



The effect of COVID-19 control measures on smallholder pig-keeping households in Uganda, analysed through a gender lens



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Summary

Within Uganda, pig-keeping is important to the livelihoods of the rural poor. Uganda has had a long history of controlling epidemics and implemented a strong and fast response to the COVID-19 pandemic. This included the closure of places where people congregate such as schools, home confinement, curfews, and travel restrictions, amongst other measures. This paper reports the perceived effects of these control measures, according to women and men smallholder pig keepers, on their pig enterprises, and households and communities more generally. Of note is that pigs, including breeding sows, were sold for income during the pandemic highlighting their insurance role. Further, the control measures disrupted household pig enterprises, both in relation to access to inputs and marketing. Women found it more difficult to sell pigs in comparison to men and results also suggested the preferred sale of women-owned pigs in some households. Other effects of the control measures on households and communities included lower incomes, disposal of other assets (notably poultry), inability to eat normal meals, inability to access health care, increased violence against women, and increased unplanned pregnancies. It is recommended that building resilience of the pig value chain in Uganda, as well as other animal source food systems, to shocks such as COVID-19 should be a high priority moving forward.

1 Introduction

The pig sector is becoming increasingly important to the economy of Uganda. Pig numbers have increased severalfold over the last few decades, with a current national herd of 4.41 million (1). This increase has been driven by increasing demand for pork, with per capita pork consumption the highest in East Africa at 3.0 kg per capita per annum (2, based on 2018 data). The majority of pigs are kept by smallholders in mixed crop-livestock systems under low-input conditions, though there are also some medium-scale semi-intensive as well as a few large-scale intensive enterprises (3). Pigs play an important role in the livelihoods of smallholders, providing income for planned and emergency needs as well as livelihood diversification (4,5). They are favoured by many due to their relatively quick returns, limited space requirements, and ability to utilize household waste. Pigs also contribute to the livelihood of other value chain actors, including input and service providers, and aggregators (traders), amongst others. Whilst the smallholder pig sector currently faces a number of constraints, it also has a high growth potential should these challenges be overcome (4,5).

Uganda has had a long history of controlling epidemics, most recently including Ebola in 2000, 2017, and 2018, and Marburg in 2018 (6). Coronavirus disease 2019 (COVID-19) was first reported in Uganda in March 2020, and the government responded rapidly with measures to reduce community spread. These measures included (at different time periods): the closure of places where people would normally congregate like schools (closed from March 2020 to January 2022), colleges, universities, public transport, places of worship, bars, markets, hotels, and others; prohibition of gatherings; home confinement; a curfew from 7 pm to 6.30 am; and countrywide and international travel restrictions (6–9). Additionally, there were strong public health campaigns promoting hand hygiene, physical distancing, and the use of face masks, with messages delivered by a range of means including radio, television, and social media (6,9). Whilst these measures have generally been considered positive in terms of containing COVID-19, with 3588 deaths and 163,301 cases reported to June 2022 (10), unintended consequences of these measures have also been reported. From studies within Uganda, these include lowered food security and dietary quality, disrupted education, lower-income, and employment loss, poorer healthcare outcomes including from lack of access to healthcare services, increased mental health problems, increased domestic and gender-based violence, and increased child abuse, amongst others (7,8,11–17).

Given the importance of pig-keeping to the livelihoods of smallholders in Uganda, and the likelihood of this being disrupted due to COVID-19 control measures, this report explores the effects of COVID-19 control measures on smallholder pig keepers. Perceptions of the effect of COVID-19 control measures on the household pig enterprise, as well as the household and community more generally, are explored, in addition to COVID-19 awareness and uptake of preventative measures. In recognition that these perceptions and practices may differ by gender of the respondent, as well as the type of household (whether female- or male-headed) comparisons to these ends are reported.

2 Materials and methods

2.1 Background to the study

This work was performed as part of a larger project which aimed to determine the profitability of smallholder pig enterprises in Uganda that kept different breeds of pigs, amongst others. Within this larger study, household pig enterprises within two sites (see below) were first surveyed for baseline information from April 2018 to October 2018, and then longitudinally monitored between October 2018 and March 2020 (with data collected from eight visits over this time). The survey ended in March 2020 due to the inability to access the field due to COVID-19 restrictions. In late December 2020, it was possible to access the field again and an additional survey (presented here) was undertaken in relation to COVID-19.

