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'To prevent this disease, we have to stay at home, but if we stay at home, we die of hunger' – Livelihoods, vulnerability and coping with Covid-19 in rural Mozambique

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ABSTRACT

Non-pharmaceutical interventions (NPIs) such as social distancing and travel restrictions have been introduced to prevent the spread of the novel coronavirus (hereinafter Covid). In many countries of the Global South, NPIs are affecting rural livelihoods, but in-depth empirical data on these impacts are limited.

We traced the differentiated impacts of Covid NPIs throughout the start of the pandemic May to July 2020. We conducted qualitative weekly phone interviews (n = 441) with 92 panelists from nine contrasting rural communities across Mozambique (3–7 study weeks), exploring how panelists' livelihoods changed and how the NPIs intersected with existing vulnerabilities, and created new exposures.

The NPIs significantly re-shaped many livelihoods and placed greatest burdens on those with precarious incomes, women, children and the elderly, exacerbating existing vulnerabilities. Transport and trading restrictions and rising prices for consumables including food meant some respondents were concerned about dying not of Covid, but of hunger because of the disruptions caused by NPIs. No direct health impacts of the pandemic were reported in these communities during our interview period.

Most market-orientated income diversification strategies largely failed to provide resilience to the NPI shocks. The exception was one specific case linked to a socially-minded value chain for baobab, where a strong duty of care helped avoid the collapse of incomes seen elsewhere. In contrast, agricultural and charcoal value chains either collapsed or saw producer prices and volumes reduced.

The hyper-covariate, unprecedented nature of the shock caused significant restrictions on livelihoods through trading and transport limits and thus a region-wide decline in cash generation opportunities, which was seen as being unlike any prior shock. The scale of human-made interventions and their repercussions thus raises questions about the roles of institutional actors, diversification and socially-minded trading partners in addressing coping and vulnerability both conceptually and in policy-making.

1. Introduction

Non-pharmaceutical interventions (NPIs) such as social distancing and travel restrictions have been introduced worldwide to prevent the spread of the novel coronavirus (SARS-CoV-2, hereinafter Covid for short). Many have raised questions about the equity implications of Covid and associated restrictions in terms of how they affect the Global South (Klassen & Murphy, 2020; Leach et al., 2021). Emerging empirical research on the impacts of Covid especially in rural settings (e.g. Córdoba et al., 2021; Gupta et al., 2021; Janssens et al., 2021; Mahmud & Riley, 2021; Puerta Silva et al., 2020a, b) is confirming prior fears of significant

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repercussions for already precarious livelihoods (Ravallion, 2020), particularly among vulnerable groups (FAO et al., 2020), and new forms of poverty have emerged especially in Sub-Saharan Africa (Sumner et al., 2020).

We contribute to this discussion with in-depth empirical data from Mozambique that demonstrate across diverse social groups, occupations, genders and age groups how the repercussions of NPIs are manifest within rural livelihoods, i.e. the means of gaining a living (Chambers and Conway, 1991: 5) in rural contexts. This is important not only to illuminate lived experiences with NPIs in rural areas, but also because identifying vulnerability to current shocks and stressors produces a starting point for understanding future vulnerabilities to environmental and social change in light of the socio-economic and biophysical circumstances (Adger, 1999; Brooks & Adger, 2003; Eriksen & Silva, 2009; Ribot, 2014). To this end, we ask two interconnected research questions:

1) How is coping with Covid affecting livelihoods in rural Mozambique?
2) How do these livelihood repercussions intersect with existing vulnerabilities, e.g. in terms of differences between ages, genders, occupations, value chains and communities?

We argue that, despite no reported direct health impacts from Covid infection in our study communities during the interview period, NPIs significantly re-shaped many lives and livelihoods. By investigating the differentiated repercussions for the lives and livelihoods of 92 panelists across five different social groups in nine study communities through weekly qualitative phone interviews from May to July 2020 (n = 441), we show that Covid restrictions have exacerbated interconnected, existing vulnerabilities resulting from age, gender and precarious incomes, or created new ones.

To what extent does Covid challenge what we know about shocks, vulnerability and coping strategies? We will show that institutional NPIs crucially shape vulnerabilities and coping by interacting with existing exposures and risks across the individual, household and community levels. As Dutta and Fischer (2021) put it, institutional responses are as important to understanding Covid as biological, demographic and economic insights. Fundamentally, we see Covid not as an idiosyncratic, individual-level hazard, yet as a covariate, i.e. community-level (Dercon, 2000; Günther & Harttgen, 2006) shock. Arguably, it is a hyper-covariate shock, given its impacts on the community level as well as on all community links to regional, national or global levels. The all-encompassing magnitude of this pandemic (Leach et al., 2021) raises some questions about the suitability of common coping and adaptation strategies including livelihood diversification, as only socially-minded, adaptive value-chain partners protected producers from NPI repercussions in our research. However, as our main emphasis is empirical, we invite future research to explore the conceptual implications of our empirically-based conclusions.

After defining key terms including vulnerability and coping in the next section, we introduce our research design and particularly the methodological metamorphoses required under Covid. Based on our research questions, we discuss in-depth the differentiated impacts of NPIs experienced by our panel, emphasizing variations between occupations, ages, social groups and genders, value chains and communities. The final section discusses the implications of our findings for debates about vulnerability, coping, diversification and value chains.

2. Defining vulnerability and coping in times of Covid

The highly infectious Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2 or Covid) from late 2019 to June 2021 claimed nearly 4 million lives globally (World Health Organization, 2021), prompting governments around the world to adopt NPIs including distancing, masks, and hygiene to prevent transmission. A global recession has ensued, increasing the number of people in poverty globally and particularly in Sub-Saharan Africa (Valensisi, 2020). There is a need to understand how the pandemic's significant socio-economic repercussions manifest across diverse social groups, ages and genders in light of common conceptualizations of vulnerability and coping.

Turner et al.'s (2003) seminal framework defines vulnerability as 'the degree to which a system, subsystem, or system component is likely to experience harm due to exposure to a hazard, either a perturbation or stress/stressor' (Turner et al., 2003: 8074). The strength of their framework is its capacity to account for the interdependent, nested relations between human and environmental influences at a world, regional or place-based level, the way such hazards interact, and the differentiated vulnerabilities of individuals and groups within a certain place. In this framework, vulnerability is viewed as a function of exposures to stresses and stressors in terms of frequency, magnitude and duration, the sensitivity to them depending on interrelated human and environmental conditions (e.g. different types of capital and endowments), with resilience then determined by coping and responses to produce adjustments (Turner et al., 2003: 8076–8077). In addition, we take from O'Brien et al.'s (2007) contextual vulnerability framework an awareness of how responses are nested within political and institutional structures and changes, given their role in shaping crisis contexts. In our analysis, we take account of the multi-scalar, interrelated, social, political, economic and environmental changes requiring coping and adaptive responses by individuals, communities and sectors (Bennett et al., 2016). This is because analyses of Covid-related impacts have emphasized the importance of institutional factors such as state support (Dutta & Fischer, 2021), tax exemptions, credit and food relief (Kansiime et al., 2021) or existing structures of government neglect in shaping vulnerabilities especially in rural contexts (Puerta Silva et al., 2020b).

In Sub-Saharan Africa (Quinn et al., 2011) and specifically Mozambique (Hanlon & Smart, 2008), a multitude of simultaneous, structural, interconnected risks and hazards produce a need for populations to prioritize stress responses. This is reflected by research into Covid effects in Sub-Saharan Africa highlighting a particular propensity to see incomes reduced and crisis responses be required among precarious populations (Janssens et al., 2021; Kansiime et al., 2021; Mahmud & Riley, 2021; Valensisi, 2020). This complex context requires a multi-layered analysis of how environmental challenges and economic processes interact in terms of creating double exposures (Leichenko & O'Brien, 2008), with a concomitant awareness of the role of human agency and interventions undertaken by governmental and non-governmental actors (O'Brien et al., 2009) in shaping both vulnerability contexts and responses at the individual and household levels. To account for the temporal dimension of coping, we used Quinn et al.'s (2011) distinction between coping strategies, i.e. shorter-term ways of dealing with stresses especially linked to economizing on food, and adaptation mechanisms, i.e. longer-term adjustments involving alternative work or support from governments or projects. Cognizant of existing adaptation strategies to ongoing environmental and economic challenges, such as the production and sale of charcoal in some study districts (Eriksen & Silva, 2009; Smith et al., 2019; Vollmer et al., 2017), we thus analyze what short-term coping strategies were used at the individual, community and sector levels in response to NPIs.

