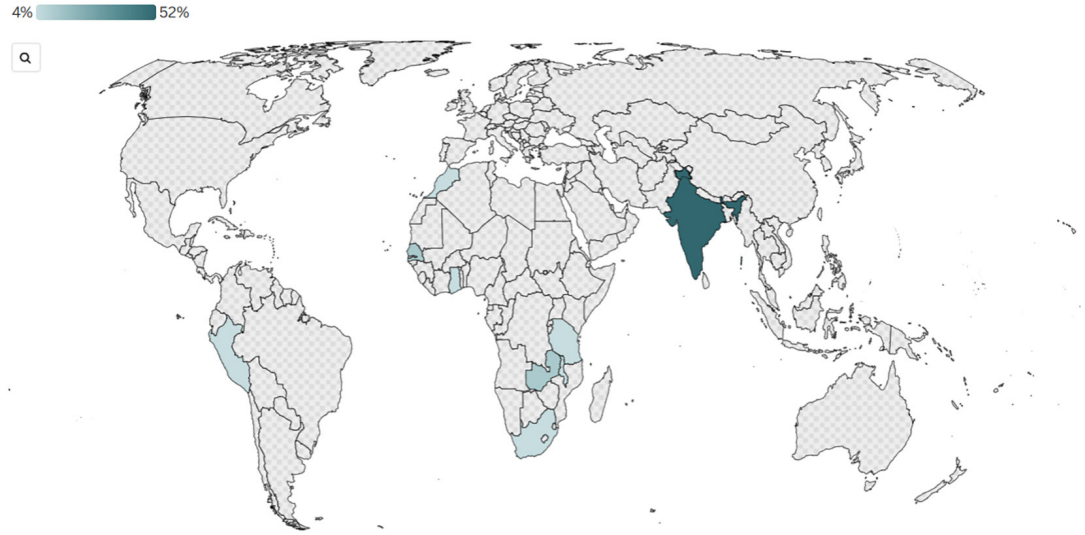
Altogether, we identify 25 studies, spanning grey literature and academic publications from various disciplines. We prioritized grey literature that underwent peer-review or institutional vetting, such as dissertations, policy papers, and working papers. We describe our search process in more detail and summarize the full list of studies in the appendix. The rate of evidence generation has increased over time, with 16 of the 25 studies published in 2020 or later. Our review uses a narrative approach, consistent with methods for emerging, loosely defined concepts and for synthesizing studies with non-standardized outcomes.

What we find

1. Evidence is geographically limited

Our review includes 24 single-country studies and one cross-country study. As illustrated in Figure 2 below, the evidence is predominantly concentrated in India, which accounts for 13 studies. Senegal and Zambia account for three studies each. The remaining countries—Côte d'Ivoire, Ghana, Malawi, Morocco, Peru, South Africa, and Tanzania—are each represented by one study. At a regional level, South Asia leads with 52% of the studies, sub-Saharan Africa follows with 40%, while the Middle East and North Africa and Latin America and the Caribbean each account for 4%. The narrow scope of countries and regions represented by existing evidence highlights a need for more geographically diverse research to better understand the global implications of domestic drudgery.

FIGURE 2. Existing evidence primarily comes from India



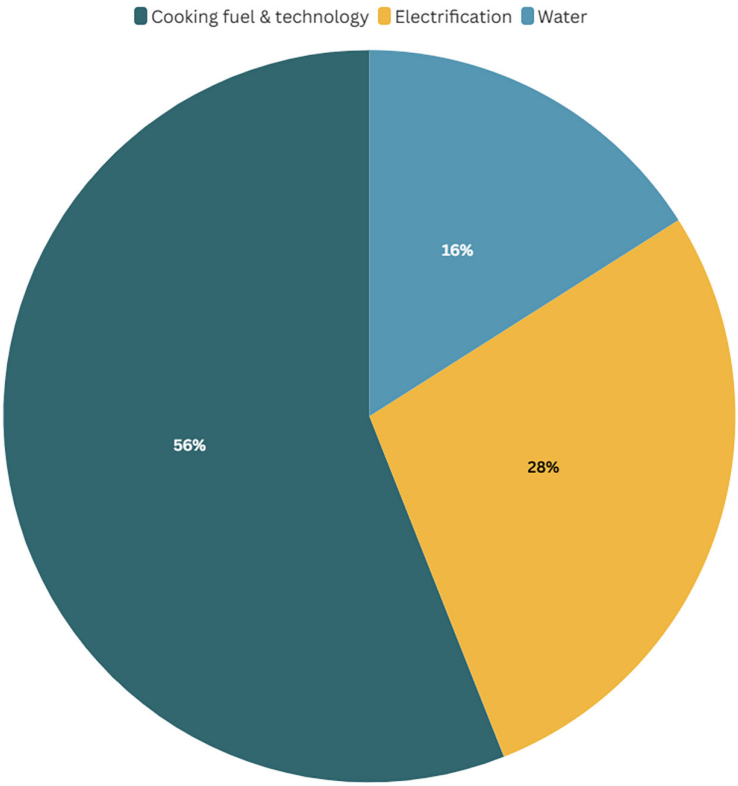
Note: There are 24 single-country studies and one multi-country study.

Most studies (92%) come from lower-middle-income countries. Upper-middle-income countries contribute 8% of the studies, while low-income countries account for 4%. Despite this variation in national income levels, studies share common characteristics, as they largely come from contexts grappling with poverty, limited infrastructure, and high burdens of unpaid domestic work. Additionally, studies predominantly focus on rural areas (64%), where domestic drudgery is often more pronounced due to limited access to infrastructure and resources. Urban settings account for 16%, while 20% of studies span both rural and urban areas. The poverty status of populations is inconsistently reported, with 14 studies explicitly targeting poor populations, while 11 studies omit this detail.

2. Improvements in cooking fuel and technology are the most frequently studied type of intervention, with fewer studies examining effects of improvements in electricity and water access

Our review identifies evidence on three primary types of interventions aimed at reducing domestic drudgery (Figure 3). These include interventions related to improving cooking fuel and technology (56% of studies), electrification (28%), and water access (16%). Strikingly, we did not find any experimental or quasi-experimental evidence on the effects of labor-saving appliances (such as washing machines, dishwashers, or vacuum cleaners). The closest evidence we find of this kind is a descriptive study that reports limited differences in time spent on domestic chores for households with varying adoption of household appliances in Colombia (Beltran-Figueroa 2024), while controlling for differences in observable household characteristics. We welcome additional evidence on this, if there are any studies we missed.

FIGURE 3. Over half of the studies in our sample analyze the effects of improvements in cooking fuel and technology



Note: This figure presents the distribution of intervention types analyzed in 25 papers.

Additionally, while transportation improvements (like upgrading roads or expanding access to bicycles and other modes of transportation) could reduce domestic drudgery by facilitating women's mobility for activities that require traveling long distances (such as fetching water or firewood), we do not find any studies estimating the causal effects of transportation interventions on women's

time spent on unpaid domestic work. Several studies establish positive impacts of transportation improvements on women's employment (Small and van der Meulen Rodgers 2023), suggesting that these interventions could offer complementary benefits by decreasing domestic drudgery while increasing labor market access. Additionally, one paper (Lambon-Quayefio 2024) estimates the impacts of proximity to fuelwood and water sources on women's wellbeing in Ghana using an instrumental variables approach, based on neighbors' proximity to these sources. She finds that shorter travel time to fetch wood or water increases women's leisure hours. Access to water also improves women's subjective health. However, access to water and wood have limited effects on women's labor market outcomes in this context, with the exception that access to water reduces the likelihood that women work on their own farm.

3. Large, statistically significant time savings are most common in cooking fuel and electrification interventions

Across studies, cooking fuel and technology interventions consistently yield the largest and most statistically significant reductions in time spent on drudgery, followed by electrification and water interventions. However, not all interventions reduce time burdens—some effects are statistically insignificant, and in rare cases, interventions even increase drudgery.

By construction, all studies in the sample report time-use outcomes. We standardize effect sizes by converting them to minutes per week and classify them by statistical significance: positive and significant, positive and insignificant, negative and insignificant, or negative and significant. Several studies report multiple coefficients disaggregated by time-use activity or intervention components. See Appendix B3 for an overview of the multiple magnitudes and their statistical significance.

Figure 4 presents only the lower-bound coefficients for time saved across intervention types. Cooking fuel and improved cooking technology interventions generate the largest time savings—ranging from 9 to 525 minutes per week (0.15 to 8.75 hours/week)—with most effects statistically significant. For example, Bensch and Peters (2015) report time savings of 525 minutes per week, while Hanna et al. (2016) find a statistically insignificant increase of 21 minutes. Krishnapriya et al. (2021) review estimates from a larger sample of studies without limiting their review to experimental or quasi-experimental studies and find an average time saving of 67.9 minutes per day (475 minutes per week), with little difference in average estimates based on experimental design.