2.2 Study site description and household selection

Project sites were the Hoima and Kamuli districts of Uganda, located in western and eastern Uganda, respectively. The sites were primarily chosen because of the importance of pig keeping to livelihoods, and because of the diversity of pig breeds kept (important to the objectives of the larger study).

Two hundred households within the study sites were selected to participate in the larger study. The households were selected through a clustered random sampling approach, where pig-keeping households were first clustered based on the type of household pig enterprise (defined according to the type of housing and pig breeds kept), and 100 households for each site were randomly selected from these clusters. Households in this study (which numbered 178 in total, see below) were those from this group who additionally consented to participate in the COVID-19 effects survey.

2.3 Survey tool

A household survey was utilized, with the majority of questions closed-ended though some were open-ended. For closed-ended questions, respondents were given the option to add an additional response, and the choices were generally not read in advance. The survey consisted of a modification of the longitudinal survey used in the larger study, which monitored the household pig enterprise (both in terms of pig production and sales, as well as income and costs, amongst others). In addition, there were more questions on the perceived impact of COVID-19 on the household pig enterprise, and household and community more generally, plus an assessment of the understanding of selected issues around COVID-19.

2.4 Survey respondents

One hundred and seventy-eight (178) households (90 from Kamuli and 88 from Hoima) participated in this survey. Overall, 36 (20%) of the households were female-headed and the remaining 142 (80%) were male-headed. Respondents were the main pig keeper within the household (defined as the person who performs most of the pig-related tasks and makes most of the pig-related decisions), of which 131 (74%) were female and 47 (26%) were male. Of the female respondents, the majority (70%) were spouses of male household heads, 29% were female household heads, and 1% was the parent of a male household head. All male respondents were household heads. See Table 1 for a summary.

Table 1. Overview of survey respondents, considering respondent gender, gender of the household head, and site.

| Site | Male-headed household | | Female-headed household | Total |
|---|-----------------------|-------------------|-------------------------|-------|
| | Male respondent | Female respondent | Female respondent | |
| Hoima | 36 | 32 | 20 | 88 |
| Kamuli | 11 | 63 | 16 | 90 |
| Total | 47 | 95 | 36 | |
| Total, comparison by gender of household head | 142 | | 36 | 178 |
| Total, comparison by gender of the respondent | 47 | | 131 | 178 |

2.5 Data collection and analysis

The COVID-19 survey data was collected between December 2020 and January 2021, by enumerators who had been working with the farmers as part of the larger study. The survey was administered in the local languages of Runyakitara and Lusoga for the Hoima and Kamuli sites, respectively. Data were entered into a CSPro database (18) and then collated (along with data from the larger survey) in a MySQL database, available from <https://data.ilri.org/portal/>.

Contextual information presented in the first part of the results is drawn from a series of baseline surveys, including that of adult male and female household members, administered from April to August 2018 as well as a pig census administered from October to December 2018 (also available from <https://data.ilri.org/portal/>). Whilst this data was collected for 200 households, the information presented here only relates to the 178 households included in this study.

Survey data were analyzed via simple summary statistics, with the denominator as the number of respondents who answered the question unless otherwise indicated. For open-ended questions, the survey responses were first coded. Distributions of responses between male and female respondents, or between male- and female-headed households, were compared using Pearson's chi-squared test, with the *p*-value computed from a Monte Carlo test (19) using 10,000 replications, and a significance level (α) of 0.05. For cases of significant differences, Pearson's residuals were examined to determine the main contributing factors. Comparisons were made as per Table 2. Due to the high number of comparisons only significant differences are noted in the results: comparisons that did not result in significant differences are not reported. For gendered comparisons, the terms 'women', 'men', and 'children' are used to refer to household members that are adult females, adult males, or children (boys and girls), respectively. The term 'joint' or 'jointly' (such as in 'the decision was made jointly') refers to between household adult females and males.