In our analysis, we also recognize that one prominent strategy promoted by governmental and non-governmental actors to reduce rural vulnerability has been diversification, i.e. pursuing

multiple livelihood strategies concurrently, given an assumption that diverse livelihoods are less vulnerable than undiversified ones (Ellis, 2000). This assumption has been problematized due to mixed evidence on additional incomes generated (Torell et al., 2017) or distribution of incomes (Gautam & Andersen, 2016), being most effective for better-off households and reliant on a dynamic economy (Ellis, 2006) . Nevertheless, international organizations (OECD, 2007; World Bank, 2013) and scholars continue to support diversification as a progressive livelihood strategy (Martin & Lorenzen, 2016) and/or as a viable safety net, especially for poorer Sub-Saharan African smallholders (Alobo Loison, 2015).

A key factor shaping vulnerabilities and coping strategies related to Covid is communities' and individuals' integration into markets (Eriksen & Silva, 2009, for one of our study districts) and value chains, i.e. the succession of transactions governing the creation of products and services (cf. Barrientos, 2019; Horner & Nadvi, 2018; Neilson & Pritchard, 2009; Oldekop et al., 2020). Differing levels of integration into networks, market knowledge or capital (Eriksen & Silva, 2009; Jones, Ryan & Fisher, 2016) crucially shape the degrees to which communities can access markets in times of crisis. Equally, the make-up of value chains plays an important role. Convention theory emphasizes that there are considerable differences between dominant value-chain stakeholders prioritizing market-based interests around price, or more civic-based regimes emphasizing ethical conduct (Renard, 2003; Krauss & Barrientos, 2021). While in the former case, the key criterion is price, affecting negotiations between stakeholders throughout the value chain, civic-based mindsets will prioritize ethical conduct and socio-environmental production circumstances, producing very different outcomes for value-chain interactions and local livelihoods especially in times of crisis. Finally, Quinn et al.'s (2011) and Pritchard et al.'s (2020) emphasis on environmental resources as pockets of agroecological resilience is vital, particularly when simultaneous exposures render some coping alternatives unavailable (Pritchard et al., 2020).

Fig. 1. Map of six study districts across Mozambique. Source: Casey Ryan.

3. Methods

3.1. Study area and the Covid context

The authors conducted a total of 441 qualitative phone interviews over up to seven study weeks in the period between May and July 2020 (cf. Table 1). The research project covered nine communities in six districts across Mozambique (cf. Fig. 1), with the study communities represented by abbreviations rather than full names to safeguard confidentiality.

The study communities, located in differing regions, ecosystems and climatic zones (cf. Fig. 1), vary also in terms of ease of water access, and livelihoods, ranging from cultivation and livestock to charcoal production or trading (cf. Table 1). A key difference was the study communities' exposure to cyclone Idai in March 2019 (Phiri, Simwanda & Nyirenda, 2020), as significant loss of lives and livelihoods had been sustained in the two study communities in Sussundenga (SMC/SMU), leaving them in a fragile situation even prior to Covid. By contrast, the Mabalane, Mapai and Mabote communities lost crops and livestock in the 2015/16 drought, requiring humanitarian intervention.

Table 1
Study districts, communities, panelists, number of study weeks, key livelihood activities and recent major hazards affecting the districts. Source: Authors.

Districts	Communities	# of panelists	Study weeks	Main livelihood activities	Recent major hazards
Guro & Tambara[1], Manica Province	GN	10	7	Agriculture (maize), horticulture, livestock, baobab	
	TL	10	7	Agriculture (millet), horticulture, livestock, baobab	
Mabalane, Gaza Province	HC	10	5	Livestock, charcoal, rain-fed agriculture (maize)	2015/16 drought
	MV	10	6	Livestock, charcoal, flood plain agriculture (maize)	2015/16 drought
Mabote, Inhambane Province[2]	MB	10	3	Livestock, rain-fed agriculture, some irrigation-fed agriculture (vegetables)	2015/16 drought
Mapai, Gaza Province	BR	10	4	Charcoal, livestock	2015/16 drought
	MF	10	5	Charcoal, livestock, rain-fed agriculture (maize)	2015/16 drought
Sussundenga, Manica Province	SMC	11	7	Agriculture (maize, banana), horticulture, bee-keeping	Cyclone Idai 2019
	SMU	11	7	Agriculture (maize), horticulture (vegetables), bee-keeping	Cyclone Idai 2019

[1] Guro and Tambara are separate districts, but combined here given their adjacent location.
[2] Mabote district has only one panel of participants. It was added after the beginning of the project in other communities, resulting in a lower number of overall study weeks.

Table 2
Panelists disaggregated by study districts and categories (vertical), gender and number of panelists/interviews (horizontal). Source: Authors.

Overall panelists[4]	# of panelists	Interviews	F #	F interviews	M #	M interviews
Total	**92**	**441**	**45**	**205**	**47**	**236**
Guro & Tambara	20	138	9	63	11	75
Mabalane	20	79	12	48	8	31
Mabote	10	14	5	8	5	6
Mapai	20	56	12	37	8	19
Sussundenga	22	154	7	49	15	105
Vulnerable	17	83	14	71	3	12
Microbusiness	19	91	9	28	10	63
Market-oriented smallholders	14	69	9	43	5	26
Traditional influence	16	74	2	13	14	61
Modern influence	23	119	10	47	13	72

[4] Three panelists, who were added after the project start, did not fit into any categories; they and their interviews have not been allocated to any of the categories.

The non-pharmaceutical interventions instituted by the Mozambican government in late March and early April 2020 affected all study communities. After the World Health Organization identified Covid as a pandemic, a Presidential Decree declared a state of emergency on 30 March. This was ratified by law the following day, 31 March, with decree 12/2020 by the Council of Ministers on how to operationalize the state of emergency following on 2 April (GoM – Government of Mozambique, 2020a). Decree 12/2020, across all professional and private spaces, required social distancing, frequent handwashing and face masks in public. At the same time, it closed borders, banned activities in public spaces including the consumption of alcohol, suspended religious worship, and limited private and public transport of people and goods, including restricting collective transport to 1/3 of occupancy. Trains were also suspended (Radio Moçambique, 2020; SaudeMaisTV, 2020). With transport thus unavailable or significantly more expensive, movement was more difficult or impossible altogether, exacerbated by a significant fear among panelists of engaging with any strangers entering their space. Schools were closed during most of the state of emergency and only to be reopened if basic conditions of hygiene were met (Deutsche Welle, 2020) . Subsequently, the state of emergency was prolonged several times (GoM – Government of Mozambique, 2020b) and then replaced by an indefinite state of public calamity nationwide from 7 September 2020 onwards (UNICEF Mozambique, 2020). Towards the end of our data collection period (May-July 2020), discussions about lifting restrictions had begun, particularly on reopening churches with limited capacity from mid-August (Vatican News, 2020). Panelists reported following these restrictions for fear of the pandemic given a lack of available medical treatments against Covid.

3.2. Research design: methodological metamorphoses

The research design selected study communities to reflect diverse rural experiences, based on prior work (Baumert et al., 2016; Jones, Ryan & Fisher, 2016; Pritchard et al., 2020; Smith et al., 2019),. Given significant travel and transport restrictions, we needed to work with study communities with which partnerships and rapport had already been built in prior collaborations. Significant existing rapport was vital firstly to safeguard free, prior and informed consent, secondly owing to remote data collection by phone, and finally due to the co-creative, dialogue-based design (Dearden & Kleine, 2020; Horvath & Carpenter, 2020), which relied on participants and stakeholders to feed back on the salience of our research enquiry in a novel pandemic. To select panelists and identify relevant research questions, the research team used prior datasets and also coordinated directly with local governments to cross-check panelists' profiles[1]. We also selected communities to represent a diversity of rural experiences in terms of livelihoods, climatic and geographical locations, demography and socio-economics.

