

Title: Household Air Pollution Intervention Network (HAPIN) Trial: Exposure contracts and adherence to the LPG stove and fuel intervention during pregnancy

Time/Date: July 6, 2021, 8-9:30AM Mountain Daylight Time / 10-11:30AM Eastern Time

Unasked/answered Panelist Questions

1. Comment: Major kudos to all involved in this study. When it was announced many "cookstove ventures" criticized so much money going to the study because it was focused on LPG. While some are concerned about the programmatic scalability of LPG this study DOES address extremely important baselines health issues. Deep bows to all on the huge team.

2. Did you attempt to document if/how COVID influenced the study? Both negative and positive? Did it impact one country more than others? It might make for an ancillary "proof-of-concept" data set that reduced smoke burden could lower risk of viral infections inclusive of covid

Response: To some extent. Gas deliveries were not impacted as this was treated as essential services in each country. So, the intervention continued without interruption. However, the lockdowns severely limited household visits for data collection for between 6 and 12 weeks, depending on the country, meaning significant data/specimen losses. Fortunately these should not impact study power. We undertook phone surveys where possible, including a special survey on how participants were impacted; these will be written up separately. We also are undertaking an antibody study to determine the prevalence of SARS CoV2 in the study participants. The outcome that is expected to be most impacted is pneumonia, as except for COVID, the incidence of lower respiratory infections fell dramatically within our children (as it did in most parts of the world) once precautions against transmission (lockdowns, school closing, mask wearing, etc.). We agree that our dataset should provide other opportunities, and we encourage investigators within and outside the HAPIN Network to explore them with us.

3. Did you include any "satisfaction surveys"? I'm interested in knowing if they used the stoves because they said they would but in fact, they hated them; vs. did they like using them and would likely continue even if they had to buy LPG fuel?

Response: We are collecting data related to this component at study exit (not yet analyzed); we are also following households after HAPIN ends to find out how their stove use patterns change.

4. How did family members FEEL about food cooked in this new way?

Response: This is an important question and was explored during a full year of formative research before HAPIN enrollment began. As has been shown in previous studies there was, as anticipated, some hesitancy about the food cooked using LPG among those who were unfamiliar with it. There were also some initial concerns about safety. Several approaches were taken to reduce these concerns, including using cooking demonstrations and "taste tests" to

familiarize participants with the preparation of customary foods on LPG and providing specialized devices (such as griddles in Guatemala and roasting appliances in Rwanda) to enable specific kinds of food preparation on LPG. We found overall that there were no consistent concerns about e.g., how food tasted after being cooked on LPG after these efforts (i.e., not liking the food was not a reason that came up when investigating reasons for traditional stove use in intervention households).

5. Detection devices interested me. That implementation must have required long histories of knowledge production and development.

Response: Definitely. The Wilson et al. publication (listed below) has more details on the stove use monitors used in HAPIN.

6. Was there any effort to limit (or at least document) other sources of PM (smoking, hooka usage, neighbor's smoke entrainment)?

Response: Yes, we asked participants about other sources of exposure at each monitoring visit, such as those referenced in the question.

7. What happens to data collection in HAPIN if LPG stoves become more widely adopted in the nations and/or regions where HAPIN was done?

Response: If increased LPG use occurs in our study areas, then our control arms should reflect these secular trends (it would not impact our data collection approach or study design). As our intention-to-treat analyses are based on comparing the intervention and control arms, the effect of hypothetical increased LPG use in the control arm could make it more difficult to see impacts on health outcomes, although we expect that households adopting LPG in the control arm would be unlikely to use LPG exclusively. Stacking LPG with traditional stoves would be unlikely to reduce exposures to the extent we hope to see in the intervention arm.

8. At baseline did you measure maternal nutritional intake and how that changed over time with use of the intervention to adjust for it for birth weight outcome?

Response: We did have a survey on diet and nutrition at baseline, and again at the final visit (~12 months post-birth).

9. Who would become responsible for generalizing technology (LPG stove) change implementation if the evidence of relative harms becomes widely available to the states where research was done, and implementation might make sense?

Response: Scaling LPG use in the study areas would be up to governments, NGO's, consumers and the markets. Ideally, HAPIN provides information on health and other potential benefits which can be used to inform decisions or shape policy affecting clean household fuels.

10. Also, I think I have missed this, how are you calculating baseline and what is the need of it?

Response: We consider the baseline the time point before randomizing into the control and intervention arms. This baseline is helpful for understanding how well matched the intervention and control arms were before randomizing into the LPG intervention and control arms, as well as track changes in our measures over time. But for analyzing our primary health outcomes, the comparisons are between the control and intervention arms.

11. Although not tested, are similar results expected for biogas and ethanol use?

Response: This is of course speculation, but if you had the same rates of traditional technology displacement in these settings, since biogas and ethanol have similar emissions performance as LPG, it would not be unreasonable to assume similar exposure contrasts. The same could be said for electric-based cooking appliances.

