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Research Article

Keywords: COVID-19, socio-economic impact, determinants, concentration curves, inequality, Kenya

Posted Date: August 18th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-820808/v1>

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Version of Record: A version of this preprint was published at Wellcome Open Research on December 14th, 2021. See the published version at <https://doi.org/10.12688/wellcomeopenres.17367.1>.

Assessing equity and the determinants of socio-economic impacts of COVID-19: results from a cross-sectional survey in three counties in Kenya

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Abstract

Background: COVID-19 mitigation measures have major ramifications on all aspects of people's livelihoods. Based on data collected in February 2021, we present an analysis of the socio-economic impacts of COVID-19 mitigation measures in three counties in Kenya.

Methods: We conducted a cross-sectional phone-based survey in three counties in Kenya to assess the level of disruption across seven domains: income, food insecurity, schooling, domestic tension/violence, communal violence, mental health, and decision-making. An overall disruption index was computed from the seven domains using principal component analysis. We used a linear regression model to examine the determinants of vulnerability to disruptions as measured by the index. We used concentration curves and indices to assess inequality in the disruption domains and the overall disruption index.

Results: The level of disruption in income was the highest (74%), while the level of disruption for domestic tension/violence was the lowest (30%). Factors associated with increased vulnerability to the overall disruption index included: older age, being married, belonging in the lowest socio-economic tertile and receiving COVID-19 related assistance. The concentration curves showed that all the seven domains of disruption were disproportionately concentrated among households in the lowest socio-economic tertile, a finding that was supported by the concentration index of the overall disruption index (CI = - 0.022; $p = 0.074$).

Conclusion: The COVID-19 mitigation measures resulted in unintended socio-economic effects that unfairly affected certain vulnerable groups, including those in the lowest socio-economic group and the elderly. Measures to protect households against the adverse socio-economic effects of the pandemic should be scaled up and targeted to the most vulnerable, with attention to the constantly evolving nature of the pandemic.

Keywords: COVID-19, socio-economic impact, determinants, concentration curves, inequality, Kenya

Introduction

The World Health Organization declared the 2019 novel coronavirus disease (COVID-19) a public health emergency of international concern and a pandemic on 11th March 2020 (1). Given the uncertainties and negative health implications of the pandemic, countries have adopted various policy measures to flatten the epidemiological curve and preserve health systems capacity to meet the healthcare needs of the general population and COVID-19 patients (2, 3). Such mitigation measures include, among others, 1) instituting country lockdowns, 2) imposing travel restrictions, 3) closing ports of entry, 4) closing schools and 5) banning large gatherings (2). Whereas these mitigation measures are critical in slowing down the spread of the virus, they are likely to lead to unintended health, economic and social impacts on populations, especially the poor and vulnerable, as the economic shocks associated with these mitigation measures are not borne equally within and across countries (3-5). In low-and-middle-income countries (LMICs), for example, evidence suggests a consistent picture of disruptions in livelihoods and economic shocks in the early stages of the pandemic (2, 6-10).

In Kenya, following the detection of the first COVID-19 case on 13th March 2020, the number of confirmed cases has accumulated to 217,276 and 4,273 deaths as of 13th August 2021 (11). The government has instituted a range of mitigation measures over time (Table 1). Nevertheless, depending on the intensity of the virus transmission, some of these restrictions have been lifted progressively since June 2020. At the outset of COVID-19 outbreak in Kenya, the government implemented a raft of measures to cushion individuals from potential socio-economic impacts of the pandemic mitigation measures. These included 100% tax waivers for individuals earning below KES 24,000 (USD 225), reduction of personal income tax from 25% to 30%, reduction of value-added tax from 16% to 14% and cash transfers to orphans, the elderly and vulnerable members of society (12, 13). Also, to restore disrupted economic activity in informal settlements, youths in 23 informal settlements across seven counties were employed under the *Kazi Mtaani* program to clean streets, drainages and collect garbage (14). These measures notwithstanding, an increasing body of evidence points to significant socio-economic impacts of the COVID-19 mitigation measures. For instance, implementation of the mitigation measures has been associated with an increase in the number of domestic or gender-based violence cases, food insecurity, loss of income or employment, learning disruption, healthcare access disruption, increased levels of stress, among other forms of disruption in people's livelihoods (6, 15-19). Specifically, the implementation of various mitigation policies in Kenya has been shown to have disproportionate negative impacts on

women dwelling in informal settlements in Nairobi as they were more at risk of facing income loss, food insecurity and foregoing needed healthcare (19).

