Balancing Work and Childcare: Evidence from COVID-19 School Closures and Reopenings in Kenya

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Abstract

This paper uses COVID-19 school closure policies in Kenya as an exogenous shock to estimate the impact of changes in household childcare needs on adult labor supply. We use nationally-representative bi-monthly panel data in a difference-in-differences design to compare changes after schools partly reopened in Kenya in October 2020 for households with a child in grade 4 or 8—the grades eligible to return to school after the partial reopening—against households with a child in adjacent grades. Having a child eligible to return increases adults' labor supply in the weeks after reopening. Increases are concentrated on the intensive margin of hours and particularly in household agriculture hours, consistent with labor in this activity being more flexible. We find no effects on the extensive margin of labor participation or on wage employment, which may take longer to adjust to a childcare shock. Impacts are not significantly different by sex of the adult: though women have greater responsibility for childcare in Kenya, men also contribute and both increased childcare hours during school closures. Effects are driven by changes in household childcare burdens and in child agricultural labor when a child returns to school, and are larger in less wealthy households. The impact of partial reopening on work hours corresponds to over 30% of the fall in average hours in the first few months after COVID-19 cases were detected, indicating that school closures are responsible for a significant share of the reduction in labor supply during the pandemic. Large labor effects of a potentially expensive childcare availability shock suggest that policies making childcare more available and affordable could have positive impacts on adult labor supply in Kenya.

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1 Introduction

The availability and cost of childcare has been shown to significantly affect adult labor supply in high-income countries, particularly for women. But there is less evidence on this relationship in low- to middle-income countries (LMICs), particularly in Sub-Saharan Africa (Halim, Perova, and Reynolds 2021). Yet, a historical perspective highlights the important role of women's labor supply in driving economic development. Understanding how childcare and adult labor supply interact is therefore crucial in these settings.

Sub-Saharan African countries differ from more frequently studied high-income countries in many ways. Households have more children on average but also more commonly have additional adults (UN 2020). Formal early childhood care availability is increasing, but from a low base and there are concerns around quality and cost (Samman et al. 2016). Female labor participation is higher in Sub-Saharan Africa than any other region, but it is concentrated in informal household activities; this region also has the world's highest gender gap in wage employment (ILO 2017). Households are more likely to engage in family farm or non-farm enterprises, which may be more accommodating of childcare needs than wage employment. It is not clear *a priori* how these differences would affect the relationship between childcare needs and labor participation.

An important factor influencing household childcare needs is the availability of low- or no-cost schooling. In response to the COVID-19 pandemic, countries around the world closed schools in an effort to limit virus transmission. This paper leverages pandemic school closure policies in Kenya as exogenous shocks to household childcare burdens to provide empirical estimates of the impact of childcare responsibilities on adult labor in an LMIC setting in Africa.

Kenya closed all schools nationwide soon after its first COVID-19 cases in March 2020 and partially reopened schools for specific grades in October 2020, prior to fully reopening in January 2021. School closures increased household childcare needs—more so for households without young children already at home due to economies of scale—creating trade-offs in adults' time allocation across childcare, work in different sectors, and leisure. Given the need to pay school costs, reopening can be seen as an expensive childcare availability shock.We exploit the quasi-random variation in the timing that children enrolled in different grades were eligible to return to school and use data from the nationally-representative panel Kenyan Rapid Response Phone Survey to implement a difference-in-differences identification strategy comparing changes in labor participation after the partial reopening for adults in 'treatment' households with children in grades 4 or 8—eligible to return—against those with children in adjacent grades.

Having a child eligible to return to school increases adults' labor supply in the weeks after reopening. Impacts are not significantly different between women and men, consistent with evidence that both sexes contribute to childcare and increased their hours during school closures. Less wealthy households—based on an index of housing and assets—account for nearly all of the labor impacts, indicating household resources influence mechanisms for dealing with changes in childcare needs. We do not observe different effects among rural or farm households.

Labor effects of the partial reopening are concentrated on the intensive margin: total work

hours in the past 7 days increase by 3.4 (21%), driven by a 24% increase in household agriculture hours. Estimated effects are larger for households whose eligible children actually returned to school, highlighting the importance of cost constraints even when childcare availability increases.

The effect of partial school reopening on adult childcare and work hours varies with household composition—in particular, the presence of below-school-age children—consistent with childcare as a primary mechanism and evidence of economies of scale in childcare and of an important role of siblings in childcare (Jakiela et al. 2020). The partial reopening also coincided with the main harvest season, and child agriculture hours decrease in treatment households by approximately one-third of the total increase in adult agriculture hours, suggesting some of the increase substituted for lost child labor. Some of the increase in labor hours after reopening, especially among less wealthy households, may also stem from the need to pay school-associated costs.