Electrification interventions generate the second largest time savings, ranging from 23 to 567 minutes per week (0.38 to 9.45 hours/week), with six studies reporting statistically significant positive effects. Notably, Bago et al. (2024) reports the largest effect overall. However, Thomas et al. (2020) find a statistically significant negative effect of –252 minutes per week, indicating that the intervention increased time spent on labor-intensive activities by 4.2 hours. Finally, water interventions result in more modest but still positive time savings, ranging from 49 to 228 minutes per week (0.8 to 3.8 hours/week), with all effects statistically significant.

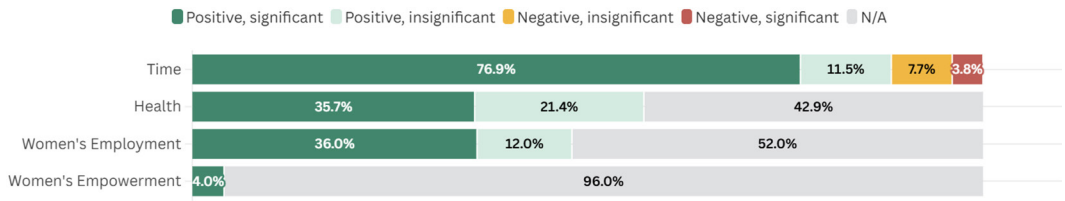
FIGURE 4. Cooking fuel and electrification interventions save the most time

Note: Effect sizes converted to minutes per week; if estimates are only available for individual activities instead of for aggregate time spent on unpaid domestic work, we report estimates for the most time-intensive activity (typically time spent cooking); only lower-bound estimates are shown if multiple coefficients are reported for the same outcome measure.

4. Around half of reviewed studies report impacts on women's health or employment, while only one study reports impact on empowerment

We examine impacts on women's outcomes across four domains—time use, employment, health, and empowerment. (Appendix Table B1, lists the specific outcomes reported under each domain.) By construction, all studies in our sample analyze effects on time use. As discussed in the prior section, 76.9% of outcome measures reported relate to statistically significant reductions in time spent on unpaid domestic work (Figure 5). These overwhelmingly positive estimates provide a relatively strong evidence base on what works to reduce unpaid domestic work. By contrast, there is substantially less evidence on outcomes related to health, employment, and empowerment, areas that are essential for advancing gender equity and economic opportunities—with only 57.1%, 48% and 4% of the reported outcome measures respectively falling into these domains. Because some studies report multiple outcomes across different domains, these percentages represent shares of total outcomes reported, not shares of studies. Only one study (evaluating the effects of reliable electrification in India) reports effects on all four domains, and finds statistically significant positive effects across each (Sedai, Vasudevan et al. 2021). For the last three indicators, we do not find any robust estimates of negative impacts on any outcomes reported, indicating that reductions in time spent on unpaid domestic work do not appear to be associated with deteriorations in other dimensions of women's wellbeing when measured.

FIGURE 5. Studies report effects on women's time use, health and employment more often than they report effects on women's empowerment

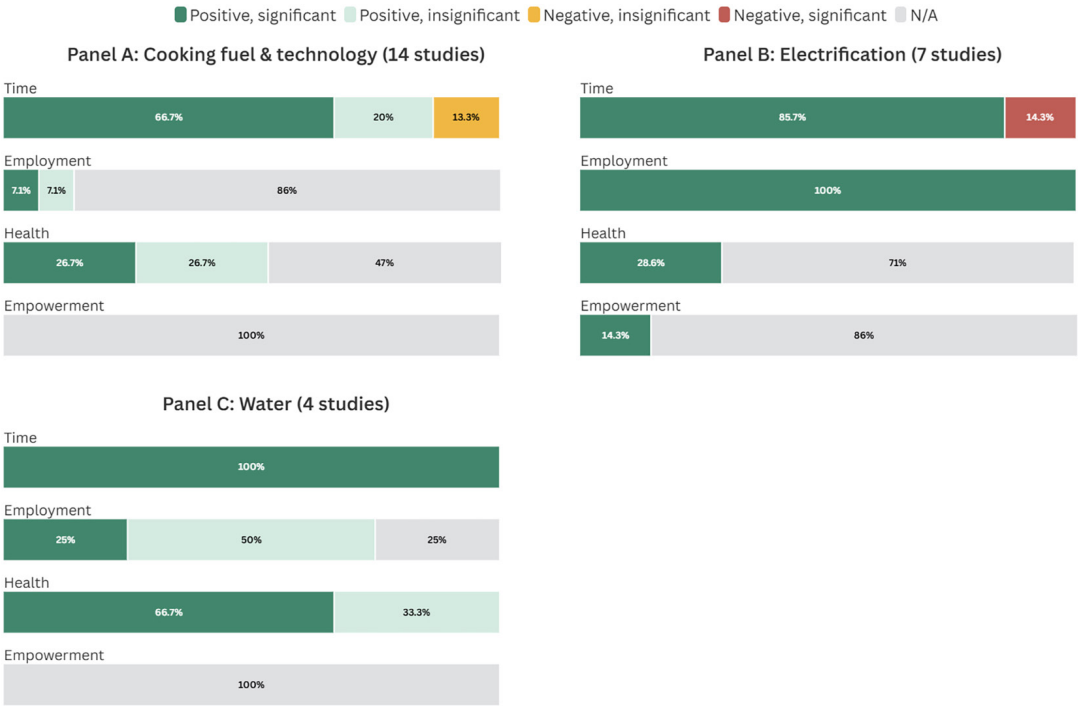


Note: This figure presents the distribution of effects estimated by outcome domain for the 25 papers in our sample.

5. Infrastructure improvements predominantly demonstrate positive impacts on women's outcomes

Although cooking fuel and technology improvements are the most frequently evaluated type of interventions in our sample, they generate mixed results (as illustrated in Panel A of Figure 6). Studies evaluating the impacts of improvements in electricity infrastructure (Panel B) and water infrastructure (Panel C) predominantly report positive impacts across outcomes when measured. Yet, one study on electrification reports a negative statistically significant effect on women's time use. We discuss the results for each intervention type in more detail below.

FIGURE 6. Cooking fuel and technology interventions have mixed effects, while electrification and water access improvements predominantly have positive impacts on women's outcomes



Note: This figure presents the distribution of effects estimated by intervention type.

Cooking fuel and technology improvements. The fourteen studies evaluating improvements in cooking fuel and technology analyze the effects of using liquified petroleum gas (LPG) relative to biomass fuel or of using improved cookstoves relative to traditional cookstoves. Adopting LPG has significant positive effects on time use in all six studies reviewed (reducing time spent cooking, collecting fuel, and making dung cakes). One study (Afridi et al. 2023) reports no statistically significant impact on time-use categories including domestic work, market work, childcare, and leisure. Once domestic work is disaggregated, there are positive effects on cooking time, but no statistically significant impact on cleaning, childcare and others. However, improved cookstoves have weaker impacts with positive effects on time use in three papers and statistically insignificant effects in three studies. Beyond time use, studies rarely focus on additional outcomes. Evidence from one study indicates that adopting LPG increases married women's employment activities and two studies on LPG adoption find positive effects on self-reported health and nutrition. By contrast, one study on improved cookstoves finds statistically insignificant effects on employment and four studies indicate inconclusive effects on self-reported health—one study (Burwen and Levine 2012) shows mixed results with a decline in self-reported symptoms associated with cooking yet indicates no reductions in exposure to carbon monoxide; while another study indicates a positive effect on

health (Bensch and Peters 2015), driven by a reduction in eye infections and respiratory system disease for household cooks. None of the studies of improvements in cooking fuel and technology assess impacts on women's empowerment. Altogether, LPG adoption appears to be a more effective way to reduce cooking-related drudgery than switching to improved cookstoves and has the potential to improve women's wellbeing more broadly by increasing economic participation and improving health.

Electricity infrastructure. Electrification leads to comprehensive reductions in time spent on unpaid domestic work (including time spent cooking and collecting fuel and water). It also yields the strongest reported impacts on women's employment, with all seven studies in our sample finding significant increases in the time women spend on economic activities (Panel B of Figure 6). Two of the seven studies also report increases in earnings, and two report positive impacts on health. Nonetheless, one study on rural electrification in India finds a negative impact on time use through an increase in hours spent on adult activities such as cooking, charging devices, and cleaning by 0.6 hours per day (Thomas et al. 2020). However, the study does not measure effects on time spent on activities related to domestic production outside the home, such as fuel or water collection, so it is possible that electrification reduced the time spent on these unobserved activities and reduced overall time spent producing domestic services, with a shift from outdoor to indoor activities. Electricity infrastructure is the only intervention evaluated by a study that assesses impacts on all four domains, finding positive impacts on all four (Sedai, Vasudevan et al. 2021). Notably, all seven studies use quasi-experimental variation in electricity access and draw on publicly available datasets with large sample sizes. This research approach allows researchers to analyze a broader range of outcomes than those typically included in a follow-up survey for a randomized experiment and increases their statistical power to detect treatment effects.

