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Understanding associations between the COVID-19 pandemic and menstrual hygiene management among adolescent girls in Ethiopia: findings from a mixed-methods longitudinal study

Maureen Murphy ,[1] Rebecca Dutton,[1] Kiya Gezahegne,[2] Nicola Jones,[3] Jennifer Seager,[1] Sarah Baird[1]

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[1]Department of Global Health, George Washington University School of Public Health and Health Services, Washington, District of Columbia, USA
[2]Department of Social Anthropology, Addis Ababa University, Addis Ababa, Ethiopia
[3]Overseas Development Institute, London, UK

Correspondence to
Maureen Murphy;
maureenmurphy@gwu.edu

ABSTRACT

Objective To understand the relationship between the COVID-19 pandemic and menstrual hygiene management (MHM) among adolescent girls in Ethiopia and to explore which girls were most affected by pandemic disruptions.

Design Two rounds of data from surveys and interviews were collected with adolescent girls immediately prior to and during the COVID-19 pandemic. The primary analysis is cross-sectional, controlling for pre-COVID-19 covariates.

Setting The setting was three zones in two regions of Ethiopia: East Hararghe and East Shewa Zones in Oromia and South Gondar Zone in Amhara. Data were collected in December 2019–March 2020 and September 2020–February 2021.

Participants 742 adolescent girls, ages 11–25 years.

Outcome measures Four primary outcomes were explored (1) the number of challenges girls experienced; (2) adolescent-identified challenges managing menstrual hygiene; (3) adolescent-identified difficulties accessing MHM products and (4) adolescent-identified difficulties accessing soap or water.

Results Girls who were more vulnerable to COVID-19 were more likely to have worse MHM outcomes. An SD increase in household vulnerability to COVID-19 was associated with an 8.7 percentage point increase in the likelihood that the respondent had difficulty getting MHM products ($p<0.001$), a 6 percentage point increase in the likelihood that she reported facing a challenge managing her menstruation ($p=0.003$) and a 5.2 percentage point increase in the likelihood she lacked soap or water ($p=0.001$). Qualitative themes, used to triangulate the quantitative findings, suggest that mobility restrictions, shutdowns of the local market, disruptions in supply chains, poverty, stigma and fear about contracting COVID-19 affected girls' access to MHM supplies.

Conclusions The results of this study suggest that MHM was left behind in the COVID-19 response. New programming and policy interventions need to address financial hardship and disruptions to supplies to manage menstruation as well as tackle the inequitable gender norms that stigmatise menstruation during emergencies.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ Data were collected during COVID-19 from a pre-established study cohort, allowing the study to collect data on the real-time effects of COVID-19 on adolescents.
⇒ Mixed-methods data allowed for triangulation of information and the ability to further interpret and contextualise quantitative findings and identify possible pathways of impact, leading to more nuanced policy and programme recommendations.
⇒ Virtual data collection for the follow-up round of data collection during COVID-19 limited the follow-up sample to those with access to mobile phones; therefore, our results may not be generalisable to the wider population of the Gender and Adolescence: Global Evidence study.

INTRODUCTION

While menstruation does not stop for an emergency, incorporating menstrual hygiene management (MHM) into relief activities has been a gap in humanitarian responses.[1–3] Traditional male leadership of humanitarian programming may contribute to MHM being overlooked while stigma and taboos around issues that affect women (eg, MHM, gender-based violence, reproductive health) may result in the lack of prioritisation of these issues within the humanitarian sector.[1 4] These challenges contribute to MHM being overlooked during emergencies and a recent systematic review on the MHM in low-income and middle-income countries (LMICs) and emergencies highlighted the limited evidence on MHM in emergency settings and called for further primary research on this topic.[5]

In 2020–2021, the COVID-19 pandemic brought about many of the same conditions as previous humanitarian emergencies but on a global scale. The pandemic disrupted global

supply chains that produce and ship sanitary products[6–8] while mobility restrictions, school closures and social isolation reduced the ability of girls to access information about puberty or to acquire products to manage their menstruation.[8 9] Increased poverty due to the pandemic also prevented girls from purchasing MHM products that they would normally rely on to manage their periods.[6] Being isolated at home in close proximity with other household members due to lockdown measures may have also increased shame and stigma associated with menstruation—particularly for adolescent girls.[6 8]

In Ethiopia, where girls have historically experienced many challenges with MHM,[10–12] the government introduced public health measures to curb the spread of the COVID-19 pandemic that could have reduced access to water, soap and menstrual hygiene products through both physical and social barriers. Measures included banning social gatherings and closing schools, and households experienced increased economic insecurity due to market disruptions.[13] There are also considerable rural–urban divides in MHM practices in Ethiopia that may have made the impacts of COVID-19 larger in rural areas. Prior to the pandemic, girls in urban areas were more likely to report that they use disposable MHM products, felt less shame about discussing menstruation, felt confident they could manage their menstruation while at school and were more able to pay for sanitary products.[12]

Despite the potential for disruption to MHM during the COVID-19 pandemic in Ethiopia, no study has explored this issue. This paper uses empirical data from immediately prior to and during the pandemic from a cohort of adolescent girls and key informants from Ethiopia to understand the relationship between the pandemic and MHM practices and to explore which girls have been most affected by pandemic-associated disruptions.