12. Fantastic, thank you so much. Did you possibly take the place of cooking in the household (inside / inside chimney / semi-outside / outside / etc.) and place (urban / peri-urban / rural / etc.) cooking into account in the BL, P1 and P2? Many thanks!

Response: We did track cooking location in the home (the sites were all generally rural). Location was well-matched during baseline, but some homes transitioned to indoor kitchens with the introduction of LPG. The current analysis is looking at overall exposure impacts for the pregnant mothers, but we do plan additional analysis with modeling approaches that take into account cooking location among other potential covariates.

13. Was there any GIS component to this trial?

Response: Households were geolocated as part of the baseline. We also geolocated ambient air quality monitors

14. Was it difficult to source LPG close to the study households?

Response: In all four countries, LPG was available and regularly distributed at least to the town centers near the study households. In some cases, we ran across difficulty with particular distributors and had to switch, et cetera - but getting the LPG "somewhat nearby" was in general not a problem. Because HAPIN staff were doing home delivery, the "last mile" often presented more logistical challenges due to weather and terrain. (Note - in India, LPG delivery was conducted by licensed distributors and not by HAPIN staff, in accordance with Indian regulation).

15. Great study implementation. Since pregnant women are mobile and not only stuck in homes. How important is the ambient exposure levels in the different communities as they do contribute to the overall exposure?

Response: We have not done any substantial ambient analysis yet, though it's reasonable to assume as cooking exposures decrease, relative contributions to ambient and other sources increase. We are currently conducting source apportionment analysis on filters from our pilot data, and hope to scale that effort up to the main trial exposures as well, which should provide much more information on the relative contributions for different sources.

Did you dilute your samples while measuring BC from the households' traditional oven? The concentration ranges that you present seem lower than other similar studies.

Response: The BC measurements were not diluted as the BC analysis was conducted on the same filters as PM2.5 samples. Our concentration ranges were similar to those reported for the PURE study, which currently has the most comprehensive set of BC HAP exposures:
<https://linkinghub.elsevier.com/retrieve/pii/S2542519620301972>

16. One of the major problems in real world scenarios is mixed usage of fuels in the kitchens. Have you come across such households? Also, how did you ensure that the measurements aren't capturing other sources of emission?

Response: There was some stacking with mixed fuel use in the study, moreso in the control homes. The 24-hr exposure measurements subsume all sources of exposure that the participants experience, though the intervention aimed to mitigate exposures to HAP generated from cooking with traditional fuels/stoves.

17. The idea of gifting 'solar cooking systems' to participants interested me. Was that (a) actually done and (b) studied (in any useful and meaningful way)?

Response: option of a solar home system was one of the compensation items available to control households in Rwanda. Notably, it was a system primarily intended to provide home lighting and small appliance charging (not a cooking system). After the study is completed we will investigate how many control households chose this option among several choices they were offered as compensation for participation in the trial.

18. What are the next steps over coming months and what are you looking most forward to? Also what did this study not cover and would you like to see going forward?

Response: We are almost done collecting the main trial data. After data collection is complete, we will be able to unblind our health measures, which will allow us to conduct our analyses for our health outcomes. We are all looking forward to seeing how effective the trial was in terms of our primary aims. Moving forward, we are hoping to follow the cohort to see how stove/fuel use patterns may change after the intervention, as well as longer term health impacts.

19. Since the intervention showed what appears to be significant reductions in exposure, what would be your response if the outcomes data also reflect a significant improvement in the intervention group relative to the control group. How would you deal with this ethical challenge in ensuring that the control group can be assisted to reduce their exposure and ultimately improve their health?

Response: Significant improvement in our primary health endpoints would be robust evidence that a clean cookstove intervention can reduce household air pollution exposure sufficiently to benefit health. As the questioner mentions, the challenge that would follow is ensuring access to these benefits across the target populations. We are currently working in several ways to prepare for this: first, by building relationships with policymakers in each country who would be poised to take action to increase access to, and affordability of, LPG and other clean fuel options in these settings; and second, by working with communities to raise awareness of the risks of household air pollution and explore options to reduce it (including actions that go beyond access to LPG, such as increasing ventilation, reducing time spent near the stove, ensuring biomass fuel is dry before combustion, et cetera).

20. Did the practice of cooking change (time, dishes, etc.) after the intervention?

Response: Measuring changes in cooking practices was not a primary goal of the trial but we will have some data to investigate cooking times. In a subset of homes, SUMs were installed on all stoves so we should be able to explore differences in time spent cooking, and an ancillary study in a subset of households will investigate time use (across a number of potential categories of time allocation, not just cooking) to explore and how it was impacted by the trial.

21: For policy purposes, has cost effectiveness including the supply chain costs etc. been measured?

Response: As part of the overall study, we are undertaking cost and cost-effectiveness analyses of the intervention. These will have more limited policy implications in this proof-of-principle efficacy trial, however, than where they might in the evaluation of a programmatically delivered intervention.

HAPIN publications to date

www.hapintrial.org

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