

Prevalence of plastic waste as a household fuel in low-income communities of the Global South

Corresponding Author: Dr Bishal Bharadwaj

This file contains all reviewer reports in order by version, followed by all author rebuttals in order by version.

Version 0:

Reviewer comments:

Reviewer #1

(Remarks to the Author)

This is an, as yet, under-researched area which is novel and very interesting to read about. The authors have worked very hard and, on the whole, presented the findings well. There are substantial shortcomings with the graphics which I have covered in detail below. I'll leave it up to you but mostly, I cannot see the need for the decimal places used – are you so sure that you have such accurate data here? They are used sometimes, seemingly without any reason and then in other places they are not used in the narrative, but we see the detail in the charts. Removing them would reduce a lot of clutter in the narrative and also make the figures easier to format.

Abstract

This isn't too shabby – but could benefit from being a bit more refined.

Can I suggest that the first sentence quickly frames the problem and the second is a combination of what is currently the first and second sentences

L59 – significant? Was it? The sentence before is correct use and relates to Table 1 but this one I don't think – maybe say 'substantial'?

L61 – provision of what?

L61-63 – could this be made clearer – 'affordability constraints' is vague – 'enhanced waste collection'? What is that? I think these households just need a waste collection service and that's clear from your findings – nothing to enhance yet!

Introduction

L66 – I am not a 'fuel person' so I didn't know what 'clean fuels' are straight away – others will be the same – we get a few examples on L108 – but we need to know sooner - can I suggest a definition is provided the first time it's mentioned.

L113-115 – I don't think it's right – steel is 1.8 billion – cement is 4 billion – and Geyer et al do not say it is the most widely produced materials

Results

This whole section contains a lot of material that should really be in the method. Suggest to sift out the remnants and slim this whole section down – could probably be half the length! That way you could make a but more space for a better discussion.

L161 – should be 'by contrast'

L166 – 'finally'? looks like you are just getting started to me

L236-249 – I was curious about whether these findings could be compared with the prevalence of each plastic type I'm guessing the reason PET is burned a lot is because it is so prevalent – could you put in context a bit?

L265-266 – please do not describe as ‘rag pickers’ they may find it as derogatory! Stick with ‘informal waste workers’ or ‘waste pickers’ to stay safe

<https://www.wiego.org/informal-economy/occupational-groups/waste-pickers/>

<https://globalrec.org/global-meeting/latin-american-colombia-2008/>

L316-317 – cite

Correlational insights into plastic burning practices.

L345-377 I’m pleased to see this section which has some interesting content and insights - but it is very Wooden. Can I suggest that rather than explain the columns (which should really be done in the caption or notes below the table), that the section is re-organised to include the findings first and then the explanation second

L362 – is this a ‘significant’ finding

L374 – suggest putting the $p=...$ In brackets after ‘significantly correlated’

Discussion

This section is quite short which is a shame because the authors have revealed some really interesting insights. For example:

- I would expect to see more discussion about the fundamental need for waste collection – which would mean that people wouldn’t resort to ‘self-management’ of waste

- I was surprised that SDG11.6.1 target indicator was not mentioned

- It would be good to see the main take-home points listed somewhere – you will know best but three are: ‘fuel poverty’, ‘poverty’, lack of waste management services’

Perhaps you might find some ideas here <https://raeng.org.uk/media/ko0adleh/engineeringx-global-review-engineer-life.pdf> and here <https://lnkd.in/ecnRtsvT> and <https://internationalwasteplatform.org/open-burning-awareness/>

There is a phrase in L206-207 which could be moved to the discussion and expanded on– the way that plastic burning is now ‘integrated’ into households – it’s become the BAU.

L393 – cite

408-413 – this is a little weak and vague – can you be more specific about what is needed – I would have thought that a method for obtaining a representative sample in global south would be beneficial – and not just ‘low income communities - but all across the global south.

Figures and tables

The figures and tables need a lot of work – I almost rejected this on the basis that they are so far from being at the standard required for a Nature group publication. The scaling is haphazard with different sized fonts used within and between them. The colours are not well thought out and we see the same colour use for two things in the same array. There is no consistency between them.

The figures must be standardised – same font, size, label types, numerical format, alignments, and the same procedure for caption creation. Suggest you follow the same standard approach of titles for each with more detail in the captions using the same format each time.

There are so many different units – mean of rank, proportion as fraction and percentage, number of respondents... Suggest you standardise 4

Figure 1:

Suggest that the vertically aligned ‘questions’ are made horizontal. These ‘questions’ are not written as such and then question marks are used – for example “prevalence of burning waste plastic in your city?” is not a question. My suggestion is to use the question as it was asked – in this example “what is the prevalence of burning waste plastic in your city?”

Then in the caption everything is repeated – suggest one is the summary of content (title) and the other is the question in full.

Suggest to standardise the size and scale of each chart and the alignment of the labels.

Figure 2

This is clearer – you have given each chart a title but the title fonts are tiny compared to everything else

But in contrast to the last one, we hear that it’s a follow up question – but what was it?

The numbers are not aligned with the bars
The units have changed to fractions and there is nothing to explain what they mean

Figure 3

The use of one colour to mean two things in the same array is confusing

The numbers are squashed and almost unreadable
The font sizes are all over the place

Two styles are used for labelling the bars

The units are fractions like figure 2 but unlike figure 1

The vertical axes need zeros before the decimals and labels

Figure 4

Unreadably small fonts and variable styles- see above

The caption is confusing. The a,b,c are listed and then various details for each are described as Panel A, Panel B etc. Could they not be described sequentially

I am not familiar with the stove types so suggest these are explained briefly in the caption – at the very least ICS should be written in full somewhere.

4a should be ordered I think

Figure 5

this was a real puzzle for me –

Figure 5C has a number 7 in the horizontal – should probably be WAF

Overlapping and inconsistent labels

Squashed axis labels

Figure 6

A and b – x is not labelled

Table 1

So squashed, I can't read easily

Reviewer #2

(Remarks to the Author)

This manuscript addresses an important and understudied issue: the use of plastic waste as a household fuel in low-income settings. The authors leverage a multi-country survey to offer new insights into the prevalence, drivers, and perceived risks associated with this practice. This is a valuable contribution given the potential public health, environmental, and climate consequences of plastic burning. However, significant methodological limitations reduce confidence in the findings and ultimately constrain the paper's utility for informing research or policy.

Major Comments

1. Sample Attrition and Data Quality

The final analytic sample comprises just 14% of those who initiated a response, and the authors acknowledge that many responses were unusable due to non-consent, abandonment, or missing data (Lines 462–472). The low usable response rate raises serious concerns about non-response bias. If the majority of initial respondents failed to complete the survey or were excluded, it becomes difficult to assess the reliability or generalizability of the remaining sample. The manuscript would benefit from a detailed accounting of response flow (e.g., a CONSORT-style diagram) and a reflection on how attrition may have affected the results. Checks against alternative data sources (e.g., household surveys such as the WB multitier framework that may contain info on plastic as a fuel) would be reassuring.

2. Selection Bias and Validity of Key Informant Methodology

The choice to rely on key informants rather than representative household surveys is perhaps justified given the scale of the research question and resource constraints. However, the authors must more directly grapple with the validity of the

sampling approach. On lines 447–455 and 473–478, it is clear that respondents were drawn from professional, academic, and NGO communities—not from the households actually engaged in plastic burning. As a result, it is unclear why we should place confidence in this population's ability to provide accurate, detailed information about plastic burning in slums. Are their perceptions systematically biased? Are they sufficiently grounded in lived experience? The authors must better justify this approach, eg by providing prior examples or validation of key informant surveys in similar contexts. As it stands, the methodology introduces uncertainty that largely undermines the paper's validity.

3. Framing of the Research Question

The current framing around urban slums and 'household fuel use' lacks sufficient justification:

- First, the exclusive focus on slum communities is not well explained. Anecdotal and published evidence suggests that plastic burning is also common in rural areas, especially where access to clean fuels and waste services is limited.
- Second, the framing emphasizes 'plastic as household fuel', but in practice, many households burn plastic as a waste management strategy rather than for cooking per se. The distinction between waste disposal and energy use is blurred throughout the manuscript.

The authors should more clearly state whether they are studying plastic burning broadly or specifically as a substitute for cooking fuels, and revise the introduction and discussion accordingly.

Minor Comments

- Terminology: Terms like “prevalence,” “extent,” and “awareness” are used somewhat interchangeably. It would help to clarify definitions early in the paper.
- Figures: Many figures are data-dense but difficult to interpret without clearer captions and labeling. Simplifying or splitting figures might improve accessibility.
- Abstract: line 56 - consider replacing the word “admitting” with something a non-pejorative term. Also lines 193, 198.
- Line 56: Lack of affordability of clean fuel - this is an awkward phrase, and seems more like a demand factor
- Line 61, 80, 87, 137, 331 -- I encourage the authors to reconsider the word “interventions,” which to me at least implies a discreet act as opposed long-term strategies. I suggest the word “policy” or “strategy” instead.
- Line 75 instead of “highly marginalized” I suggest “humanitarian crisis” or something to that effect. The generalizability of the paper cited in support of the statement here is likely low.
- Table 1 is confusing as it appears to combine individual level and city level dependent variables. I suggest running household level regressions with household's own use of plastic fuels as independent variable and city level regressions with awareness as independent variable. Given the sampling limitations, claims should be clearly caveated.

Recommendation

Major revision. The topic is significant and is largely unstudied, and the paper has the potential to make a meaningful contribution. However, the authors must substantially strengthen the justification for their methodological approach, clearly address sample limitations, and clarify the framing of their research questions. Any conclusions offered must include specific caveats related to sampling limitations. Perhaps the paper could be recast as more of a hypothesis generation activity.

Reviewer #3

(Remarks to the Author)

This broad cross-sectional survey across 26 countries presents the plastic waste prevalence in low-income countries globally. The paper is well written and clearly delineates a massive problem. Noteworthy results include an understanding of plastic waste management and the burning of plastic in household fires. The work will contribute to the literature because it characterizes regions of the globe, not one specific country or region. The methodology needs to be explained a bit more (recruitment of a convenience sample and whether that is generalizable). The supplement provides enough information to understand the methods.

General:

1. How were participants “purposively sampled” or identified?
2. The statistical analysis is primarily descriptive, and the tables are hard to read because they are either mis-aligned, missing information, or poorly labeled (Table 1 “correlational analysis” when providing odds ratios or OLS). 95% CI are preferred over standard errors. You are measuring bivariate associations with OR and OLS, not correlations.
3. The figures are very hard to read and there are too many bar graphs. Some are all blue, with % superimposed on the bars (Figure 1) or a decimal number instead of a percent, which it should be (Figure 2). Figure two doesn't provide a number for N= _____. Figures 3, 4, 5 have decimals instead of percents on the bars or above the bars and they are impossible to read. Figure 3 is missing a statement about the color of the bar next to the description. Most of these figures (especially Figures 3, 4, 5 and 6) would be better in a table or in some other graphical display that is easier to read.
4. More should be provided about the respondents. The supplementary table should be a table in the main paper and then the two paragraphs summarizing the table could be removed. In the methods, the authors call them “responses” but they are respondents (See supplemental table too).
5. Table S3: Prevalence, but measured in decimal units. Change to percentage numbers and label columns as such. It is not clear what the numbers refer to in some of them—Likert scale?

Version 1:

Reviewer comments:

Reviewer #1

(Remarks to the Author)

The authors have made an impressive effort to almost completely rewrite the manuscript which has improved immensely. The figures and tables are now readable and on the whole well labelled.

There were no line numbers in this version and no track changed version was provided - presumably because there was such a substantial re-write. I have therefore, made further comments on your latest version of the manuscript attached. I made also a few stylistic edits using track changes which you can take or leave.

I also have the following general comments:

- There are still some inconsistencies in the fonts, font sizes, column spacing, column styles and colours used within and between tables and figures - every figure should have the same scale, font size etc - otherwise it is off-putting
- It was not easy to see the central tendency and spread of the results. With hindsight, it would have been better to see boxplots, but we are here now. Even if you choose to continue to keep these figures, it would be helpful for others to easily see the spread - a simple spreadsheet of the results of each question would help practitioners to make sense of it all - making it accessible to those who cannot run the code. I suggested adding some more stats to Table 1 - you could consider another version of that table in the supplementary which shows the same list of demographics for the rows, and has the countries as columns - so we can see the mix per country...

Overall its looking very good now

Good luck

(Remarks on code availability)

Reviewer #2

(Remarks to the Author)

The authors have largely addressed reviewer comments, and the revised manuscript provides a fair representation of the implications of the survey results while providing appropriate caveats. This paper provides a meaningful step towards quantifying an important public health issue, and will hopefully inspire additional research.

