

Easing liquidity constraints might be insufficient for exclusive clean cooking fuel use

Clean cooking fuels can be unaffordable. A year-long randomized control trial in Tanzania finds that a lockbox with savings nudges modestly increases participants' liquified petroleum gas (LPG) use but does not result in exclusive use. Easing liquidity constraints is insufficient to foster exclusive clean fuel use when women save alone and must choose between LPG and other household needs.

This is a summary of:

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The problem

More than two billion people rely on smoky solid fuels, which have a devastating health impact. Exclusive use of clean cooking fuels is needed to avoid these negative health effects, but clean fuels remain unaffordable to many individuals with low incomes¹. These individuals often have neither regular cash flows nor financial tools (such as saving accounts or credit)², leading them to purchase or collect traditional fuels (wood and charcoal) day-to-day and to struggle to save even modest sums for cleaner fuels, such as liquefied petroleum gas (LPG), which is sold only in cylinders that might last a month or longer. The struggle to save is compounded by the stress of chronic poverty, which often leads individuals to focus on short-term needs³. Understanding how policies could accommodate the spending patterns of low-income users and encourage savings could help alleviate the unaffordability of clean fuels, increase clean fuel use and avert detrimental health outcomes.

The solution

We envisioned that microsavings programmes, which help low-income, typically unbanked individuals save small sums of money and have proved effective at increasing savings for healthcare and education, could increase savings for clean fuel use. To test this idea, we conducted a year-long stepped-wedge randomized control trial in rural Tanzania (involving 511 participants) in which we evaluated the effect of providing new LPG users with a locked deposit box ('lockbox') with savings nudges (that is, reminders to save) during in-person visits from community workers⁴. The lockbox was earmarked for LPG cylinders, but our intervention had no enforcement or commitment component. Our control group just received the savings nudges. We hypothesized that the lockbox would serve as an informal financial device and a physical reminder to save. Our theory of change was that if individuals saved in the lockbox, this would increase their on-hand liquidity, thereby easing their liquidity constraints and potentially allowing for increased spending on LPG. Participants were mostly female main cooks but anyone in the household could contribute to the lockbox. With data from every-other-week structured surveys, we used linear, logistic and Poisson regressions to estimate the impact of the intervention on LPG and biomass use. Following the trial, we conducted six months of interviews, focus groups and budget games to explain our survey results.

Our findings show that compared with savings nudges alone, the combination of the lockbox and savings nudges increased annual refills of LPG by 1.4 cylinders (0.054 cylinder refills per two weeks [95% confidence interval: 0.043, 0.066], $P < 0.0001$) and minimally decreased firewood use, but had no effect on the frequency of charcoal and LPG use (Fig. 1). The treatment increased savings, thus easing liquidity constraints. However, participants considered LPG purchases as one priority among many. We found that women alone were responsible for purchasing LPG, but also all daily domestic needs. Thus, women saved in the lockbox for LPG and general household items, and rationed LPG purchases to meet other household needs and social expectations. Saving for LPG is thus even more challenging when it is solely a woman's responsibility.

The implications

Policymakers might need to consider that increasing income and/or savings, subsidizing LPG, and/or providing purchasing options with relaxed liquidity constraints (such as smaller quantities and pay-as-you-go technologies) are necessary but probably not sufficient to ensure habitual or exclusive LPG use and the abandonment of polluting fuels. Simply alleviating liquidity constraints or providing cheaper LPG will not be enough to ensure exclusive use if there are too many other needs and only a portion of household income available for them.

As with all survey-based research, our work might be vulnerable to self-selection, social desirability and recall biases. However, there was little programme refusal or attrition, and we carefully designed and piloted surveys, built rapport with respondents, and triangulated self-reported measures with LPG receipts and photos to protect against these biases. All experiments have challenges with external validity; however, we believe our findings have research and policy implications beyond Tanzania, as gender-specific budget 'domains' and multiple unmet household needs are common in sub-Saharan Africa⁵.