Water infrastructure. Four studies assess interventions targeting water infrastructure, reporting positive impacts on time use in all four cases (Panel C of Figure 6), primarily through decreased time spent on water collection. Additionally, two of the four studies report positive impacts on health (with reductions in diarrhea, upper respiratory infections, typhoid fever and measles). One study in Zambia finds positive but statistically weak evidence that disruptions in piped water access reduced children's routine checks and vaccinations. Yet, gaps persist in reporting outcomes for women across domains. None of the water infrastructure studies address women's empowerment, reflecting the prevalent exclusion of this domain. Furthermore, in contrast to the focus on women's employment in studies on electricity access, only one of the water access studies reports impacts on women's employment and finds increases in the likelihood of employment and in wages. This dearth of evidence indicates a need for more research on the relationship between reduced drudgery from water collection and women's economic participation.

6. Drudgery-reducing interventions have heterogeneous impacts, typically with larger effects for women versus men, in rural versus urban areas, and for poorer versus wealthier households

The effects of drudgery-reducing interventions may differ across populations, with the potential to increase or decrease inequality in constraints on women's time. We find some evidence of heterogeneity in impacts based on gender, rurality, and poverty status.

Gender. Women tend to benefit more than men from drudgery-reducing interventions since they undertake most of the drudgery to begin. Reliable electrification reduces fuel and water collection disproportionately more for women than for men in India (Sedai, Vasudevan et al. 2021), while access to piped water also reduces time burdens particularly for women (Winter et al. 2021) and girls (Ashraf et al. 2021) in Zambia. In terms of economic activity, in India (Sedai 2021), indoor piped water also improves women's likelihood of employment and wages. However, some interventions may favor men, such as rural electrification increasing male earnings while reducing female wages in South Africa (Dinkelman 2011).

Rurality. Studies in India highlight stronger impacts in rural settings, where electrification improves women's autonomy (Sedai, Vasudevan et al. 2021) and household income (Sedai, Nepal et al. 2021). In India, access to piped water decreases the incidence of diarrhea by 0.8 percentage points in urban areas without any effects in rural areas (Sedai 2021).

Poverty. Poorer households often experience greater benefits, such as improved cookstove adoption yielding greater time savings for low-income households in Rajasthan (Jeuland et al. 2020). Electrification in rural areas increases consumption for low-income households in India (Sedai, Nepal et al. 2021). In Senegal, poor households have a greater willingness to pay for grid reliability (Cisse 2025). In India, access to indoor piped water reduces time fetching water and incidence of diarrhea particularly for poor households (Sedai 2021).

Overall, these findings underscore important patterns of heterogeneity in drudgery-reducing interventions, with women, rural areas, and poorer households often experiencing more pronounced benefits. However, gender disparities and economic inequalities may be exacerbated in contexts where benefits accrue disproportionately to men or to wealthier populations.

7. Few studies report on cost-effectiveness

Only five studies in our review reported intervention costs, focusing primarily on improved cookstoves and water infrastructure. For example, the cost of two improved cookstoves was approximately US$7.50 (Jeuland et al. 2020), while acquiring a water connection in rural areas cost about $10.50 (Thomas et al. 2020). Another cookstove for US$40 reported a 295 percent annual

return with $237 in charcoal savings over two-year lifespan (Berkouwer and Dean 2022). One electricity reliability intervention demonstrated an exceptionally high internal rate of return (IRR) of around 174.5%, recouping the initial $8,000 investment in under one year (Cisse 2025). Even under conservative assumptions on the benefits accrued, the IRR remained favorable at 31%. Additionally, increasing village access to indoor piped drinking water by 0.1% raised women's overall employment likelihood by 0.33 percentage points, highlighting the economic benefits of improved water infrastructure (Sedai 2021).

Compared to other women's economic inclusion initiatives, these figures suggest that interventions reducing domestic drudgery through infrastructure improvements can yield high economic returns at relatively low costs. While cost-effectiveness analyses are sparse in this domain, available evidence indicates that such interventions compare favorably to established strategies like childcare provision, which is known to enhance women's labor market participation but often entails higher recurring costs. This underscores the potential value of investing in domestic infrastructure as a complementary approach to broader women's economic empowerment programs.

Strengthening efforts to decrease domestic drudgery

Altogether, we find that while infrastructure and cooking-focused interventions show promise in decreasing domestic drudgery and improving women's wellbeing, significant gaps remain in the measurement and reporting of women-centered outcomes, particularly in areas of empowerment, health, and economic participation. These findings underscore the need for more comprehensive, gender-focused research to inform policies and programs that effectively address the multifaceted impacts of drudgery on women's lives. Our work has several research and policy implications.

Research implications

Prioritize time-use surveys and qualitative data. While we gained valuable insights from the 25 studies in our sample, we excluded multiple other studies that evaluated potentially transformative interventions because they did not estimate impacts on women's time spent on domestic drudgery. Documenting time savings in unpaid domestic work can uncover previously undervalued interventions and strengthen the case for investing in reducing domestic drudgery. Additionally, qualitative data can provide informative insights into the mechanisms linking reductions in domestic drudgery to additional outcomes and illuminate the role of contextual factors like social norms.

Refine standardization. Developing cross-study measures for time-use impacts is crucial for facilitating an understanding of the relative efficacy of alternative interventions, both within and across intervention types.

Broaden the scope of outcomes measured. Domestic drudgery is a central feature of many women's lives. Therefore, shifts in levels of domestic drudgery potentially have ramifications for a wide range of aspects of their wellbeing, in both positive and negative ways. For example, although time spent on unpaid domestic tasks outside the home (like fetching water or firewood) could have positive effects on women's social capital—by providing women an opportunity to leave their homes and socialize with other women in public spaces, diversifying their peer networks (Kandpal and Baylis 2013)—we do not find any evidence indicating whether drudgery reductions cause negative impacts on women's social networks. Instead, all reported impacts of drudgery-reducing interventions on broader dimensions of women's wellbeing are weakly positive, suggesting that the benefits of decreasing domestic drudgery exceed any documented negative impacts. Broadening the scope of outcome metrics to consistently include employment, empowerment, health, social engagement, and wellbeing measures will enable a comprehensive assessment of impacts.

Increase collection of cost data. Enhancing cost-effectiveness analysis by integrating return on investment estimates can strengthen the business case for investing in interventions to reduce domestic drudgery.

Policy implications

Pair infrastructure with inclusion efforts. Time savings alone may not translate into empowerment without economic opportunities. Our review highlights the significant potential of investments in infrastructure improvement to reduce drudgery (particularly for women, rural populations, and poorer households), by alleviating the time and energy demands associated with producing domestic services. However, the findings suggest that infrastructure interventions alone may be insufficient to fully harness these benefits. Complementary economic inclusion strategies can provide an added boost to ensure that the time savings from reduced drudgery translate into meaningful economic participation and empowerment for women. Without such measures, the redistribution of women's time toward economic work may remain limited, thereby constraining broader development outcomes. Similarly, economic strengthening interventions on their own are unlikely to achieve their full potential in the absence of investments to alleviate domestic drudgery. There is some evidence that increasing household income can decrease the time women spend on domestic drudgery (Ndlovu et al. 2018). It would be informative to understand how additional interventions can complement these impacts. As an example of promising work in this area, researchers are partnering with a social enterprise in India to facilitate women's access to online jobs so that they can secure paid work for the short amount of time freed up by LPG adoption. Small time savings are unlikely to have transformative impacts otherwise.

Leverage cost-effective solutions. Early evidence suggests high returns for low-cost interventions like LPG stoves and water access. Scaling up these interventions allows a readily available approach to reduce women's domestic drudgery and improve their wellbeing.

Align with green transition goals. Cleaner cooking fuels and electrification reduce drudgery and emissions. Our results uncover an important synergy between the objectives of decreasing domestic drudgery and fostering a green transition, because the most effective interventions to decrease drudgery—shifting away from biomass cooking fuels and improving electricity access—have direct implications for environmental sustainability. Existing evidence of switches in cooking fuel comes from studies on LPG adoption, however, ethanol-burning stoves could be similarly effective at reducing time spent cooking and collecting fuel while lowering carbon emissions. Furthermore, electricity from renewable sources could provide the benefits of reducing time spent on unpaid domestic work while facilitating women's transition into spending more time on paid market work. Large-scale electrification initiatives like the Mission 300 partnership between Africa Development Bank and the World Bank, which seeks to provide electricity access to 300 million people in Africa by 2030, offer an opportunity to improve women's wellbeing by reducing domestic drudgery. However, the overall environmental effects will ultimately depend on the type of electricity used.