METHODS

Study design

This paper draws on mixed-methods data from a sample of adolescents collected in Ethiopia as part of the Gender and Adolescence: Global Evidence (GAGE) study (see Jones *et al*[14] for more details). GAGE is a mixed-methods, cross-national study following over 20 000 adolescents and their caregivers over 9 years. GAGE relies on a conceptual framework focused on the adolescent's capabilities, change strategies and contexts to understand their development and empowerment.[15] In Ethiopia, GAGE is following a cohort of over 11 000 adolescents who were initially enrolled in the cohort in 2017–2018 or 2019–2020. The original sampling frame included both a probability random sample of initially adolescent boys aged 10–12 years and adolescent girls aged 15–17 years as well as a purposeful sampling of more marginalised adolescents including out-of-school adolescents, adolescents who experienced child marriage and adolescents with a disability. Broadly speaking, our overall sample should be considered representative of marginalised adolescents in Afar, Amhara and Oromia. Qualitative respondents were predominantly selected from the quantitative sample but also included internally displaced persons who were present in significant numbers after baseline due to substantial ethnic unrest and conflict in 2017–2019 in Oromia region. For more details on the sampling strategy, see Hicks *et al*[16] and Hamory *et al*.[17]

There was also a robust protocol for referral to support services and all data collection was done in private locations or confidentially on the phone (see Hamory *et al*[17] and Oakley *et al*[18] for more on data collection protocols).

Study sample, setting and data collection

Quantitative data were collected in December 2019–March 2020 prior to the outbreak of the COVID-19 pandemic (henceforth, baseline) through in-person surveys with adolescents and their caregivers and in November 2020–February 2021 (henceforth, follow-up) with the same adolescents virtually via a telephone survey.[19 20] The phone survey took place in all GAGE locations, except Afar where there was limited to no cell phone connectivity. Data collection tools (for baseline and follow-up) covered all aspects of the GAGE conceptual framework[15] and can be found in online supplemental appendix 1. These questionnaires were built on previous rounds of GAGE data collection and were extensively pretested with adolescents with the same demographics.

For this analysis, we focused primarily on longitudinal survey data from 742 adolescent girls, ages 11–25 at the latest interview, who had reached menarche at the time of the 2019/2020 survey and were reinterviewed at follow-up (2020/2021). Considerable efforts were made to reduce loss to follow-up by calling respondents up to 15 times across different days of week and weekend, and times (morning, afternoon, evening). In urban areas, 74.7% (605/810) of girls who had reached menarche in 2019/2020 were successfully reinterviewed at follow-up, with adolescents who were enrolled in school pre-COVID-19 being more likely to be surveyed (online supplemental appendix 2, table 1). In rural areas, 28.8% (137/475) of girls who had reached menarche at baseline were successfully reinterviewed at follow-up, with attrition largely driven by access to a phone and enrolment in school pre-COVID-19 (online supplemental appendix 2, table 1). Thus, our sample should be considered representative of in school adolescents with access to a phone across locations. This should be kept in mind when interpreting findings.

Qualitative data were collected during the COVID-19 pandemic with 99 adolescent girls and 26 key informants who were interviewed between September and December 2020 to capture pandemic effects. It was collected in rural South Gondar, urban Debre Tabor, rural East Hararghe and urban Batu (in the East Shewa zone). Respondents were selected from adolescents who were part of the longitudinal cohort, and an inclusive sample was sought based on locality, education status pre-COVID-19, gender, age, marital status and disability status. We sought to overcome

connectivity challenges by working with local community facilitators who helped set up interviews with adolescents who did not have their own phones or were unaccustomed to using phones for calls. Nevertheless, there was some bias as those with less familiarity with mobile phones were less comfortable participating in remote interviews. Where possible, we tried to match the researchers who had previously interviewed these respondents with the same respondents in order to facilitate trust and rapport.