Given the low levels of COVID-19 vaccine coverage, the evolving nature of the pandemic, and the associated long-term effects, it is imperative for the government to continuously monitor the pandemic's indirect effects and implement appropriate mitigation measures during and after the pandemic. This paper presents an analysis of the burden, inequalities and the determinants of vulnerability to disruption across seven domains of livelihood (i.e. income, food insecurity, schooling, domestic tension/violence, communal violence, mental health and decision-making) in three Kenyan counties.

Table 1: Timings and duration of mitigation measures against COVID-19 in Kenya since March 2020

Mitigation measure	Mitigation strategy	Duration	Implementation status
COVID-19 Screening	Mandatory screening at all points of entry	March 2020	Ongoing
	Requirement for screening in all public places and buildings	March 2020	Ongoing
COVID-19 Testing	Testing and contact tracing	March 2020	Ongoing
	Mandatory COVID-19 testing for truck drivers. Only those with negative tests allowed into the country.	May 2020	Ongoing
Isolation and quarantine	Travellers coming into Kenya could be subject to 14-day self-quarantine	March 2020	Ongoing
	Government imposes mandatory quarantine for positive patients and their contacts	March 2020	Ongoing
Physical distancing restrictions	Requirement for 1.5 meters physical distancing in public places	March 2020	Ongoing
	Ban on all gatherings (including but not limited to political, social gatherings)	March 2020	Ongoing
	-Recommended working from home (except for employees in essential services) -State and public officers with pre-existing conditions working from home	March 2020	Ongoing
	Regulations limiting the number of passengers in public transport vehicles	March 2020	Ongoing
	Restaurants remain open but a ban on opening of bars (Initially only take-aways in restaurants but lifted after 30 days)	March 2020	Lifted
	Informal businesses remain open adhering to physical distancing measures	March 2020	Ongoing
	Closure of golf clubs, open sporting clubs and walking fields	April 2020	Lifted
	Phased re-opening of worship places	July 2020	Lifted
	Closing time for all bars and restaurants shall be 10pm every day	September 2020	Ongoing
	The permitted maximum size of religious gatherings is increased to one-third of its normal sitting capacity	September 2020	Ongoing
	The permitted maximum number of persons attending funerals, weddings, ceremonies of rites of passage or other similar events may have no more than 100 persons (revised over time)	September 2020	Ongoing
	All funerals must be held within 72 hours after confirmation of death	June 2021	Ongoing
	The schools in Kenya re-open from 12th October 2020 starting with examination classes, i.e. Grade 4, Class 8 and Form 4 students	12 th October 2020	Lifted
	All political gatherings and rallies are suspended for a period of 60 days. Anyone wishing to hold such meetings to do so in town halls and limit the attendees to one-third seating capacity of the hall	November 2020	Ongoing
	All bars, restaurants and other establishments open to the public must close by 21h00	November 2020	Ongoing