Moving forward, there is a critical need for more standardized and targeted research on domestic drudgery to better understand its impacts, particularly on women's empowerment and economic inclusion. By addressing these gaps, policymakers, researchers, and practitioners can design more effective interventions that not only reduce domestic drudgery but also unlock women's full economic and social potential.

Appendix to "Decreasing Domestic Drudgery: Why it matters and what we know about what works in low- and middle-income countries"

A1. Conceptual framework

FIGURE A1. Multiple mechanisms link decreases in domestic drudgery to improvements in women's wellbeing

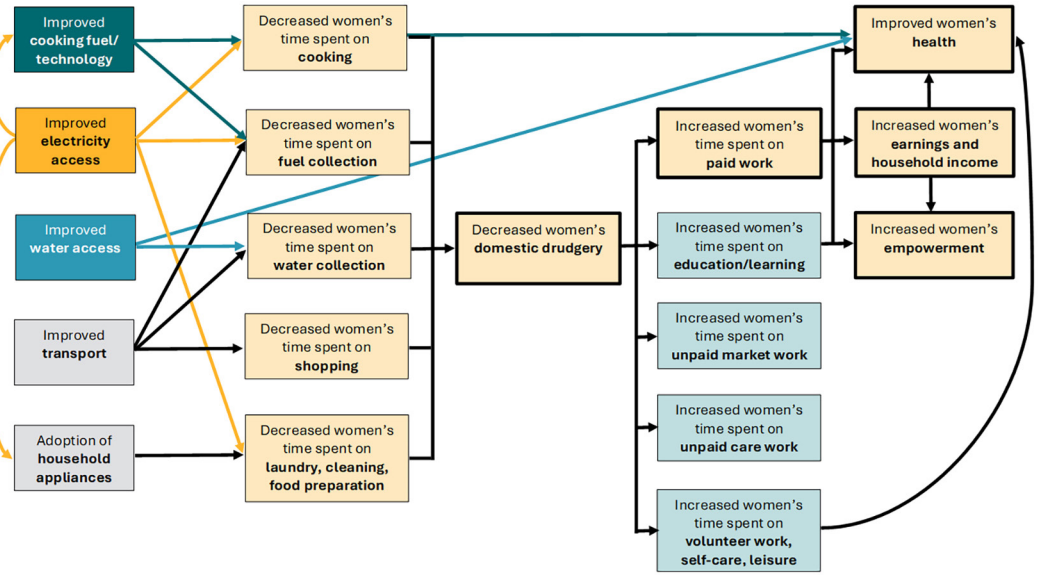


Figure A1. outlines the conceptual linkages between decreases in domestic drudgery and improvements in women's wellbeing. The five interventions on the left—improvements in cooking fuel and technology, electricity access, water access, transport, and adoption of household appliances—each impact women's time spent on unpaid domestic work in some way (sometimes through multiple channels). By reducing women's time spent on unpaid arduous domestic tasks (cooking, fuel collection, water collection, shopping, laundry, cleaning, and food preparation), these interventions ultimately reduce women's domestic drudgery. This shift in time use frees up women's time for other activities. Notably, the impacts of shifts in time use depend on how women use their additional time between alternative activities (including paid work, education and learning, unpaid market or care work, volunteer work, or self-care and leisure). Each of these alternative activities in turn impacts women's wellbeing. For example, if women increase their time spent on paid work, they can subsequently increase their earnings. Additionally, this yields improvements in women's health and empowerment. Similarly, women could increase their time spent acquiring education and skills, which could also increase their productivity, agency, and health-seeking behaviors, leading to positive effects on earnings, health, and empowerment.

In addition to directly impacting time use, improved electricity access also facilitates two of the other key interventions, by facilitating a shift to electric stoves and facilitating the adoption of electric household appliances.

Finally, improvements in cooking fuel or technology and improvements in water access could both directly impact health by reducing respiratory illness and water-borne illness respectively (even without significantly impacting time use).

B1. Search strategy

The lack of standardization in the concept of drudgery poses challenges for meta-analysis, as insights are often reported as secondary findings across studies spanning a range of disciplines. While our initial aim was to conduct a standardized keyword search, the diversity in terms, framing, and scope across studies necessitated a narrative approach grounded in anchor studies and citation networks.

We adopted a phased approach to identify and synthesize existing evidence on drudgery-reducing interventions. In the first phase, we conducted an exploratory search to refine our methodology and search terms. Screening for terms like "drudgery," "arduous work," "labor intensive," "agony," "monotony," and "hardship," combined with population- and setting-specific keywords (e.g., "women," "household," "domestic"), provided important insights into the evidence landscape. Literature on drudgery often focuses on agriculture-related interventions, tends to be descriptive, and is challenging to locate using search terms alone. To address these limitations, we shifted from using a keyword search to a targeted screening of papers, narrowing our scope to domestic-focused interventions.

In the second phase, we employed a two-step search. First, we created a list of anchor studies aligned with our focus on domestic drudgery and women's wellbeing, drawing on our awareness of existing papers and on previous reviews (including Dinkelman and Ngai (2022) and Small and van der Meulen Rodgers (2023)). We then used Connected Papers and Google Scholar to expand our list with additional studies that were cited in or cited by these anchor papers. Our final sample includes 25 studies, spanning grey literature and academic publications from various disciplines. Studies were included based on the following criteria: (i) published in English between January 2010 and September 2025; (ii) focused on low- or middle-income countries; (iii) evaluate interventions that could reduce domestic drudgery; (iv) employ experimental or quasi-experimental research designs to estimate causal impacts on women's time spent on unpaid domestic work.

We use several exclusion criteria to sharpen the relevance of our synthesis. We exclude studies focused on reducing unpaid care work, as the effects of care-focused interventions are well-documented elsewhere (including Evans et al. (2021) and Halim et al. (2023)). We also exclude studies simulating hypothetical impacts of potential interventions based on observed gender distributions of unpaid work and exclude descriptive studies quantifying women's time spent on drudgery to focus on studies estimating causal effects of existent interventions. Additionally, there is a large literature analyzing interventions to reduce agricultural drudgery with a view to increasing the productivity of subsistence agriculture (Vemireddy and Choudhary 2021). We focus on domestic drudgery in our review and exclude agricultural drudgery because of the predominant role domestic drudgery plays

in women's lives and the resulting potential that decreased domestic drudgery will improve women's wellbeing by impacting their time use, health, employment, and empowerment.

Finally, there is a growing literature on the effects of interventions to redistribute unpaid domestic work by engaging men to take on a larger share of home production. Our focus is on understanding the effects of interventions to reduce domestic drudgery, as a complement to efforts to redistribute unpaid work, so we exclude studies that instead focus on shifting the intrahousehold allocation of labor while keeping the total time households spend on unpaid domestic work unchanged.

B2. Population coverage

Regarding population demographics, the studies predominantly focus on adults. Specifically, 10 studies include adults aged 18–45, and 9 studies include individuals aged 45 and above. Adolescents aged 15–17 are included in 5 studies, while 15 studies do not report the age of individuals in their sampled population. We include studies with samples of mixed gender if they report gender-specific results. Our sample includes 14 studies with mixed gender and 11 studies with women only. The scope of populations covered in our review highlights limitations in the geographic, economic, and demographic diversity of evidence, while underscoring the need for consistent reporting on location, poverty status, and age to better inform future research and interventions.