(Remarks on code availability)

I was able to review the code but am unable to log on to codeocean.com (I get error messages for both my institutional and personal accounts)

Based on my inspection, however, the code appears correct and is well-documented.

Reviewer #3

(Remarks to the Author)

Line 130 "nor can it be easily sold to recyclers" -- would change to "nor does it have the resale value that metals have, thus is not easily sold to recyclers"

Line 137 "egg samples"-- please clarify what eggs you are talking about-- I assume chicken eggs that are consumed?

Line 278: How were disabilities defined? Can include in this line, "such as..."

Table 1. All of the categorical statistics of respondents are presented as means and SDs which should be in % (n). For instance, male gender has a mean of 0.543 and a SD of 0.498 with a range of 0 to 1. What does SD mean in the context of being male? The categorical variables should be reported as 49.8% were male, n=X. It is confusing to the reader to see these reported in this way, and it is a simple fix (and is reported as such in methods). The only continuous variable, age, is of course reported as mean (SD).

Variables in Figure 7 are challenging to interpret. What does "urban basic sanitation rate" mean? Could say urban basic sanitation rate < 10%? Or age (in years?) Graduate of what? Labeling these variable clearly would help the reader with the interpretation.

The figured are greatly improved, as is the text.

(Remarks on code availability)

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Response to reviewer's comments

1. Reviewer #1 (Remarks to the Author):

- 1.1. This is an, as yet, under-researched area which is novel and very interesting to read about. The authors have worked very hard and, on the whole, presented the findings well. There are substantial shortcomings with the graphics which I have covered in detail below. I'll leave it up to you but mostly, I cannot see the need for the decimal places used – are you so sure that you have such accurate data here? They are used sometimes, seemingly without any reason and then in other places they are not used in the narrative, but we see the detail in the charts. Removing them would reduce a lot of clutter in the narrative and also make the figures easier to format.

Response: We appreciate your very constructive feedback on our work. We have revised our paper thoroughly and responded to each comment. The main changes include:

- Rewriting of the abstract.
- Improving the presentation of numbers in figures and text.
- Improving the quality of the figures.
- Thorough revision of the text, including responding to the other reviewers' comments.

Abstract

- 1.2. This isn't too shabby – but could benefit from being a bit more refined. Can I suggest that the first sentence quickly frames the problem and the second is a combination of what is currently the first and second sentences

Response: We revised the abstract as suggested, rewriting the first sentence and then combining the second and third sentences. The new version appears below (Line 52-63):

“Anecdotal evidence suggests that households burn plastics to manage waste and help satisfy their energy demand. To examine the prevalence, extent and reasons for use of plastic waste as household fuel, a survey was conducted with 1,018 key informants from cities in 26 countries in the Global South. Informants were purposively selected due to their familiarity with the living conditions in their communities. One-third of respondents reported being aware of plastic waste burning, with some reporting that their households engaged in this practice. Analyses of the data reveal significant correlations of plastic waste burning with both supply factors, such as the lack of waste management, high volumes of plastic waste, and expensive clean fuels, and demand factors, including energy needs. Expanding essential public waste management services and implementing programs that enhance the affordability of clean energy technologies, especially among marginalised and low-income communities, could reduce this health- and environment-damaging practice.”

- 1.3. L59 – significant? Was it? The sentence before is correct use and relates to Table 1 but this one I don't think – maybe say 'substantial'?
- 1.4. L61-provision of what?

- 1.5. L61-63 – could this be made clearer – ‘affordability constraints’ is vague – ‘enhanced waste collection’? What is that? I think these households just need a waste collection service and that’s clear from your findings – nothing to enhance yet!**

Response:: We revised the abstract thoroughly to address these three comments. It no longer includes the incorrect use of significant and revised the final sentence in line with the suggestions to say: *“Expanding essential public waste management services and implementing programs that enhance the affordability of clean energy technologies, especially among marginalised and low-income communities, could reduce this health- and environment-damaging practice.”* (Line 60-63)

Introduction

- 1.6. L66 – I am not a ‘fuel person’ so I didn’t know what ‘clean fuels’ are straight away – others will be the same – we get a few examples on L108 – but we need to know sooner - can I suggest a definition is provided the first time it’s mentioned.**

Response: We have now revised the sentence to say: *“Clean fuels and technologies whose emissions meet the fine particulate matter (PM_{2.5}) and carbon monoxide (CO) levels recommended in the WHO global air quality guidelines, such as electricity, liquefied petroleum gas (LPG), biogas, natural gas, and ethanol, remain largely unaffordable for people living in extreme poverty.”* (Line 76-79)

- 1.7. L113-115 – I don’t think it’s right – steel is 1.8 billion – cement is 4 billion – and Geyer et al .do not say it is the most widely produced materials**

Response: We moved the paragraph to the front of the introduction and revised accordingly. The relevant passage now simply reads: *“The management of plastic, with over half a billion tons produced annually and rising, is a major global environmental challenge¹⁻³. Meanwhile, in cities across much of the Global South, waste management systems are inadequate, and the volumes of unmanaged plastic waste are therefore increasing⁴⁻⁵.”* (Line 66-69)

Results

- 1.8. This whole section contains a lot of material that should really be in the method. Suggest to sift out the remnants and slim this whole section down – could probably be half the length! That way you could make a but more space for a better discussion.**

Response: Thank you for this valuable comment. We edited the section thoroughly, as suggested.

- 1.9. L161 – should be ‘by contrast’**

Response: Revised as suggested. (Line 163)

- 1.10. L166 – ‘finally’? looks like you are just getting started to me**

Response: We removed ‘Finally’ from the sentence. (Line 168)

1.11. L236-249 – I was curious about whether these findings could be compared with the prevalence of each plastic type I’m guessing the reason PET is burned a lot is because it is so prevalent – could you put in context a bit?

Response: We now provide more context for the type of plastic and its source type as indicated in this passage (Line 244-261):

“Respondents who reported an awareness of burning plastic waste as a household fuel (N=365), were asked additional questions to determine the specific types of plastic materials being burned, the product(s) they originated from, and the stoves used for their combustion. As shown in Figure 4, Panel A, Polyethylene Terephthalate (PET or PETE) is the most frequently reported type of burned plastic waste, followed by Low Density Polyethylene (LDPE). PET and LDPE are common single-use plastics found in beverage bottles (e.g., water and juice bottles) and bags, and are the most common plastics found in household waste and accumulating in the oceans bordering Sub-Saharan Africa and South Asia³³⁻³⁵. The third most frequently reported plastic being burned is polyvinyl chloride (PVC), which is mostly used in plastic plumbing pipe, followed by high-density polyethylene (HDPE), a material frequently used for chemical containers. In terms of product origin, nearly two-thirds of respondents reported burning food wrappers, followed by chemical packaging materials such as fertilizers, pesticides, and cleaning liquid containers (43%) (Figure 4, Panel B). Food wrappers, made from polypropylene (PP), account for the largest share of waste generation by polymer type^{13,39,40}, and are reported as the most frequently burned plastic product. Other commonly burned plastic items included non-food household plastics like buckets (31%), construction materials such as pipes (28%), and components from tyres and white goods, i.e., household electrical appliances (23%).”

1.12. L265-266 – please do not describe as ‘rag pickers’ they may find it as derogatory! Stick with ‘informal waste workers’ or ‘waste pickers’ to stay safe
<https://www.wiego.org/informal-economy/occupational-groups/waste-pickers/>
<https://globalrec.org/global-meeting/latin-american-colombia-2008/>

Response: Thank you for raising this concern. We agree with your view and have corrected the word to ‘waste pickers’ throughout the text.

1.13. L316-317 – cite

Response: We have now cited two papers, one country-specific and another Africa-focused, both illustrating the importance of contextual effort on household energy transition. (Line 335-336)

Mulugetta, Y. *et al.* Africa needs context-relevant evidence to shape its clean energy future. *Nat Energy* 7, 1015–1022 (2022).

Bharadwaj, B., Malakar, Y., Herington, M. & Ashworth, P. Context matters: Unpacking decision-making, external influences and spatial factors on clean cooking transitions in Nepal. *Energy Res Soc Sci* 85, 102408 (2022).

Correlational insights into plastic burning practices.

1.14. L345-377 I’m pleased to see this section, which has some interesting content and insights - but it is very Wooden. Can I suggest that rather than explain the columns

(which should really be done in the caption or notes below the table), that the section is re-organised to include the findings first and then the explanation second

Response: We thoroughly revised and streamlined this section to focus on the results. We have also added an explanation of the results as the last part of this section (page 14, Line (378-391)).

1.15. L362 – is this a ‘significant’ finding

Response: We revised the description of results to focus on statistically significant correlations only (Line 368-379).

1.16. L374 – suggest putting the p=.... In brackets after ‘significantly correlated’

Response: Following the reviewer’s comment, we have added the p-values.

Discussion

1.17. This section is quite short which is a shame because the authors have revealed some really interesting insights. For example: I would expect to see more discussion about the fundamental need for waste collection – which would mean that people wouldn’t resort to ‘self-management’ of waste

Response: We have thoroughly revised and rewritten the discussion in response to this and the other reviewers’ comments (Page 17, Line 410-501).

1.18. I was surprised that SDG 11.6.1 target indicator was not mentioned

Response: We have included a paragraph to describe potential synergies between SDG11 and SDG7, to describe how and why progress on SDG11 would help reduce the problem of plastic burning for energy purposes, and in turn, how this reduced burning would enable safer and cleaner cities (Page18, Line 445-455).

1.19. It would be good to see the main take-home points listed somewhere – you will know best but three are: ‘fuel poverty’, poverty’, lack of waste management services’

Perhaps you might find some ideas here:

<https://raeng.org.uk/media/ko0adleh/engineeringx-global-review-engineer-life.pdf>

<https://lnkd.in/ecnRtsvT>

<https://internationalwasteplatform.org/open-burning-awareness/>

Response: We have now revised the discussion section by adding key takeaway messages (Page 17, Line 417-455).

1.20. There is a phrase in L206-207 which could be moved to the discussion and expanded on– the way that plastic burning is now ‘integrated’ into households – it’s become the BAU.

Response: We moved these sentences to the opening of the discussion, followed by key takeaway messages (Page 15, Line 410-416):

“The energy sources used by households are determined by the context in which they live, as well as availability and affordability of alternative options. Given the combustible nature of plastic, the increasing volumes of this material in waste, and the reality that many households in the Global

South must self-manage refuse, it should not be surprising that the use of plastic as a domestic fuel might be increasing. However, systematic and comprehensive understanding of the scale and distribution of plastic waste burning has heretofore been missing, impeding efforts to plan and develop effective strategies to mitigate the problem.

The results of this study lend much stronger credence to this conjecture; a survey of key informants from 26 countries in the Global South shows that plastic waste has been integrated into household energy practices in myriad and diverse ways in many urban communities..”

1.21. L393 – cite

Response: We have now cited three papers, two local and another from a global analysis, to support this argument.

Sun, S. & Tong, K. Rural-urban inequality in energy use sufficiency and efficiency during a rapid urbanization period. *Appl Energy* 364, 123133 (2024).

Tian, Y., Tsendbazar, N.-E., van Leeuwen, E. & Herold, M. Mapping urban–rural differences in the worldwide achievement of sustainable development goals: land-energy-air nexus. *Environmental Research Letters* 17, 114012 (2022).

Bharadwaj, B., Rai, R. K. & Ashworth, P. Traditional Knowledge Systems in the Himalayas: Why Moving Away from Biomass Cooking Fuel Is So Difficult? in *The Resilience of Traditional Knowledge Systems for a Sustainable Future: A Focus on Agriculture and Food Practices in the Himalayas* (eds. Borthakur, A. & Singh, P.) 183–192 (Springer Nature Switzerland, Cham, 2024). doi:10.1007/978-3-031-56858-9_8.

1.22. 408-413 – this is a little weak and vague – can you be more specific about what is needed – I would have thought that a method for obtaining a representative sample in global south would be beneficial – and not just ‘low income communities - but all across the global south.

Response: Thank you for this comment, we revised the paragraph thoroughly as below (Page 18, Line 468-490):

“This study took an initial step toward filling critical knowledge gaps in this domain, but several limitations should be addressed in future work to improve understanding and inform decision making. First, as noted above, the study used a purposive sampling strategy to select knowledgeable community informants as respondents and thus does not provide a population-representative understanding of the scale and distribution of plastic waste burning to meet households’ waste management and energy needs. To build on this work, further investigation is recommended using representative household samples living across the Global South and in plastic waste hotspots, incorporating plastic as a fuel category and considering local waste management and settlement contexts...”