This paper contributes to a broad literature on childcare and labor (e.g., Browning 1992; Connelly 1992; Ribar 1992). This literature largely focuses on childcare for younger children below primary school-age in settings dominated by wage employment. Studies in African contexts (Bjorvatn et al. 2021; Clark et al. 2019; Delecourt and Fitzpatrick 2019; Heath 2017; Lokshin, Glinskaya, and Garcia 2000; Martinez, Naudeau, and Pereira 2012; Quisumbing, Hallman, and Ruel 2007) generally find that childcare plays a role in labor decisions and outcomes, but the results are mixed, causal identification is limited, and only one paper reports on effects in rural areas. This paper estimates causal impacts of a change in household childcare needs using a natural experiment with a nationally-representative sample of rural and urban households in an African LMIC with many engaged in household farm and non-farm enterprise rather than wage work, and focusing on school-age children who may both demand and supply childcare in a household.

We also contribute to our understanding of the labor impacts of pandemics and pandemic-related policies. A growing number of studies analyzes the gendered effects of the COVID-19 pandemic on childcare and labor supply (Albanesi and Kim 2021; Alon et al. 2021; Amuedo-Dorantes et al. 2020; Collins et al. 2021; Del Boca et al. 2020; Farré et al. 2020; Furman, Kearney, and Powell 2021; Grantham et al. 2021; Heggeness 2020; Zamarro and Prados 2021). Though descriptive evidence from COVID-19 in India (Chauhan 2020; Deshpande 2020) and South Africa (Casale and Posel 2020) and from Ebola in Sierra Leone and Liberia (Wenham et al. 2020) suggests that women increase domestic work and reduce their labor during pandemics more than men in LMICs, causal estimates of impacts of changes to household childcare needs during a pandemic on parents' labor participation in a LMIC are currently lacking.

The impact of partial reopening on adult work hours corresponds to over 30% of the fall in average hours after the first COVID-19 cases in Kenya. A back-of-the-envelope calculation indicates that school closures decreased work hours across Kenya by 2.1 billion in 2020—at the average hourly income in the data a cost of USD 2.3 billion. More generally, we demonstrate that reducing household childcare burdens can broadly increase adults' labor participation.

2 Context and Data

This section summarizes Kenyan COVID-19 school closure policies, the data we use to analyze their impacts on labor, and information on childcare arrangements.

2.1 Kenyan COVID-19 School Closure Policies

Pandemic school closure policy in Kenya was decided nationally. Top-down changes in policies thus represent exogenous shocks to households, unrelated to local economic or health conditions. Figure 1 shows a timeline of school closures and reopenings, other key pandemic-related policy changes, and weekly confirmed COVID-19 cases in Kenya.[1]

Schools in Kenya closed on 16 March 2020, days after the first reported COVID-19 cases, as part of a broad set of national restrictions to reduce the risk of disease transmission. On 15 September the Ministry of Education released guidelines for safe reopening of schools, but the timing and nature of reopening remained uncertain until 6 October when the Ministry announced that students in grades 4, 8, and 12—those sitting national exams—should return to school on 12 October. This announcement was presented in the media as "a shocking move that caught parents and candidates off guard" (The Star 2020b). On 4 November the President announced that schools would reopen fully for all students on 4 January 2021.

We focus on the impacts of the partial school reopening for several reasons. Unlike initial school closures, the partial reopening did not coincide with other pandemic-related policies, allowing for cleaner identification.In addition, we can exploit discontinuities in the timing that children enrolled in different grades were eligible to return to school to isolate the effect of a childcare shock. Further, we can think of schools reopening as a potentially expensive positive childcare availability shock, as parents must pay some school costs (depending on grade and type of school) for their children to return. This would be the case for most candidate policies in the childcare space, increasing policy relevance.

[Figure 1]

2.2 Data

Data come from the Kenya COVID-19 Rapid Response Phone Survey (RRPS) panel, collected by the World Bank in collaboration with the Kenya National Bureau of Statistics and the University of California at Berkeley (Pape 2021).[2] The main sample ($\sim$ 80%) is drawn from the nationally-representative Kenya Integrated Household Budget Survey (KIHBS) conducted in 2015-2016, and this sample is supplemented by random digit dialing (RDD). The sample is intended to be representative of the population of Kenya using cell phones—80% of households nationally report owning a mobile phone (Pape et al. 2021). We use data from the first four survey rounds, covering May

1. An overview of specific pandemic-related policies is presented in Appendix C.
2. See section 6 for more detail.

2020-March 2021 (Figure 1). In addition, we construct measures for February 2020, before the first COVID-19 cases in Kenya, using recall questions from the first survey round.