When monetary values are given in United States dollars (USD), a conversion rate of 1,000 Uganda shilling (UGX) to 0.28 USD was used.

Table 2. Comparisons between female and male respondents, or female and male-headed households, reported in this study.

| Analysis | Comparisons between female and male respondents | Comparisons between female and male-headed households |
|--|---|---|
| Impact of COVID-19 on the household pig enterprise | Yes | Yes |
| The impact of COVID-19 on the household | Yes | Yes |
| The impact of COVID-19 on the community | Yes | No |
| Understanding of, and perceptions around, COVID-19 | Yes | No |

2.6 Approvals

Approval for this study was obtained from the Uganda National Council for Science and Technology (UNCST, approval number SS4550) as well as the International Livestock Research Institute's (ILRI's) Institutional Research Ethics Committee which is registered by the National Commission for Science, Technology, and Innovation in Kenya (approval number ILRIIREC2018-01).

3 Results

3.1 Contextual information

Livelihoods and income of the study households. All households kept pigs (a criteria for inclusion in the study). Other main livelihood activities were named as food crop production (82% of households), own business not related to livestock or agriculture (24%), off-farm salaried employment (16%), cash-crop production (15%), and dairy cattle keeping (10%). Key household livelihood activities did not significantly differ according to the gender of the respondent or gender of the household head. The majority of households (75%) indicated they had an income of between UGX 100,000 and 600,000 (USD 28 to 166) per month, whilst 12% and 13% of households indicated a lower or higher monthly income than this, respectively.

Household demographics, land ownership, and housing. Most respondents (96%) gave their religion as Christian. Ethnicity was named as Basoga and Banyoro for the majority of respondents from the Kamuli and Hoima sites, respectively. The number of persons per household ranged from 1 to 17, with a mean of 6. The most common highest education level of any household member was middle secondary (38%), though it ranged from higher primary through to university.

Households typically had either earth or cement floors, earth or cement brick walls, and iron sheets for roofing. Lighting was solar (63%), paraffin or another type of lantern (28%), or electricity (9%). The main means of cooking (71%) was using a traditional three-stone stove with firewood, with some households (15%) using a paraffin stove. Seventy-three % (73%) of households had one or more radio, 17% a television, and 87% one or more mobile phones (with relatively equal ownership by women and men). All households owned land, with land ownership of less than one acre, between one and three acres, and three or more acres (usually up to 10 acres) in 32%, 35%, and 33% of cases, respectively.

Household pig enterprises. The most highly rated reasons for keeping pigs were 'savings and insurance' followed by 'income from pig sale' (with average ratings of 4.1 and 3.7 respectively, using a 0 to 5 rating scale where 0 was of no importance and 5 was the highest importance). The next highest rated reason was income from boar sire service (1.2). Reasons considered least important (with an average rating of 1 or less) were manure use for income or cropping, home consumption of pig meat, use of pigs for ceremonies or dowries, and keeping of pigs for prestige. The keeping of pigs for savings and insurance was statistically significantly more important for females in comparison to males ($p=0.03$). Similar results are given in Babigumira et al. (20) where this analysis is reported for the larger data set.

The main uses of the income from pigs were given as payment of school fees (83% of respondents), followed by paying off debts, purchasing medication, purchasing clothes, and home improvement (18% to 31%, depending on the expense type). This distribution was significantly different between male and female respondents, mainly due to more females naming 'paying off debts' than males (42% versus 3%).

At the time of the pig census, almost three-quarters of households (73%) kept sows, whilst the remaining households only kept growing piglets. Of households that kept sows, the majority (53%) kept one sow, though some households (29%) kept two, and other households (18%) between three and seven. Few (9%) of households kept a boar (these households would access boars from neighbours or friends, or the village boar keeper). For most households (83%) total pigs of any type (including piglets) ranged from 1 to 5 with a mode of 2 (in other cases total pig number ranged up to 36).