Community-level and district-level officials were selected to participate in in-depth interviews. For example, teachers, health extension workers, kebele (community administrators) and representatives from the Bureaus of Health, Education and Women and Children at the district-level were interviewed and given their key roles in responding to the pandemic and service closures. We used semistructured interview guides, structured around the GAGE conceptual framework, to facilitate these discussions. For details, see Małachowska *et al*.[21]

At baseline, quantitative and qualitative data were collected face to face while follow-up was collected via phones due to the ongoing COVID-19 pandemic. At baseline, surveys were conducted in a private space to ensure confidentiality. For the follow-up, as surveys were conducted via phone, instructions were provided to the respondent via phone to find a private place to speak to ensure confidentiality, and respondents were informed that they were not obligated to respond to questions if they felt they were not in a sufficiently private place. Data were collected using secure systems on SurveyCTO on tablets and stored securely on a box with limited access.

The research team was Ethiopian but selected to ensure that they had the same regional and linguistic backgrounds as the areas in which they are researching. They all had at least a first degree and many had been involved in other longitudinal studies in the country involving adolescents and youth, including from marginalised backgrounds. All enumerators went through extensive 2 weeks of training on data collection and research ethics at study baseline and then received additional training about considerations for remote data collection before implementing the follow-up questionnaire during COVID-19. Data collector training materials are available at the UK Data Archive (https://beta.ukdataservice.ac.uk/datacatalogue/studies/study?id=9196#!/documentation and https://beta.ukdataservice.ac.uk/datacatalogue/studies/study?id=8985). Research instruments were translated into Afaan Oromo, Afar Af or Amharic. We ensured that male researchers interviewed male respondents, and female researchers interviewed female respondents. For young people with disabilities, we adapted the tools and settings in which the interviews were carried out and also involved sign language interpreters for young people with hearing impairments.

COVID-19 vulnerability and shocks

We measured household vulnerability using an index of nine indicators that capture a household's overall vulnerability to COVID-19 across five domains, following Seager *et al*[22]: socioeconomic, housing and hygiene, healthcare access, demographic, and epidemiologic. The measures included in the index across the socioeconomic, housing and hygiene, and healthcare access domains were captured during baseline. The measures used for the demographic and epidemiological domains were captured in the follow-up survey; however, they include measures of the number of household members with chronic conditions, who were over the age of 60, and who were currently or recently pregnant—all arguably unaffected by the pandemic. The index was standardised to the mean and SD of the sample for regression analysis.

In addition, we measured four primary COVID-19 shocks: (1) a binary indicator that someone in the household lost employment, (2) a binary indicator for the adolescent reporting restricted mobility since March 2020, (3) a binary indicator for the adolescent reporting that they had been or thought they were likely to be infected with COVID-19 and (4) a binary indicator for the adolescent being completely or moderately scared or fearful about COVID-19. A variable documenting if an adolescent used improved MHM immediately prior to the pandemic was also included to control for prepandemic MHM practices. Improved MHM was defined as the respondent using either a reusable or disposal sanitary pad or another modern sanitary product.

Outcomes

We focused on four primary outcomes related to MHM during the COVID-19 pandemic: (1) an index of the number of challenges (in general) girls experienced, including having to wear clothing they would not normally wear at home, not being able to do things for entertainment they used to, not being able to talk on the phone/chat online with friends as they used to, finding it more difficult to manage their menstruation cycle with male family members at home and spending more time responding to the demands of male household members. This resulted in a 0–5 score with higher numbers indicating more challenges experienced. In addition, three binary indicators were used as the remaining outcomes where adolescents directly identified if they experienced (1) challenges managing menstrual hygiene; (2) difficulties accessing MHM products and (3) difficulties accessing soap and/or water. All outcome data were collected during follow-up data collection, which occurred during the COVID-19 pandemic. See online supplemental appendix 2, table 2 for further details.

Controls

All multivariate regressions included the following controls due to their association with MHM (household controls were all collected in 2017–2018 (prior to COVID-19) during the initial data collection for the GAGE longitudinal study in Ethiopia.): baseline household size, baseline enrolment in school, baseline age, an indicator that the household receives Productive Safety

Net Programme (PSNP) benefits at follow-up, a social protection programme in Ethiopia (The PSNP is a social protection safety net programme implemented by the Government of Ethiopia that targets food-insecure households. Households with labour capacity are provided food in exchange for community work while labour-constrained households (due to pregnancy, lactation, widowhood, disability and chronic illness) receive direct cash support.),[23] and an indicator for ever married at follow-up.