Sanitation	Requirement for soap, water and hand sanitizers in public areas for hand and cough hygiene	March 2020	Ongoing
	Mandatory wearing of face masks in public areas	April 2020	Ongoing
Movement restrictions	Suspension of travel for all persons coming into Kenya from any country with reported COVID-19 (except for Kenyan citizen and those with residence permits)	March 2020	Lifted
	Passengers arriving from or who in the past 14 days have been in or transited through India are not allowed to enter (does not apply to nationals or residents of Kenya).	June 2021	Ongoing
	Cessation of movement into and out of Nairobi, Mombasa and Mandera (except for movement of food supplies and other cargo)	April 2020 – July 2020	Lifted
	Cessation of movement into and out of Kilifi and Kwale (except for movement of food supplies and other cargo)	April 2020 – June 2020	Lifted
	Cessation of movement into and out of Old town in Mombasa and Eastleigh in Nairobi	May 2020 -July 2020	Lifted
	Cessation of movement persons and vehicles across the Kenya-Somalia and Tanzania International borders except for cargo vehicles.	May 2020	Lifted
	Inter-country cessation of movement in and out of Nairobi, Mombasa and Mandera effective 7th July 2020;	6 th July 2020	Lifted
	Resumption of local air travel under strict guidelines and protocols	15 th July 2020	Ongoing
	Resumption of international air travel under strict guidelines and protocols	1 st August 2020	Ongoing
	Movement restrictions in five counties (Nairobi, Kiambu, Kajiado, Machakos and Nakuru)	26 th March 2021	Lifted
	Movement restrictions in 13 Nyanza and Western counties	17 th June 2021	Lifted
Education	Closure of all learning institutions – reviewed over time. Schools are opened at the time of writing	March 2020	Lifted
Curfew	Nationwide curfew – timing of curfew has been varied over time. The curfew in the 13 “hotzone” counties (Busia, Vihiga, Kisii, Nyamira, Kakamega, Trans Nzoia, Bungoma, Kericho, Bomet, Siaya, Kisumu, Homa Bay and Migori) has been revised to 10 pm to 4 am.	March 2020	Ongoing
Economics	State interventions to cushion Kenyans from economic shocks (tax refunds, rebates, waivers and cash transfers) and implementation of food aid programs including suspension of taxes on food items	March 2020	Accomplished
	Launch of a National Hygiene Programme that would create jobs for the youth working in 23 informal settlements in across 7 counties	April 2020	Accomplished
	Government asks Nairobi City County and Kenya Power not to disconnect water and electricity over unpaid bills.	April 2020	Accomplished
	Allocation KES 5 billion towards local manufacture of basic medical equipment and supplies for local use and export largely by the Jua kali sector	April 2020	Accomplished

	Economic stimulus amounting to KES 53.7 Billion (Infrastructure, Education, Health, Small, Medium Enterprises, Agriculture, Tourism, Environment, Manufacturing)	May 2020	Accomplished
Workforce	Additional funds for the recruitment of additional health workers	March 2020	Accomplished
	Development of medical insurance package for health care workers	April 2020	Accomplished

Source: updated from Barasa *et al.* 2021

Methods

Study Design

A cross-sectional study design was employed through a phone-based platform to administer a knowledge, attitudes, practices, and experiences survey in February 2021 as part of a series of studies conducted by the Population Council.

Study Population and Setting

The data used in this analysis was collected in a survey administered to participants sampled from households in three existing Population Council prospective cohort studies across three counties; Nairobi, Kisumu, and Kilifi (20). In Nairobi county, participants were drawn from two cohort studies in five urban informal settlements. The first cohort consisted of 2,565 households enrolled in the Adolescent Girls Initiative-Kenya (AGI-K) study in Huruma and Kibera (20, 21), while the second cohort consisted of 4,519 households enrolled in the NISITU study in Mathare, Dandora and Kariobangi (19, 20). The cohort study methods have been explained in detail elsewhere (22). The target population in Kisumu county, located in Western Kenya, were enrolled in the PEPFAR DREAMS study (20) and consisted of households in Kolwa (a peri-urban area) and Nyalenda (a large informal settlement). Participants in the DREAMS study were sampled from a list of compiled households by the Population Council. The target population in Kilifi county, located in the coastal region of Kenya, was drawn from households in three sub-counties (Magarini, Ganze and Kaloleni) who were enrolled in the Nia project (20). Participants enrolled in the study came from low-income households and informal settlements. Table 2 outlines the distribution of participants in the three counties.

Table 2 Study population and sample size

County	Location	Population Council Cohort	Sample size
Nairobi	5 informal settlements (Dandora, Kariobangi, Kibera, Huruma and Mathare)	-Adolescent Girls Initiative-Kenya (AGI-K) study -NISITU study	n = 1,560 (594 males)
Kisumu	1 peri-urban area (Kolwa East) and 1 informal settlement (Nyalenda)	-PEPFAR DREAMS project	n = 1,016 (163 males)
Kilifi	3 sub-counties (Magarini, Kaloleni, Ganze)	-NIA project	n = 1,331 (508 males)

Sample size and sampling procedure

A ratio of 1:3 for male and female interviews was used to randomly sample households with phone numbers in the existing cohorts in Kilifi and Kisumu. In contrast, respondents from Nairobi were sampled by location. Because of inclusion criteria for the three existing cohorts, the randomly sampled participants were from households with at least one adolescent. As such, households that solely had adults or young children were not eligible for inclusion and are therefore not represented in the study.