The panelists agreed to take part in weekly phone calls with the research team in local languages, compensated by receiving phones and phone credit. The social groups to be included in our panel were selected to cover a range of livelihoods and experiences, and were identified based on prior work in study communities (e.g. Baumert et al., 2016; Smith et al., 2019; Vollmer et al., 2017) as well as consultation with partners[2]. The categories chosen were:

1) Vulnerable people based on precarity of income, age, gender
2) Microbusiness owners, e.g. bakers, small-scale traders and vendors
3) Market-oriented smallholders, including charcoal, livestock or agricultural producers selling to value chains/markets
4) Traditionally influential individuals, including traditional local leaders, traditional healers
5) Modern influential individuals, including teachers, church pastors, health agents

Given the disproportionate effects expected on vulnerable groups and women through the Covid pandemic (Ahmed, Ahmed, Pissarides, & Stiglitz, 2020; Quisumbing, Kumar, Meinzen-Dick, & Ringler, 2020; United Nations, 2020), care was taken to safeguard inclusion of different ages and genders within the 'vulnerable' category, and of women across all categories (cf. Table 2).[3]

The questionnaire design built on prior work (Pritchard et al., 2020; Smith et al., 2019), while also accommodating the specific circumstance of phone data collection (Block & Erskine, 2012). The study used a detailed questionnaire in Week 1 with predominantly closed questions to establish baseline information about individuals, their livelihoods, households and communities, with

[1] Although the research team were initially concerned about potential political influence on the selection of panelists and resulting bias, analytical rigor and diversity of rural experiences across the five social groups were the key determinants in choosing panelists. Despite interviewers and the research team being sensitized to the possibility of influence, there was no noticeable political or selection bias identified in terms of answers given.

[2] Panelists were only allocated to one category in light of what best fit their situation, i.e. there were no overlaps e.g. between traditionally influential and modern influential individuals.

[3] 3 to 7 study weeks in different locations depending on availability of interviewees in light of pandemic restrictions, cf. Table 1 for details. For instance, in some sites, there were logistical difficulties with making phones available to respondents. Equally, there were sites with poor mobile reception, requiring alternative arrangements.

this strategy also employed to ease participants into unfamiliar phone interviews[5]. Subsequent weeks posed fewer, but more open questions to ascertain changes from the previous week in three key respects: information flows, coping strategies with Covid, and livelihood impacts. In the final two weeks of phone interviews, questions were added in light of incoming data and feedback, focusing on vulnerabilities to Covid and NPI livelihood implications, as well as collective coping strategies.[6]

In terms of data collection and coding, the researchers conducted qualitative phone interviews in local languages and subsequently translated them into Portuguese. The summarized Portuguese versions were analyzed and coded across sites through Nvivo 12 following Mikkelsen's approach (2005): an initial round of open coding, i.e. analyzing initial key themes to inform questionnaire revisions. This was followed by axial coding, i.e. going through the data to assign both higher-order categories in light of the research themes and questionnaire headings, including 'livelihoods', 'information', 'coping strategies' or 'vulnerabilities', and sub-categories. The third 'selective' step meant selecting answers to illustrate key empirical results (Mikkelsen, 2005). Given the novelty of Covid, there was a conscious effort to be driven by participants' answers in identifying, naming and clustering codes and analysis.

3.3. Limitations

Although great care was taken to include a diversity of rural experiences across social groups, ages and genders, a key limitation of our study is the make-up, size and availability[7] of our panel which shapes what we can report. Equally, while our research team worked together very closely to undertake data-driven analysis across all sites, the pandemic rendered impossible personal engagement between the entire research team across preparation, data collection and analysis. This inevitably limits the insights we have gained. Thirdly, as explained above, our empirics consisted of qualitative interviews rather than any quantitative data collection. All findings are based on a mixture of qualitative data, particularly interview quotes[8], and analysis in terms of how frequently different issues were raised by panelists, while contextualizing these frequencies with qualitative quotes or in relation to the composition of the wider panel. We do not claim these to be representative of the broader population, but present them to indicate prevalence within our panel.

4. Results: Covid-19 effects on livelihoods and vulnerabilities in rural Mozambique

After an initial discussion of key changes due to Covid, results are structured in accordance with our research questions to reflect variations between ages, social groups and genders, divergences between occupations and value chains, and variations between communities.

4.1. Key changes due to NPIs

Four key changes resulted from Covid and were reported across the panel: prevention measures, transport restrictions, access to consumables, and repercussions for money and income. Firstly, Covid communication through village gatherings, posters, TV, radio and project-provided phones and radio programs had successfully produced awareness of the importance of wearing masks, distancing and hand-washing, though information channels hampered by social distancing caused erroneous or lack of knowledge especially among the elderly as discussed below. The heavy reliance on hand-washing produced additional expenses for soap or difficulties purchasing it (MV-06-02; TL-04-02), though many used ash as a more available alternative. Additional expenses were also incurred for face masks.

Transport, mentioned 321 times across our 441 interviews, and the impact of Covid NPIs on it, was a key concern in our rural study communities. The reduced availability of travel complicated access to goods, including clothing, food or consumables in all districts because of local vendors partly being unable to travel to wholesale markets (HC-05-03, HC-08-05, SMC-01-01), or traders no longer visiting rural communities (BR-05-04, HC-03-04, HC-06-05, MB-05-03, MV-02-06, TL-10-01). A range of panelists reported higher prices as a result:

> 'Now traders don't come here anymore. And local vendors are raising prices because there is no competition.' (HC-05-05)

> 'Those who have little stalls here in the community used to travel to the city [to buy wholesale] and then resell here, but now many do not have products to sell any more.' (MF-05-04)

Consequently, some individuals, despite the inherent risks, felt they had to travel to larger settlements to restock or obtain key consumables (BR-05-04, HC-08-05, HC-09-05, MF-06-05).

> 'I would like to just stay at home, but . . . I need to put myself at risk and go to the city.' (MV-06-05)

Finally, the restrictions led to diminished cash and non-cash income in many sectors:[9]

> 'The interruption of trains and restriction of car circulation has led to a lack of money among community members here. We are all disadvantaged, no-one has benefited . . . Here in the community, we have nowhere to buy soap, flour, all food products. I cannot go to [another settlement] because there too, they do not want any strangers. We only survive on forest food products now.' (HC-01-05)

No Covid infections in our communities were reported in the interview period and it appears there were no significant health impacts from Covid infections, though diets were compromised and accessing treatment for chronic illnesses became more difficult due to NPIs.

4.2. Variation between social groups, ages, and genders

Firstly, on variations between social groups, Fig. 2 highlights with what frequency transport and movement were mentioned across our panel, with microbusiness owners and market-

[5] The original questionnaire is available from: https://blogs.ed.ac.uk/miombo-matters/wp-content/uploads/sites/961/2020/07/CwC_Datacollectionsheet_EN_PT.xlsx.

[6] This new set of questions was asked of 75 out of 92 panelists for at least one week of study (36 female, 39 male panelists; 14 vulnerable, 16 microbusiness, 11 market-oriented smallholders, 13 traditional influence, 19 modern influence, with two panelists in Mabote unallocated to any categories). The questionnaire can be found here: https://blogs.ed.ac.uk/miombo-matters/wp-content/uploads/sites/961/2020/07/200710_CwC_Datacollectionsheet_NewQs_EN_PT_V6.xlsx.

[7] Please cf. Table 2 for details on how many interviews could be conducted in different communities, by gender and social groups.

[8] Interview quotes (xx-xx-xx) are indicated with interview codes, which reflect the study community, the interviewee's number, and the study week. Where more than one interview code is stated, they are ordered alphabetically.

[9] We acknowledge that there may be businesses who benefited from the crisis and may not have wished to acknowledge that in interviews. However, based on both interviews and on-the-ground observations from researchers and civil-society partners, our panelists' unanimous description of either neutral or adverse livelihood impacts in response to open-ended interview questions was accurate for our sample. We detail in 'Results' the degree to which other value-chain stakeholders benefited in light of power asymmetries.