B3. Reported outcomes by domain

TABLE B1. Indicators of women's wellbeing

Time Spent Producing Domestic Services	Employment	Health	Empowerment
Time spent cooking	Time spent on income-generating activities	Self-reported respiratory health	Involvement in economic, social, and reproductive decision-making
Time spent on fuel collection	Indicator for labor force participation	Self-reported eye problems	
Time spent fetching water	Indicator for non-agricultural employment	Self-reported assessment of cooking arrangement (e.g., excessive smoke or dangerous)	
Time spent on household chores	Quality of employment	Incidence of indoor pollution	
Time spent on unpaid labor activities (including care work)	Earnings	Incidence of fecal contamination and diarrhea	
Time spent repairing cookstoves	Household income and expenditure	Nutrition intake based on number of meals	
Time spent on leisure	Agricultural output	Incidence of typhoid fever and measles	
		Preventative care for children (routine check-ups and vaccinations)	

B4. Studies included in the review

TABLE B2. Summary of studies and findings

Study	Country	Intervention	Methodology	Population	Time Savings (Converted to min/week)	Summary of Findings
Cooking fuel & technology						
(Afridi et al. 2023)	India	Cooking fuel & technology: health awareness treatment on negative effects of cooking with solid fuels, and LPG public subsidies for cleaner LPG	Experimental: cluster-randomized RCT	Women. Aged 25–45. Poor.	140** min/ week from cleaner fuels 35* min from energy information nudge, marginally significant.	• cleaner fuel use reduces weekly cooking time by 140 minutes (7 days × 20 minutes per day), ($p < 0.05$). • energy information nudge reduces cooking time by 35 minutes a week, with a coefficient of −5.344 ($p < 0.10$). • There are no statistically significant results in any other time-use categories, including domestic work, market work, personal care, and leisure. • When disaggregating domestic work, there are no statistically significant results in cleaning, childcare, and others.
(Akter and Pratap 2022)	India	Cooking fuel & technology: LPG adoption	Quasi-experimental: Fixed-effect panel regression model	Women.	116.76*** min/ week	• "LPG adopters spend around 15 min less time cooking food per day than non-adopters with no significant change in the number of meals cooked", with a coefficient of −0.278 ($p < 0.01$). ○ Estimated time-saved: 0.278 hrs/day × 60 min = 16.68 min/day → 16.68 min × 7 days = 116.76 min/week • LPG adopters collect firewood less frequently and prepare fewer pieces of dung cake than non-adopters. • LPG adopters report more convenient and simpler cooking experience: "While LPG adopters were significantly less likely than non-adopters to believe that their cooking arrangement was dangerous, the magnitude of the coefficient was rather small (6% points)."

(Continued)

TABLE B2. Summary of studies and findings (Continued)

Study	Country	Intervention	Methodology	Population	Time Savings (Converted to min/week)	Summary of Findings
(Azam 2023)	India	Cooking fuel & technology: LPG transition	Quasi-experimental: Difference in Difference	Mixed gender.	137.2*** min/week for a complete LPG transition 82.6*** min/week for incomplete transition to LPG	• households that completely (incompletely) transition to LPG from biomass spent 10 (6) percent less time on cooking per day, equal to 19.6 min/day for a complete transition, and 11.8 min/day for those transitioning from solid to mixed fuels; coefficient are 19.608 and 11.848 ($p < 0.01$). ○ Estimated time-saved: 19.6 min × 7 days = 137.2 min/week & 11.8 min × 7 days = 82.6 min/week • households that switched from solid fuels to LPG are considerably less likely to report that their cooking arrangement is producing excessive smoke, or it is too dangerous compared to the households that continued using solid fuels. • households that switched to LPG increased frequency of cooking, but decreased cooking time for each meal by 12 minutes.
(Beltramo and Levine 2013)	Senegal	Cooking fuel & technology: Solar ovens (cookstoves)	Experimental: Randomized Control Trial	Women. Poor.	77.17 min/week in fuel collection 113.05 min/week in time spent by cookfire (most time-intensive category of time used)	• no impact on time as seen in "treatment households did not have statistically significantly lower time spent collecting fuel or time spent next to the cook fire"; the two largest coefficients include an insignificant decrease of 77.17 min/week in fuel collection for a household cooking for six or fewer people, and an insignificant decrease of16.15 min/day decrease in time by cookfire in households with 7–12 members. ○ Estimated time-saved: 16.15 min × 7 days = 113.05 min/week • no impact on health as seen "there is no evidence solar ovens reduced exposure to carbon monoxide or self-reported respiratory symptoms such as coughs and sore throats."

(Continued)

TABLE B2. Summary of studies and findings (Continued)

Study	Country	Intervention	Methodology	Population	Time Savings (Converted to min/week)	Summary of Findings
(Bensch and Peters 2015)	Senegal	Cooking fuel & technology: Biomass-burning improved cookstoves (ICS)	Experimental: Randomized Control Trial	Mixed gender.	567*** and 525*** min/week in cooking time (most time-intensive category of time used) 148 and 136 min/week in firewood collection	• decreased time on domestic services: "the cooking duration of all three meals throughout a typical day decreases significantly by more than 75 min"; coefficients are 75 and 81 ($p < 0.01$). ○ Estimated time-saved: 75 min × 7 days = 525 min/week; 81 min × 7 days = 567 min/week • statistically insignificant reductions in firewood collection time, 136 min and 148 min, ($p = 0.15$ to 0.19) for ITT with and without controls. • improved health: "In the group of household members responsible for cooking the prevalence rates for both respiratory disease symptoms and eye infections go down by almost seven percentage points."
(Berkouwer and Dean 2022)	Kenya	Cooking fuel & technology: Biomass-burning improved cookstoves (ICS)	Experimental: Randomized Control Trial	Women (95%).	394*** min/week in cooking time	• Estimated time saved: 56.31 min/day ($p < 0.01$). ○ Estimated time-saved: 56.31 min × 7 days = 394.17 min/week
(Burwen and Levine 2012)	Ghana	Cooking fuel & technology: Improved wood cookstoves (ICS)	Experimental: Randomized Control Trial	Women. Poor.	9 min/week	• although: "There were no detectable reductions in a households' weekly time from wood collection or in exposure to carbon monoxide". The difference in the number of days of wood collection in past week × duration of most recent wood collection (min) is only 9, and not statistically significant. • improved health: "a sharp decline in participants' self-reported symptoms associated with cooking, such as burning eyes, and in respiratory symptoms, such as chest pain and a runny nose."

(Continued)

TABLE B2. Summary of studies and findings (Continued)

Study	Country	Intervention	Methodology	Population	Time Savings (Converted to min/week)	Summary of Findings
(Chandrasekaran 2024)	Tanzania, Malawi, and Zambia	Cooking fuel & technology: distribution of free fuel-efficient cookstoves ("TLC rocket stoves") (ICS)	Quasi-experimental: Difference in Difference	Women.	112* min/ week in fuel collection in Zambia 73.563* min/week in cooking time in Tanzania (most time-intensive category of time used)	• Overall, statistically insignificant effects on time use, with two exceptions: ○ Zambia: "consistent decrease in time spent on fuel collection across models, though the pattern does not hold across countries or in our pooled results" (only when using the alternative fuel collection time of min/day) finds a time saving of 16 min/day in fuel collection ($p < 0.10$). – Estimated time-saved: 16 min × 7 day = 112 min/week ○ Tanzania: "decrease in time spent cooking when we use matching techniques." The decrease is 10.509 min/day ($p < 0.10$). – Estimated time-saved: 10.509 min × 7 days = 73.563 min/week • statistically insignificant effects on labor productivity, measured by: time spent on income generating activities, time spent on unpaid labor on one's own farm, household income, and agricultural output.
(Fadly et al. 2023)	India	Cooking fuel & technology: LPG relative to dirty/biomass fuel (firewood and dung cakes)	Quasi-experimental: Difference-in-difference (Kernel matching) & Poisson fixed effects models	Mixed gender. Aged 18+	112*** to 161*** min/ week in cooking time (most time-intensive category of time used) 180 to 900 min/week in fuel collection, note this is an estimation	• decreased cooking time "8% reduction (…) amounts to almost 2 h a week" specifically a cooking reduction of 9 min per meal on average or 16–23 min/day; coefficients are 0.269 and 0.382 ($p < 0.01$). ○ Estimated time-saved: 16 min × 7 days = 112 min/week; 23 min × 7 days = 161 min/week • decreased frequency of fuelwood collection implying "time savings ranging from 3–15 h per week", though not statistically significant. ○ Estimated time-saved: convert to min, 180 min/week–900 min/week • 1.5% increase in number of meals per day, "equivalent to an impact on nutrition from a 2.6 to 6.25% change in household expenditures."

(Continued)

TABLE B2. Summary of studies and findings (Continued)

Study	Country	Intervention	Methodology	Population	Time Savings (Converted to min/week)	Summary of Findings
(Hanna et al. 2016)	India	Cooking fuel & technology: improved cookstoves (ICS)	Experimental: Randomized Control Trial	Women. Poor.	–21 min/week	• no impact on time "if anything, the stoves increased the time spent cooking evening meals by about three minutes, although this is not statistically significant at conventional levels." ○ Estimated time-saved: –3 min × 7 days = –21 min/week • increase in time repairing stoves: "treatment households made, on average, about 2.4 more repairs to their stove in the last year (column 4), translating to about a half hour of time over the last year." ($p < 0.01$). We exclude this small estimate from our calculation of impacts on time used. ○ Estimated time-saved: –30 min/52.1775 weeks in a year = –0.574 min/week • no impact on health seen through health outcomes such as smoke inhalation "the stoves failed to achieve their primary goal of reducing exposure to hazardous air pollutants." "no difference in lung functioning (as measured by spirometry tests) between women who regularly cook in the treatment and control groups" "fail to find a positive impact on a wide variety of measured and self-reported health outcomes, including infant birth weight, infant mortality rates, probability of a cough, blood pressure, or even the probability of any illness in the last 30 days."
(Jeuland et al. 2020)	India	Cooking fuel & technology: Biomass-burning improved cookstove (ICS)	Experimental: RCT with phased rollout	Mixed gender. Poor.	294*** min/week 210* min/week	• decreased time spent on cooking and fuel collection ("savings of 0.5–0.7 h/day in total across both variables"); coefficients are –0.47 and –0.28 on the upper bound ($p < 0.01$), and –0.43 and –0.14 in the lower bound ($p < 0.05$ and $p < 0.10$). ○ Estimated time-saved: 0.5 h × 60 min = 30 min → 30 min × 7 days = 210 min/week; 0.7 h × 60 min = 42 min → 42 min × 7 days = 294 min/week • self-reported respiratory health, not statistically significant.