Empirical analysis

For the quantitative analysis, we first conducted a descriptive and bivariate analysis of the study outcomes, COVID-19-related shocks and vulnerabilities, and key covariates. T-tests were used to compare means between stratified subsamples (urban vs rural). We then present multivariate regression analysis (linear probability models for binary outcomes), again overall and stratified by urban/rural location, controlling for key covariates. The regression equation is:

$$y_{ic1} = \alpha + \beta_1 \text{Mob}_{ic1} + \beta_2 \text{Scare}_{ic1} + \beta_3 \text{Risk}_{ic1} + \beta_4 \text{Emp}_{ic1} + \beta_5 VI_{ic1} + \text{X}'_{ic0}\gamma + \text{Z}'_{ic1}\delta + \varepsilon_{ic1}$$

Where y_{ic1} is the outcome of interest for individual I in community c at follow-up, Mob_{ic1} is the measure of lost mobility due to COVID-19, Scare_{ic1} is the measure of the respondent's fear of COVID-19, Risk_{ic1} is the measure of the respondent's self-assessed risk of getting COVID-19, Emp_{ic1} is the measure of lost employment due to COVID-19, VI_{ic1} is the standardised COVID-19 vulnerability index, X'_{ic0} is the vector of baseline controls listed previously and Z'_{ic1} is the vector of covariates measured at follow-up. The SEs ε_{ic1} are clustered at the subkebele level to account for the sampling design. STATA V.18 was used for all quantitative analyses. Since the outcome questions focus on experiences during the COVID-19 pandemic, this is a cross-sectional regression controlling for pre-COVID-19 pandemic covariates and vulnerability. Outside of overall attrition discussed above, missing data are limited (less than 5%) and missing at random (online supplemental appendix 2, table 3).

For qualitative analysis, all interviews were transcribed, translated and coded using a thematic codebook in MAXQDA 12 following the GAGE conceptual framework.[15] UK and Ethiopian researchers with extensive experience working in Ethiopia conducted the data analysis. An inductive research approach—whereby we used oral debriefings with the team to identify emerging themes and then used these to develop a code book—was used. The thematic codebook has codes related to sexual and reproductive health, especially menstruation and puberty-related knowledge, information, access and affordability of services and supplies, as well as associated attitudes, norms and stigma. The codebook was used to code the translated and transcribed interviews using MAXQDA qualitative data software to identify patterns by age, locality, education and other social status. We double-coded a selection of transcripts to check for consistency and also developed a data dictionary. Debriefing sessions with the research team were also used to discuss emergent themes and similarities and differences across sites.

Patient and public involvement

Data collection instruments were informed by research with adolescents, caregivers and service providers during baseline as well as from participatory research groups with especially vulnerable adolescent girls—including in rural areas, married, out of school, adolescents with disabilities.

RESULTS

Descriptive analysis

On average, girls in the quantitative sample were aged 16.8 years old, 22% of the sample were ever married and 70% had an adult or peer that she trusted. In terms of household characteristics, 69% of households had a literate household head, and 9% of the sample received PSNP support. At baseline, 86.5% of girls in urban areas reported using improved MHM practices compared with only 52.2% in rural areas (p<0.001). Across the sample, most girls reported using reusable pads (40.8%), disposal sanitary pads (41%) or cloth (18.7%) at baseline (table 1).

At follow-up, 33% of households reported losing work (temporarily or permanently) due to the pandemic, and 33.8% of adolescent girls indicated their mobility was completely or moderately restricted during the pandemic period. Girls were also concerned about contracting COVID-19. Girls in urban households were more likely to experience employment disruptions (36.6% in urban areas vs 17% in rural, p<0.001). Girls in urban areas were also more likely to be scared or fearful about the virus (22.6% in rural areas vs 39.5% in urban areas, p<0.001) (see table 2).

Association of COVID-19 disruptions and MHM practices

The disruptions of the COVID-19 pandemic (including changes in mobility, fear of COVID-19, belief that infection was likely) were associated in both quantitative and qualitative data with changes to girls' lives and menstrual hygiene practices. Key additional themes also emerged in qualitative data that brought nuance and depth to these findings. These included the challenges of poverty and the affordability of MHM products, especially for particularly vulnerable populations, the availability of sanitary products in markets, stigma around the use of MHM products and the use of coping strategies to make what MHM products they had available last longer. These results will be explored in more detail below.