Figures and tables:

1.23. Figures and tables: the figures and tables need a lot of work – I almost rejected this on the basis that they are so far from being at the standard required for a Nature group publication. The scaling is haphazard with different sized fonts used within and between them. The colours are not well thought out and we see the same colour use for two things in the same array. There is no consistency between them.

Response: We revised all of the figures. All figures now present percentages on the y axis, except for the variables that were measured using a ranking exercise. Revised figures have different colours for each variable, and values are rounded to the nearest whole number. Finally, we converted tables into coefficient plots and shifted the tables into the Supplementary Information.

- 1.24. The figures must be standardised – same font, size, label types, numerical format, alignments, and the same procedure for caption creation. Suggest you follow the same standard approach of titles for each with more detail in the captions using the same format each time.**

Response: We revised all figures to maintain consistency in font, size, label and numeric format. We also revised the figure captions to present concise captions and then describe the plots in detail in the notes in sequential order.

- 1.25. There are so many different units – mean of rank, proportion as fraction and percentage, number of respondents... Suggest you standardise 4**

Response: We now have standardized units to percentages throughout, except for the variables that were measured using a ranking exercise.

- 1.26. Figure 1: Suggest that the vertically aligned ‘questions’ are made horizontal.**

Response: Revised as suggested.

- 1.26.1. These ‘questions’ are not written as such and then question marks are used – for example “prevalence of burning waste plastic in your city?” is not a question. My suggestion is to word the question as it was asked – in this example “what is the prevalence of burning waste plastic in your city?”**

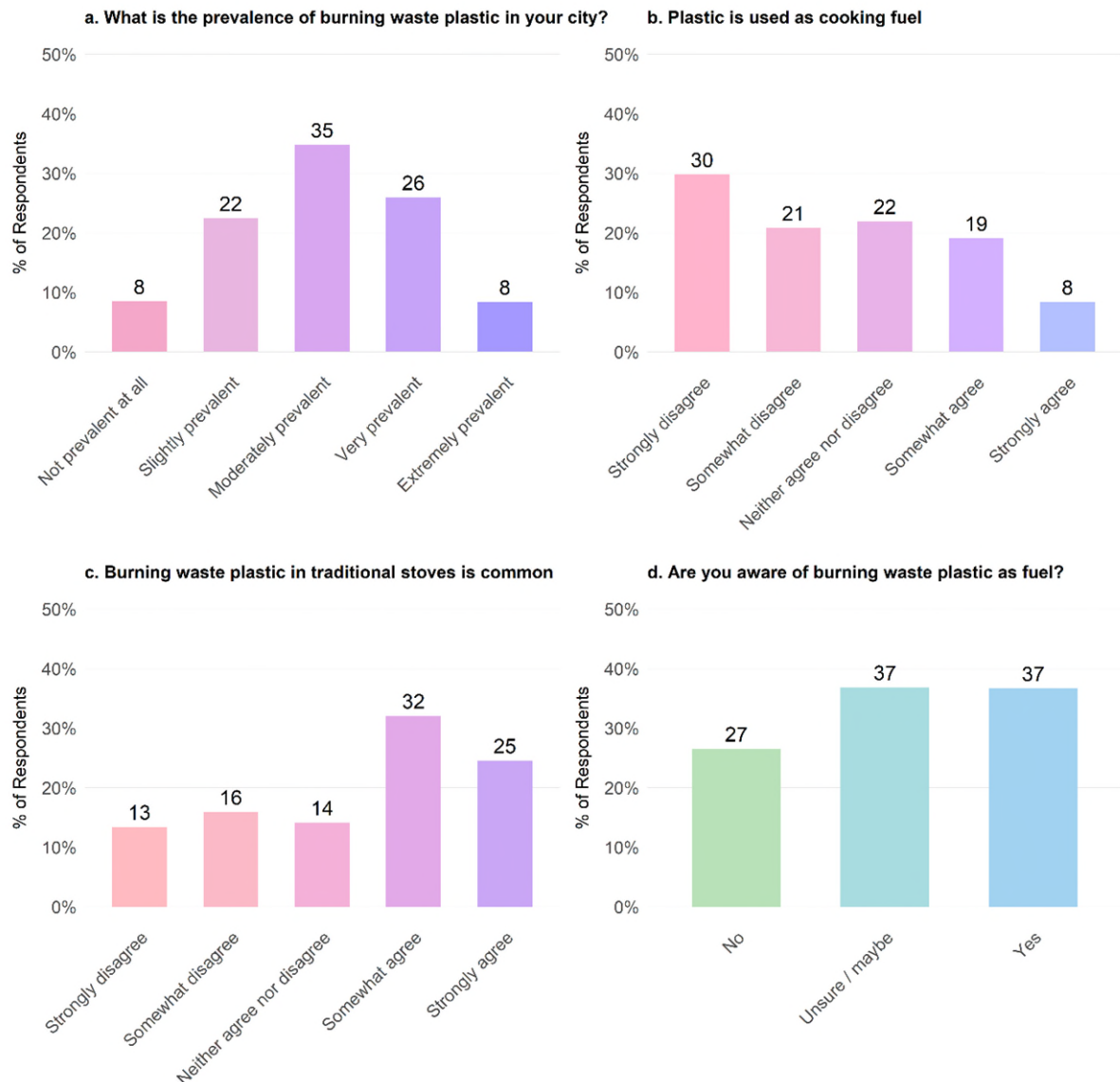
Response: Revised as suggested.

- 1.26.2. Then in the caption everything is repeated – suggest one is the summary of content (title) and the other is the question in full.**

Response: Revised as suggested.

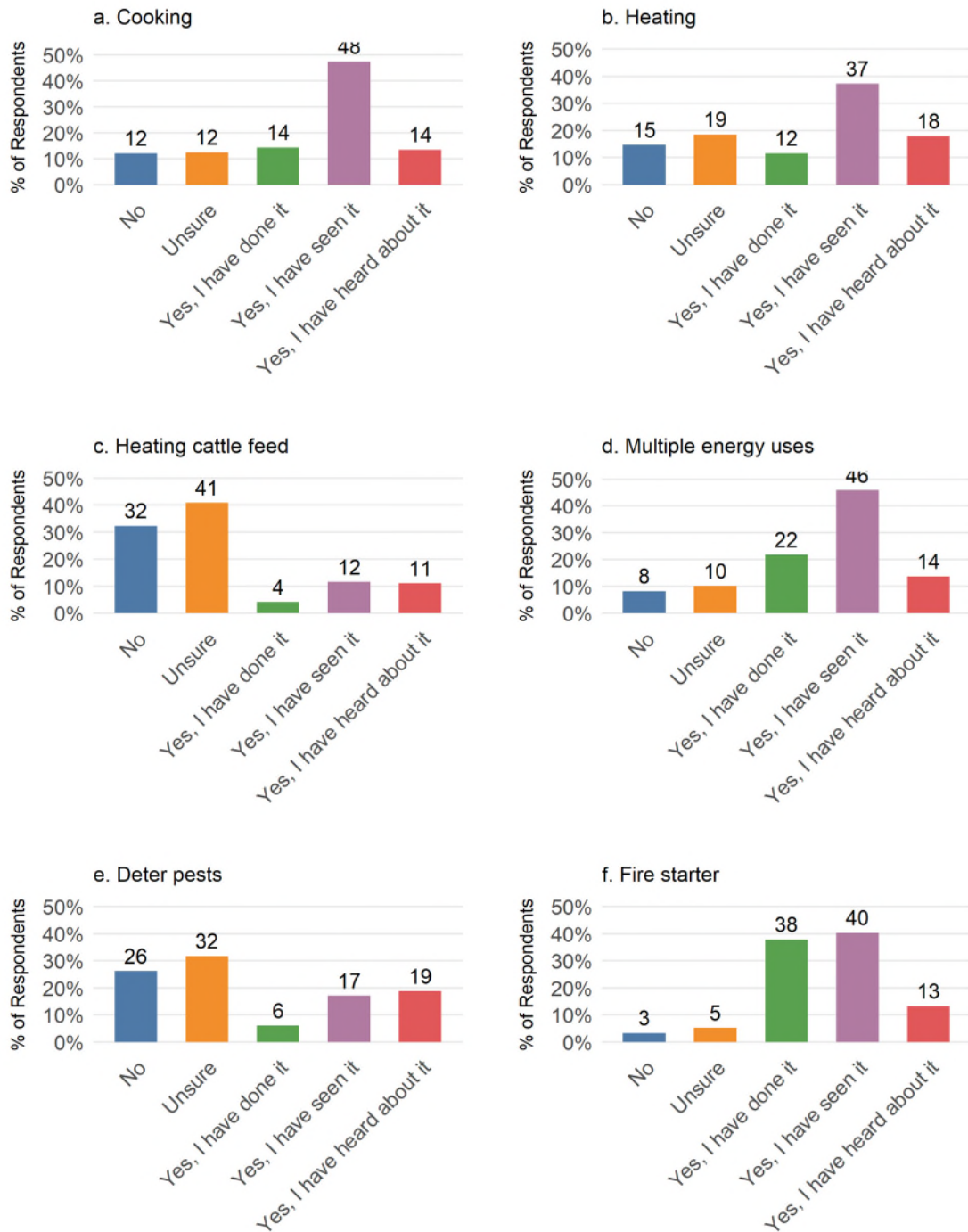
- 1.26.3. Suggest to standardise the size and scale of each chart and the alignment of the labels.**

Response: Revised as suggested, see below:



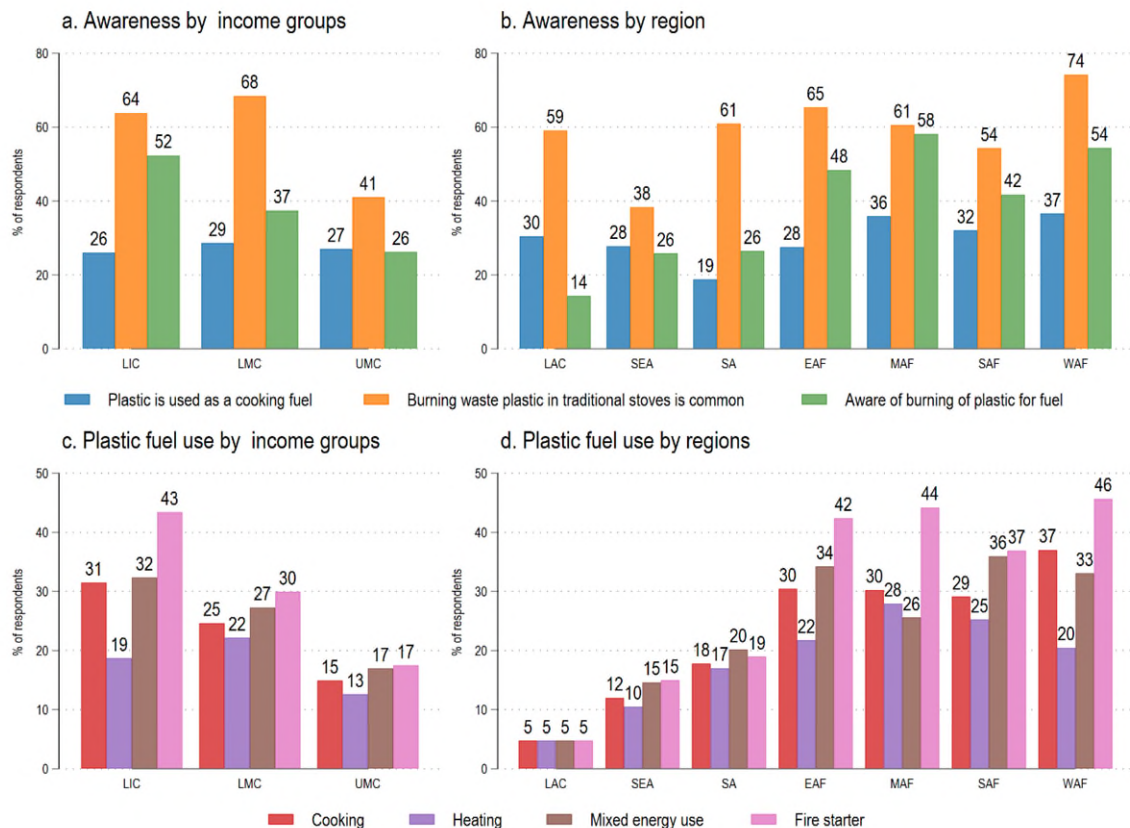
1.27. Figure 2 This is clearer – you have given each chart a title but the title fonts are tiny compared to everything else But in contrast to the last one, we hear that it’s a follow up question – but what was it? The numbers are not aligned with the bars The units have changed lto fractions and there is nothing to explain what they mean

Response: We now include the question in the caption, aligned the bar and numbers. and changed the units to percentages. Below is the revised figure.