To foster exclusive clean fuel use, it might be necessary to explore direct fuel provisions, such as vouchers for the entire cylinder, or direct, targeted delivery that can ensure a level of use consistent with improving public health.

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EXPERT OPINION

“The paper presents findings from a carefully executed randomized control trial on the investment in clean cooking fuels in Tanzania. I like the analysis of LPG refills, as opposed to the large existing literature on cookstove adoption, and the study seems

to be well embedded in its local context. The authors discuss many important points in the refill choice (such as intermittency of income) that merit — and will inspire — more investigation in future research.”

An anonymous reviewer.

FIGURE

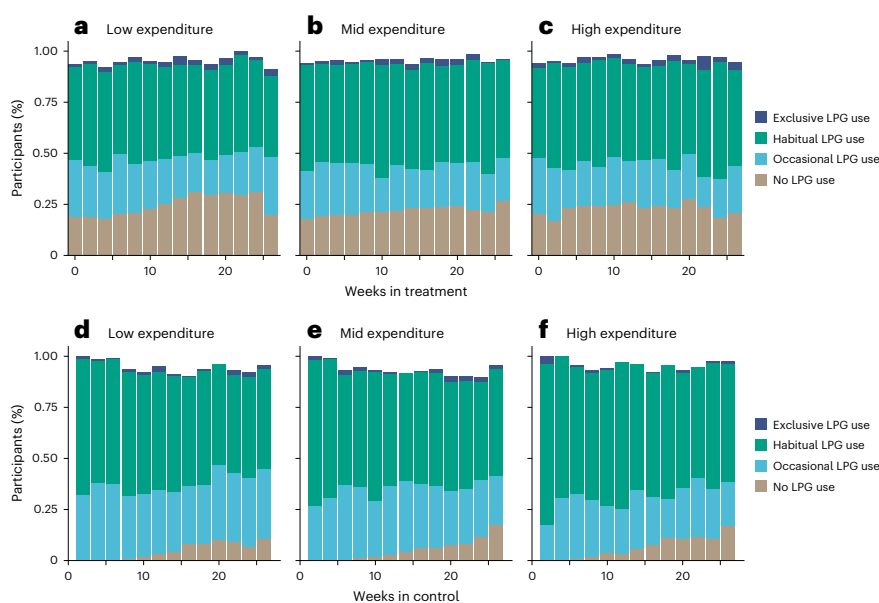


Fig. 1 | Effect of lockbox and savings nudges on LPG use. a–f, Respondents’ level of LPG use during treatment (lockbox and savings nudges) (panels a–c) and control (only savings nudges) (panels d–f) periods across low, mid and high per capita expenditure strata. The percentage of participants reporting no LPG use rose with the number of weeks in control across all income strata. The percentage of respondents reporting no LPG use was, on average, higher during treatment than during control, but did not increase measurably with weeks in treatment. Most respondents were using both LPG and biomass (firewood and/or charcoal). © 2025, Gill-Wiehl, A. et al.

BEHIND THE PAPER

This trial stemmed from preliminary work in our study site, Shirati, Tanzania, and collaborations with local partners starting in 2016. Our household energy surveys across Shirati in 2016 revealed that users were spending in aggregate as much on charcoal and firewood as on LPG. In 2018–2019, we conducted a pilot of this work, testing whether visits from local community workers could encourage increased LPG use. Participants expressed a want and need for a safe place to save for LPG. Through a literature review, we

identified a mismatch between how clean fuels are purchased (lump sums) and how those with low incomes tend to earn (daily small sums), motivating further research into microsavings. We initially envisioned a mobile money intervention, but participants in further piloting in 2021 were averse to these platforms owing to the relatively high transaction fees. By contrast, participants loved the lockbox, with one participant explaining that the lockbox was like her bank account (Respondent 427). **A.G.-W. & I.R.**

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FROM THE EDITOR

“This paper stood out to us as a behavioural study on the factors that might encourage LPG use, shedding light on barriers to LPG uptake in lower-income countries as well as on the importance of gender in decision making in low-income households.”

Editorial Team, Nature Energy.