Low input management systems were predominantly practiced. Twenty-nine per cent (29%) of households kept their pigs in pig housing (stys) all the time, whilst the other households practiced various combinations of keeping pigs housed, tethered, or allowing them to free-range (with free ranging particularly practiced for piglets). A variety of feeds were reported to be used including maize and rice bran, sweetpotato vines and roots, cassava and yam leaves, other plants including amaranth, pigweed, spurge, kitchen leftovers (swill) both boiled and unboiled, and commercial feeds. The main pig breeds as named by the pig keepers were local or Ugandan (38% of pigs), exotic (known to include Large White and Landrace amongst others 37%), crossbreed between local and exotic (13%), or unknown (12%). Additional information on the genotype of pigs in these study sites is given in Babigumira et al. (21).

According to female respondents in male-headed households, the feeding of pigs (a major labour activity) was predominantly performed by women (58% of households) or jointly (32%). Control of income from the sale of slaughter pigs was most commonly by men (40%) or jointly (37%), and less commonly by women (14%). In female-headed households, the feeding of pigs was most commonly done by women (75%) but also by men and children (11% in each case), with control of income from pig sale by women (74%) and also jointly and by men (17% and 9%, respectively).

Other livestock enterprises. Other household livestock enterprises included poultry (kept by 75% of households, with most commonly between 1 and 20 per household, though up to 230), goat (42%, most commonly 1 to 5, though up to 11), cattle (34%, most commonly 1 to 3, though up to 25), and sheep (7%, most commonly 1 to 5, though up to 10).

3.2 Impact of COVID-19 on the household pig enterprise

The impact of COVID-19 on the household pig enterprise was reported as follows. Pig sale price (reported by those who had tried to sell pigs, 73% of households) was mostly considered to be lower than normal (48% of respondents) or as normal (37%). This aligns with that reported in Hammond et al. (13) who looked at the impact of COVID-19 on smallholders within a number of low- and middle-income countries including Uganda, where a subset of Ugandan farmers within that study perceived lower animal sales prices due to COVID-19 restrictions.

In terms of ease of pig sale, many respondents (61%) considered this to be as normal or easy, though 36% of respondents considered it difficult or not possible to sell pigs. Here there was a significant difference in responses between male and female respondents, with females more commonly indicating sales were difficult and males more commonly indicating they were normal or easy. Low sales prices and difficulties in selling were mainly attributed (by both women and men) to the lack of buyers or traders, with respondents perceiving that these either had closed their business or did not have sufficient funds to purchase animals, as well as lack of transport. Half (50%) of respondents indicated they were selling pigs to a different buyer or trader than normal, mostly commonly selling to traders, butchers, or farmers within the village rather than to traders from outside the village. Here the distribution of responses was again different between male and female respondents, with females more commonly indicating they could not sell to the usual buyer, whilst males more commonly reported they could: the reason(s) for this difference was not clear from the data.

Of households who tried to purchase feed (70% of all households), the majority considered feed availability to be lower than normal (79%) and the price to be higher than normal (91%). Of households who accessed veterinary services (64% of all households), the majority considered the availability of veterinarians to be lower than normal (50%) or as normal (30%). Service fees were considered higher than normal by about two-thirds of respondents (68%). Of households buying pharmaceuticals for their pigs (70% of all households), 78% considered the price to be higher than normal. This perceived disruption to livestock service provision is notably higher than reported in Uganda by Hammond et al. (13) but hard data have been lacking. We present the results from 9201 interviews with smallholder farmers from seven countries. OBJECTIVE: The objectives are to describe: i, where disruptions to crop inputs, seeds, and labour were more commonly reported. There are many possibilities for this difference, including different portfolios of agricultural activities undertaken by the study households.

Almost all respondents (98% to 99%) indicated there had been no change in who provides labour for the pigs, makes decisions on pig husbandry or sale, or controls the income from the pigs over the COVID-19 period.

The sale of pigs for cash in response to difficulties caused by COVID-19 was reported by just over half (51%) of households (47% of female-headed and 51% of male-headed), with these households mostly selling one, two, or three pigs (47%, 20% and 11% of households who sold pigs, respectively), though up to 10. Many of the pigs sold (68%) were adults, thus likely breeding animals. The average sale price of adult pigs was UGX 286,000 or USD 80 (with a range of UGX 82,500 to 750,000 or USD 23 to 160), whilst younger pigs sold for an average sale price of UGX 52,000 or USD 15 (with a range from UGX 25,000 to 7,000 or USD 7 to 20). The total value of pig sales per household averaged UGX 413,300 or USD 116 (with a range from UGX 50,000 to 2,750,000 or USD 14 to 770). The sale of pigs as a coping strategy over the COVID-19 period was also reported for Ugandan farmers by Hammond et al. (13) but hard data have been lacking. We present the results from 9201 interviews with smallholder farmers from seven countries. OBJECTIVE: The objectives are to describe: i.