In the quantitative data adolescents whose mobility was restricted during the pandemic faced more challenges (in general) due to COVID-19 (b=0.308, p=0.002, see table 3), while qualitative interviews suggested that shutdowns of the local market and restrictions on transport affected girls' ability to generate income to buy MHM

Table 1 Pre-COVID-19 characteristics of adolescents who have reached menarche

	Full sample		Urban		Rural		Urban–rural
	n=742		n=605		n=137		
	Mean	SD	Mean	SD	Mean	SD	P value
Household characteristics							
Household size	4.9	2.5	4.9	2.4	5.2	2.9	0.163
=1 if household is literate	0.692	0.462	0.738	0.440	0.493	0.502	<0.001
=1 if household ever received PSNP or UPSNP	0.090	0.286	0.065	0.247	0.200	0.401	0.003
Respondent characteristics							
Adolescent age	16.8	2.0	17.1	1.9	15.4	2.0	<0.001
=1 if adolescent enrolled in school during the most recent session before COVID-19	0.768	0.422	0.819	0.385	0.547	0.500	<0.001
=1 if adolescent ever married	0.217	0.412	0.161	0.368	0.460	0.500	<0.001
=1 if adolescent has an adult (s)he trusts	0.699	0.459	0.710	0.454	0.655	0.477	0.321
=1 if adolescent has female friends she trusts	0.693	0.462	0.695	0.461	0.683	0.467	0.760
Mean age of menarche (among those who had reached menarche)	13.8	1.4	13.7	1.4	14.0	1.3	0.112
COVID-19 vulnerability							
COVID-19 Vulnerability Index (sum of 9 indicators of vulnerability with nine as most vulnerable)	3.0	1.6	2.7	1.5	4.0	1.4	<0.001
Menstruation practices							
=1 if adolescent has improved menstrual hygiene management	0.801	0.399	0.865	0.342	0.522	0.501	<0.001
=1 if adolescent uses reusable pad to manage menstruation	0.408	0.492	0.443	0.497	0.259	0.440	0.001
=1 if adolescent uses cloth to manage menstruation	0.187	0.390	0.138	0.345	0.403	0.492	<0.001
=1 if adolescent uses disposable pads to manage menstruation	0.410	0.492	0.438	0.497	0.288	0.454	0.003
=1 if adolescent uses other paper, toilet paper or plant material to manage menstruation	0.018	0.131	0.018	0.134	0.014	0.120	0.783
=1 if adolescent uses nothing to manage menstruation	0.036	0.187	0.017	0.128	0.122	0.329	<0.001

The baseline sample includes only respondents for whom follow-up data (during COVID-19) are available. Presented p values are results of t-tests between urban and rural samples.
PSNP, Productive Safety Net Programme; UPSNP, Urban PSNP.

Table 2 Follow-up (during COVID-19): characteristics, COVID-19 experiences and outcomes

	Full sample		Urban		Rural		Urban–rural
	n=742		n=605		n=137		
	Mean	SD	Mean	SD	Mean	SD	P value
Respondent characteristics							
=1 if adolescent ever married	0.235	0.424	0.172	0.378	0.504	0.502	<0.001
COVID-19 experiences							
=1 if adolescent reports complete/moderate restricted mobility	0.338	0.473	0.344	0.476	0.309	0.464	0.418
=1 if adolescent thinks COVID-19 infection likely (5+ on scale 0–10)	0.354	0.478	0.339	0.474	0.417	0.495	0.150
=1 if adolescent completely or moderately scared/fearful about COVID-19	0.363	0.481	0.395	0.489	0.226	0.420	<0.001
=1 if someone in the household lost employment permanently or temporarily due to COVID-19	0.330	0.471	0.366	0.482	0.170	0.377	<0.001
Outcomes							
Total number of challenges faced during COVID-19 (out of 5)	0.590	1.127	0.542	1.075	0.799	1.309	0.046
=1 if adolescent reports difficulty getting menstral hygiene products	0.284	0.451	0.258	0.438	0.399	0.491	0.002
=1 if adolescent reports facing challenges in managing menstruation	0.296	0.457	0.257	0.437	0.468	0.501	<0.001
=1 if adolescent lacks water or soap	0.216	0.412	0.167	0.374	0.424	0.496	<0.001

All data were collected virtually at follow-up during COVID-19. Presented p values are results of t-tests between urban and rural samples.

Table 3 Regression analysis for MHM outcomes during the COVID-19 pandemic

	Total number of challenges (0–5)	Has difficulty getting MHM products	Faces challenges managing menstruation	Lacks soap or water
	Col 1	Col 2	Col 3	Col 4
COVID-19 experiences				
Adolescent reports complete or moderate restricted mobility during COVID-19	0.308***	−0.002	−0.061	0.003
	(0.095)	(0.033)	(0.038)	(0.035)
Adolescent scared or fearful of COVID-19	0.406***	0.117***	0.214***	0.044
	(0.116)	(0.038)	(0.036)	(0.035)
Adolescent thinks COVID-19 infection likely	−0.162**	0.062	−0.036	0.068**
	(0.074)	(0.039)	(0.031)	(0.031)
Household lost employment during COVID-19	0.068	0.013	0.047	0.006
	(0.095)	(0.039)	(0.039)	(0.032)
COVID-19 vulnerability				
COVID-19 Vulnerability Index, standardised	0.070	0.087***	0.060***	0.052***
	(0.050)	(0.018)	(0.020)	(0.016)
N	708	705	711	711
R^2	0.096	0.077	0.096	0.063