Data collection

The tool used for data collection gathered information on 1) knowledge, attitudes and practices about COVID-19 reported by households, 2) the economic, education, food, social and mental health effects of COVID-19 mitigation measures, and 3) socio-demographic status. Two questionnaires were administered; one for adults and another one for adolescents. The tools were translated to Kiswahili and Dholuo, piloted and administered by trained interviewers over the phone. Interviews lasted for an average of 30 minutes. Data were collected using Open Data Kit.

Data Analysis

Table 3 outlines a description of the domains of disruption assessed in the study. The seven domains of disruption were a combination of 24 variables across the following categories: 1) food disruption, 2) income disruption, 3) school disruption, 4) domestic tension/violence, 5) community violence, 6) mental health disruption and 7) decision-making disruption. First, we used descriptive statistics to analyze participants' characteristics by county. Second, we estimated the level of disruption for each domain, overall and by county. Third, a disruption index from the seven domains of disruption was generated through principal component analysis (PCA) (23). Fourth, a linear regression model was fitted to assess the determinants of susceptibility or vulnerability to the disruption index. Multicollinearity of the independent variables was assessed using variance inflation factors. The dependent variable was the disruption index (continuous variable), while the selection of independent variables was informed by factors that have been suggested in the literature to determine individuals' vulnerability to COVID-19 mitigation measures (7, 19, 24-26). These included age, sex, level of education, marital status, socio-economic status, household size, location of residence (urban or rural), and receiving COVID-19 related assistance (Table 3). Household characteristics and asset ownership (i.e. electricity, piped water source, reliable water source, livestock, and mobile phone ownership) variables were used to generate the socio-economic status (SES) index. PCA was used to compute the SES index, which was categorized into three tertiles.

Lastly, we conducted an equity analysis using concentration curves (CC) and indices (27) to assess whether the distribution across the seven domains and the overall disruption index disproportionately affected individuals in higher or lower SES groups. The CC plots the cumulative share of disruption for a given domain (y-axis) against the cumulative share of households, ranked from lowest SES rank to highest SES rank (x-axis). So, if everyone experiences disruption for a given domain irrespective of their SES rank, the CC will consistently lie on the equality (45-degree) line. If, by contrast, the disruption domain is concentrated among individuals in the lower (higher) SES rank, the CC will lie above (below) the line of equality, with the distance between the CC and equality line depicting the extent of inequality (27, 28). The concentration index (CI_D) was computed as twice the covariance between a given domain of disruption, say income, and an individual's SES rank divided by the mean of the specific disruption domain (28). Theoretically, the CI_D lies between -1 (i.e. when the disruption domain is concentrated on the poorest individual) and +1 (i.e. when the disruption domain is concentrated on the richest individual) (28). Overall, a positive (negative) CI_D corresponds to a pro-higher SES (pro-lower SES) distribution (27, 28). Statistical significance for our analysis was set at < 0.05 . Stata (version 15.0) was used in the analyses.

Table 3 Variables of interest in the analysis

Description	Categorization	Notes
Dependent Variable		
Disruption Index	Food disruption (Eaten less/skipped meals because of insufficient money or food if related to coronavirus)	Principal component analysis was used to generate a disruption index from the seven domains
	Income disruption (Complete loss of job/income OR Partial loss of job/income OR Less income compared to earnings before coronavirus OR Partner earns less income compared to earnings before coronavirus)	
	School disruption (Only doing learning activities at home OR Not attending school in person or doing any learning activities at home)	
	Domestic tension/violence (More tension in the household (HH) OR More arguing in the HH OR More fear partner may harm OR More violence in the HH)	
	Communal violence (Increase in neighborhood crime OR More violence outside of house)	

	Decision-making disruption (Less control over decision to leave house into the community OR Less control over decision to work outside of the house OR Less control over the decision to make large household purchases OR Less control over decision about when or where to seek health care OR Less control over the decision to buy food, water and soap for the HH)	
	Disrupted mental health (Less interest/pleasure in doing things normally enjoyed OR Feeling more depressed/down OR Feeling more nervous, anxious/edgy OR More worried/not able to stop worrying AND Sought no help from family/friends)	
Independent variables		
Socio-demographic	Age in years (18-35, 36-57, 58+)	
	Sex (Male, Female)	
	Marital status (Single, Married)	
	Education status (No schooling, Primary, Secondary, Tertiary)	
	Location (Urban: Nairobi and Kisumu; Rural: Kilifi)	
	Total household size (1-3, 4-5, > 5)	
Received COVID-19 related assistance (last 7 days)	<ul style="list-style-type: none"> • Yes • No 	
Socio-economic status	Tertile 1 (Lowest)	Principal component analysis was used to calculate socio-economic status based on (electricity, piped water source, reliable water source, livestock, and mobile phone ownership) and categorized into tertile.
	Tertile 2	
	Tertile 3 (Highest)	