The key advantage of pig keeping over the COVID-19 period was named as income by almost half of the respondents (49%) for food, school fees, medical expenses, and general household expenses (such as paraffin or soap). Other advantages named by fewer respondents (5% to 11%) included the pigs' ability to utilize locally available feedstuffs, ease of marketing, suitability to keep in a small space, and quick returns. No specific advantage of keeping pigs over the COVID-19 period was indicated by 21% of respondents.

Overall, the majority of household pig enterprises were negatively affected by lower sales prices and increased difficulty in selling pigs and/or more expensive and less available inputs. Females experienced more difficulties in selling pigs than males, though no gender differences were evident on the input side. A study on the impact of COVID-19 on smallholder poultry farmers in Nigeria similarly found that access to markets (for birds and eggs) was more reduced for females in comparison to males (22). Pig sale for cash was relatively common (around half of the households). That many pigs of breeding age were sold is of concern, and follow-up studies on whether, and how, households have replaced this livestock asset are recommended. Whilst the majority of households could name one or more advantages of pig keeping over the COVID-19 period, these overlapped with reasons for pig keeping more generally (see sections 3.1, also [5, 20]).

3.3 The impact of COVID-19 on the household more generally

The impact of COVID-19 on the household (beyond the pig enterprises) was also examined. Almost all (98%) of respondents indicated their household had less income since the onset of the COVID-19 pandemic. This was attributed to lower farm income from both cropping and livestock, due to lack of buyers, lower prices, inability to go to the market during lockdowns, and in the case of crops the need to keep the produce for home consumption, as well as reduced

off-farm employment and less profitable off-farm enterprises. The loss of household income was said to impact all family members (women, men, girls and boys). Receiving lower remittances was also reported by 61% of households. A reduction in both off-farm and farm income over the COVID-19 period, as well as lower remittances, was also reported by Ugandan farmers in Hammond et al. (13) but hard data have been lacking. We present the results from 9201 interviews with smallholder farmers from seven countries. OBJECTIVE: The objectives are to describe: i.

The inability to eat normal meals was reported by 51% of households, with about one-fifth (21%) of these households indicating a serious food shortage. This was said to impact all family members. Sick household members were not able to be cared for properly in 61% of households, with insufficient funds to buy medicine or pay for health care named as key contributing factors. On loans, money was borrowed by 47% of households, mainly from a friend or relative (77% of those who borrowed) but also from a formal loan provider (23%). Only 9% of households reported additional household members returning home (most common 1 person but up to 17), whilst 2% of households reported people leaving the home (2 or 3 persons per household). Similar to this study, reduced food quantity and food diversity, as well as the incurrance of risky debts, were reported by about one-fifth of Ugandan farmers in the Hammond et al. study (13). In contrast to this study, however, Hammond et al. (13) found only 1% of Ugandan households perceived they had reduced education or healthcare. Other studies within Uganda, including those targeting groups of people with different demographics, also reported issues related to food and nutritional security, healthcare, education, and borrowing of money in response to COVID-19 (7,12,15,16).

Household livestock sale, for cash over the COVID-19 period, was reported by 67% and 68% of female- and male-headed households, respectively. The most common livestock types sold (across all households) were pigs (51% of households, mostly selling 1 pig though up to 10) and chicken (19%, mostly two chickens, though between 1 and 10). A smaller proportion of households also sold cattle (7%, mostly 1 and less commonly 2) or goats (5%, mostly 1 but up to 6). That households sold more pigs and poultry, compared to cattle and goats, aligns with households keeping more pigs and poultry in comparison to the other species (see section 3.1) as well as poultry, in particular, being an easily disposable asset. For households who sold livestock, the average sale value (for all animals sold by a household) was UGX 491,000 (USD 136) with a range from UGX 12,000 to 5,000,000 (USD 3 to 1,388) per household. The sale of livestock species, particularly pigs and poultry, as a coping strategy in response to COVID-19 was also reported by Ugandan farmers in Hammond et al. (13).