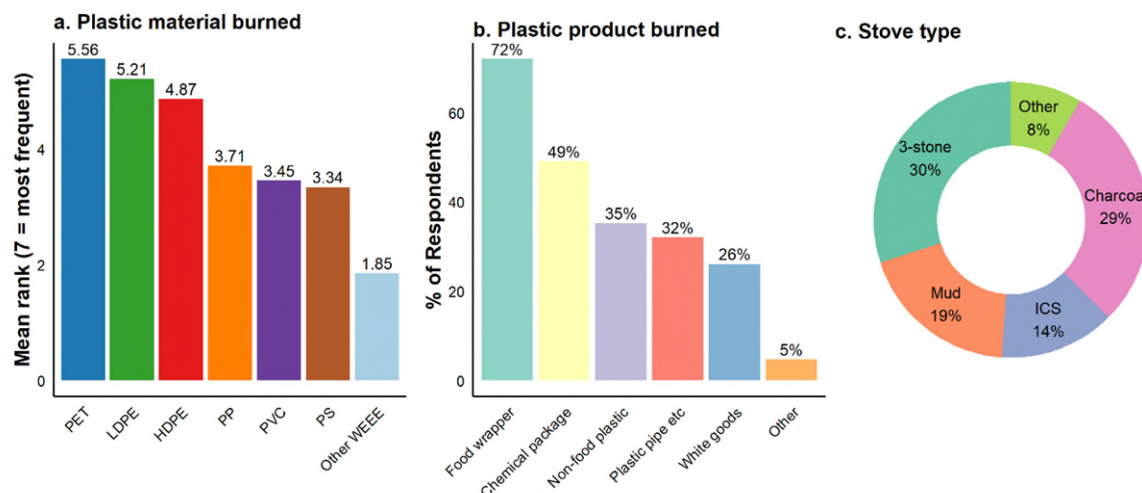
1.28. Figure 3 The use of one colour to mean two things in the same array is confusing. The numbers are squashed and almost unreadable. The font sizes are all over the place. Two styles are used for labelling the bars. The units are fractions like figure 2 but unlike figure 1. The vertical axes need zeros before the decimals and labels

Response: We revised Figure 3 as shown below, where we now use a consistent font, different colours for each variable, and visible bar values. The fonts are now consistent with the previous graph.



1.29. Figure 4 Unreadably small fonts and variable styles- see above
The caption is confusing. The a,b,c are listed and then various details for each are described as Panel A, Panel B etc. Could they not be described sequentially I am not familiar with the stove types so suggest these are explained briefly in the caption – at the very least ICS should be written in full somewhere. 4a should be ordered I think

Response: We have now revised the figure and its caption. The revised figure has larger font,

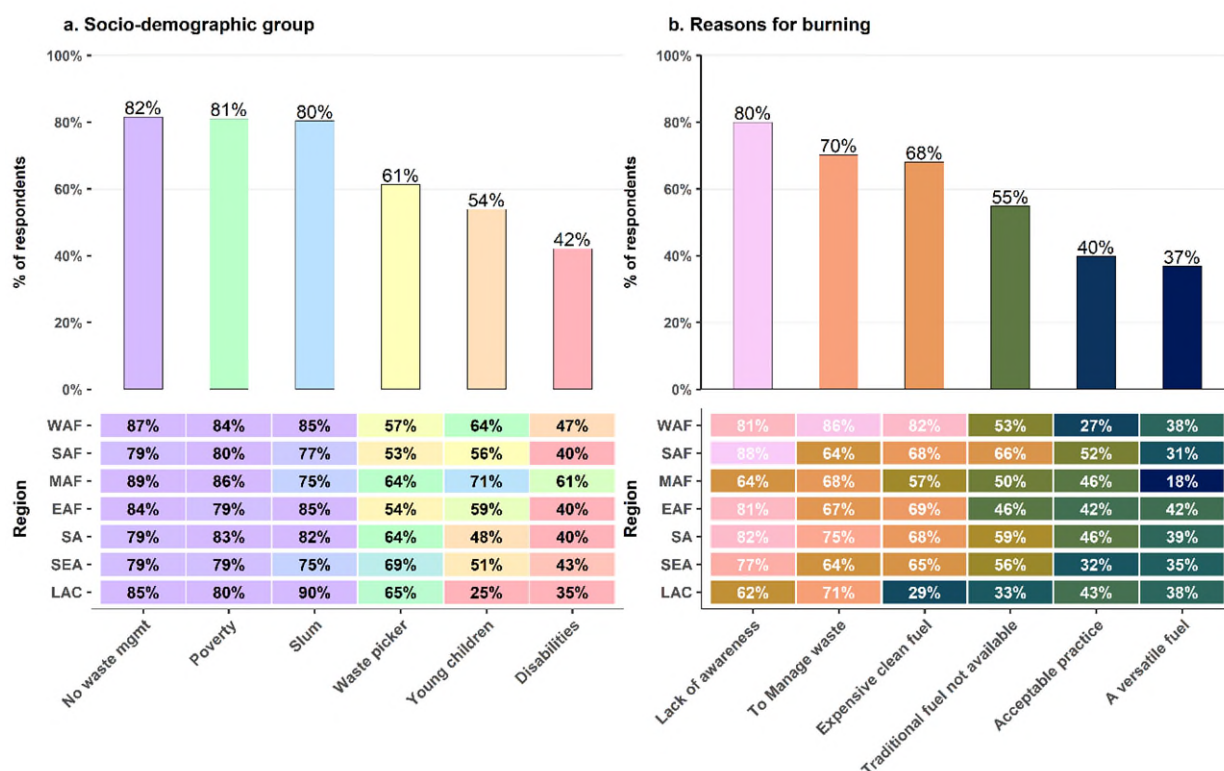


1.30. Figure 5

This was a real puzzle for me –

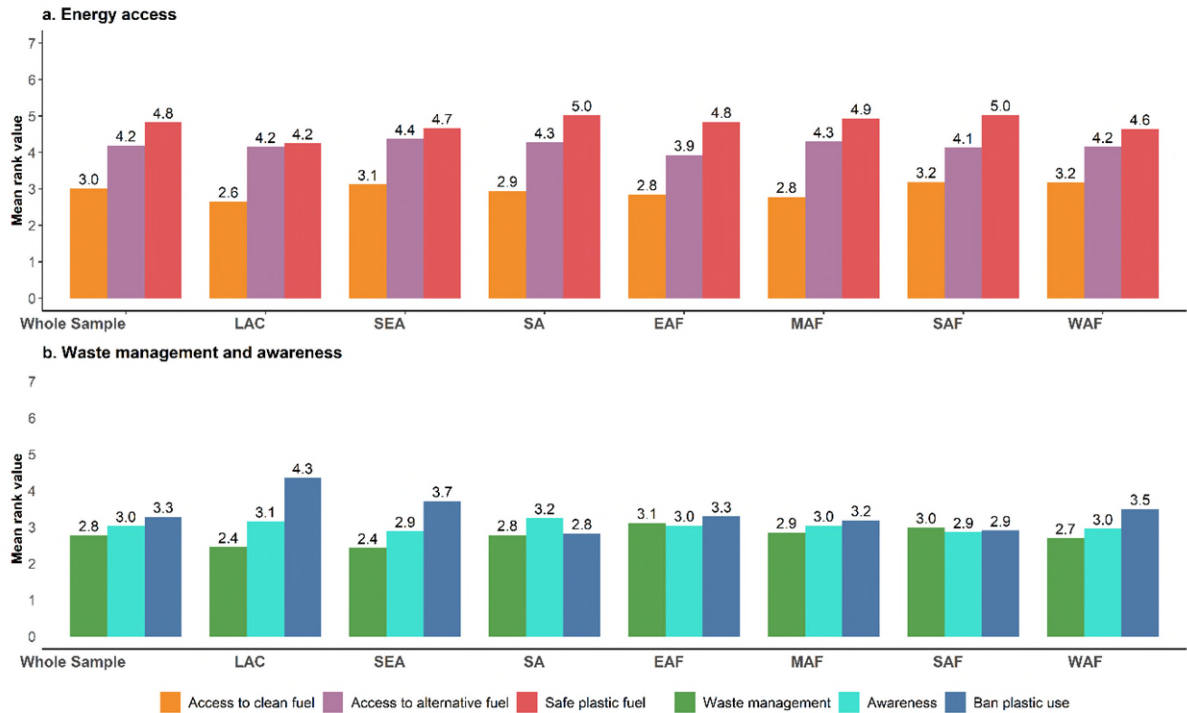
Figure 5C has a number 7 in the horizontal – should probably be WAF
Overlapping and inconsistent labels
Squashed axis labels

Response: We revised the figure as shown below. The region label was corrected, and the fonts are now clear and consistent. We converted Likert scales into percentages of respondents who somewhat or strongly agreed that specific socio-economic groups were more likely to burn plastic waste for fuel than the average. The bar in plot a is now in descending order to make it consistent with plot b.



1.31. Figure 6 A and b – x is not labelled

Response: We revised Figure 6 by removing the risk-related graph. The revised figure shows the agreement that various interventions would address the problem of burning plastic waste for fuel, in the full sample and by region. To make it easier to read, we separated the solutions into energy access-related and waste management-related solutions.



1.32. Table 1 So squashed, I can't read easily

Response: We revised the table, as shown below. We replaced the extent of use (third model) with the respondent's own use of plastic waste as fuel, to make it easy to understand and maintain consistency in the use of logistic regression. We report odds ratios for all models. We shifted the Table to the Supplementary Information and replaced it with a coefficient plot with 95% CI bar as below.