(Continued)

TABLE B2. Summary of studies and findings (Continued)

Study	Country	Intervention	Methodology	Population	Time Savings (Converted to min/week)	Summary of Findings
(Pattanayak et al. 2019)	India	Cooking fuel & technology: Improved cookstoves (ICS)	Experimental: Randomized Control Trial	Women	71.4 min/week	• Treated households spent 10 fewer minutes per day collecting fuel (or more than one fewer hour per week, a 9% reduction), although not statistically significant at conventional levels. ○ Estimated time-saved: 10.2 min × 7 days = 71.4 min/week
(Su and Azam 2023)	India	Cooking fuel & technology: use of LPG	Quasi-experimental: Leave-one-out Instrumental Variable	Women. Aged 18–60.	17.5** min/ week	• reduced time cooking by 2.462 min/day ($p < 0.05$); marginally more cooking events in a day; no impact on probability of women participating in cooking activities (not statistically significant). ○ Estimated time-saved: 2.5 min × 7 days = 17.5 min/week • 8.7 min/day (11.8%) increase in married women's employment activities.
(Williams et al. 2020)	Peru	Cooking fuel & technology: LPG adoption	Experimental: RCT	Women. Aged 25–64. Poor	348*** min/ week	• 3.2 to 3.9 fewer hours cooking per week (17 min/day) and 1.9 fewer hours (113 min) collecting fuel per week, for a total of up to 5.8 hours saved per week ($p < 0.001$). ○ Estimated time-saved: 5.8 hrs/week × 60 min = 348 min/week • 1 more cooked meal per day. • Companion paper analyzes health outcomes and reports "We did not find evidence of a difference in blood pressure, lung function, or respiratory symptoms during the year-long intervention with LPG."

(Continued)

TABLE B2. Summary of studies and findings (Continued)

Study	Country	Intervention	Methodology	Population	Time Savings (Converted to min/week)	Summary of Findings
Electrification						
(Cisse 2025)	Senegal	Electrification: installation of remote devices to reduce outage durations	Quasi-experimental: Difference in Difference	Mixed gender.	313.32** min/week on household chores (most time-intensive category of time used) 150.78* min/week on child and elder care 44.94** min/week on wood collection	• decreased "hours spent on household chores, in hours spent taking care of other household members, and in hours spent searching for wood" per day equal to 0.746 ($p < 0.05$), 0.359 ($p < 0.10$), and 0.107 ($p < 0.05$). ○ Estimated time-saved: 0.746 hrs × 60 min = 44.76 min → 44.76 min × 7 days = 313.32 min/week; 0.359 hrs × 60 min = 21.54 min → 21.54 min × 7 days = 150.78 min/week; 0.107 hrs × 60 min = 6.42 → 6.42 min × 7 days = 44.94 min/week • increased hours worked daily by 1.449.

(Dinkelman 2011)	South Africa	Electrification: household access to electricity	Quasi-experimental: Panel fixed effects and instrumental variable regressions using survey data	Mixed gender. Aged 15–59. Poor.	534*** min/week	• Note the study does not measure time use directly. Since authors imply that electrification reduced women's time spent in home production, we make an assumption of time use and calculate the shifted hours into time saved:
						  ○ "Electrification increases employment on the intensive margin for women: in districts with the average increase in electrification over the period (15 percent), women work about 8.9 ($p < 0.01$) more hours per week, a 3.5 percent increase."
						  ○ Estimated time-saved: 8.9 hrs/week × 60 min = 534 min/week
						• "reliance on wood for cooking falls by 3.9 percentage points, and cooking with electricity rises by 5.6 percentage points."
						• 9 to 9.5 percentage point increase in women's employment mostly because household electrification served as a labor-saving technology and reduced women's time spent in home production.

(Continued)

TABLE B2. Summary of studies and findings (Continued)

Study	Country	Intervention	Methodology	Population	Time Savings (Converted to min/week)	Summary of Findings
(Bago et al. 2024)	Côte d'Ivoire	Electrification: household electrification provided at the locality-level	Quasi-experimental: Inverse probability weighted regression adjustment with Heckman selection bias correction	Women. Aged 17–64.	567*** min/ week	• 12.6% reduction in time allocated to performing household chores ($p < 0.01$). Table A1 shows that on average women spend 75.01 hours per week on household work. In comparison, men spend 21.6 hours/week. A 12.6% reduction equals 9.45 hours/ week. ○ Estimated time-saved: 9.45 hrs/week × 60 min = 567 min/week • reallocation of time to full-time paid work in the agricultural and non-agricultural sectors: "increase of about 23% of the average time spent by women" which "seems to reflect a catch-up effect, as men spend on average 41 h per week on nonagricultural activities compared to 31 h for women"; "although the time spent on agricultural activities increases significantly at the 1% threshold, the effect is weaker" at only 13.9%.
(Khandker et al. 2014)	India	Electrification: access to electrification	Quasi-experimental: Instrumental Variables	Mixed gender. Poor.	49.5** min/ week	• reduces time spent on fuel collection: "reduce time allocated to fuel wood collection by household members and increases time allocated to studying by boys and girls" "For both men and women, biofuel collection time decreases by more than 3.3 hours per month ($p < 0.05$). This may also mean that electrification reduces drudgery for household members." ○ Estimated time-saved: 3.3 hours per month/4 weeks = 0.825 hrs/week → 0.825 hrs/week × 60 min = 49.5 min/week • increases employment: "Rural electrification also increases labor supply of men and women (…) and household per capita income and expenditure" "The impact of electrification on labor supply is positive for both men and women; that is, household access to electricity increases employment hours by more than 17 percent for women and only 1.5 percent for men."

(Continued)

TABLE B2. Summary of studies and findings (Continued)

Study	Country	Intervention	Methodology	Population	Time Savings (Converted to min/week)	Summary of Findings
(Sedai, Vasudevan et al. 2021)	India	Electrification: hours of electricity on a typical day	Quasi-experimental: Panel fixed-effects and Instrumental Variables	Mixed gender. Aged 18–70. Poor.	37*** min/ week	• reduces women's time allocation to home production, including fuel and water collection: "10 more hours of electricity significantly reduces women's weekly time spent on fuel collection by 37 min ($p < 0.01$), and men's weekly fuel collection by 26 min." • improves women's economic, social and reproductive decision-making ability: "10 more hours of electricity increases women's agency in major purchase decision of the household by 4.8 pp", "increases women's autonomy over their fertility by 6.6 pp", "reduces the likelihood of women having to ask for permission from family members to visit a health center by 13.3 pp." • increase women's employment opportunities in the usual status; 10 more hours of electricity increases women's likelihood of usual status employment (4.2 pp) more than that of men (2.8 pp), while both women and men gain similar levels of full-time employment, 3.9 pp and 4.0 pp, respectively. • increases women's earnings; reliable electrification increased the real annual earnings for both men and women ("10 more hours of electricity increases the annual earnings of men and women by 15.6% and 16.7%"). • improved health by increasing "likelihood of women reporting good health by 9.2 pp. After controlling for employment and earnings, the effect is reduced to 7.1 pp." • improved health-related fuel choices and the provisions of basic household amenities: "Ten more hours of electricity reduces the likelihood of using wood for cooking by 7.3 pp", "increases the likelihood of having a toilet in the house by 1.6 pp", "increases the likelihood of having indoor piped drinking water by 1.9 pp."

(Continued)

TABLE B2. Summary of studies and findings (Continued)

Study	Country	Intervention	Methodology	Population	Time Savings (Converted to min/week)	Summary of Findings
(Sedai, Nepal et al. 2021)	India	Electrification: additional hours of electricity in a day	Quasi-experimental: Panel fixed effects and instrumental variable regressions using survey data	Mixed gender. Poor.	23*** min/ week	• reduced fuel collection time for both men and women; an additional quintile of electricity hours in a day reduces weekly fuel collection time by 23 min ($p < 0.01$) for women and 19 min for men. • improved health, captured by results showing that additional electricity hours lead to an increase in the likelihood of having toilet facilities, reduction in indoor pollution, piped water facility and artificial lighting for reading at night. Note this result is at the household level. • "an additional hour of electricity increases rural household income by 0.4% and poor household's income by 1.1%, highlighting the relative significance of each additional hour for poor households." "Higher electricity hours also imply better agricultural income, higher labor hours, more businesses. Note this result is at the household level."
(Thomas et al. 2020)	India	Electrification: access to electrification	Quasi-experimental: Instrumental Variables	Mixed gender.	–252*** min/ week	• decrease time by increasing the "number of hours adults spend at home for adult activities, including work, cook, charge, and clean, except leisure, by 0.6 hours/day" ($p < 0.01$). ○ Estimated time-saved: 0.6 hrs × 60 min = 36 min → 36 min × 7 days = 252 min/week • increases employment through increments in the "number of hours adults spend at home for work by 1.8 hours/day."