The value (UGX) of livestock sold over the COVID-19 period attributed to livestock owned by women, men, and jointly, in male-headed households, was 38%, 9%, and 53% (of the total value of livestock sales) respectively; whilst in female-headed households, all livestock sold were female-owned. Comparisons were made between the distributions of intrahousehold ownership of animals kept (according to the baseline survey) and those reported as sold over the COVID-19 period for pigs and poultry, based on the animal numbers (regardless of animal type or sales values, as these details were not available within the baseline data). The distribution of intrahousehold ownership between animals kept and those sold were statistically significantly different ($p < 0.001$) for both male and female-headed households (Table 3). In all cases, the proportion of animals sold that were female-owned was higher than the proportion kept. For example, in male-headed households, females owned 11% of all pigs, but 29% of pigs sold were female-owned. As another example, in female-headed households, females owned 77% of poultry but all (100%) of poultry sold were female-owned (note that about two-thirds of female-headed households had adult males, usually children of the household head up to 30 years of age, allowing for male and joint ownership of livestock assets). These results suggest that in some households' female-owned livestock assets are sold in preference to those owned jointly or by males. However, this needs to be interpreted with caution as 'ownership', and particularly 'joint ownership', can be interpreted differently (23, 24). Further we shall compare ownership at the time of the baseline survey to sales at a later date. Follow-up studies on this, for validation and (if validated) to explore and identify the underpinning gender norms and how these can be addressed, are recommended. Note this comparison was not performed in the case of cattle and goats as too few animals were reported as being sold.

Table 3. Pig and poultry ownership distributions at the time of the baseline survey (baseline) and for animals that were sold over the COVID-19 period (sales), for male and female-headed households.

| Ownership | Male-headed households | | | | Female-headed households | | | |
|-----------|------------------------|-------|----------|-------|--------------------------|-------|----------|-------|
| | Pigs | | Poultry | | Pigs | | Poultry | |
| | Baseline | Sales | Baseline | Sales | Baseline | Sales | Baseline | Sales |
| Female | 0.11 | 0.29 | 0.19 | 0.38 | 0.70 | 1.00 | 0.77 | 1.00 |
| Male | 0.10 | 0.13 | 0.13 | 0.15 | 0.01 | | 0.00 | |
| Joint | 0.79 | 0.58 | 0.68 | 0.47 | 0.29 | | 0.23 | |
| p-value | <0.001 | | <0.001 | | <0.001 | | <0.001 | |

For the livestock sold there was reportedly good correspondence between who owned the animal(s), the decision-maker(s) on the sale, and who controlled the income. For male-headed households, this correspondence was reported in 77% of sale cases, representing 86% of the total value of livestock sales. In female-headed households, this correspondence was reported in 84% of sale cases, representing 92% of the total value of livestock sales (in the other cases the income was controlled by a male household member or a non-household member). In cases where this correspondence was not observed, there was no strong pattern on the relationship between who owned, made the decision, or controlled the income. This finding, however, also requires additional follow-up for validation due to the nuances and different interpretations around joint ownership, decision-making, and income control (23–25).

Household asset sale (other than livestock), for cash over the COVID-19 period, was reported by fewer households (6% of female-headed and 3% of male-headed). These included land, motorbikes, household furniture, and goods. For households who sold assets, sale value ranged from UGX 25,000 to 9,000,000 (USD 7 to 2,498). On the sale of household assets, the proportion of the total value of the asset sales attributed to assets owned by males, by females, and jointly was 51%, 48%, and 1% for male-headed households, respectively. All assets sold from female-headed households were female-owned. Similar to livestock, there was reasonable correspondence on who owned the asset, made the decision for its sale, and controlled the income. Hammond et al. (13) also reported a few Ugandan households selling assets as a coping strategy to COVID-19.