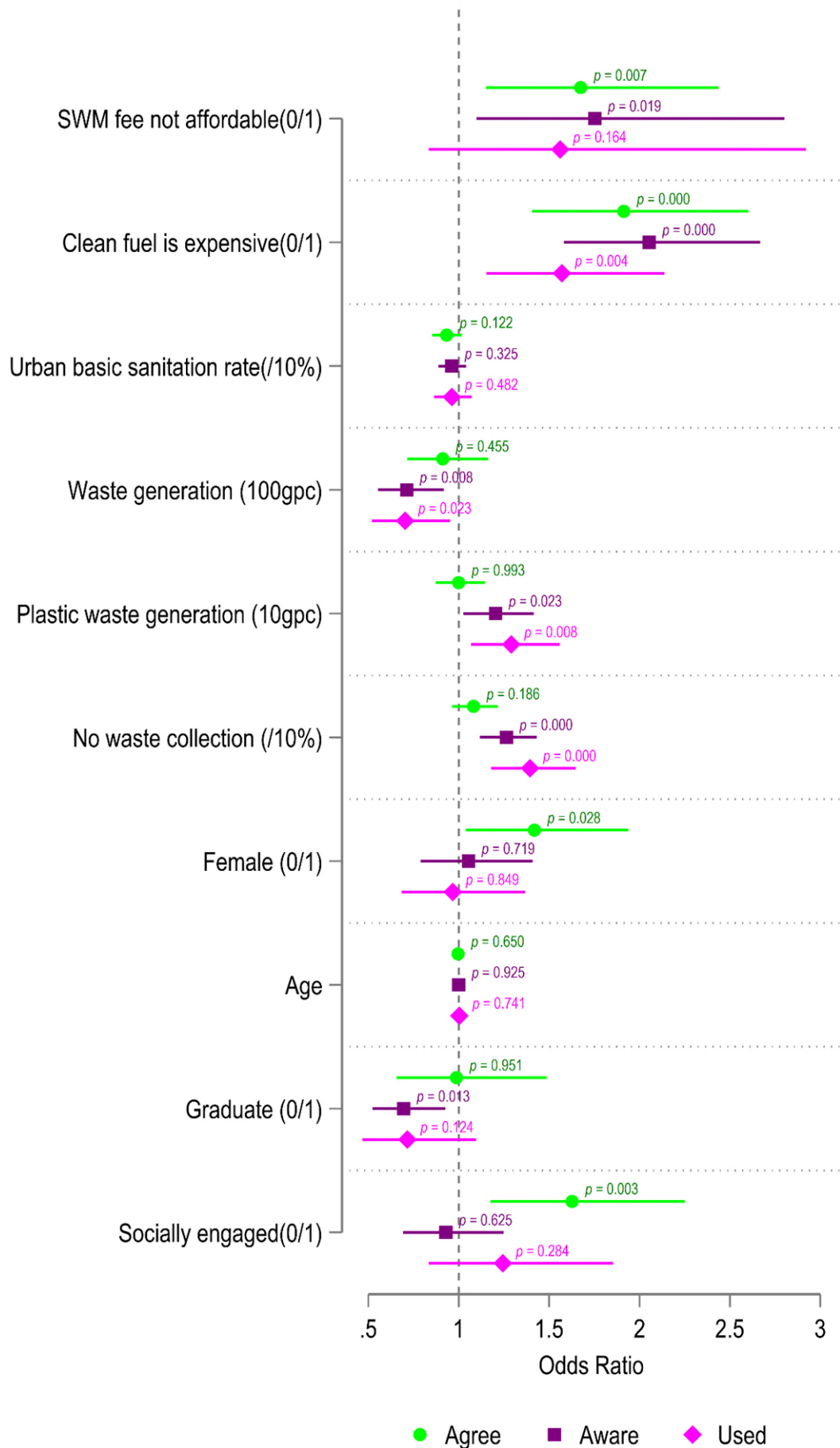


Figure 7 Plot showing odds ratio of burning plastic waste as fuel with 95% confidence interval. Agree (green) shows odds ratios from logistic regression for respondents' agreement on the use of plastic as fuel. The dependent variables are binary variables, converted to indicate if respondents somewhat or strongly agreed with the statements "It is common practice to burn plastic waste (like polythene bags) in the fire of traditional stoves." as 1, and otherwise 0. Aware (purple) presents the odds ratios for the dependent variable for awareness of plastic waste burning based on the third question in Figure 1, which takes the value of 1 if respondents answered 'yes' to the question: "Are you aware of households burning plastic waste as fuel to meet their household energy needs (e.g. fire starters and for cooking and heating)?", otherwise 0. Used (lavender) shows the odds of respondents' own burning plastic waste for various purposes, where the dependent variable takes a value of 1 if respondents reported burning plastic themselves (yes, I have done it) for cooking, heating, mixed energy use, preparing cattle feed, deterring pests, or starting fires. To improve the readability of coefficient estimates and odds ratios in the coefficient plot, variables measured in percentages (no waste collection and basic sanitation services) and grams (total waste and plastic waste generation) were rescaled. Robust 95% confidence interval in bar. Errors are clustered at the city level. See Table S3 for summary statistics of variables and Table S4 for full results).

Table S4: Correlation analysis of plastic waste burning

Variables	(1) Agree	(2) Aware	(3) Used
Municipality SWM not affordable	1.67***	1.75**	1.56
	(1.15 - 2.44)	(1.10 - 2.80)	(0.83 - 2.92)
Expensive clean fuel	1.91***	2.05***	1.57***
	(1.41 - 2.60)	(1.58 - 2.67)	(1.15 - 2.14)
Urban basic sanitation rate	0.93	0.96	0.96
	(0.85 - 1.02)	(0.89 - 1.04)	(0.86 - 1.07)
Waste generated	0.91	0.71***	0.70**
	(0.71 - 1.16)	(0.55 - 0.92)	(0.52 - 0.95)
Plastic waste generated	1.00	1.20**	1.29***
	(0.87 - 1.15)	(1.03 - 1.41)	(1.07 - 1.56)
No waste collection	1.08	1.26***	1.39***
	(0.96 - 1.22)	(1.12 - 1.43)	(1.18 - 1.65)
Female	1.42**	1.05	0.97
	(1.04 - 1.94)	(0.79 - 1.41)	(0.68 - 1.37)
Age	1.00	1.00	1.00
	(0.98 - 1.01)	(0.98 - 1.01)	(0.98 - 1.02)
Graduate	0.99	0.70**	0.72
	(0.66 - 1.49)	(0.52 - 0.93)	(0.47 - 1.10)
Socially engaged	1.63***	0.93	1.24
	(1.18 - 2.25)	(0.69 - 1.25)	(0.83 - 1.85)
Constant	1.84	0.70	0.10***
	(0.34 - 10.09)	(0.22 - 2.21)	(0.02 - 0.40)
Observations	1,018	1,018	1,018

Column 1 in Table 1 presents the odds ratios from the logistic regression for respondents' agreement on the use of plastic as fuel. The dependent variables in Column 1 are binary variables, converted to indicate if respondents somewhat or strongly agreed with the statements "It is common practice to burn plastic waste (like polythene bags) in the fire of traditional stoves." as 1, and otherwise 0. Column 2 presents the odds ratios for the dependent variable for awareness of plastic waste burning based on the third question in Figure 1, which takes the value 1 if respondents answered 'yes' to the question: "Are you aware of households burning plastic waste as fuel to meet their household energy needs (e.g. fire starters and for cooking and heating)?", otherwise 0. Column 3 shows the odds of respondents' own burning plastic waste for various purposes, where the dependent variable takes a value of 1 if respondents reported

burning plastic themselves for cooking, heating, mixed energy use, preparing cattle feed, deterring pests, or starting fires. To improve the readability of the coefficient estimates and odds ratios in the coefficient plot, variables measured in percentages (no waste collection and basic sanitation services) and grams (total waste and plastic waste generation) were rescaled. Robust 95% confidence interval in parenthesis. Errors are clustered at the city level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

2. Reviewer #2

- 2.1. This manuscript addresses an important and understudied issue: the use of plastic waste as a household fuel in low-income settings. The authors leverage a multi-country survey to offer new insights into the prevalence, drivers, and perceived risks associated with this practice. This is a valuable contribution given the potential public health, environmental, and climate consequences of plastic burning. However, significant methodological limitations reduce confidence in the findings and ultimately constrain the paper's utility for informing research or policy.

Response: Thank you for your constructive comments. We have responded to each in our point-by-point response below.

Major Comments;

- 2.2. **Sample Attrition and Data Quality:** The final analytic sample comprises just 14% of those who initiated a response, and the authors acknowledge that many responses were unusable due to non-consent, abandonment, or missing data (Lines 462–472). The low usable response rate raises serious concerns about non-response bias. If the majority of initial respondents failed to complete the survey or were excluded, it becomes difficult to assess the reliability or generalizability of the remaining sample. The manuscript would benefit from a detailed accounting of response flow (e.g., a CONSORT-style diagram) and a reflection on how attrition may have affected the results. Checks against alternative data sources (e.g., household surveys such as the WB multitier framework that may contain info on plastic as a fuel) would be reassuring.

Response: We believe the reviewer misinterpreted the information we reported on the response rate. The non-response rate was 14%, with 170 out of 1188 surveys that were initiated not providing usable data (instead of a response rate of 14% as interpreted by the reviewer). This 14% non-response includes non-consent, responses that were from individuals located outside the study countries, and respondents who reported problems with moving forward with the survey beyond the consent page (likely due to incompatibility with their mobile phones or other connection problems). Thus, the data analysed in our manuscript includes 1,018 useable responses (86% of this total of 1,188), which we believe is an acceptable response rate. We also added a consort-style diagram (Figure S2); thank you very much for that suggestion.

- 2.3. **Selection Bias and Validity of Key Informant Methodology.** The choice to rely on key informants rather than representative household surveys is perhaps justified given the scale of the research question and resource constraints. However, the authors must more directly grapple with the validity of the sampling approach. On lines 447–455 and 473–478, it is clear that respondents were drawn from professional, academic, and NGO communities—not from the households actually engaged in plastic burning. As a result, it is unclear why we should place confidence in this population's ability to provide accurate, detailed information about plastic burning in slums. Are their perceptions systematically biased? Are they sufficiently grounded in lived experience? The authors must better justify this approach, e.g., by providing prior examples or validation of key informant surveys in similar contexts. As it stands, the methodology introduces uncertainty that largely undermines the paper's validity.

Response: Thank you for raising this important concern. As stated in the introduction, this analysis aims to understand the prevalence of burning waste plastic as fuel, which is a practice about which very little information currently exists. Given the resources we had available, it was impossible to conduct a comprehensive and representative household survey in even a single country and city, not to mention such a large number of countries. Nonetheless, the study team felt the problem was sufficiently understudied to warrant an initial survey of key informants living in these locations. We discussed with the country collaborators at length about the types of informants who might have insight into the plastic burning practices and situations in their cities and neighbourhoods, to develop the list of potential key informant types.

We fully agree that the results reported here should not be interpreted as statistics on the percentages of people burning plastic as fuel in these locations. Moreover, we acknowledge that the subjective views of these key informants may be biased and require validation in future population surveys in the study locations. Nonetheless, as indicators of the general widespread prevalence of plastic burning for fuel and to motivate more attention to this potential problem, we believe the survey results are very informative and compelling. We also note that we asked respondents if they had engaged in burning plastic themselves or witnessed it in their settings, which are experience-based questions where the reported rates were also alarming. This is particularly so, given that these key informants are likely “positively selected” relative to the general population in their cities, where positive selection means that they are likely better off, owing to their relatively higher social status compared to the poorest and most marginalized people living there. And though our results are indicative rather than statistically precise, the proportion of respondents who reported burning plastic waste as fuel is also consistent with the World Bank’s Multi-Tier survey conducted in North West Nigeria.

We have added comments on these caveats in the discussion section (Page 18, Line 468-490):

“This study took an initial step toward filling critical knowledge gaps in this domain, but several limitations should be addressed in future work to improve understanding and inform decision making. First, as noted above, the study used a purposive sampling strategy to select knowledgeable community informants as respondents and thus does not provide a population-representative understanding of the scale and distribution of plastic waste burning to meet households’ waste management and energy needs. It is possible that such respondents have a biased view of practices in their communities. To build on and validate this work, further investigation is recommended using representative household samples living across the Global South and in plastic waste hotspots, incorporating plastic as a fuel category and considering local waste management and settlement contexts. Such work could also investigate these practices in rural areas, which our study did not consider. Second, and relatedly, this study used a relatively short, internet-based survey due to resource and logistical constraints, and this limits the extent to which we could more fully probe the nature and drivers of this practice. Third, the study does not identify the impacts of these practices on household health and well-being, as well as environmental quality, nor is it capable of identifying useful strategies to mitigate harmful effects. Work on the former requires attention to research designs that would allow valid inferences on the specific effects of plastic waste burning, which typically co-exists with many other harms, on individual and overall social welfare^{17,42}. The latter, meanwhile, requires careful impact evaluations of pilot and scaled-up efforts – combining improved energy access and waste management elements – to reduce the prevalence of this practice. Such studies must devote attention to measuring emissions, food contamination risks, and health and welfare endpoints, to provide deeper insights into the behavioural, economic, and systemic drivers compelling households to use plastic waste for fuel.”

In any case, we very much appreciate the comments, and thoroughly revised the abstract, main text, methods, and discussion to acknowledge the important limitations of our study.

- 2.4. Framing of the Research Question: The current framing around urban slums and 'household fuel use' lacks sufficient justification. First, the exclusive focus on slum communities is not well explained. Anecdotal and published evidence suggests that plastic burning is also common in rural areas, especially where access to clean fuels and waste services is limited.**

Response: We agree with the reviewer. Although, our survey questions did not specifically ask about the burning of plastic waste in slums. As such, we have revised the text to refrain from framing this issue as one purely affecting slum settlements. Instead, the paper discussed the emerging practice of burning plastic waste as one rooted in the nexus between urban governance, energy poverty, plastic pollution and waste management.

We also agree with the reviewer that plastic burning also occurs in rural settings. However, our study does not cover these areas, so we refrain from discussing them. See the line in the paragraph on limitations above (Page 18, Line 477-478): *“Such work could also investigate these practices in rural areas, which our study did not consider.”*

- 2.5. Second, the framing emphasizes 'plastic as household fuel', but in practice, many households burn plastic as a waste management strategy rather than for cooking per se. The distinction between waste disposal and energy use is blurred throughout the manuscript.**

Response: This point was also emphasized by reviewer 1. We agree, and have revised the introduction as well as the discussion to better emphasize that plastic burning is often undertaken at least in part to manage waste. Supply-related factors, such as inadequate waste management and accumulating plastic waste, and demand factors, like the need for low-cost energy sources, both play a key role in the problem of burning plastic waste as fuel. The revised paper frames the practice of burning plastic waste as fuel as an outcome of the nexus between energy poverty and a lack of waste management.

- 2.6. The authors should more clearly state whether they are studying plastic burning broadly or specifically as a substitute for cooking fuels, and revise the introduction and discussion accordingly.**

Response: Our study does focus on burning plastic waste as a household fuel and we revised accordingly. In particular, see the beginning of the revised abstract: *“Anecdotal evidence suggests that households burn plastic waste to manage waste and help satisfy their energy demand. To examine the prevalence, extent and reasons for use of plastic waste as a household fuel, a survey was conducted with 1,018 key informants from cities in 26 countries in the Global South, who were purposively selected due to their familiarity with the living conditions in their communities.”*

- 2.7. Minor Comments: Terminology: Terms like “prevalence,” “extent,” and “awareness” are used somewhat interchangeably. It would help to clarify definitions early in the paper.**

Response: We have revised the paper to add clarity to our use of these terms.