P values: **0.05 ***0.01; Odinary least squares regression includes controls for has improved MHM prior to COVID-19, has an adult she/he trusts, household ever received PSNP, adolescent was ever married (at follow-up), adolescent age (prior to COVID-19), enrolled in school (prior to COVID-19) and household size (prior to COVID-19). The SEs are clustered at the subkebele level to account for the sampling design. Adjusted R^2 is presented at the bottom of the table.
MHM, menstrual hygiene management; PSNP, Productive Safety Net Programme.

supplies. Girls who were fearful about COVID-19 had significantly worse MHM outcomes across all outcomes examined. They experienced more challenges (b=0.406, p=0.001), were 0.117 percentage points more likely to report difficulty getting MHM products (p=0.003) and were 21.4 percentage points more likely to report facing a challenge in managing menstruation (p<0.001). Similarly, believing COVID-19 infection was likely was associated with a 6.8 percentage point increase in the likelihood that they lacked soap or water (p=0.033). Qualitative interviews corroborated these findings, with girls disclosing that fear of contracting COVID-19 at health clinics prevented travel to these sites to get necessary MHM supplies. Compounding these challenges, restrictions imposed by the government to control the spread of the virus, in particular school closures, created challenges for girls in accessing MHM supplies.

> Sanitary pads were given by the schools. But it stops when the schools were closed. We have been giving sanitary pads to the [local] school.…We have given it beginning from 2018. After the coming of COVID, we stop distributing it.—Health extension worker, South Gondar

> I experienced my first menstruation when I was grade 5 student. I did not tell my mother in the first few years as I experienced menstruation I was collecting sanitary pads from the school girls' club.…Then with Covid I had to tell her… She did not say nothing when I told her.…Sometimes she takes sanitary pad by credit from shop and pays it when she gets money. —18-year-old adolescent girl, Batu

Girls who faced higher vulnerability to COVID-19 experienced more challenges in accessing MHM products, challenges managing menstruation, and were less likely to have access to soap and water. A 1 SD increase in vulnerability to COVID-19 was associated with, on average, an 8.7 percentage point increase in likelihood that the respondent reported difficulties in getting MHM products (p<0.001), a 6 percentage point increase in likelihood that the respondent faced challenges managing her menstruation (p=0.003) and a 5.2 percentage point increase in likelihood that they lacked soap or water (p=0.001) (see table 3 for details).

Vulnerability to COVID-19 impacted girls in urban and rural areas differently. In rural areas, mobility restrictions (b=1.025, p=0.002) and increases in household vulnerability (b=0.274, p=0.038) were associated with increases in the number of challenges faced, whereas these associations are negligible in urban areas. In urban areas, a 1 SD increase in COVID-19 vulnerability was more likely to report facing challenges in managing menstruation (b=0.051, p<0.001). While the loss of household employment in quantitative data was not associated with negative MHM outcomes in the overall sample, qualitative data suggested that economic stress, particularly in urban areas, did affect MHM practices. For example, girls in

urban areas reported they lacked money for protective equipment (eg, masks) but faced pressures to travel to work in public transport where rules were not enforced or to be in working environments where social distancing precautions were not taken. Girls in urban areas also reported using the same sanitary pad for multiple days, rather than adapting and using cloth or other locally available materials.

'I use 1 piece of sanitary pad for 1 day and night; I change it the following day…. I was using it freely sometimes I use 2 sanitary pad only for day time. Using it like that is difficulty these days since we are in financial pressures…. I feel discomfort, but what can I do…I never think of using pieces of cloth, I decided to use the sanitary pad for long time.'—17-year-old adolescent girl, Batu

In rural areas, some qualitative respondents also noted that, with market disruptions, they had been reduced to begging in the district towns, including to be able to afford essential items like soap. Poverty/lack of affordability of MHM products was particularly seen in vulnerable households, such as adolescent-headed and displaced. For girls who did live with family members, stigma around menstruation due to entrenched gender norms contributed to their fear of asking family members to use limited resources to purchase MHM products. Respondents reported that the onus was often on adolescent girls themselves to save the funds to provide for MHM products and that MHM was often deprioritised within the household during times of financial distress. This was also reflected in the quantitative data, where girls in rural areas in households that experienced employment loss were 27.5 percentage points more likely to have reported challenges managing menstruation (see table 4).