Ethics approval

Ethical approval for the study was obtained from the Population Council IRB (p936) and AMREF ESRC (P803/2020). The National Commission for Science, Technology and Innovation (NACOSTI) issued the research permit (P20/5010) for the study. Verbal informed consent was obtained from respondents before initiating interviews.

Results

Descriptive analysis

A total of 3,907 respondents took part in the study and their socio-demographic characteristics are outlined in Table 4. A higher proportion of the participants were female (67%), were in the 36-57 years age group (54%), were married (63%) and had primary level of education (46%). The average household size was 6.9 people (SD = 4.1) in the overall sample. Specifically, the mean household size was higher (mean of 8.8 people) in the rural county (Kilifi) compared to the urban counties (Nairobi and Kisumu) (mean of 5.9 people). A low proportion (4%) of the respondents reported having received any form of COVID-19 related assistance seven days before the interview.

Table 4 Participant Characteristics by County

Demographic characteristics	Overall n (%)	Kilifi County n (%)	Kisumu County n (%)	Nairobi County n (%)
Sex				
Male	1,255 (32.8)	505 (39.3)	159 (15.9)	591 (38.2)
Female	2,576 (67.2)	780 (60.7)	841 (84.1)	955 (61.8)
Age group (years)				
18-35	1,508 (40.2)	320 (26.0)	496 (50.5)	692 (45.0)
36-57	2,027 (54.0)	795 (64.5)	438 (44.5)	794 (51.7)
58+	217 (5.8)	118 (9.6)	49 (5.0)	50 (3.3)
Marital Status				
Single*	1,443 (36.9)	344 (25.8)	445 (43.8)	654 (41.9)
Married	2,464 (63.1)	987 (74.2)	571 (56.2)	906 (58.1)
Highest level of education				
No schooling	468 (12.0)	356 (26.8)	43 (4.2)	69 (4.4)
Primary school	1,805 (46.2)	720 (54.1)	467 (46.0)	618 (39.6)
High school	1,238 (31.7)	196 (14.7)	381 (37.5)	661 (42.4)
Tertiary	396 (10.1)	59 (4.4)	125 (12.3)	212 (13.6)
Socio-economic status				
Tertile 1 (lowest)	1,244 (32.5)	430 (33.4)	424 (42.6)	390 (25.2)
Tertile 2	1,438 (37.6)	447 (34.8)	263 (26.4)	728 (47.1)
Tertile 3 (highest)	1,144 (29.9)	408 (31.8)	309 (31.0)	427 (27.6)
Mean household size (SD)				
Rural county	8.8 (4.8)	8.8 (4.8)	-	-
Urban county	5.9 (3.2)	-	6.5 (3.9)	5.4 (2.6)
Household size				
1 to 3	409 (10.5)	52 (3.9)	112 (11.0)	245 (15.7)
4 to 5	791 (20.3)	154 (11.6)	250 (24.6)	387 (24.8)
>5	2,707 (69.3)	1,125 (84.5)	654 (64.4)	928 (59.5)
Received COVID-19 assistance				
No	3,672 (95.9)	1,239 (96.4)	945 (94.5)	1,488 (96.2)
Yes	159 (4.1)	46 (3.6)	55 (5.5)	58 (3.8)

* Includes single, separated, divorced or widowed

Level of disruption across domains

Figure 1 illustrates the level of disruption across the seven domains. Overall, income disruption was the highest (74%) of the seven domains of disruption, whereas domestic tension or violence was the least (30%). Of interest, with few exceptions (i.e. income and food disruption), the level of disruption across domains was somewhat lower in Kilifi county compared to Kisumu and Nairobi counties (Figure 1). Also, it is worthy to note that the level of school disruption was higher in urban counties (i.e. Kisumu (48%) and Nairobi (50%)) compared to the rural county (i.e. Kilifi (27%)).