The outcomes of interest are measures of labor participation. The extensive margin is measured by participation in the last 7 days in three activities: employed/wage labor, household non-farm enterprise, and household agriculture. The intensive margin is captured using hours of work by activity in the last 7 days; an individual not working in a given activity is coded as working 0 hours. The survey also includes data on total child hours spent working in household agriculture.

Information on what grades children were enrolled in prior to the initial closures allows to identify households affected by the partial reopening. We define 'treatment' households as those with children enrolled in grades 4 or 8 prior to the pandemic (eligible for the partial reopening)[3] while 'control' households have children in grades 3, 5, 6, 7, or 9.[4] We separate 'mixed' households with children in both grade groups from 'treatment' households as they might experience different effects when not all of their children in the relevant grade range return to school. The main analysis sample includes 327 treatment, 362 mixed, and 934 control households.

We do not have data from around the partial reopening on whether individual children returned to school, only whether *all* household children had returned.[5] News stories suggest schools and parents were unprepared for the sudden partial reopening, and that some parents struggled to pay school-related costs (Nation Africa 2020a, 2020b; The Star 2020a). Public primary and secondary education in Kenya is free for all children starting at age 6, though households pay for a variety of school-related costs, such as materials, meals, and examinations. School costs are not collected in the RRPS, but can run to thousands of Kenyan shillings per term, with higher costs for private schools and for boarders (Zuilkowski et al. 2018). Households can choose to pay these costs in installments or all at once; some parents may have been asked to pay outstanding bills from before the school closures once schools reopened in October. This highlights the potentially expensive nature of the partial school reopening childcare availability shock, and echoes evidence of a general challenge with childcare affordability in Kenya (Clark et al. 2021; Murungi 2013).

Finally, the data include questions on household childcare arrangements, including respondent childcare hours.

2.3 Childcare Arrangements

Primary school in Kenya begins at age 6, and pre-primary or nursery schools are also broadly available for children ages 4 and 5. At least 93% of children at each age from 6-16 in the RRPS are reported to have been enrolled in school in February 2020. After the March closures these children were all home requiring care and supervision during the working day, representing a large and unexpected shock to household childcare needs. Children primarily stayed at home with a parent

3. Few households report any children in grade 12; we test robustness of our results to including them.

4. Results are robust to including households with children in grade 2 as controls and to excluding households with children in grade 9 (in secondary school) or in grade 6 (to focus only on immediately adjacent grades).

5. The likelihood of all children being in school does not differ along key household characteristics, including wealth and the presence of young children, or by whether the child is in public or private school.

during the closures (Figure A1), including situations where parents were simultaneously working. Almost no households report their children spending time with childcare providers outside the home or with a maid/domestic helper at home, and this does not vary by rural/urban setting or change as pandemic restrictions were relaxed and case numbers fluctuated. Adults with schoolchildren at home will have faced trade-offs in their allocation of time across childcare, work in different sectors, and other activities given a limited time budget to accommodate increased childcare burdens.

Figure 2 Panel A presents how hours of childcare from different providers vary with the number of household children, using data from after schools fully reopened. Non-household members provide very little childcare on average—85% of households with children report 0 hours of care from non-household members in the last 7 days.

[Figure 2]

Respondents provide 30-35 hours a week of childcare. Figure 2 Panel B shows that while female respondents provide around 10-15 hours more than men, men still contribute around 25 hours on average. This contrasts with the image of fathers in African countries as primarily providing economic support and little childcare, but is consistent with recent evidence (Clark, Cotton, and Marteleto 2015; Kah 2012). The gender gap in childcare hours per week increased during school closures—women's hours increased by 14.1 on average compared to 9.5 for men—but the burden increased significantly for both. After schools fully reopened, respondent childcare hours returned to slightly below pre-pandemic levels.

Other adults besides the parents are present in just under 40% of households with children, and collectively provide around 10 hours per week of childcare. Siblings also play an important role in childcare (Jakiela et al. 2020). In households with at least 2 children 55% of children provided childcare to siblings in the last 7 days, for 15-20 hours on average. Sibling childcare hours may have been higher during school closures as school-age children were at home, but we only measure sibling childcare after the full reopening.

Figure 2 indicates that there are significant economies of scale in childcare hours in Kenya: respondent childcare hours increase very little after the first child, with total childcare hours likely determined by the child that requires the most care. Households with children below school-age might thus have been less affected by school closures as they could absorb additional childcare needs into their existing childcare time. Adults in these households might have even had a smaller childcare burden as school-age siblings provided more childcare while out of school. Conversely, parents with no young children would have needed to increase their childcare allocation by more to meet the increased need of schoolchildren out of school.