- 2.8. Figures: Many figures are data-dense but difficult to interpret without clearer captions and labeling. Simplifying or splitting figures might improve accessibility.**

Response: We revised all figures, also in line with comments from reviewer 1. Please refer to those responses above in Page 10 to Page 16.

- 2.9. Abstract: line 56 - consider replacing the word “admitting” with something a non-pejorative term. Also lines 193, 198.**

Response: This was replaced with “reporting” (Line 57 in abstract) and text revised “while 14% responded that they did so themselves.” (Line 181-182)

- 2.10. Line 56: lack of affordability of clean fuel - this is an awkward phrase, and seems more like a demand factor**

Response: Revised to read (Line 58-60) *“Analyses of the data reveal significant correlations of plastic waste burning with both supply factors, such as the lack of waste management, high volume of plastic waste, and expensive clean fuels, and demand factors, including energy needs and indicators of development.”*

- 2.11. Line 61, 80, 87, 137, 331 -- I encourage the authors to reconsider the word “interventions,” which to me at least implies a discreet act as opposed long-term strategies. I suggest the word “policy” or “strategy” instead.**

Response: We replaced the word interventions with programs, policies, and strategies as relevant to the text (line 96,146, 353,416,458, 459, 482,499).

- 2.12. Line 75 instead of “highly marginalized” I suggest “humanitarian crisis” or something to that effect.**

Response: Revised with “humanitarian crisis” (Line 90).

- 2.13. The generalizability of the paper cited in support of the statement here is likely low.**

Response: We have cited other relevant papers (Line 90-92).

- 2.14. Table 1 is confusing as it appears to combine individual level and city level dependent variables. I suggest running household level regressions with household’s own use of plastic fuels as independent variable and city level regressions with awareness as independent variable. Given the sampling limitations, claims should be clearly caveated.**

Response: We would like to clarify that none of the dependent variables in Table 1 (now Table S4 and Figure 7) were city-level variables. All were based on individual key informant responses, though some were about their perceptions of plastic waste burning in their cities, rather than concerned with their own actions. Similarly, some of the independent variables considered in these descriptive correlations are city- or national-level variables, while others come from individual responses. We believe that an individual unit of analysis is the most appropriate approach for analyzing these data, as informants reported different things and these are influenced by both individual and national and city-level factors. Standard errors are clustered at

the city level, given the likely correlation in responses within cities. We describe this in the methods section in additional detail under the section titled “Regression Analysis”.

However, given this reviewer’s comments we did revise the table. Specifically, we replaced the third dependent variable with the respondents’ reported own burning of plastic waste as fuel (Column 3, now Table 2) to include a more direct measure of burning plastic waste as fuel. We revised the text to reflect the interpretation of those new results. See Table S4 below, which we moved from main text and replaced it with a coefficient plot with 95% confidence interval bar and p-value.

We also have now included a supplement analysis with responses aggregated at the city level (Table S4).

Table S4: *Regression analysis of plastic waste burning*

Variables	(1) Agree	(2) Aware	(3) Used
Municipality SWM not affordable	1.67*** (1.15 - 2.44)	1.75** (1.10 - 2.80)	1.56 (0.83 - 2.92)
Expensive clean fuel	1.91*** (1.41 - 2.60)	2.05*** (1.58 - 2.67)	1.57*** (1.15 - 2.14)
Urban basic sanitation rate	0.93 (0.85 - 1.02)	0.96 (0.89 - 1.04)	0.96 (0.86 - 1.07)
Waste generated	0.91 (0.71 - 1.16)	0.71*** (0.55 - 0.92)	0.70** (0.52 - 0.95)
Plastic waste generated	1.00 (0.87 - 1.15)	1.20** (1.03 - 1.41)	1.29*** (1.07 - 1.56)
No waste collection	1.08 (0.96 - 1.22)	1.26*** (1.12 - 1.43)	1.39*** (1.18 - 1.65)
Female	1.42** (1.04 - 1.94)	1.05 (0.79 - 1.41)	0.97 (0.68 - 1.37)
Age	1.00 (0.98 - 1.01)	1.00 (0.98 - 1.01)	1.00 (0.98 - 1.02)
Graduate	0.99 (0.66 - 1.49)	0.70** (0.52 - 0.93)	0.72 (0.47 - 1.10)
Socially engaged	1.63*** (1.18 - 2.25)	0.93 (0.69 - 1.25)	1.24 (0.83 - 1.85)
Constant	1.84 (0.34 - 10.09)	0.70 (0.22 - 2.21)	0.10*** (0.02 - 0.40)
Observations	1,018	1,018	1,018

Column 1 in Table 1 presents the odds ratios from logistic regression for respondents’ agreement on the use of plastic as fuel. The dependent variables in Column 1 are binary variables, converted to indicate if respondents somewhat or strongly agreed with the statement “It is common practice to burn plastic waste (like polythene bags) in the fire of traditional stoves,” as 1, and otherwise 0. Column 2 presents the odds ratios for the dependent variable for awareness of plastic waste burning based on the third question in Figure 1, which takes the value 1 if respondents answered ‘yes’ to the question: “Are you aware of households burning plastic waste as fuel to meet their household energy needs (e.g. fire starters and for cooking and heating)?”, otherwise 0. Column 3 shows the odds ratios of respondents’ own burning plastic waste for various purposes, where the dependent variable takes a value of 1 if respondents reported burning plastic themselves for cooking, heating, mixed energy use, preparing cattle feed, deterring pests, or starting fires. To improve the readability of coefficient estimates and odds ratios in the coefficient plot, variables measured in percentages (no waste collection and basic sanitation services) and grams (total waste and plastic waste generation) were

rescaled. Robust 95% confidence interval in parentheses. Errors are clustered at the city level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

- 2.15. Recommendation - Major revision. The topic is significant and is largely unstudied, and the paper has the potential to make a meaningful contribution. However, the authors must substantially strengthen the justification for their methodological approach, clearly address sample limitations, and clarify the framing of their research questions. Any conclusions offered must include specific caveats related to sampling limitations. Perhaps the paper could be recast as more of a hypothesis generation activity.**

Response: Thank you again for the constructive feedback. We have revised the introduction, discussion and methods sections in line with the comments, and as noted above, include a thorough discussion of limitations. We believe the edits made address most of the reviewer's concerns, but are happy to consider further changes if needed.

3. Reviewer #3 (Remarks to the Author):

- 3.1.** This broad cross-sectional survey across 26 countries presents the plastic waste prevalence in low-income countries globally. The paper is well written and clearly delineates a massive problem. Noteworthy results include an understanding of plastic waste management and the burning of plastic in household fires. The work will contribute to the literature because it characterizes regions of the globe, not one specific country or region. The methodology needs to be explained a bit more (recruitment of a convenience sample and whether that is generalizable). The supplement provides enough information to understand the methods.

Response: Thank you for the constructive feedback. We revised the introduction, explicitly describing the limitations in sampling and sample size, and include a thorough discussion of interpretation and limitations in the revised manuscript.

General:

- 3.2.** How were participants “purposively sampled” or identified?

Response: We revised the method to describe the sampling method in additional detail, and to clarify that the sampling was purposive. It was not possible to list and randomly select respondents. Therefore, we relied on country collaborators to find socially engaged people who are familiar with the situation in their cities and asked them to reach out to them.

Please see the limitations section in discussion section (page 18, Line 468-490):

“This study took an initial step toward filling critical knowledge gaps in this domain, but several limitations should be addressed in future work to improve understanding and inform decision making. First, as noted above, the study used a purposive sampling strategy to select knowledgeable community informants as respondents and thus does not provide a population-representative understanding of the scale and distribution of plastic waste burning to meet households’ waste management and energy needs. To build on this work, further investigation is recommended using representative household samples living across the Global South and in plastic waste hotspots, incorporating plastic as a fuel category and considering local waste management and settlement contexts...”

- 3.3.** The statistical analysis is primarily descriptive, and the tables are hard to read because they are either mis-aligned, missing information, or poorly labeled (Table 1 “correlational analysis” when providing odds ratios or OLS). 95% CI are preferred over standard errors. You are measuring bivariate associations with OR and OLS, not correlations.

Response: We generally agree with the feedback and have replaced standard errors with 95% CI. However, we note that the logit regressions used to obtain the odds ratios are multivariate regressions, not bivariate ones.

- 3.4.** The figures are very hard to read and there are too many bar graphs. Some are all blue, with % superimposed on the bars (Figure 1) or a decimal number instead of a percent, which it should be (Figure 2). Figure two doesn’t provide a number for N= _____. Figures 3, 4, 5 have decimals instead of percents on the bars or above the bars and they are impossible to read. Figure 3 is missing a statement about the color of the bar next to the description. Most of these figures (especially Figures

3, 4, 5 and 6) would be better in a table or in some other graphical display that is easier to read.

Response: We completely revised the figures throughout the manuscript, also in line with the comments from reviewer 1 (page 10 – 16 of this document). See the detailed response to those suggestions. Regarding Figure 6, we removed two subplots and placed them in the Supplementary Information. The design of the other figures is now substantially different, and we hope that the reviewer finds the new figures more helpful and appropriate.

3.5. More should be provided about the respondents. The supplementary table should be a table in the main paper and then the two paragraphs summarizing the table could be removed. In the methods, the authors call them “responses” but they are respondents (See supplemental table too).

Response: We moved the summary statistics of respondents to the main text (now Table 1, page 5). We also revised the text to ensure it correctly identified these as respondents.

3.6. Table S3: Prevalence, but measured in decimal units. Change to percentage numbers and label columns as such. It is not clear what the numbers refer to in some of them—Likert scale?

Response: The variable was measured on a Likert scale, and we revised Table S3 to indicate the Likert scale where relevant.

MS# NCOMMS-25-18263A

Revision # 2

We thank the reviewers for their comments – they significantly improved the manuscript. We have also clarified language in the new version of the manuscript.

Response to reviewer's comments

Reviewer #1

1.1 The authors have made an impressive effort to almost completely rewrite the manuscript which has improved immensely. The figures and tables are now readable and on the whole well labelled.

Response: Thank you for these comments.

1.2 There were no line numbers in this version and no track changed version was provided - presumably because there was such a substantial re-write. I have therefore, made further comments on your latest version of the manuscript attached. I made also a few stylistic edits using track changes which you can take or leave.

Response: Thank you for these comments.

1.3 Comments from pdf version

A1.1 Cannot say 'both' and then list three things

Response: We have revised as below

"Analyses of the data reveal significant correlations of plastic waste burning with both supply factors, such as, the massive amount of plastic waste generated ($p=0.000$), expensive clean fuels ($p=0.004$), and demand factors, including self-management of waste ($p=0.000$)."

A1.2 How is waste management a 'supply factor'?

Response: We have revised as demand factor (See response to A1.1).

A1.3 'why is the 'volume' important' – suggest mass, amount, quantity

Response: We have revised the statement to 'massive amount of plastic waste'.

A1.4 please add p-value if using term significance

Response: We have included p-values where relevant, for example, in the abstract, and deleted 'significant' in some instances.

A.2 'generated' - not to be confused with plastic production (Line 1, Page 2)

Response: Revised as *“The management of plastic waste, with over half a billion tons of plastic produced annually and rising, is a major global environmental challenge”*

A3 quantity (Line 3, page 2)

Response: We have corrected the text.

A4 please add p-value

Response: We replace ‘significant’ with ‘substantial’.

A5 suggest this modification as there is no certainty the phenomenon will continue (Last line, page 2)

Response: As suggested by the reviewer, we have revised the text by adding ‘Historically’.

A6 OK but these are incinerators, not open burning sites - need to differentiate carefully between the two- actually that study includes data for open burning sites - so why not link to that instead

Response: Revised as *“For example, chicken egg samples from an electronic waste site in Ghana, where plastic and cable were burnt in open, have been found to contain toxins^{33,34}.”*

A7 studies cannot collect things

Response: Revised *“The responses from 1,018 key informants familiar with the context of their cities were analysed in this study”.*

A8 there is little sense of spread in this table and i'm not convinced the mean alone gives the right sense of the central tendency - i recommend at least the median but why not put some quartiles in too

Response: We have now added p25, p50 and p75 in the table. However, based on Reviewer 2's comments, we have shifted this table to SI and replaced it with a frequency table, making it easier for general readers to follow.

A9 The caption does not match the titles in each case (Figure 1 caption).