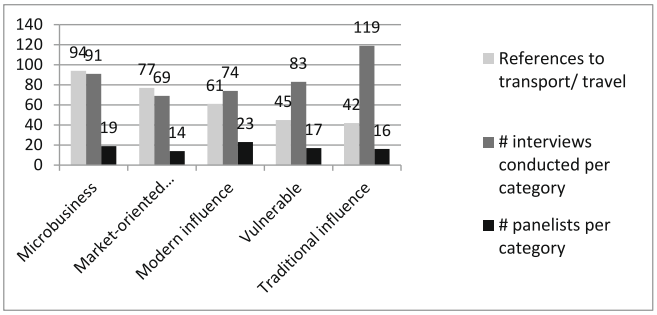

Fig. 2. Number of references to transport or travel in interviews (light gray) across the five different social groups (left to right: microbusiness, market-oriented smallholders, modern influence, vulnerable, traditional influence); juxtaposed with total number of interviews (gray) and panelists per group (dark gray). Colors arbitrary. Source: Authors.

oriented smallholders dependent on selling e.g. charcoal or agricultural produce most vocal on the effects of NPIs on transport:

In terms of lived experiences differentiated by age, there were significant concerns across the panel about the education that children were missing on account of NPIs resulting in school closures, and the degree to which this would affect their vulnerability long-term. Consequently, the majority of parents[10] wanted their children to return to school when they reopened, for example 'so that they do not become illiterate like me' (MV-01-05), or for girls to complete 12th grade before they got married (SMC-10-07, GN-07-07). However, numerous parents were concerned about letting children go back to school.

> 'When they reopen schools, my children will only go back if prevention is in place. Distancing, water, disinfectant, mask obligation need to be implemented.' (HC-03-04)

One reason is that both ends of the age spectrum were seen by many panelists as being particularly at risk of contracting Covid. Children were considered in danger as lacking in prevention, awareness of prevention strategies, and willingness to listen (MV-01-06, SMC-01-07):

> 'Some of the children and young people … don't understand that they have to be careful and use masks.' (MF-07-05)

> 'It is very hard to stop [children] from playing outside.' (SMU-05-06)

In some cases, against the backdrop of children being home from school and economic hardship experienced, parents were considering early marriages for their daughters in two of our study communities, in Sussundenga SMC and Guro-Tambara GN. In one case, a children's rights non-governmental organization was called in to reverse an early marriage of an underage female adolescent. A second gender aspect of children being home from school was that, with children and adolescents now at home and in the charge of their mothers (GN-10-06, HC-03-05; HC-05-05, MB-05-03, MF-09-05, SMC-04-06), women's workload significantly increased due to added unpaid reproductive labor.

At the other end of the age spectrum, the perception of the elderly being particularly at risk stemmed from the stay-at-home orders exacerbating their level of isolation, and limited information flow about Covid:

> 'People who are most affected are people who are not aware, the elderly, the people who are not up-to-date on what is going on in the world.' (HC-03-04)

> '[Most vulnerable to Covid are] elderly people who live alone … some have relatives, but others only depend on neighbors.' (MF-05-04)

This perceived vulnerability for the elderly due to lack of knowledge was confirmed in our interviews by poor or erroneous knowledge on how to identify or prevent Covid. Although only 26 out of 90 panelists[11] were over 55 years of age, half the interview statements demonstrating no or erroneous knowledge occurred in the 55+ age range (43 out of 83 instances in interviews). While poor or erroneous knowledge on Covid was therefore not highly prevalent, knowledge gaps nevertheless appeared to expose the elderly differentially to risks in a novel pandemic.

On gender, there was a clear difference in using environmental resources as a coping strategy. While NPIs changed almost all aspects of our panelists' lives and livelihoods, interviewees across all genders and social groups stated that their access to natural products was unchanged, ranging from timber for construction, fuelwood, forest food products, to baobab for collection and sale. Crucially, panelists in more vulnerable situations, be it due to pre-existing precarity, difficult water access or NPI-eliminated livelihoods, reported relying more heavily than before on natural products. This included using forest food products as a means of survival due to food insecurity, as well as recourse to collecting and selling baobab, a livelihood only available to women in our study communities. This increased environmental dependence was particularly reported by women across all social groups (cf. Fig. 3):

A related, final key difference between genders was the degree to which Covid made panelists vulnerable to food insecurity and hunger.

> '… the government should give us food; if they give me food, I will never leave the house. The prevention measures are good, but since we are hungry, we need to leave the house to get money to buy food.' (MF-02-04)

> 'To prevent this disease we have to stay at home, but if we stay at home, we die of hunger.' (MF-04-05)

Across 441 interviews, Covid-related hunger was mentioned 115 times. However, across all social groups, women referenced food insecurity and hunger due to NPIs more frequently than men (83 compared with 32 mentions; total panel: 45 female and 47 male panelists), with vulnerable and smallholder panelists equally citing food insecurity more often than traditional or modern influential individuals. Covid-related hunger and food insecurity also varied by community, as we explore further below.

4.3. Variation between occupations and value chains

Through our qualitative interviews, considerable differences were reported in terms of how NPIs affected different occupations and value chains. Firstly, transport restrictions eliminated some livelihoods entirely. These included purchasing wholesale to sell locally (MF-07-05, GN-08-01): 'Many people from the community used to go to [a bigger settlement] to buy products wholesale, but now that the train is not running, they have lost their businesses, especially women' (MF-05-05). This equally applied to those relying on tourism revenue close to a protected area in Sussundenga (SMC-06-01; SMC-07-01), and to casual labor associated with e.g. transporting bananas (SMC-02-04; SMC-06-06).

[10] BR-05-04; BR-07-03; GN-10-06; HC-08-05; MB-06-03; MF-05-04; MF-07-05; MF-09-05; MV-01-06; MV-02-06; MV-04-05; MV-06-05; MV-07-06; SMC-01-07; SMC-04-06; SMC-07-06; SMC-10-06; SMU-05-06; TL-05-06; TL-07-06.

[11] For two panelists, ages were not known; they were excluded from this analysis.

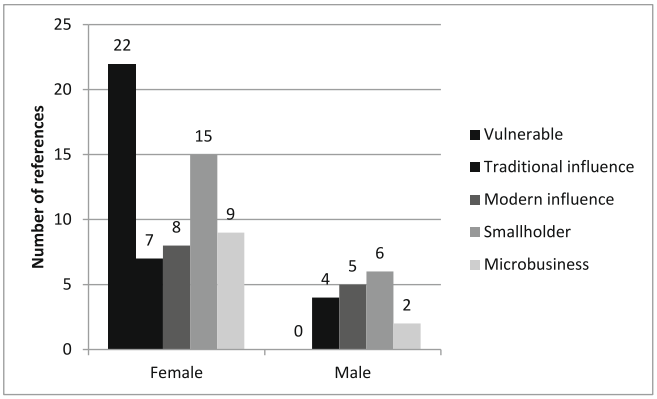

Fig. 3. Instances of reported higher environmental dependence in times of Covid by gender and social group (female left; male right; groups from left to right: vulnerable, traditional influence, modern influence, market-oriented smallholder, microbusiness). Colors arbitrary. Source: Authors.

In addition, transport restrictions limited business for various other occupations. NPIs restricting transport operators to 1/3 capacity entailed considerably higher fares (BR-05-04, HC-09-05) given identical operating costs, yet fewer passengers. Consequently, the frequency of service use was diminished for transport business operator TL-07, despite an elevated risk of contracting Covid by virtue of being in the car with strangers (TL-07-01, TL-07-06). The reduced use of transport was also due to a fear of travel (e.g. GN-06-07, HC-08-04, HC-09-05, MB-03-03, MF-01-05, MV-01-05, SMC-04-06):

> 'The main risk of contamination with this disease is during travel to the city, because people sit so close together, and there are also a lot of people in the city.' (HC-04-04)

More generally, the mobility required for livelihoods including transport, trading or community leadership was seen as putting individuals at elevated risk of catching Covid (e.g. BR-01-03, GN-02-06, HC-07-05, MF-07-05). A reliance on travel for business also was seen as exposing households and communities to the effects of NPIs and changing buyer and seller behaviors (e.g. GN-02-06, GN-07-06, SMC-01-06, SMC-06-06, SMU-01-06, SMU-04-01, TL-06-06):

> 'Traders cannot travel any more for their business. I have to stay at home and just sell small things.' (SMC-10-06)
> 'I used to sell bread outside of my community, but now I . . . only sell from home.' (TL-06-01)

Beyond transport restrictions, a key restriction imposed on business owners concerned banning the sale of alcohol, including traditional home-made drinks (HC-05-01). This restriction reflects that a subset of panelists explicitly identified people who had consumed alcohol as more vulnerable to contracting Covid, given a lack of inhibition (n = 5). This measure also had consequences for the livelihoods of traders:

> 'People are not circulating much anymore; they do not buy *nipa* [traditionally brewed drink] any more; there is no more business going on.' (SMC-01-01)
> 'I don't sell like I used to any more. We used to be able to sell alcohol, because that is where the money is. Now people don't have money. [It used to be that] when I buy product today, I can get the money to replenish the stock in three days, but that does not happen anymore.' (BR-10-01)

The banning of alcohol also threatened the livelihoods of those previously brewing traditional beverages, meaning it disproportionately affected women.