> My parents are having to take loans from friends…. no one from our household has a mobile phone… no one is using face masks…even at the demonstrations against the death of Hachulu Hundessa [well-known Oromo activist]…. We can't afford sanitary pads now… we are using pieces of cloth…when the schools were open we could get pads there if need be but now we make do with cloth.—13-year-old adolescent girl, East Hararghe

> It costs 20 birr to buy sanitary pads every months… It is difficult to afford now. But we don't have a choice…. I can only buy them when I have the money…otherwise I use strips of clothes.—16-year-old adolescent girl, South Gondar

DISCUSSION

Overall, the results of this analysis demonstrate that MHM for adolescent girls in Ethiopia has been impacted by the COVID-19 pandemic and the conditions brought

Table 4 MHM COVID-19 outcomes by location (urban vs rural)

	Total number of challenges (0–5)		Has difficulty getting MHM products		Faces challenges managing menstruation		Lacks soap or water	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
	Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7	Col 8
COVID-19 experiences								
Adolescent reports complete or moderate restricted mobility during COVID-19	0.148*	1.025***	0.020	−0.124	−0.026	−0.223**	0.013	−0.068
	(0.082)	(0.320)	(0.033)	(0.110)	(0.040)	(0.096)	(0.035)	(0.108)
Adolescent scared or fearful of COVID-19	0.458***	0.207	0.105**	0.169	0.204***	0.220**	0.029	0.081
	(0.127)	(0.278)	(0.041)	(0.108)	(0.038)	(0.104)	(0.038)	(0.108)
Adolescent thinks COVID-19 infection likely	−0.143*	−0.331	0.025	0.347***	−0.060*	0.192	0.060*	0.167
	(0.073)	(0.256)	(0.041)	(0.099)	(0.031)	(0.115)	(0.032)	(0.113)
Household lost employment during COVID-19	0.102	0.112	−0.003	0.170	0.039	0.275**	0.020	0.061
	(0.097)	(0.434)	(0.042)	(0.132)	(0.041)	(0.105)	(0.033)	(0.137)
COVID-19 vulnerability								
COVID-19 Vulnerability Index (0–9)	0.008	0.274**	0.075***	0.098**	0.051***	−0.003	0.032*	0.071
	(0.051)	(0.129)	(0.020)	(0.047)	(0.021)	(0.045)	(0.017)	(0.047)
N	584	124	582	123	587	124	587	124
R^2	0.080	0.163	0.062	0.114	0.088	0.059	0.022	0.009

P values: *0.10, **0.05, ***0.01; Regressions were stratified by the respondent's location (urban vs rural). Orindary least squares regression includes controls for has improved MHM prior to COVID-19, has an adult she/he trusts, household ever received PSNP, adolescent was ever married (at follow-up), adolescent age (prior to COVID-19), enrolled in school (prior to COVID-19) and household size (prior to COVID-19). The SEs are clustered at the subkebele level to account for the sampling design. Adjusted R^2 is presented at the bottom of the table.
MHM, menstrual hygiene management; PSNP, Productive Safety Net Programme.

about by the pandemic (eg, lockdowns, social distancing, disruptions of supply chains through school closures and market disruptions). Several factors emerged as driving these challenges in MHM. Overall, poverty and lack of financial resources to purchase MHM products was a key theme, with the supplies needed by girls for MHM deprioritised by their households at large and compounded by conservative gender norms that contribute to a stigmatisation of menstruation. Mobility restrictions and lockdowns (including market closures, closures of schools and disrupted employment) compounded these financial difficulties and affected girls' ability to access sanitary products (provided at school) and to earn money to purchase supplies and their ability to access supplies. Respondents' fears of contracting COVID-19 also appear to have constrained girls' ability to manage their menstruation. This fear and anxiety appear to be leading to less help-seeking behaviours as girls and their caregivers reported avoiding health clinics to avoid contracting COVID-19.

While the pandemic conditions have an impact on the lives of girls broadly, girls who were the most vulnerable in terms of their pre-COVID-19 socioeconomic conditions, household assets, accessibility of health services and presence of particularly vulnerable household members were most affected by the disruptions caused by COVID-19 and had the most challenges managing their menstruation. These findings suggest that girls who were more vulnerable prior to the pandemic continued to suffer the most during the crisis and support the findings of previous research in multiple contexts that have found links between vulnerability (eg, economic vulnerability, slum populations, disabled populations) and poor MHM.[24–27]

MHM is often deprioritised during public health emergencies and our results suggest that MHM was similarly left behind during the COVID-19 response. For example, public health responses to COVID-19 diverted health resources and distribution mechanisms (such as schools) where girls would typically access MHM supplies. The results of our study found very similar trends to the data generated after the 2013–2016 West African Ebola outbreak[28]—with unmet need for menstrual materials and overlooked menstrual challenges in the humanitarian response. This suggests that despite increased advocacy on the issue of MHM, it is still not prioritised during public health crisis. In addition, the findings of this study further support previous research in LMICs and contexts facing natural disasters and/or displacement where girls reported considerable barriers to effectively managing their menstruation.[3 29–31] These disruptions reflect the continued deprioritisation of the health of women and girls during emergencies.