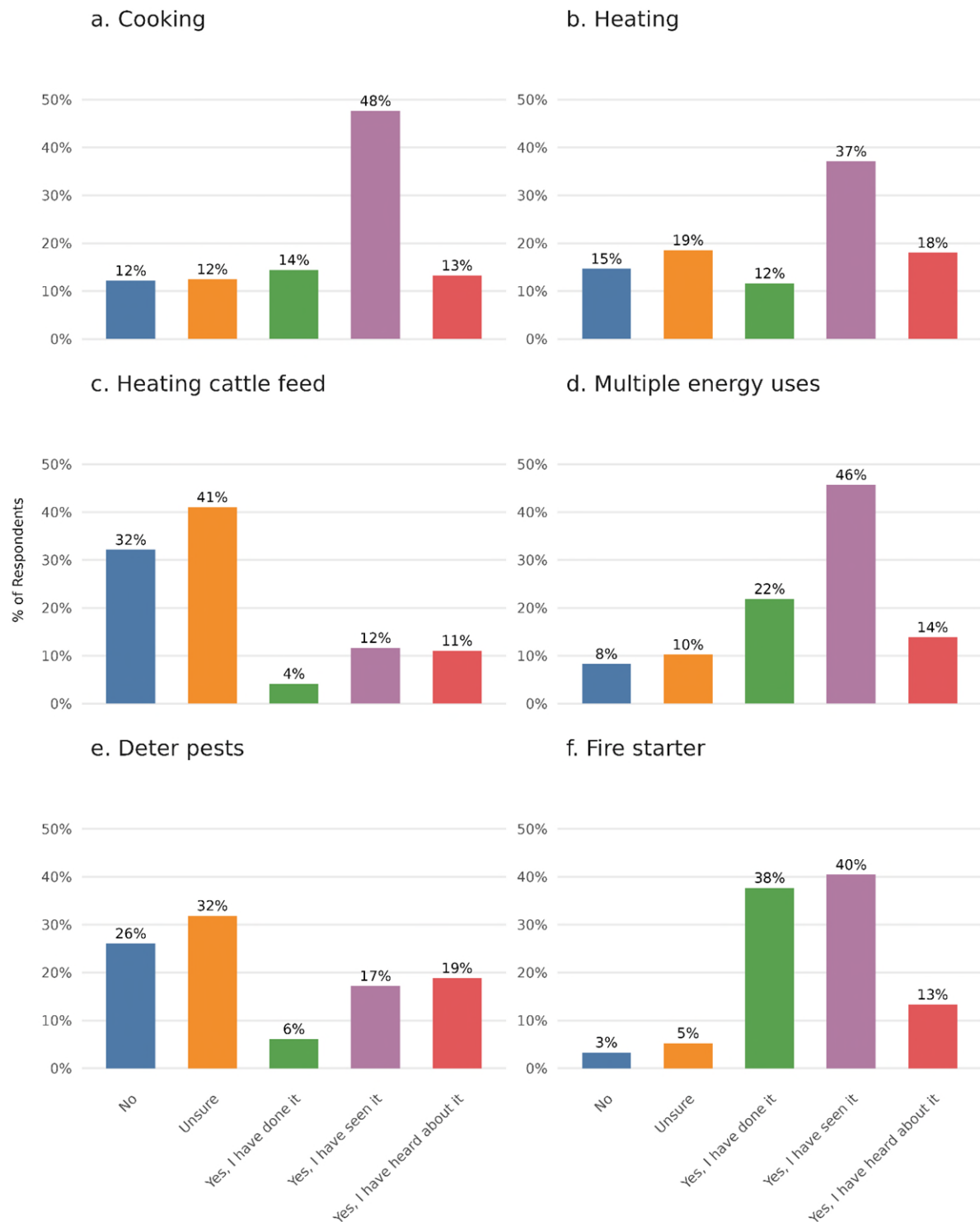
Response: The caption was revised, but note that the caption descriptions are paraphrased.

A10 cannot write such things – what question? I suggest that questions are codified and the copes referred to at every stage.

Response: Revised as “*The 365 respondents who indicated awareness of plastic waste burning for energy purposes in their city, from the final question ‘Are you aware of burning waste plastic as fuel’, were also asked follow-up questions regarding the specific purpose of this practice.*”

A11 it would be possible and much neater / readable to arrange these with just a single x axis

Response: We have revised the plots to include a single x-axis.



A12 this is a very interesting and somewhat surprising finding. I almost find it hard to believe because PVC is not a prevalent plastic type in municipal solid waste - i would suggest that this is discussed later - i also wonder if the respondents understood the

question.... this is terribly important because PVC is the dominant cause of dioxin emission from open burning - if PVC is somehow disproportionately burned in open fires - I would want to understand why and as a priority take steps to mitigate it.

Response: We have now checked the data and revised the text as below:

“The third most frequently reported plastic being burned is high-density polyethylene (HDPE), a material frequently used for chemical containers. The fifth most frequently used plastic material is polyvinyl chloride (PVC), which is mostly used in plastic plumbing pipes, and is a major cause of dioxin emission⁴¹.”

A13. what does this sentence refer to?

Response: We have now moved this sentence to the end of the paragraph so that it refers to the result presented in Fig S1 and Table S2.

A14 ?? why both?

Response: We have corrected this in the text.

A15 please reorganise this sentence which is not easily understandable

Response: Following the reviewer’s comment, we have revised the sentence.

“Respondents were asked to rank what they believed was the most important solution to the issue of burning plastic waste as household fuel in their city. As shown in Fig. 6, the average rankings (where lower values indicate higher effectiveness) suggest that improved and expanded solid waste management services for informal settlements (waste management) are seen as the most effective solution to the problem, followed by increased access to clean energy technologies and raising awareness about the negative effects of burning plastics for fuel.”

A16 suggest deleting this preparatory sentence - this information should already be clear from the figure - the reader wants to know what it means - i.e. it is obvious that it is there.

Response: We have deleted the preparatory sentence as suggested.

A17 glad to see this discussion - but I am confused by this sentence as it is written - it seems to contradict itself - could it be broken into two and the second part explained a little.

Response: Revised as below

“Meanwhile, city-level factors such as volumes of plastic waste ($p < 0.023$, Column 2; $p < 0.008$, Column 3), and population without waste collection services ($p < 0.000$, Column 2; $p < 0.000$, Column 3) were positively correlated with direct awareness of others’ or individuals’ own plastic waste burning for energy purposes. The insignificant correlations

between the volume of mismanaged plastic waste in the city and the population without waste collection, on one hand, and respondents' general agreement that plastic is burned for energy purposes, on the other, may be related to overreporting of general awareness compared to direct awareness."

A18 again - just get on with it and explain without the preparatory

Response: Following the reviewer's comment, we have deleted the text.

A19 refuse' is a little ambiguous and not always well-understood in all English speaking countries.

Response: Following the reviewer's comment, we have corrected the text.

A20 supposition - i think just make the speculation but remove the bit about being surprised you made it.

Response: We have revised the text as follows:

"Given the combustible nature of plastic, the increasing volumes of this material in waste, and the reality that many households in the Global South must self-manage waste, the use of plastic as a domestic fuel might be increasing."

A21 This is a very interesting discussion point - this would be a good opportunity to highlight /emphasise how challenging it must be to make such a tough decision between having the fuel to cook for your family and suffering exposure to potentially hazardous substances.

Response: We have revised the sentence as follows:

"The survey results help illustrate how burning plastic waste emerges as such a zero- or low-cost option and the challenges in deciding between cooking a meal for the family and exposure to potentially hazardous emissions."

A22 you are not at the end

Response: We have corrected the text.

A23 this is very strong and I'm not convinced you have evidenced it.

Response: We have revised the text to soften the tone as:

"Meanwhile, on the demand side, hardly anyone would want to burn plastic waste as a fuel or use a traditional stove to manage it."

A24 could you add more detail about the specific sub-indicators - for example a lot of what you consider specifically refers to SDG11.6 - at the moment the general discussion about SDG11 is vague because there are so many sub-indicators unrelated to your topic.

Response: We have added a text to highlight SDG11.6, which specifically deals with waste management and emissions in cities, as below:

“SDG11.6 specifically targets increased waste collection services, management of waste in controlled facilities, and reduction of fine particulate matter concentrations in cities. Reducing the burning of waste plastic as fuel is thus a potential channel and area of action to lower emissions through improved waste management.”

A25 specifically - and mainly waste collection correct?

Response: We have revised the text as follows:

“For example, it is clear that improved solid waste management, specifically waste collection, would decrease the need for burning of plastic as a waste management strategy,..”

A26 I'm struggling to understand what is meant by this - how is providing formal collection services in these contexts linked to revenue generation? You mean user fees? or reclamation of materials .. please be specific.

Response: We have revised the text as below:

“..but effectively delivering such services in crowded, low-income areas, where collecting waste management fee is difficult and trust in formal government institutions is low, remains a significant challenge.”

A27 how many?

Response: We have revised the text as follows:

“This study took an initial step toward filling critical knowledge gaps in this domain, but three main limitations should be addressed in future work... ”

A28 i should hope that you would choose 'hotspots' too.

Response: Yes – we have also chosen ‘hotspots’, we have revised the text as follows:

“To build on and validate this work, further investigation is recommended using representative household samples from across the Global South, including plastic waste hotspots and notspots, underserved communities, and informal settlements.”

A29 really?

Response: We have edited the text to:

“World Bank. Nigeria - Multi-Tier Framework (MTF). <https://energydata.info/dataset/nigeria-multi-tier-framework-mtf-survey-59> (2020).”

1.4 I also have the following general comments:

1.4.1 There are still some inconsistencies in the fonts, font sizes, column spacing, column styles and colours used within and between tables and figures - every figure should have the same scale, font size etc - otherwise it is off-putting

Response: We have revised the figures to maintain consistency in scale and font. Figure 2 is revised to have single x-axis to make it clearer and effective.

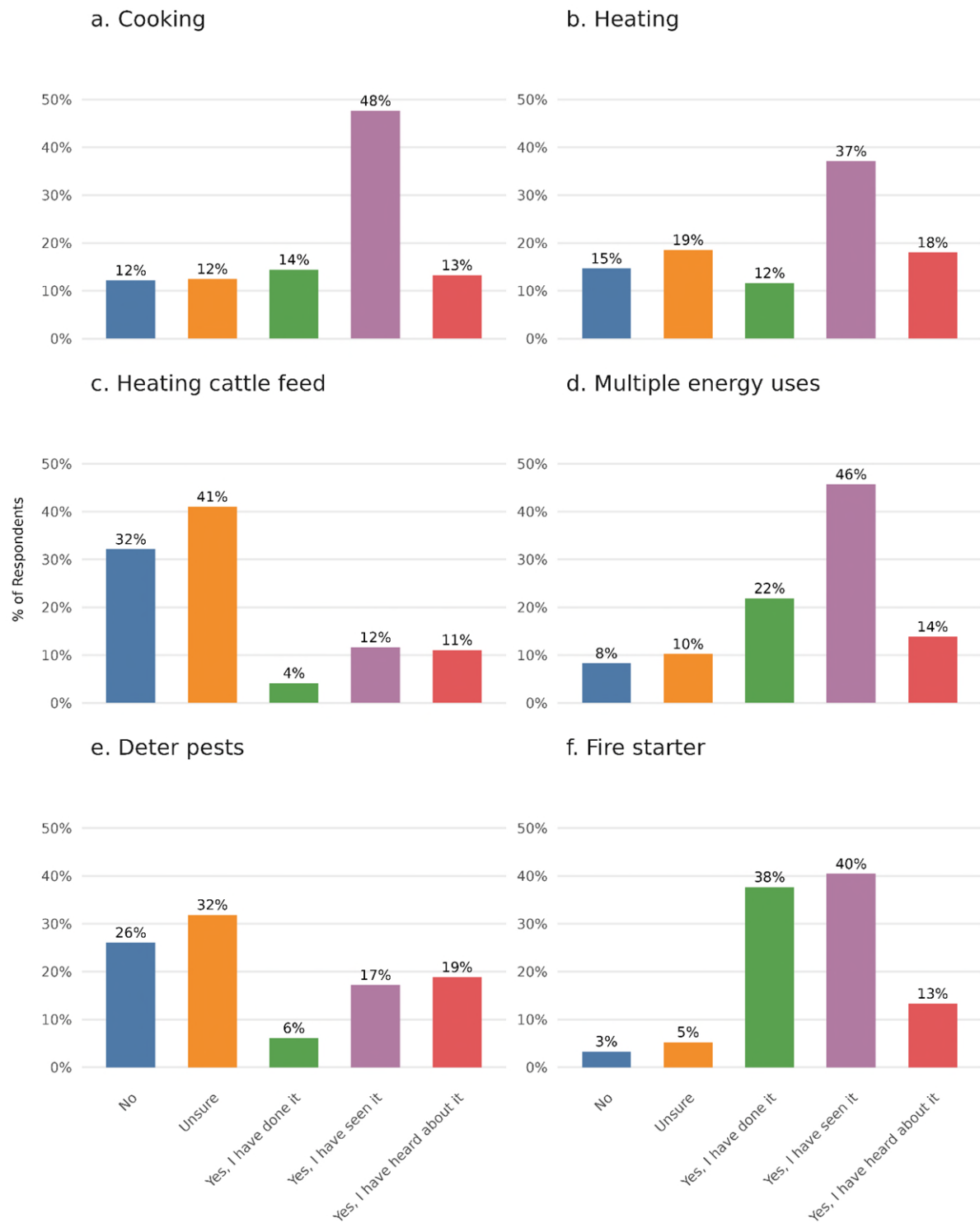


Figure 3 has been revised according to the guidelines.