Fig. 1 Level of disruption across domains in three counties in Kenya

Determinants of vulnerability to disruption

Table 5 outlines the determinants of vulnerability to disruption. Males were less vulnerable to experiencing disruption compared to females (coefficient: -0.328; $p=0.187$, while married respondents were more vulnerable to disruption compared to those who were unmarried (coefficient: 0.312; $p=0.051$). However, these vulnerabilities were not statistically significant at the 5% level. Of note, older participants compared to younger participants were significantly more vulnerable to experiencing disruption (coefficient: 0.530; $p=0.017$). Vulnerability to disruption was statistically the same for respondents residing in rural or urban counties (coefficient: -0.006; $p=0.984$). This implies that respondents from either a rural or urban county were similarly vulnerable to disruption. As would be anticipated, respondents belonging to the highest socio-economic tertile were significantly less vulnerable to disruption compared to those in the lowest socio-economic tertile (coefficient: -0.313; $p=0.040$). Interestingly, respondents who received COVID-19 related assistance were still significantly more vulnerable to disruption compared to those who received no support (coefficient: 0.642; $p=0.028$).

Table 5: Linear regression analysis for factors associated with COVID-19 disruption among respondents in three counties in Kenya

Socio-demographic factors	Coefficient (95% CI)	p-value
Sex (Ref female)		
Male	-0.328 (-1.044-0.387)	0.187
Age group (years) (Ref 18-35)		
36-57	0.454 (-0.316-1.225)	0.127
58+	0.530 (0.226-0.833)	0.017*
Marital status (Ref Single)		
Married	0.312 (-0.002-0.626)	0.051**
Highest level of education (Ref No schooling)		
Primary	0.181 (-0.063-0.424)	0.086**
Secondary	0.036 (-0.339-0.410)	0.720
Tertiary	-0.004 (-0.595-0.586)	0.977
County (Ref Urban (Nairobi/Kisumu))		
Rural (Kilifi)	-0.006 (-1.187-1.175)	0.984
Household size (Ref 1 to 3)		
4 to 5	0.123 (-0.087-0.333)	0.129
>5	-0.932 (-1.848-0.284)	0.111
Socio-economic status (Ref Tertile 1 (Lowest))		
Tertile 2	-0.141 (-0.394-0.445)	0.120
Tertile 3 (highest)	-0.313 (-0.593- -0.034)	0.040*
Received COVID-19 assistance (Ref No)		
Yes	0.642 (0.169-1.115)	0.028*

Notes: * $p < 0.05$; ** $p < 0.1$

Inequalities in disruption across domains

The concentration curves in Figure 2 suggest that disruption across the seven domains of interest in this study disproportionately affected respondents in the lowest socio-economic tertile (i.e. all concentration curves lie above the line of equality). Except for school disruption, these findings are confirmed with the concentration indices for disruption in Table 6. For instance, although not statistically significant, the overall disruption index was disproportionately concentrated among respondents in the lowest socio-economic tertile ($CI_D = -0.022$; $p = 0.074$). Of all the seven domains of disruption, only two (i.e. food disruption and domestic tension/violence) were significantly concentrated among the lowest tertile (Table 6). Supplementary file 1 provides inequality findings at the county level.

Fig. 2 Concentration curves for disruption across domains

Table 6 Concentration indices for disruption across domains

Domain	Concentration index	Std. Error	p-value
Food disruption	-0.040	(0.006)	0.023*
Income disruption	-0.012	(0.009)	0.312
School disruption	0.012	(0.022)	0.622
Domestic tension/violence	-0.062	(0.002)	0.001*
Communal violence	-0.031	(0.015)	0.168
Decision-making disruption	-0.009	(0.013)	0.552
Mental health disruption	-0.029	(0.010)	0.104
Overall disruption index	-0.022	(0.006)	0.074**

Notes: Robust standard errors in parentheses. * $p < 0.05$; ** $p < 0.1$

Discussion

To inform policy formulation and target resources to mitigate the adverse socio-economic impacts of COVID-19, governments and other stakeholders need timely and reliable evidence on the circumstances faced by the population, disaggregated by key vulnerability indicators. Our study is based on data collected in February 2021 and may not reflect what is currently happening, given the rapidly evolving nature of the pandemic. The study nonetheless provides insights into the socio-economic impacts of the pandemic. Several observations emerge from our study. First, the pandemic and related mitigation policies have resulted in substantial socio-economic impact to individuals and households in Kenya. Our findings show that the level of disruption for income was the highest across the seven domains explored. While the other domains, such as food disruption and education disruption are directly impacted, it is likely that their disruption is also compounded by income loss. Our findings mirror those of other studies conducted in Mombasa and Nairobi counties in Kenya, where the loss of income and food insecurity were the most reported adverse consequences of COVID-19 mitigation policies at the early stages of the pandemic (18, 19, 29). Other African countries like Sierra Leone (24), Ethiopia, Malawi, Uganda, Nigeria (7) and South Africa (30) have increasingly reported food insecurity and income loss as the most prevalent and unintended consequences of implementing COVID-19 mitigation measures.