In summary, almost all households reported income loss over the COVID-19 period, with this attributed to both reductions in on-farm and off-farm income. Negative impacts on food and nutrition security, health care as well as the taking out of loans, were also reported by a significant number of households. This aligns with findings of other studies in Uganda and elsewhere (14, 26–28) on the negative impact of COVID-19 control measures. Livestock sale, particularly of pigs and poultry, was reported as a coping strategy by about two-thirds of households, highlighting the insurance role that livestock plays in rural livelihoods to meet unforeseen expenses resulting from shocks (29). That results suggest female-owned livestock assets are preferentially sold in some households is concerning.

3.4 The impact of COVID-19 on the community

Respondents were also asked to share their perceived impacts of COVID-19 on their community. On mobility, the majority of respondents (85%) felt it was somewhat less safe to walk around (such as to the markets) with this mainly attributed to the possibility of getting COVID-19, and in fewer cases attributed to the fear of being attacked or stigmatized. Respondents indicated this applied to everyone (women, men, girls, boys).

Violence against women (expressed to the respondents as husbands or partners hitting or beating their wives or girlfriends; and asked at the community level rather than in relation to the respondent's own home) was considered to have increased by the majority (73%) of respondents. Here the distribution of responses was significantly different between the male and female respondents ($p=0.004$), notably with a higher proportion of males giving the response of 'unsure' in comparison to females. The number of unplanned pregnancies (also asked at the community level) was also considered to have increased by the majority (81%) of respondents. Further 79% of respondents perceived increased conflict within the community. Increased violence against women over the COVID-19 period was also reported in a study targeting Western Uganda (15). Whilst not asked in this study, an increase in child abuse over the COVID-19 period has also been documented in Uganda (16).

An increase in diseases or illnesses, other than COVID-19, was perceived by 50% of respondents, who most commonly named malaria. Here the distribution of responses was significantly different between the male and female respondents ($p<0.001$), notably with a higher proportion of males reporting no increase and females reporting an increase. An increase in the number of people begging, and loss of aid support was perceived by about half of the respondents (52% and 55%, respectively). Fewer respondents felt there was an increase in the number of homeless people (17% of respondents), less access to public toilets (9%), or less access to clean water from public access points (12%).

In summary, several negative impacts of COVID-19 were reported at the community level. Of great concern is the reported increase in violence against women and unplanned pregnancies, which has also been reported in numerous other studies (30–32).

3.5 COVID-19 awareness and adoption of preventative measures

Awareness around COVID-19 and the adoption of preventative measures were also explored. COVID-19 symptoms most named by respondents were fever (66% of respondents), sneezing / runny nose (63%), dry cough (53%), difficulty breathing (37%), headache (31%), sore throat (17%), and loss of taste or smell (17%). On how COVID-19 spread, the most common response was through the air (72%) followed by touching objects or surfaces that have been touched by infected people (48%) or with respiratory drops from infected persons (47%). Eight per cent (8%) of respondents were not able to name any means of the diseases' spread. The majority (81%) of respondents indicated that they felt anyone could be infected by COVID-19. Those named as most likely to be adversely affected were those above 70 years of age (87%); people with underlying conditions including AIDS / HIV, cardiovascular disease, diabetes, cancer, or 'already sick' (12% to 41% of respondents); and children (31%).

On actions being taken to prevent infection with COVID-19, the main responses were washing hands (92%), mask-wearing (84%), avoiding crowded places (43%), and staying at home (20%). Here the distribution of responses was significantly different between the male and female respondents ($p<0.001$), notably with a higher proportion of males naming the avoidance of crowded places than females. Main responses about what action the respondents would take in case of infection were going to a medical facility for testing and treatment (85%) and staying at home not to infect others (31%). Five per cent (5%) of respondents could not provide an answer. When asked about potential management and treatment options for COVID-19 infection, the most common responses were 'don't know' (60% of respondents), followed by garlic, vitamins, sun exposure, antibiotics, cow urine, and there is no treatment (16% to 22% of respondents each). Here was a significant difference in the distribution of responses between male and female respondents ($p<0.001$), with a higher proportion of males naming 'don't know', and a higher proportion of females naming vitamins and garlic.