> '[Most affected by Covid restrictions, are] the women who produce traditional drinks in their houses. They don't have another source of livelihood.' (GN-05-06)

More generally, NPIs required shop or stall owners to provide water and soap or ashes at shop entrances (HC-03-01), and ensure that customers observed social distancing (SMC-03-01). Both customers and stall owners identified negative consequences of NPIs in terms of opening times, access to goods and additional stocks (HC-01-01; HC-05-04; HC-08-02), and elevated prices for key staples including flour or sugar (GN-01-01; TL-04-01):

> 'Things have changed - everything is more expensive. Food stalls close at 17:00. To buy from there we have to wear masks, wash hands before entering and enter one at a time.' (BR-08-01)
> '[My access to food and goods] has been affected a lot; sometimes when I go to the stalls, the stalls can be closed . . . And some people are raising prices a lot.' (SMU-03-01)

For those producing for or selling into domestic and international value chains, degrees of market integration and prevalence of price-focused or civic-based priorities played a considerable role in shaping livelihood impacts as a result of NPIs. In some value chains such as honey and baobab, socially-oriented investors prioritizing ethical conduct and socio-environmental benefits safeguarded value-chain access and stable prices, despite transport restrictions and distancing orders. The baobab buyer, ECOMICAIA, which is run by authors Kingman and Nuvunga, made efforts to change its procurement and collection practices to adapt to NPIs, observing social distancing and putting up Covid prevention and information posters in baobab purchasing centers (GN-01-01; GN-07-01, TL-05-02). While baobab has in the past also served as emergency food in crises (GN-04-06), its collection and sale, benefiting exclusively women, was seen as remaining constant despite Covid, and a key lifeline in the Guro/Tambara communities (GN and TL; GN-06-06; GN-09-06; TL-03-01):

> 'There is social distancing where we sell baobab. Selling baobab has not been affected by Covid.' (TL-05-02)
> 'I am just glad I can make money by selling baobab.' (TL-04-05)

In other value chains, NPIs drove down producer prices and diminished opportunities to sell, including peanut, vegetable, banana and charcoal production. With a concomitant increase in retail prices for consumables including food (cf. sections 4.1, 4.2 and below), NPIs effectively reduced purchasing power for parts of our panel.

The case of Tambara's peanut farmers illustrates the dynamics of insecure market integration. Early in the study, there was a perception that peanut demand was low, prompting many farmers to sell early at lower prices (TL-03-02). When out-of-town buyers came back later offering higher prices, many had already sold off their produce (TL-04-07).

In the peanut and banana value chains, agricultural producers accustomed to selling their produce to non-local buyers, including in or from Zimbabwe or Malawi (TL-07-06, GN-03-06), saw prices significantly reduced due to closed borders and a lack of transport (TL-01-01, TL-04-01, TL-09-01, SMC-02-01, SMC-05-01, GN-10-01). Moreover, this led to a lack of casual labor opportunities (SMC-06-06).

> 'I used to sell bananas at good prices, but not anymore because we are not allowed to leave the community to sell.' (SMC-02-01)

'I used to sell peanuts to buyers from [far-away locations], and they bought at good prices. Now I can only sell locally, and at bad prices.' (TL-04-01)

A value chain affected in diverse ways by transport restrictions and reduced purchasing power was charcoal. Charcoal is an important revenue in the Mabalane and Mapai study communities (BR, HC, MF, MV) due to high-quality resources and demand from the urban areas of Maputo and Xai-Xai; it is a longer-term adaptation strategy which preceded Covid (Baumert et al., 2016; Eriksen & Silva, 2009; Smith et al., 2019). This value chain was affected by NPIs firstly because of its heavy reliance on collaboration.

'Charcoal production requires working together to be effective, but now we cannot help each other, and working alone is harder, especially for us women.' (BR-07-03)

Secondly, Covid's travel and transport restrictions played a key role, as accessing urban charcoal markets through trains was no longer possible. Consequently, sellers were reliant on itinerant trucks buying from them.

'The livelihood which we have here to survive is producing ... charcoal. Now that the trains are no longer running, those that depend on those livelihoods are bankrupt.' (HC-10-04)
'We now depend on vehicles which buy charcoal so we get any money at all.' (MF-07-05)

Moreover, charcoal sellers very explicitly linked transport restrictions to lower prices that passing vehicles were willing to pay for charcoal:

'Now that we have the disease, we are not selling well ... Without the disease, we sell [a charcoal sack] at 500 Mts[12], but now we sell it at 450 Mts by the roadside ... Wholesale they used to buy at 350 Mts, but now it's 300 Mts ... Revenues are lower ... now we can only buy flour ... Now when we sell 10 sacks [of charcoal] - flour is 1500 Mts, oil is 280 Mts, so we have nothing left over. It feels like we are getting ripped off because of coronavirus.' (BR-05-02)
'Before this disease came, I used to sell alcoholic drinks; I bought things in [bigger settlement] and sold them here. Since this disease came, trains are not running any more, and we can only sell charcoal. ... A sack of charcoal can stay by the side of the road for a month without being sold. Now ... when cars do come, ... they do not want to pay the price we tell them.' (MF-03-03)

This panelist, MF-03, thus adopted charcoal production, with which her neighbors had engaged as a longer-term adaptation strategy, as a short-term coping strategy in response to Covid restrictions limiting other income sources. However, the lack of integration into markets and the absence of socially-oriented partners in the charcoal value chain left charcoal sellers at the mercy of itinerant, non-integrated buyers, further diminishing in-community value generation through charcoal.

4.4. Variation between communities

A final, related dimension is variation between study communities, which was particularly pronounced firstly around the use of water in the pandemic, and secondly the prevalence of Covid-related food insecurity. Firstly, a range of NPIs affected water collection and use, as panelist BR-07-03 explains.

'In my house it is my daughter-in-law who collects water; she is the only one who does so. Now it takes her longer to fetch water, because now, when she gets to the collection point, she has to wait her turn. Now to fetch water, it takes her more time, and she has to wash clothes at home. ... We used to use water just for drinking, cooking and washing, but now we have to have a water bucket at the entrance to the house and we always have to wash our hands. Now she collects five or ten water containers, and it takes her a long time. She has to go fetch water twice now, in the morning and at the end of the day. Before this disease, she only had to go once a day, and five containers were enough.'

This testimony highlights firstly, the time commitment related to water collection, and secondly, social distancing, which we will explore in turn. Fundamentally, our study communities state that fetching water is the domain of women and children, mostly girls (SMC-01-06, SMU-02-06, TL-09-06, GN-07-06, BR-07-03). In one community, men expressed that by tradition, men do not fetch water (SMC-02-06, SMC-03-06) – 'it would be a disgrace if a man went to fetch water' (SMC-03-06). In other households, both male and female children help women with water collection (TL-09-06), though elsewhere, boys refuse to fetch water (GN-02-06, GN-07-06).

While there may be an assumption that, because water collection is women's labor and the Covid response relies heavily on water, women's workload and related time commitment increased significantly, there is a more differentiated picture in our panelists' responses. Among those believing there was no change (n = 16)[13], one woman said: 'Washing hands does not take a lot of water' (MV-01-06). Others said that the time commitment had increased (n = 15)[14] – either because of higher volume needed, because of extra time spent at the pump to guarantee social distancing, because of limits imposed on how much water could be collected at any one time, or because of more time needed to do washing away from the collective water collection point. There is thus a mix of perceptions across diverse social groups, genders and locations. However, it appears that in communities with more difficult water access (BR, GN, HC, MB, MF, MV), there is a stronger sense among panelists (n = 19 compared with n = 12 in other communities) of more time being spent on water-related activities, pointing to wider, complex water scarcity dynamics.

A definite change regarding water collection was noted due to social distancing requirements. Social distancing requirements make it more difficult for women to carry the water home as it makes mutual assistance with other women impossible (MV-04-04). In some cases, social distancing equally increased the amount of time spent collecting water due to waiting times (GN-03-06), with some women setting off around 3 a.m. for a five-hour round trip to fetch water (GN-04-06). Though this level of distancing is not observed everywhere (TL-02-06), it appears that where they are in force, social distancing requirements are respected (HC-03-04, BR-07-03):

'Before, women used to go in groups to get water, but now everyone goes in their hour, and ... they practice social distancing.' (HC-05-04).