It is apparent that the various economic measures adopted by the government of Kenya to cushion Kenyans against the socio-economic impacts of COVID-19 have not had sufficient effects, possibly due to documented implementation challenges and low coverage (14). The finding that respondents who received COVID-19 assistance were still vulnerable to experiencing disruption underscores the fact that their needs are still not being met and hence there is an urgent need to scale-up coverage with these mitigation measures. Moreover, a previous study conducted in informal settlements in Nairobi showed that 86% and 48% of recipients of COVID-19 related assistance reported that their food and cash needs, respectively, were still not being met (19).

The reported increase in domestic tension/violence corroborates media reports and a previous Kenyan study that reported an increase in the number of sexual violence cases per out-patient visit during the onset of the pandemic (15). Similar findings are reflected in an Ethiopian study that estimated 25% of women reported intimate partner violence (31). The high level of communal violence and mental health disruption (especially in urban counties) that were observed in this study can be attributed to, among other things, loss of income and food insecurity as a result of disruption in food supply chains that have been documented to disproportionately affect urban

poor households (32). In addition, loss of employment or income during the pandemic, particularly for those working in the informal sector, has been increasingly documented to result in poor mental health (26, 33, 34). Our study also established that 42% of adolescents experienced school disruption due to COVID-19 mitigation measures, with urban counties reporting a higher level of school disruption. While the country implemented digital learning initiatives (35), it has been shown that this had little effect in ensuring learning continuity, given that access to digital devices and the internet is low and inequitably distributed (36). Similar trends were observed in a longitudinal study in Ethiopia, Malawi, Nigeria and Uganda that estimated that student-teacher contact dropped from 96% (pre-covid) to 17% a week before the survey (7). As schools in Kenya re-open, the government of Kenya, through the ministry of education, should implement measures to ensure all school-age children return to school.

Second, our findings revealed that being in an older age group and being married significantly increased an individual's vulnerability to disruption. This finding can be explained in several ways. One, compared to middle-aged adults who are more likely to be economically active, elderly individuals are less likely to be involved in income-generating activities to be able to cushion themselves against the indirect effects of COVID-19 mitigation measures but rather depend on others. This position is corroborated by findings of a study from Uganda that showed that older people (above 60 years), among other things, lacked access to enough food, lost the little income generated from selling farm produce and could not access healthcare or interact with family and friends due to the COVID-19 regulations (25). Two, married women or women, in general, are more likely to be vulnerable to the indirect COVID-19 mitigation measures because compared to men, they are less likely to be employed, take on unpaid care burden for children and other household chores, depend on their male partners and are more at risk of experiencing gender-based violence, especially when employment or income is lost (37-39). Such gendered-disparities during the COVID-19 pandemic have been reported in previous studies in Kenya (19) and Zambia (33).

Third, the study finds that individuals in lower socio-economic ranks bear a disproportionate burden of disruption across the domains explored. This can be explained in two ways. Firstly, households in the lowest socio-economic tertile are already vulnerable to disruption given their low-income position, the likelihood that their employment is more informal and that they have little or no savings, coupled with limited access to social/financial capital to overcome the disruptions. This vulnerability was exacerbated by COVID-19 mitigation measures, as the concentration curves and indices revealed that households in the lowest tertile were

disproportionately affected. Secondly, the finding that lower socio-economic groups are the most affected across the disruption domains suggests that either those who are most in need are not reached by the interventions targeted at them, or there is a need to scale up such interventions, with a focus on urban informal settlements and marginalized rural areas. This finding is particularly interesting since our study sample was drawn from predominantly poor locations, and hence the socio-economic ranking reflects a ranking among the poor. It is apparent that even among the poor, the intensity of poverty is associated with increased vulnerability to socio-economic disruptions from the pandemic. These findings compare well with evidence from nine LMICs, including South Africa, where missed meals, reduced income, delayed health access, and poor health was unfairly concentrated among households in the lowest socio-economic groups (5, 6).