(Continued)

TABLE B2. Summary of studies and findings (Continued)

Study	Country	Intervention	Methodology	Population	Time Savings (Converted to min/week)	Summary of Findings
Water						
(Ashraf et al. 2021)	Zambia	Water: access to piped water	Quasi-experimental: Panel fixed effects	Mixed gender. Aged <1, 1–5; >5. Poor.	73.5* min/ week	• Negative effects of outages on the amount of time spent on household chores by adolescent girls: "outages are associated with an increase in time spent on household chores, and a decrease in hours spent on school, though the magnitudes are small and only the coefficient on chores is marginally significant." Table A8 shows that number of hours that girls spent on household chores to be 0.175 ($p < 0.10$). Since the treatment would be reliable piped water, we interpret the result as time saved. ○ Estimated time-saved: 0.175 hours/day × 60 min = 10.5 min/day → 10.5 min/day × 7 days = 73.5 min/week • piped water outages decrease health through "an increased incidence of diarrhea disease, upper respiratory infections, typhoid fever and measles"; "a one standard deviation increase in outstanding complaints is associated with 24 additional case of diarrhea" particularly for the infants younger than 1 and children ages 1–5; as similar impact is seen in "0.05 extra typhoid fever cases", which is a 23% increase, predominately for older people, "increase of 57.7 respiratory cases, which is 12% of the mean" for all ages, "0.85 more measles cases, which is 18% of mean", exclusively in elder people. • Large negative but not statistically significant effect of outages on children's routine checkups: "a one standard deviation increase in outstanding complaints is associated with 158 fewer well-child visits for children under the age of 1. This reduction is 12% of the sample mean"; and "associated with a 20% decrease in the number of well-child visits for children between 1 and 5 years of age." • Negative effects of outages on the likelihood of DPT vaccination, statistically significant for the first two out of three shots: "A one standard deviation increase in the days with supply issues is associated with 12.4 fewer shots, or a 12% decrease."

(Continued)

TABLE B2. Summary of studies and findings (Continued)

Study	Country	Intervention	Methodology	Population	Time Savings (Converted to min/week)	Summary of Findings
(Devoto et al. 2012)	Morocco	Water: access to private water grid	Experimental: RCT	Mixed gender. Poor.	60.72** min/ week	• From Table 8, Panel B, the index of time spent on leisurely activities shows: connected households gained +0.253 standard deviations ($p < 0.05$) (column 8). This index is based on 8 activities, each measured in 30-minute periods. ○ Estimated time-saved: 0.253 standard deviations × 8 activities × 30 minutes = 60.72 minutes/week • time gains which were used primarily for leisure and "social activities such as visiting or receiving the visits of family or friends." • there is a positive and statistically significant impact on reported happiness and integration. • there is no statistically significant impact on public health impact, in particular the program does not reduce the incidence of waterborne diseases. • there is no statistically significant impact on labor market participation and income.
(Sedai 2021)	India	Water: access to indoor piped drinking water (IPDW)	Quasi-experimental: Fixed-effects and instrumental variable regressions using survey data	Mixed gender. Aged 15–49. Poor.	140*** min/ week on water collection for women in poor households 49*** min/ week on water collection for the whole sample	• reduced time on unpaid domestic work: "IPDW has a significant relationship with water collection minutes for women, especially for those in poor households and in rural areas (…) there is an association between IPDW and 20 minutes' reduction in the time spent collecting water for women from poor households. For the whole sample, the reduction in daily water collection minutes is 7 minutes a day." ($p < 0.01$) ○ Estimated time-saved: 20 min × 7 days = 140 min/week; 7 min × 7 days = 49 min/week • reduced time fetching fuel and water: "having access to IPDW reduces the daily fuel and water collection time by 31 minutes for women in poor households." ($p < 0.05$) ○ Estimated time-saved: 31 min × 7 days = 217 min/week

(Continued)

TABLE B2. Summary of studies and findings (Continued)

Study	Country	Intervention	Methodology	Population	Time Savings (Converted to min/week)	Summary of Findings
						• increased employment: "having access to IPDW increases women's likelihood of any employment (≥ 30 days) by 1.7 percentage points (pp) and men's likelihood of employment by 1.3 pp in rural areas. There is no such effect in urban areas... IPDW increases women's likelihood of employment by 1.5 pp overall and by 2.9 pp in rural areas." • increased earnings: "access to IPDW increases annual earnings by 7.5% for the aggregate sample. The effect is stronger for women: a 9.9% increase in annual earnings compared with 6.6% for men. However, the increased annual earnings for women are observable only in rural areas, with an 11.8% increase, while in urban areas there is no significant effect on the earnings of women with IPDW. Men, on the other hand, have increased earnings both in rural and in urban areas with IPDW, with rural men gaining larger increases than urban men." • decreased the incidence of diarrhea: "access to IPDW has a negative association with the likelihood of diarrhea in the past month by 0.2 percentage points for the overall sample. We found a significant association of IPDW with the reduction of the likelihood of diarrhea in urban areas but no significant associations in rural areas."

(Continued)

TABLE B2. Summary of studies and findings (Continued)

Study	Country	Intervention	Methodology	Population	Time Savings (Converted to min/week)	Summary of Findings
Winter et al. (2021)	Zambia	Water: access to piped water	Quasi-experimental: linear and generalized linear mixed effects models	Mixed gender. Aged 18+.	228***min/week	• households that obtained piped water reduced their fetching time by 80%, with the majority of time saved accruing to women and girls. ○ "The intervention was associated with a median 3.8 h per week in time savings per household, most of which accrued to women and girls" ($p < 0.01$) ○ Estimated time-saved: 3.8 hrs/week × 60 min = 228 min/week • Increases in the frequency of gardening and the size of garden plots in treatment households were observed, treatment households cultivated gardens almost 60 m2 larger on average, and reported consuming much of their produce. • "We did not observe a significant increase in per-capita reported household expenditures among treatment households." • "We saw no (or negative, in the case of chickens) effect of introducing piped water on livestock ownership." • "Households receiving piped water reported being happier, healthier, and having more time to participate in work inside or outside the home, respondents who obtained access to piped water reported feeling happier (64%), healthier (47%), and less worried (22%) as compared to the pre-intervention period."

References for studies in evidence review

Afridi, Farzana, Sisir Debnath, Taryn Dinkelman, and Komal Sareen. 2023. "Time for Clean Energy? Cleaner Fuels and Women's Time in Home Production." *The World Bank Economic Review* 37 (2): 283–304. https://doi.org/10.1093/wber/lhac031.

Akter, Sonia, and Chitra Pratap. 2022. "Impact of Clean Cooking Fuel Adoption on Women's Welfare in India: The Mediating Role of Women's Autonomy." *Sustainability Science* 17 (1): 243–57. https://doi.org/10.1007/s11625-021-01069-9.

Ashraf, Nava, Edward Glaeser, Abraham Holland, and Bryce Millett Steinberg. 2021. "Water, Health and Wealth: The Impact of Piped Water Outages on Disease Prevalence and Financial Transactions in Zambia." *Economica* 88: 755–81. https://doi.org/10.1111/ecca.12369.

Azam, Mehtabul. 2023. "Fuel Transition and Time-Saving: Evidence From Longitudinal Survey and Multivalued Treatment Effects." SSRN Scholarly Paper 4413800. Rochester, NY, April 10. https://doi.org/10.2139/ssrn.4413800.

Bago, Jean-Louis, Wadjamsse Djezou, Luca Tiberti, and Landry Achy. 2024. "Rural Electrification and Women's Empowerment in Côte d'Ivoire." *Journal of Agribusiness in Developing and Emerging Economies* (Bingley) 14 (1): 25–43. https://doi.org/10.1108/JADEE-11-2021-0295.

Beltramo, Theresa and David Levine. 2013. *The Effect of Solar Ovens on Fuel Use, Emissions and Health: Results from a Randomised Controlled Trial*. https://doi.org/10.1080/19439342.2013.775177.