This social-distancing requirement chimes with some male panelists viewing women as particularly at risk of catching Covid because of water collection (e.g. GN-10-06, GN-01-07). For additional protection, some women also have agreed to fetch water in masks (GN-03-04). Another common prevention strategy has

[12] At the time of data collection 1 USD was ca. 80Mts.

[13] No change: MB-05-03, MB-06-03, BR-05-04, GN-01-06, GN-05-06, GN-09-06, MV-01-06, MV-07-06, SMC-02-06, SMC-04-06, SMC-05-06, SMC-06-06, SMC-08-06, SMC-09-06, SMU-07-06, TL-08-06.

[14] More time: BR-06-04, BR-07-04, GN-02-06, GN-03-06, GN-04-06, HC-04-06, HC-08-06, HC-09-06, MB-03-03, MB-08-03, MF-02-04, SMC-10-06, SMU-05-06, TL-09-06, TL-10-06.

been to separate locations of clothes washing from locations of fetching water (BR-01-03) or requiring women to do washing at home instead (MB-07-03), which was seen as further adding to women's workload.

Finally, the previously discussed observations around what value chains and occupations were particularly affected by transport restrictions and reduced income opportunities equally translate to a marked difference in terms of what communities most frequently report hunger and food insecurity as a result of Covid NPIs. Especially the border closures made coping strategies previously employed in times of drought, such as buying food or seeking employment abroad, unavailable (SMU-07-06, SMU-09-06, TL-06-06). Given the above-explained dynamics in the charcoal value chain, which saw returns for small-scale producers grow lower and less predictable under Covid NPIs, communities in Mabalane and Mapai study districts mention food insecurity far more frequently (cf. Fig. 4):

5. Discussion: relevance to Global South research and policy

5.1. Vulnerabilities, old and new: intersecting precarities

A key emerging theme relevant for research and policy concerns the ways that Covid NPIs exacerbated existing vulnerabilities. With respect to gender, age, poverty and other disadvantages, our study thus confirms similar findings from other sites in the rural Global South (e.g. Kansiime et al., 2021; Mahmud & Riley, 2021; Puerta Silva et al., 2020a, b). Covid NPI-specific influences interacted with existing exposures to climate change and variability, including the prior shocks of cyclone Idai, the 2015/16 drought and limited rainfall restricting cultivation, to enhance sensitivity to NPIs. This confirms other studies which found that, more than exposure to the shock, pre-existing socio-economic and environmental conditions shaped vulnerabilities (Batterbury & Forsyth, 1999; Gupta et al., 2021; Sapkota et al., 2016). As Covid-related hunger numbers, in our panel, were much higher among those already disadvantaged, our study thus confirmed estimates that Covid NPIs would entail significant impacts for vulnerable populations (FAO et al., 2020), with food insecurity reflecting and reinforcing socio-economic inequities (Klassen & Murphy, 2020; Kansiime et al., 2021). Consequently, these pre-existing vulnerabilities and inequalities merit particular attention in all Covid-related analysis and policy recovery efforts.

By exacerbating existing vulnerabilities and creating new exposures, the hyper-covariate nature of Covid and NPIs entailed considerable, yet varied consequences across social groups, occupations, value chains, ages and genders, the nuance of which is documented in our qualitative empirical data. At the community, household and individual levels, vulnerabilities and livelihoods were reshaped by Covid-reconfigured human and environmental conditions, including the impact that travel, transport and trading restrictions exerted. Panelists commented on past coping strategies to crises such as cholera or drought not being viable under Covid NPIs due to border closures and travel restrictions prohibiting e.g. seeking employment or food elsewhere and abroad. In our charcoal communities, Covid NPIs combined with a lack of rain limiting cultivation opportunities to produce food insecurity and reliance on forest food products especially among the vulnerable. In addition, Covid created new economic vulnerabilities: firstly, even larger-scale agricultural producers were affected as a result of transport restrictions. Livelihoods were eliminated or diminished especially in the realms of vending, wholesale trading or the traditionally female livelihood of making traditional beverages, with the overall reduction in cash-income opportunities affecting especially those ordinarily engaging in casual labor. Unlike in some other Covid-affected contexts (e.g. Dutta & Fischer, 2021 for India; Gupta et al., 2021 globally; Kansiime et al., 2021, for Kenya and Uganda), there was no state support: the institutional level thus

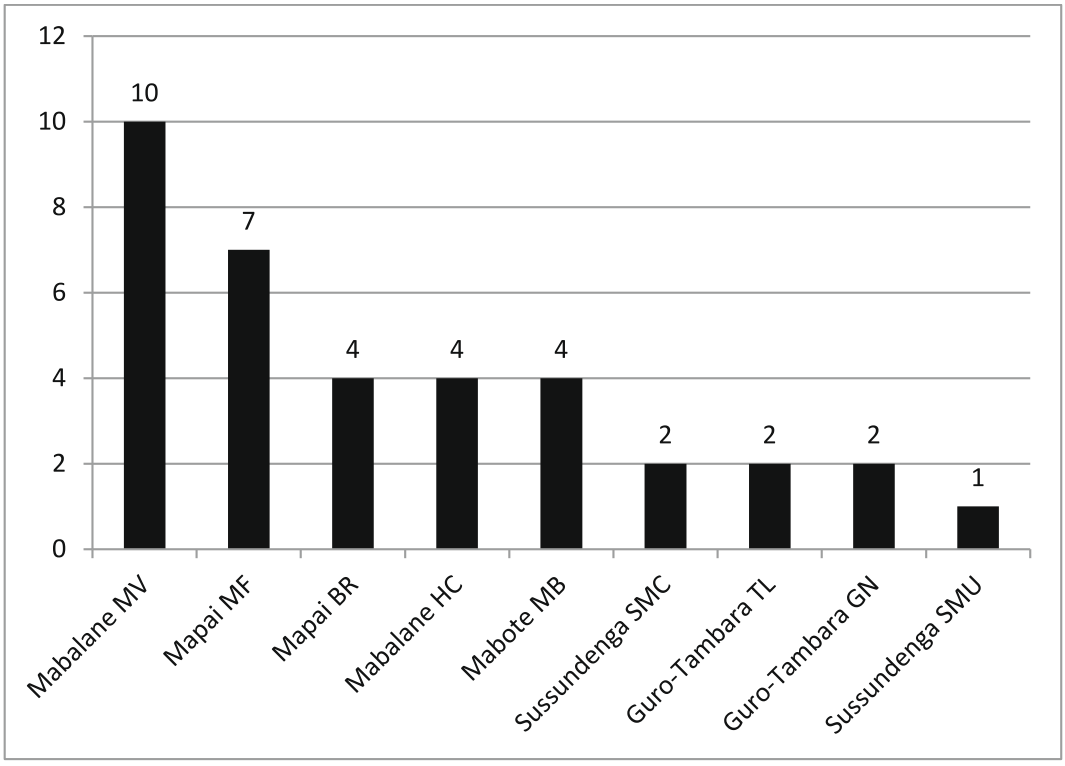

Fig. 4. Number of panelists mentioning hunger and food insecurity because of Covid NPIs, disaggregated by study community (left to right: MV, MF, BR, HC, MB, SMC, TL, GN, SMU; 10 panelists per community except in SMC and SMU, which had 11 each). Color arbitrary. Source: Authors.

only worked to restrict options, rather than providing livelihood support in a time of crisis. As environmental influences on vulnerabilities and livelihoods in rural Mozambique and beyond are likely to expand due to accelerating environmental changes, the unprecedented, hyper-covariate shock of Covid demonstrated a concerning lack of safety nets especially for the more precarious panelists and communities in our sample.

The diverse vulnerabilities resulting from the exposure to NPIs thus recall Bonilla and LeBrón's (2019) idea of aftershocks. They highlight the importance of analyzing not only a shock, but the ripple effects and their myriad repercussions across social, economic and environmental domains, creating new urgencies and complicating recovery efforts. Our findings confirm that Covid is a health crisis with diverse impacts on food, social and economic systems (Swinnen and McDermott, 2020). Far beyond any impacts from the disease itself, which remained an unknown in our interview period and communities in terms of transmission or incidence, the ripple effects of institutional restrictions, limits and bans accentuated vulnerabilities and created new exposures.