When interpreting the findings of this study, several limitations should be considered. First, given the rapidly evolving nature of the pandemic, the socio-economic impacts of COVID-19 mitigation measures quickly become dated, given the time lag between data collection and when findings are published. Second, the findings of this study are not generalizable to the entire population in the three counties since the participants were drawn from low socio-economic status households that have adolescents participating in ongoing cohort studies. As such, households without an adolescent were not selected. Third, given that data was collected from respondents who could be reached via phone calls, there is a likelihood of reporting and selection bias. Fourth, given the study's cross-sectional nature, it was not possible to establish the temporal trends in disruption over time. Despite these limitations, this study provides important findings on the level, determinants of disruption and inequalities in seven critical domains of livelihood and suggests areas amenable to policy action if Kenyans are to be cushioned from the socio-economic impacts of COVID-19.

Drawing from our findings, we make policy recommendations that could see the poor and vulnerable cushioned from the negative impacts of COVID-19 mitigation measures. First, whereas attempts have been made by the government of Kenya and other stakeholders to cushion Kenyans from the adverse socio-economic effects of the pandemic, there is need to strengthen these measures by improving targeting and coverage. Specifically, food distributions or cash transfer programmes should be scaled-up equitably to ensure those in need are not left out. Second, the capacity of the already available toll-free call centres and rescue centres for victims of gender-based violence should be enhanced to ensure wider population coverage and their responsiveness. Lastly, alongside increasing vaccine coverage and the implementation of non-pharmaceutical

interventions, the government and other actors should scale-up novel and innovative measures such as peer-learning groups or deployment of community health volunteers to mobilize parents and caregivers to support the learning of girls, especially in urban informal settlements where school disruption was high.

Conclusion

Our findings reveal that more than a year into the COVID-19 pandemic, households still experience a high level of disruption in critical aspects of their livelihoods, with poor households being disproportionately affected. Given that the study was conducted before the third wave of the pandemic outbreak in Kenya, there are chances that the domains assessed in the study may have worsened. Therefore, it is critical to scale-up and ensure equity in the coverage of support programmes and initiatives to vulnerable households and population groups.

Abbreviations: AMREF: African Medical Research Foundation; AGI-K: Adolescent Girls Initiative-Kenya; CC: Concentration Curve; COVID-19: novel 2019 Coronavirus disease; DREAMS: Determined, Resilient, Empowered, AIDS-free, Mentored and Safe; HH: Household; IRB: Institutional Review Board; USD: United States Dollars; KES: Kenya Shillings; National Commission for Science, Technology and Innovation: NACOSTI; NISITU: Nisikilize Tujengane; PCA: Principal Component Analysis; PEPFAR: The US President Emergency Plan for AIDS Relief; SES: Socio-economic status

Author Contributions: Conceptualization, E.B., K.A., T.A., and J.P.; formal analysis, R.O.; methodology, E.B., R.O., S.O., J.P., E.M., and D.M.; validation, T.A., K.A., and E.B.; investigation, J.P., D.M., F.M., T.A., and K.A.; data curation, D.M., S.O., and E.M.; writing—original draft preparation, R.O.; writing—review and editing, E.B., J.P., D.M., T.A., M.H., S.O., F.M., and K.A.; visualization, S.O., J.P., D.M., T.A., K.A., and E.B.; supervision E.B.; funding acquisition, K.A. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by Innovations for Poverty Action, the University of California San Diego, the Kenya Executive Office of the President Policy and Strategy Unit, and the UK Foreign Commonwealth and Development Office. RO is funded by a Wellcome Trust International Masters fellowship (#214622). SO is funded by the international decision support initiative. EB is funded by a Wellcome Trust core grant (#092654).

Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Institutional Review Board of Population Council (protocol code 936) and AMREF-Ethics and Scientific Review Committee (protocol P803/2020)

Informed Consent Statement: Verbal informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available from the corresponding author on reasonable request.

Conflicts of Interest: The authors declare no conflict of interest. The sponsors had no role in the design, execution, interpretation, or writing of the study.

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Figures

Figure 1

Level of disruption across domains in three counties in Kenya

Figure 2

Concentration curves for disruption across domains

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