Main information sources on COVID-19 were given as radio (91% of respondents), family, friends, or neighbours (58%), television (29%), and government health workers (14%). Three per cent (3%) of respondents indicated they did not have an information source.

Overall, these results show that the majority of participants had reasonable to good knowledge about COVID-19 symptoms, transmission mechanisms, preventative actions to take if infected, and risk groups. The public health measures of hand washing and mask-wearing were commonly practiced, though crowded places were not always avoided, particularly by women. Potential treatment and management options were less understood, with respiratory therapy not specifically mentioned and other named options not evidence-based (33,34). The use of cow urine to treat COVID-19 has also been reported in India where it has been raised as a public health concern (35). That Ugandans are informed on many aspects related to COVID-19 has previously been reported and attributed to the government's strong education campaign on COVID-19 and related control measures which were initiated soon after the first infection was reported in the country in March 2020 (6,36,37). Studies undertaken in May 2020 (38) and March to July 2020 (16) already reported respondents to be well informed on COVID-19 and adopting (to varying degrees) the government's recommended measures.

3.6 Conclusion

There have been numerous studies relevant to low-and middle-income countries on the impact of COVID-19 and related control measures, often reported with recommendations for COVID-19 coping and mitigation strategies (see, for example, 26–28,32,39–42). A smaller body of work has focused on COVID-19's effect on smallholder or pastoral livestock keepers and / or their livestock enterprises. These include those considering effects on smallholder or pastoral households in general (for example, 13,15,43–51), and two focusing more on specific livestock enterprises particularly poultry and dairy cattle (22,52) in addition to this study. Further studies at different levels of breadth and specificity are important, as each helps to build a comprehensive picture.

This study showed that pigs, including breeding sows, were sold for income during COVID-19, and also that COVID-19 control measures disrupted household pig enterprises, both in relation to access to inputs and marketing. A study of rural households in western Uganda in May 2020 by Mahmud and Riley (15) showed that households had coped with less income due to COVID-19 through decreased food expenditure and use of savings, but had not yet liquidated their fixed assets or sold livestock. That livestock sales were reported to a larger degree in this study may be due to the additional time under COVID-19 control measures (with this study undertaken seven months later than that of Mahmud and Riley (15) resulting in a situation where food consumption could not be further decreased and savings were depleted, and/or the different household livelihood profiles between the studies.

Gendered impacts of the effect of COVID-19 control measures on household pig enterprises were observed, importantly including women finding it more difficult to sell pigs in comparison to men, and potentially the preferred sale of women-owned pigs (and poultry) in some households. The intersection of livestock keeping, COVID-19, and gender has been neglected in the literature (besides this study, there are only two others of which we are aware (22,53) and more work to this end is strongly recommended.

This study focused on pig keepers: it is recognized that other actors along the pig value chain would also have been impacted by the COVID-19 control measures. Of note here is that many pig keepers felt that pig traders had ceased operations or did not have sufficient funds to continue their business activities, suggesting that traders were heavily negatively impacted. The impact on input service providers is less clear as they were reported to be less accessible but charging higher fees. Also, whilst not explicitly investigated here, it is likely that the control measures negatively impacted pig welfare, due to the difficulties in accessing feed supply and health care. An overview of studies considering the impact of COVID-19 control measures on different nodes of livestock supply chains, as well as animal welfare, is given in Abu Hatab et al. (39).

Building resilience of animal-source food systems, including the pig value chain in Uganda, to shocks such as COVID-19 should be a high priority moving forward. Efforts should be placed on approaches that build competitiveness and resilience of food systems such that system actors are able to address, absorb and overcome shocks in the market, policy environment, resource base or other aspects of the system. For instance, studies by Kayobyo et al. (54) and World Vision International (55) have shown the importance of market systems interventions in enhancing the resilience of communities and food systems. Such interventions include improving access of food system actors to financial services to smoothen consumption, allowing households to solve pressing needs and avoid distress sales of productive assets such as livestock whenever there are shocks. Other interventions include enhancing business development and technical capacities of system actors, diversification of income sources through product diversification, and strengthening capacities of groups to lobby for support and services from relevant government programs that impact on the food system.

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