Bensch, Gunther, and Jörg Peters. 2015. "The Intensive Margin of Technology Adoption – Experimental Evidence on Improved Cooking Stoves in Rural Senegal." *Journal of Health Economics* 42: 44–63. http://dx.doi.org/10.1016/j.jhealeco.2015.03.006.

Berkouwer, Susanna B., and Joshua T. Dean. 2022. "Credit, Attention, and Externalities in the Adoption of Energy Efficient Technologies by Low-Income Households." *American Economic Review* 112 (10): 3291–330. https://doi.org/10.1257/aer.20210766.

Burwen, Jason and Levine, David. 2012. "A Rapid Assessment Randomized-Controlled Trial of Improved Cookstoves in Rural Ghana." *Energy for Sustainable Development* 16 (3): 328–38. https://doi.org/10.1016/j.esd.2012.04.001.

Chandrasekaran, Maya. 2024. "Energy Access, Time Use, and Women's Empowerment in Low- and Middle-Income Countries." Ph.D., Duke University. https://hdl.handle.net/10161/30841.

Cisse, Abdoulaye. 2025. "The Value of Electricity Reliability: Evidence from a Natural Experiment in Senegal." Unpublished Working Paper. https://are.berkeley.edu/events/2024/09/value-electricity-reliability-evidence-natural-experiment-senegal.

Devoto, Florencia, Esther Duflo, Pascaline Dupas, William Parienté, and Vincent Pons. 2012. "Happiness on Tap: Piped Water Adoption in Urban Morocco." *American Economic Journal: Economic Policy* 4 (4): 68–99. https://doi.org/10.1257/pol.4.4.68.

Dinkelman, Taryn. 2011. "The Effects of Rural Electrification on Employment: New Evidence from South Africa." *American Economic Review* 101 (7): 3078–108. https://doi.org/10.1257/aer.101.7.3078.

Fadly, Dalia, Francisco Fontes, and Miet Maertens. 2023. "Fuel for Food: Access to Clean Cooking Fuel and Food Security in India." *Food Security* 15 (2): 301–21. https://doi.org/10.1007/s12571-023-01350-y.

Hanna, Rema, Esther Duflo, and Michael Greenstone. 2016. "Up in Smoke: The Influence of Household Behavior on the Long-Run Impact of Improved Cooking Stoves." *American Economic Journal: Economic Policy* 8 (1): 80–114. https://doi.org/10.1257/pol.20140008.

Jeuland, Marc A., Subhrendu K. Pattanayak, Sushmita Samaddar, Ronak Shah, and Mansi Vora. 2020. "Adoption and Impacts of Improved Biomass Cookstoves in Rural Rajasthan." *Energy for Sustainable Development* 57 (August): 149–59. https://doi.org/10.1016/j.esd.2020.06.005.

Khandker, Shahidur R. Hussain A. Samad, Rubaba Ali, and Douglas F. Barnes. 2014. *Who Benefits Most from Rural Electrification? Evidence in India*. https://www.jstor.org/stable/24695761.

Pattanayak, S. K., M. Jeuland, J. J. Lewis, et al. 2019. "Experimental Evidence on Promotion of Electric and Improved Biomass Cookstoves." *Proceedings of the National Academy of Sciences of the United States of America* 116 (27): 13282–87. https://www.jstor.org/stable/26744182.

Sedai, Ashish Kumar. 2021. *Who Benefits from Piped Water in the House? Empirical Evidence from a Gendered Analysis in India*. Working Paper 1273. ADBI Working Paper Series. https://www.econstor.eu/handle/10419/238630.

Sedai, Ashish Kumar, Rabindra Nepal, and Tooraj Jamasb. 2021. "Flickering Lifelines: Electrification and Household Welfare in India." *Energy Economics* 94 (February): 104975. https://doi.org/10.1016/j.eneco.2020.104975.

Sedai, Ashish Kumar, Ramaa Vasudevan, Anita Alves Pena, and Ray Miller. 2021. "Does Reliable Electrification Reduce Gender Differences? Evidence from India." *Journal of Economic Behavior & Organization* 185 (May): 580–601. https://doi.org/10.1016/j.jebo.2021.03.015.

Su, Qinghe, and Mehtabul Azam. 2023. "Does Access to Liquefied Petroleum Gas (LPG) Reduce the Household Burden of Women? Evidence from India." *Energy Economics* 119 (March): 106529. https://doi.org/10.1016/j.eneco.2023.106529.

Thomas, Daniel, S.P. Harish, Ryan Kennedy, and Johannes Urpelainen. 2020. "The Effects of Rural Electrification in India: An Instrumental Variable Approach at the Household Level." *Journal of Development Economics* 146 (102520). https://doi.org/10.1016/j.jdeveco.2020.102520.

Williams, Kendra N., Josiah L. Kephart, Magdalena Fandiño-Del-Rio, et al. 2020. "Exploring the Impact of a Liquefied Petroleum Gas Intervention on Time Use in Rural Peru: A Mixed Methods Study on Perceptions, Use, and Implications of Time Savings." *Environment International* 145 (December): 105932. https://doi.org/10.1016/j.envint.2020.105932.

Winter, James C., Gary L. Darmstadt, and Jennifer Davis. 2021. "The Role of Piped Water Supplies in Advancing Health, Economic Development, and Gender Equality in Rural Communities." *Social Science & Medicine* 270 (February): 113599. https://doi.org/10.1016/j.socscimed.2020.113599.

Additional references

Aguiar, Mark, and Erik Hurst. 2007. "Measuring Trends in Leisure: The Allocation of Time Over Five Decades." *The Quarterly Journal of Economics* 122 (3): 969–1006.

Beltran-Figueroa, Laura. 2024. "Understanding The Second Shift: Have Technological Advances Reduced Chore-Time? Evidence From Colombia." Unpublished Working Paper. https://www.aeaweb.org/conference/2024/program/paper/YF3EDtA.

Cowan, Ruth S. 1983. More Work for Mother: The Ironies of Household Technology from the Open Hearth to the Microwave. Basic Books.

Crow, Ben, and Jamie Mcpike. 2009. "How the Drudgery of Getting Water Shapes Women's Lives in Low-Income Urban Communities." *Gender, Technology and Development* 13 (1): 43–68. https://doi.org/10.1177/097185240901300103.

Dinkelman, Taryn, and L. Rachel Ngai. 2022. "Time Use and Gender in Africa in Times of Structural Transformation." *Journal of Economic Perspectives* 36 (1): 57–80. https://doi.org/10.1257/jep.36.1.57.

Evans, David K., Pamela Jakiela, and Heather A. Knauer. 2021. "The Impact of Early Childhood Interventions on Mothers." *Science* 372 (6544): 794–96. https://doi.org/10.1126/science.abg0132.

Gottlieb, Charles, Cheryl Doss, Douglas Gollin, and Markus Poschke. 2024. "The Gender Division of Work Across Countries." SSRN Scholarly Paper 4786066. Social Science Research Network, April 9. https://doi.org/10.2139/ssrn.4786066.

Halim, Daniel, Elizaveta Perova, and Sarah Reynolds. 2023. "Childcare and Mothers' Labor Market Outcomes in Lower- and Middle-Income Countries." *The World Bank Research Observer* 38 (1): 73–114. https://doi.org/10.1093/wbro/lkac003.

Kandpal, Eeshani and Kathy Baylis. 2013. "Expanding Horizons: Can Women's Support Groups Diversify Peer Networks in Rural India?" *American Journal of Agricultural Economics* 95 (2): 360–367. https://doi.org/10.1093/ajae/aas052.

Krishnapriya, P. P., Maya Chandrasekaran, Marc Jeuland, and Subhrendu K. Pattanayak. 2021. "Do Improved Cookstoves Save Time and Improve Gender Outcomes? Evidence from Six Developing Countries." *Energy Economics* 102: 105456. https://doi.org/10.1016/j.eneco.2021.105456.

Lambon-Quayefio, Monica P. 2024. "Walking for Water and Fuelwood: Welfare Implications for Women and Children in Ghana." *Journal of International Development* 36 (1): 365–97. https://doi.org/10.1002/jid.3818.

Ndlovu, Patrick, Sandeep Mohapatra, and Marty Luckert. 2018. "Income Effects on Intra-Household Time Allocation: Regression Discontinuity Evidence." *Journal of International Development* 30 (4): 713–19. https://doi.org/10.1002/jid.3333.

Small, Sarah F., and Yana van der Meulen Rodgers. 2023. "The Gendered Effects of Investing in Physical and Social Infrastructure." *World Development* 171: 106347. https://www.sciencedirect.com/science/article/pii/S0305750X23001651.

Vemireddy, Vidya, and Anjali Choudhary. 2021. "A Systematic Review of Labor-Saving Technologies: Implications for Women in Agriculture." *Global Food Security* 29 (June): 100541. https://doi.org/10.1016/j.gfs.2021.100541.