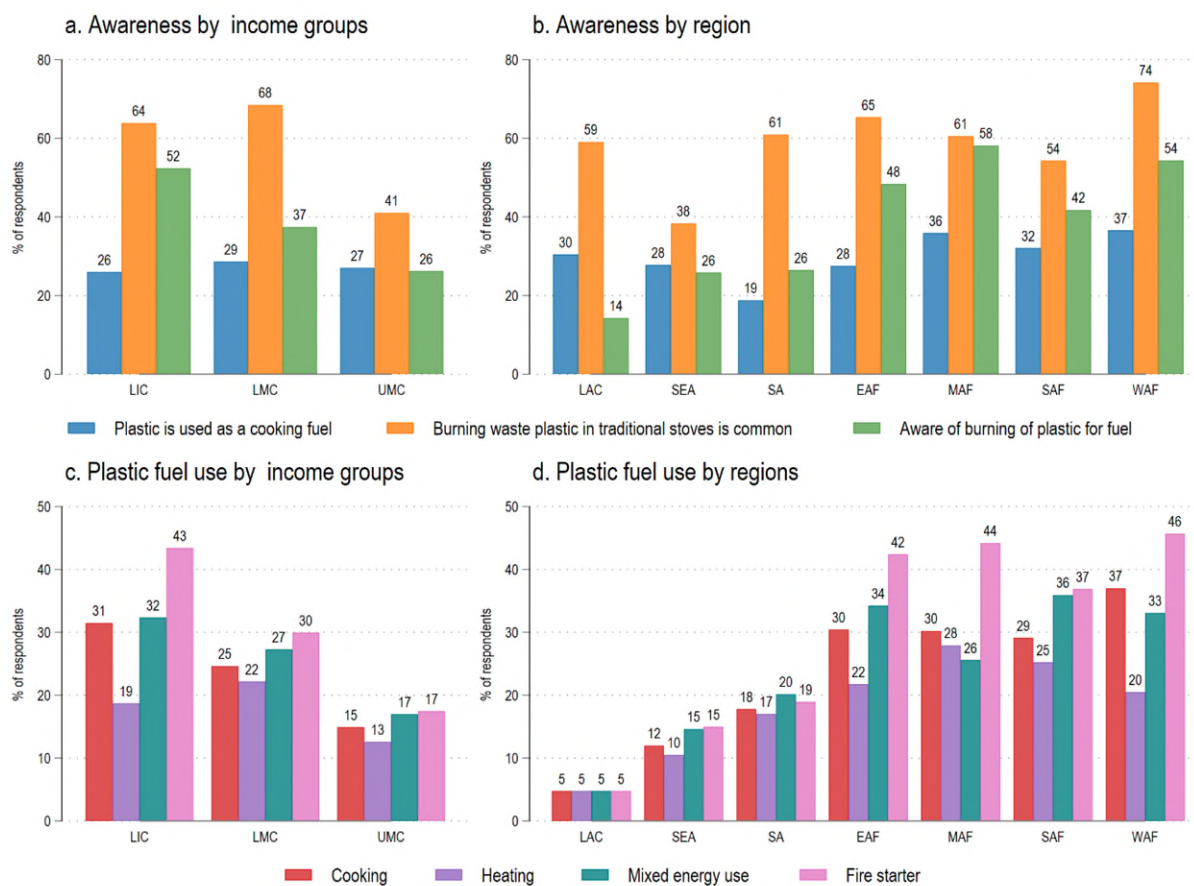


Figure 4 is revised to have a scale up to 7 (plot a) and 0 to 100% (plot b).

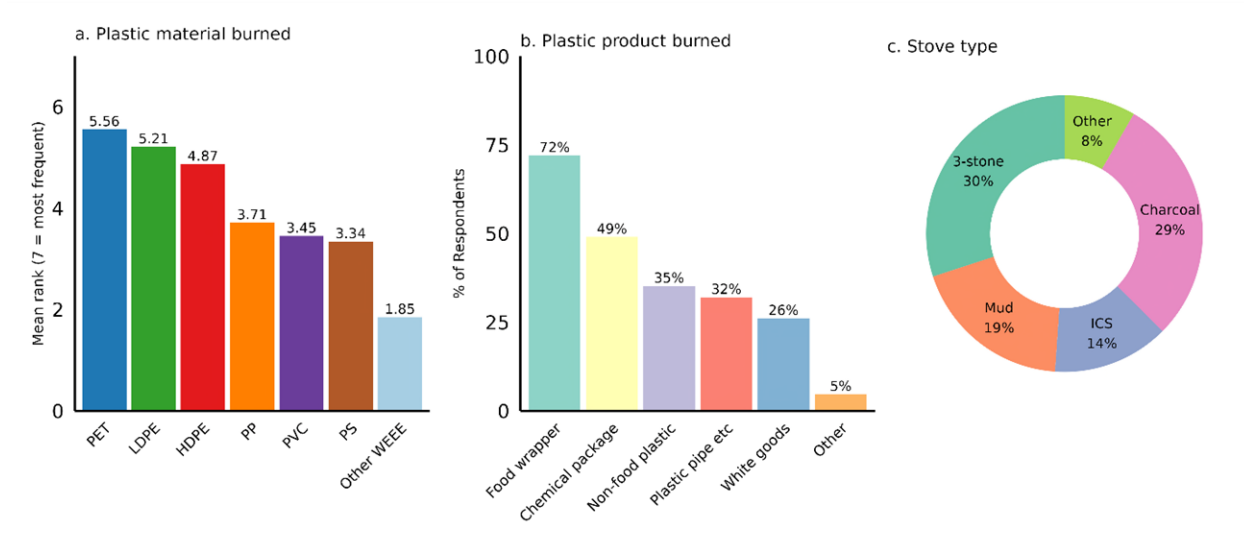
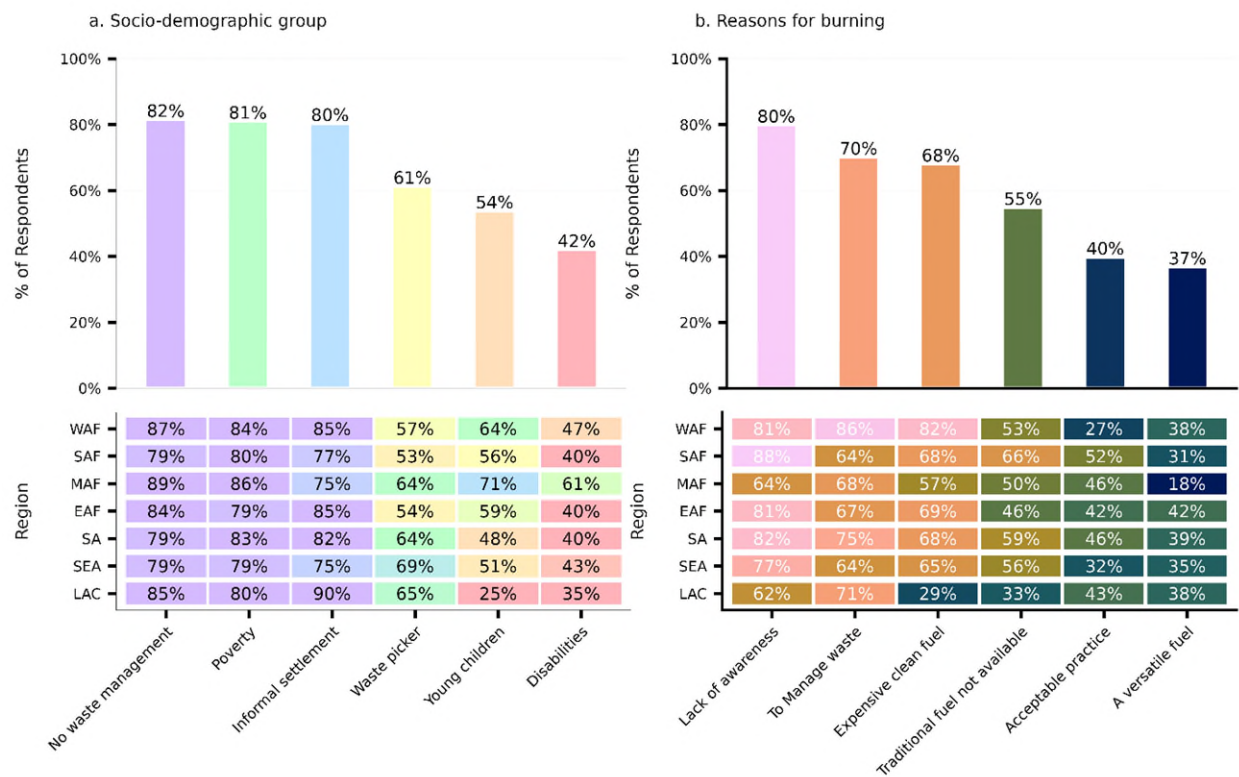


Figure 5 revised for a consistent y axis on both plots.



1.4.2 It was not easy to see the central tendency and spread of the results. With hindsight, it would have been better to see boxplots, but we are here now. Even if you choose to continue to keep these figures, it would be helpful for others to easily see the spread - a simple spreadsheet of the results of each question would help practitioners to make sense of it all - making it accessible to those who cannot run the code. I suggested adding some more stats to Table 1 - you could consider another version of that table in the supplementary which shows the same list of demographics for the rows, and has the countries as columns - so we can see the mix per country...

Response: We have now revised Table 1 as suggested by Reviewer 2. We added the median, p25, and p75 to the table and shifted it to supplementary information (Supplementary Table 6). As suggested, we also created an Excel file that shows respondent characteristics by country and added it as a supplementary file.

1.4.3 Overall its looking very good now. Good luck

Response: We have addressed all comments and would like to thank reviewer for their constructive comments.

Reviewer #2

2.1 The authors have largely addressed reviewer comments, and the revised manuscript provides a fair representation of the implications of the survey results while providing appropriate caveats. This paper provides a meaningful step towards quantifying an important public health issue, and will hopefully inspire additional research.

[Response: Thank you for the constructive comments.](#)

Reviewer #2 (Remarks on code availability):

2.2 I was able to review the code but am unable to log on to codeocean.com (I get error messages for both my institutional and personal accounts). Based on my inspection, however, the code appears correct and is well-documented.

[Response: Thank you for checking the code.](#)

Reviewer #3

3.1 Line 130 "nor can it be easily sold to recyclers" -- would change to "nor does it have the resale value that metals have, thus is not easily sold to recyclers"

Response: We have revised the text as suggested.

Line 137 "egg samples"-- please clarify what eggs you are talking about-- I assume chicken eggs that are consumed?

Response: We have revised the text as follows:

"For example, chicken egg samples from an electronic waste site in Ghana, where plastic and cable were burnt in open, have been found to contain toxins^{33,34}."

3.2 Line 278: How were disabilities defined? Can include in this line, "such as..."

Response: In our survey question, we did not define disabilities or provide examples of disabilities, therefore, we do not know what the respondent would have imagined while responding to the question.

3.3 Table 1. All of the categorical statistics of respondents are presented as means and SDs which should be in % (n). For instance, male gender has a mean of 0.543 and a SD of 0.498 with a range of 0 to 1. What does SD mean in the context of being male? The categorical variables should be reported as 49.8% were male, n=X. It is confusing to the reader to see these reported in this way, and it is a simple fix (and is reported as such in methods). The only continuous variable, age, is of course reported as mean (SD).

Response: We have now revised Table 1 as suggested. We also include full summary statistics as suggested by reviewer 1, and also country-wise respondent characteristics in an Excel file.

3.4 Variables in Figure 7 are challenging to interpret. What does "urban basic sanitation rate" mean? Could say urban basic sanitation rate < 10%? Or age (in years?) Graduate of what? Labeling these variable clearly would help the reader with the interpretation.

Response: We agree with the reviewer and tried to revise the figure with additional details in the coefficient plot (Fig. 7). However, adding more detail on variable in graph added difficulty in reading the graph. Instead, we have provided supplementary Tables 4 and 5 with a full description of the variables with summary statistics and also the full results.

The figured are greatly improved, as is the text.

Response: We have further revised the figures to make them consistent and color-blind friendly (See response to comment 1.4.2.