In gender terms, the above findings showed that women in Mozambique were affected by Covid NPIs in terms of food security, productive and reproductive labor. Women in our sample mentioned food insecurity as a concern more frequently than men, especially in the vulnerable and smallholder social groups. A specifically female livelihood, producing and selling traditional and alcoholic drinks, was affected by the government trading ban. Female reproductive labor equally expanded, confirming similar findings from South Asia (Nichols et al., 2020; Agarwal, 2021). Specifically female roles including child care and water collection also were impacted considerably by Covid, as mothers' workload was increased due to school closures, and water collection in water-poor contexts grew more complicated and partly more time-intensive due to NPIs. These findings highlight the more vulnerable position of many women towards Covid and its implications (Agarwal, 2021; Nichols et al., 2020; UN Women, 2020). Our study reiterates the importance of considering women of all ages, their higher levels of informal employment, their higher involvement in unpaid care and domestic work, and their higher levels of precarity, in all research and policy efforts to address the socio-economic implications of Covid and Covid NPIs.

In terms of age, both children and the elderly were affected particularly by Covid NPIs in ways that increased their vulnerability. Children saw schools being closed and were thus significantly limited in their education while seeing their chores at home increase, particularly for girls in terms of fetching water in water-poor contexts. In some communities, girls were also at increased risk of early marriage. Both children and the elderly, according to our panelists, were particularly in danger of contracting Covid on account of a lack of knowledge and awareness, with the elderly, particularly those living alone, frequently cut off from reliable information channels on a novel disease, its symptoms and transmission.

The dynamic of Covid NPI-related hunger disproportionately affecting vulnerable groups, including women, is relevant for both policy and research in two main ways. Firstly, NPIs led to reduced incomes and higher food insecurity among more vulnerable populations in Kenya and Uganda (Kansiime et al., 2021), mirroring our findings. Secondly, more vulnerable populations in terms of deprivation in Brazil have been found to be at greater risk of contracting and dying from Covid due to poor housing and livelihoods that make it impossible to implement all preventive measures (Tavares & Betti, 2021). Finally, it reinforces the need to analyze carefully the suitability of policy responses including stay-at-home policies for vulnerable people (Alon et al., 2020; Barnett-Howell & Mobarak, 2020) in the absence of state support or any other mechanisms that would soften the blow. Our findings show the nuance of how various dimensions of deprivation, ranging from gender via age to status and income, were accentuated and new exposures created through the hyper-covariate shock of Covid. By accentuating the contextual, institutional-political dimension of vulnerability (O'Brien et al., 2007), the findings raise the question at what point and in what contexts the trade-off between illness due to the virus, and hunger and poor nutrition due to disruptions to markets and institutions (Ravallion, 2020), needs to be rethought. Conceptually, the ways that Covid NPIs intersected with preexisting vulnerabilities including gender, age, income raise broader questions about the degrees to which these axes need to be recognized more explicitly in crisis response policies and vulnerability frameworks, as further explored below.

5.2. Coping and adaptation: rethinking diversification?

A further key theme concerned coping and adaptation strategies, and which approaches remained viable under Covid NPIs. The above-discussed reliance on natural products and the environment highlights firstly the importance of environmental resources to more vulnerable populations in crisis (Pritchard et al., 2020), especially since access to natural products – unlike almost all other aspects of life – remained unchanged under Covid NPIs according to panelists. The importance of natural products also highlights that some, but not all, diversification strategies proved viable under Covid.

Across our panelists, diversified livelihoods came in different manifestations, as respondents relied on some combination of agriculture, bee-keeping, a stall or vending business, charcoal, tourist revenue, livestock or baobab collection. The degree to which these strategies worked as Covid NPI coping strategies varied considerably. Tourist revenues were eliminated, stalls and vending businesses severely limited. Baobab collection, given a socially inclined trading partner, continued providing income streams even as many other value chains were affected by absent buyers. Food crop cultivation was a lifeline for some, yet was limited in some areas by low rainfall in 2020. In Mabalane and Mapai, charcoal production and sale is a major contributor to diversified livelihoods (Baumert et al., 2016). Here, charcoal also proved to be a Covid coping strategy given other livelihoods such as brewing drinks or having a stall being eliminated through NPIs. This has occurred even though charcoal production, given its reliance on collaboration and its links to respiratory illness (Jagger and Shively, 2014) as well as the cough it can produce, could be seen as unsuitable in Covid times. Equally, the growth in particularly female involvement in charcoal production in our study mirrors Jones, Fisher and Ryan's (2016) finding of significant female participation in charcoal production in central Mozambique. Charcoal as a Covid coping strategy was severely impacted by transport NPIs, leading to a squeeze in purchasing power and comparatively higher levels of food insecurity. Thus a popular diversification strategy pre-Covid became the sole cash income source, despite a lack of market integration and strong networks failing to safeguard value generation in the communities, which had already been low (Baumert et al., 2016).

Overall, our data and analysis thus emphasized a complex picture in terms of which diversification approaches, and more generally, which coping or adaptation strategies, remained viable under Covid restrictions, and what was required for each strategy to continue being effective. Other studies on Covid impacts and diversification have produced diverse perspectives on economic diversification potentially reducing vulnerability in rural contexts (Bassett et al., 2021), vs. Covid exceeding the scale of shocks for which households in Sub-Saharan Africa have previously used diversification as a coping mechanism (Hilson et al., 2021). The empirical data collected in the context of the hyper-covariate shock of Covid thus produce a nuanced picture in terms of diversi-

fication reducing vulnerability (Ellis, 2000): as diversification can depend on a dynamic wider economy (Ellis, 2006), the broad economic ramifications of the hyper-covariate Covid shock both significantly affected economic productivity and dynamism overall, and created new vulnerabilities including for wealthier panelists. Consequently, those that would generally be seen as better-off – e.g. a transport operator or large-scale banana cultivator – were unable to use diversification as a shield from the impacts of Covid, challenging existing findings on diversification often benefiting the better-off (Alobo Loison, 2015; Ellis, 2006). We thus encourage further empirical and conceptual work e.g. at system level to identify what coping, adaptation or diversification strategies, in Covid and beyond, have remained viable in the face of what types of shock.

5.3. Covid-proofing value chains?

Crucially, the empirical data about the highly diverging experiences of value chains under Covid emphasizes questions of equity (Leach et al., 2021) and 'who gets what' between value-chain actors (Barrientos, 2019; Krauss & Krishnan, 2021; Oldekop et al., 2020). For charcoal, Baumert et al. (2016) previously showed that little value remains with local communities, who have limited control over commercialization. Our study confirms these to be crucial issues given charcoal producers reporting lower prices being paid, and commercialization links to the capital ceasing to work reliably under Covid NPIs, creating unpredictability both for volume and frequency of sales. Across charcoal-producing communities, questions were raised about why trucks stopped coming, and why charcoal prices reduced at a time when prices for consumables including flour increased. Given significant multidimensional vulnerability, which charcoal production previously has been found not to alleviate sufficiently (Vollmer et al., 2017), the parallel crises of Covid and poor harvests caused considerable levels of food insecurity and hunger among our panelists, confirming similar findings from Kenya and Uganda (Kansiime et al., 2021) and Colombia (Puerta Silva et al., 2020a, b).

The dynamics seen in our empirical data reiterate the importance of market integration (Eriksen & Silva, 2009) and, crucially, integration into civic-based markets and value chains (Renard, 2003; Krauss & Barrientos, 2021). There was a clear discrepancy: baobab and honey value chains, which involve socially-oriented stakeholders prioritizing civic-based mindsets including ethical conduct and reliable socio-economic benefits for producers, made necessary adjustments to maintain fair operations and producer livelihoods even under NPIs. This mirrors findings from the Andes, where organizations prioritizing fairness in trading and solidarity-based understandings of society were reinvigorated under Covid as a counter-movement to purely market-oriented practices (Córdoba et al., 2021). Conversely, value chains following exclusively the market-based regime, which prioritizes price, either produced adverse outcomes including lower prices or largely broke down, given producers' lack of integration into upstream buyers or retailers. Even communities selling vegetables or peanuts, whose links to out-of-town buyers were stronger than for charcoal, partly reported selling lower quantities and at lower prices, yet the impact of transport NPIs was considerably less than in charcoal-producing communities. For charcoal, the lack of integration into urban charcoal retailers meant that both prices and selling opportunities proved extremely unpredictable for producers, as they were unable to safeguard fair prices and engagement from more powerful value chain actors, who sold at elevated prices in urban centers. Given the elimination of livelihood options such as traditional brewing under Covid, some panelists began engaging with charcoal to survive, yet many panelists reported significantly reduced prices, frequencies of sales, and partly a need to rely on forest food products to survive. Opportunities for cross-learning by communities across value chains would be vital to explore going forward.