Programming and policy interventions need to consider how best to reduce disruptions to supplies to manage menstruation in chronic emergency contexts. While there has been increasing attention to MHM in the context of acute emergency responses—for example, through the distribution of dignity kits (including basic soap, cloth, context-specific MHM products)—these interventions are often one-time occurrences that do not consider the ongoing needs of girls.[1] In addition, previous research has demonstrated many humanitarian crises fail to integrate dignity kits to address women's health into their emergency response.[32] The specific conditions of a public health emergency such as COVID-19, which separates people and isolates them within their homes (rather than creating mass population movements or displacement camps), also bring particular challenges that prevent reaching girls who need support to manage their menstruation. Newer efforts to support the integration of MHM into emergency response such as the Toolkit for Integrating Menstrual Hygiene Management into Humanitarian Response,[33] provide guidance on how to think through wholistic MHM in the context of emergency response. As there is no one-size-fits-all approach for MHM in emergencies, efforts such as this to promote contextualised and culturally appropriate integration of MHM into emergencies are essential.

This study has several limitations. First, these findings should be interpreted as associations and not as causal. In addition, we are using self-reported data about a potentially sensitive subject reported by adolescents themselves. This could have biased our results as girls who were from particularly conservative backgrounds may have been less willing to speak about these sensitive topics or did not have complete privacy during the phone interview. In addition, not all girls who were reached during baseline data collection were able to be reinterviewed (particularly in rural areas) during the follow-up survey. The findings are thus limited to girls who are more likely to be in school and have mobile phone access. However, these biases mean that our results are likely underestimating the true associations of pandemic-associated disruptions and MHM—as the most vulnerable girls were likely not included in the final sample. Finally, this analysis was only able to focus on certain aspects of MHM (primarily procurement and use of clean absorbent materials and access to water/sanitation) while MHM overall is wider construct of multiple behaviours (eg, frequency of changing absorbent materials, safe disposal of materials). This limits the conclusions our study can make.

Our analysis shows that the COVID-19 pandemic affected how girls managed their menstrual hygiene needs due to factors such as poverty, mobility constraints, market shutdowns, disruptions in supply chains, restrictions on transport and fears of contracting COVID-19. Unequal gender norms also continue to stigmatise MHM and lead to its deprioritisation during emergencies. Our results suggest that MHM was overlooked in the response to COVID-19 in Ethiopia, as it has been in other humanitarian crises. Given the unique conditions brought on by a global public health emergency compared with more traditional humanitarian responses, new efforts are needed to ensure the most vulnerable girls are able to access the appropriate MHM throughout any future pandemics. For example, sharing information through

online education platforms for adolescents who were in-school prior to the pandemic and via community-based women's and youth associations for those who were already out of school. In addition, factoring in the costs of sanitary products as part of emergency social protection interventions. Underlying these considerations is the need to continue the challenge the inequitable gender norms that stigmatise MHM and lead to its deprioritisation during emergency response.

Contributors MM drafted the manuscript. RD conducted data analysis. KG conducted the qualitative data collection and analysis. NJ designed the qualitative study, oversaw data collection and conducted qualitative data analysis. JS oversaw data analysis. SB designed the quantitative study, oversaw data collection and is the study guarantor.

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Patient and public involvement Patients and/or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research. Refer to the Methods section for further details.

Patient consent for publication Not applicable.

Ethics approval This study involves human participants and the research design and tools were approved by the George Washington University Committee on Human Research's Institutional Review Board (071721), the Overseas Development Institute Research Ethics Committee (02438), the Ethiopian Development Research Institute (EDRI/DP/00689/10), the Addis Ababa University College of Health Sciences Institutional Review Board (113/17/Ext) and the Amhara and Oromia regional Bureaus of Health ethics committees. Participants gave informed consent to participate in the study before taking part.

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Data availability statement Data are available in a public, open access repository. Data are available on reasonable request. Quantitative data are available at the UK data archive (https://www.data-archive.ac.uk/). Qualitative data are not publicly available due to ethical concerns. If you are interested in working with the qualitative data, please contact the GAGE programme at gage@odi.org.uk.

ORCID iD

Maureen Murphy http://orcid.org/0000-0002-3507-7564

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