In all value chains prioritizing market-based and price-focused mindsets, Covid NPIs accentuated significant power differentials to the detriment of our panelists. Though agriculture-oriented value chains (vegetables, bananas, peanuts) fared somewhat better than charcoal, producers were just as dependent on buyer behavior as in charcoal communities. Across all these value chains without socially-oriented stakeholders with civic-based priorities, there were reports of transport restrictions leading to lower quantities being purchased, lower prices being paid, while producers themselves were at the mercy of higher prices for food and other consumables. As such, these findings confirm Reardon, Bellemare and Zilberman's (2020) analysis that Covid impacts are likely to affect especially the commercialization of farm products, while driving up food prices. On power and power asymmetries in value chains and production networks (Coe, Dicken, & Hess, 2008; Henderson, Dicken, Hess, Coe, & Yeung, 2002; Krauss & Barrientos, 2021), this reiterates the question of how the corporate power of organized buyers, and the institutional power of state interventions, rendered the collective power of producers largely irrelevant. The design of sustainable, inclusive markets as a precursor for well-being improvements to safeguard no-one being left behind (Smith et al., 2019) thus remains as crucial as it is elusive, especially under and after Covid (Córdoba et al., 2021, Puerta Silva et al., 2020a, b). A highly relevant question for national and development policies is to what extent formalization of producer associations to augment bargaining power and enhance value-chain accountability through local involvement, as well as the promotion of solidarity-based economic models (Córdoba et al., 2021), would improve producers' standing, for charcoal and agriculture alike.

5.4. Reframing vulnerability and coping?

The empirical data presented above both confirms and challenges existing literatures. We can confirm, in keeping with (Turner et al. (2003)) observations, that individuals in the same community, as well as communities in the same country, could not be assumed to have broadly similar vulnerabilities, as variations occurred between occupations, genders, social groups, ages, value chains and communities. This was even more the case amid the unprecedented scale of shock that was Covid (Hilson et al., 2021). The considerable reliance on environmental resources among our panel equally highlights their importance as lifelines and safety nets to cope with crisis, supporting Pritchard et al.'s (2020) findings. Finally, the complex interplay between national-level policy g and variegated local repercussions emphasized the importance of assessing diverse factors affecting contextual vulnerability, exposure as well as capacities for resilience (O'Brien, Eriksen, Nygaard, & Schjolden, 2007; Turner et al., 2003). A surprising finding was the considerable role of integration into value chains and markets in shaping livelihood vulnerability and resilience in our sample. While baobab and honey, operating under a civic-based regime prioritizing socio-environmental production conditions and ethical conduct (Renard, 2003; Krauss & Barrientos, 2021) provided a crucial reliable cash income source under Covid, especially charcoal, a solely price-oriented, market-based value chain, proved highly unstable for small-scale producers due to transport-restricting NPIs. Based on our novel data and findings, there is a need to explore further what factors in value-chain governance and composition can boost livelihood resilience in crisis.

However, the empirical data also challenged existing literatures. New vulnerabilities arose for certain diversification or adaptation strategies which had previously been considered wise precautions, including trading or vending and charcoal production,

and affected the better-off, who ordinarily would be expected to benefit from diversification (Ellis, 2006). In terms of challenging conceptual lenses, our empirical data showed how critically human-institutional interventions, i.e. NPIs such as restricting transport, shaped local vulnerabilities as well as coping strategies, emphasizing the importance of analyses cognizant of such institutional circumstances. Finally, Covid NPIs exacerbating vulnerability resulting from income, status, gender, age in diverse, but pronounced, ways, equally raises questions about how systematically these lenses are, or should be, taken into account by analyses investigating particularly how crisis-proof coping and adaptation strategies including diversified livelihoods are.

6. Conclusion

In this article, we addressed the questions of how Covid NPIs affected livelihoods in rural Mozambique, and how these impacts intersect with existing vulnerabilities and crises across different occupations, social groups and genders. Based on in-depth qualitative interviews with 92 panelists from 9 Mozambican communities at the start of the pandemic (n = 441, May–July 2020), we show that NPIs significantly reshaped lives and livelihoods. Unlike in some other contexts (e.g. Dutta & Fischer, 2021; Gupta et al., 2021; Kansiime et al., 2021), there was a paucity of external support from the state or other safety nets for our panelists; state interventions such as restricting transport, trading and distancing, only produced adverse impacts for our panelists. Stall owners had opening times and permissible sales curtailed, eliminating the specifically female livelihood of brewing traditional drinks. Travel restrictions significantly affected diverse occupations such as transport operators, wholesale-to-retail vending, stall operators, and charcoal producers, whose train links to wholesalers and urban customers ceased altogether. For many panelists especially in charcoal communities, this led to elevated levels of food insecurity and hunger (Puerta Silva et al., 2020a, b; Kansiime et al., 2021), prompting panelists to rely more strongly on environmental resources including forest food products (Pritchard et al., 2020).

Akin to previous infectious disease outbreaks creating disproportionate burdens on certain groups, such as Ebola on women (UNDP, 2020), our empirical data shows vulnerabilities being accentuated or created by the hyper-covariate shock of Covid NPIs in ways that may require rethinking aspects of vulnerability and coping. School closures and social distancing at water collection points meant greater workloads for women, children lost out on education and some underage girls were at risk of early marriage, while isolation of the elderly was accentuated. Charcoal production, a rare opportunity for cash income in many parts of rural SSA (Zulu & Richardson, 2013), was not a highly effective coping strategy under Covid NPIs given a breakdown of transport links, reliable pricing and sales opportunities, which prompted considerable food insecurity for some panelists. The better-off, such as transport operators or larger-scale agricultural sellers, who would ordinarily be expected to benefit from diversification (Ellis, 2007), were unable to do so given the hyper-covariate nature of Covid NPIs leading to border closures, distancing and transport restrictions. The only value chains which largely continued to function were those involving socially-oriented investors with civic-based priorities, including maintaining fair livelihoods for baobab collectors and honey producers, contrasting sharply with particularly the charcoal value chain. Abiding power asymmetries in value chains (Krauss & Krishnan, 2021), and the ways they were accentuated under Covid, merits further research. In sum, Covid NPIs in rural Mozambique thus exacerbated existing vulnerabilities in variegated ways, while creating new exposures.

CRediT authorship contribution statement

Judith E. Krauss: Conceptualization, Methodology, Data curation, Formal analysis, Conceptualization, Writing – original draft, Writing – review & editing, Project administration, Funding acquisition. **Luis Artur:** Conceptualization, Methodology, Investigation, Writing – review & editing, Project administration, Supervision, Funding acquisition. **Dan Brockington:** Conceptualization, Methodology, Writing – review & editing, Project administration, Funding acquisition. **Natasha Ribeiro:** Conceptualization, Methodology, Investigation, Conceptualization, Writing – review & editing, Project administration, Supervision, Funding acquisition. **Julio Tembe:** Methodology, Investigation, Data curation, Formal analysis. **Eduardo Castro:** Methodology, Investigation, Data curation, Formal analysis, Writing – review & editing. **Jone Fernando:** Conceptualization, Methodology, Investigation, Data curation, Formal analysis, Project administration, Funding acquisition. **Janet Fisher:** Methodology, Conceptualization, Writing – review & editing, Project administration. **Casey M. Ryan:** Conceptualization, Methodology, Conceptualization, Writing – review & editing, Project administration, Funding acquisition. **Andrew Kingman:** Conceptualization, Methodology, Investigation, Writing – review & editing, Project administration, Supervision, Funding acquisition. **Hosia Mavoto Moises:** Methodology, Investigation, Data curation. **Ana Mlambo:** Methodology, Investigation, Data curation. **Milagre Nuvunga:** Conceptualization, Methodology, Investigation, Data curation, Formal analysis, Conceptualization, Writing – review & editing, Project administration, Supervision, Funding acquisition. **Rose Pritchard:** Conceptualization, Methodology, Conceptualization, Writing – review & editing, Project administration, Funding acquisition. **Clemence Zimudzi:** Project administration, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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