3 Empirical Approach

We identify the effect of a shock to the childcare burden from school closures through a difference-in-differences analysis comparing outcomes before and after the partial school reopening between

households with and without children eligible for the reopening. We estimate regressions of the form

$$y_{iht} = \alpha + \beta_1 \cdot Post_t \times Treat_h + \beta_2 \cdot Treat_h + \beta_3 \cdot Post_t + \mu_h + County_h \times \tau_t + X_{iht} + \epsilon_{iht} \quad (1)$$

y_{iht} are labor supply[6] for adult (age 18-64) i in household h at time t. $Post_t$ is an indicator for observations after the partial reopening on 12 October 2020. We include observations from May-November, omitting data from after schools fully reopened. $Treat_h$ indicates whether all household children in grades 3-9 were eligible to return to school (treatment), none were eligible (control), or some were eligible and others not (mixed). Household fixed effects μ_h absorb time invariant characteristics of households which may affect labor outcomes. County-by-month fixed effects control for common shocks affecting households across locations and over time. Finally, X_{iht} is a vector of possibly time-varying individual- and household-level controls.[7] We cluster standard errors at the household level.

We exploit quasi-random discontinuities in which households are affected by the partial reopening by restricting our control group to households with children in grades adjacent to those eligible to return to school. Identification is based on the argument that unobserved factors that could affect outcomes are continuous around the thresholds of children being in adjacent grades of school. Respondent and household characteristics and labor participation are similar for treatment and control households during the full school closures period (Table A1). Figure A2 provides support for parallel trends in labor participation while schools were closed, and non-significant coefficients for the period from September to 11 October indicate limited anticipation effects. Figure A3 shows that mean labor hours trended similarly for adults treatment and control households from February until the partial school reopening in October, and that differences after the partial reopening are eliminated after schools fully reopen in January—when all households become 'treated.'

Our analyses pool women and men as both contribute to childcare and increased childcare hours during school closures in our sample, though we also test for different impacts by sex, as well as by particular household characteristics.

4 Results

Table 1 presents results for the impacts of partial reopening on labor supply by activity at the individual level. Just 59% of adults age 18-64 among control households were working in the last 7 days during the school closures period. Mean work hours of 16.5 reflect this large share of adults not working. Work is concentrated in household agriculture, despite 46% of the sample being classified

6. We use the term labor 'supply' to refer to equilibrium outcomes, acknowledging that individuals may have been willing to supply additional labor but faced limited demand.

7. We include individual age, sex, and household headship status, the sex and age of the household head, the number of adults, young children (age 0-4), and school-age children (5-17) in the household, a normalized index of household wealth based on asset ownership, and household dummies for electricity connection, urban location, engagement in agriculture, and engagement in enterprise.

as 'urban'—urban locations include city peripheries, where agriculture remains common. Labor supply did not change in control households after schools partly reopened. This suggests that general labor conditions were not changing, consistent with no major simultaneous pandemic policy changes.

[Table 1]

We find no effects of treatment on the extensive margin of labor supply but a large impact on the intensive margin. Work hours in the last 7 days increase by 3.4 (21%) relative to adults in control households before schools reopened, driven by a 24% increase in household agriculture hours. Greater impacts on household agricultural hours than in wage work or in work participation are not surprising given that we estimate short-term impacts in the weeks following the partial reopening. Changing wage work participation is dependent on employers so may be more constrained in the short term. Non-significant impacts on household agriculture participation likely reflect that such participation was affected less by school closures and other pandemic restrictions. Households may have been more likely to pause their engagement in enterprise—more exposed to infections and pandemic restrictions as well as potentially more challenging to combine with childcare—and slower to resume these activities after the partial reopening.

'Mixed' households with children eligible to return to school as well as children in adjacent grades experience no labor supply impacts of the partial reopening. This is not surprising given what we observe about economies of scale in childcare hours in Kenya: one child returning while another of a similar age stays home is unlikely to decrease adult childcare hours in this context.

These results are intent to treat impacts based on the presence of a child eligible to return to school after the partial reopening. As some eligible children may not have returned, Table A2 presents treatment on the treated impacts of all household children returning to school, using whether the household has at least one eligible child as an instrument.[8] We observe positive impacts on adult working hours driven by household agriculture with much larger magnitudes than for the main intent to treat impacts. Larger estimated impacts in the IV regression are consistent with the shock of partial reopening being larger for households who eligible children actually returned to school. Our main intent to treat results should therefore be seen as conservative estimates of the labor impacts of actually reducing a household's childcare burden. This result emphasizes that not all households will be able to take advantage of an expensive childcare availability shock, so policies to also address affordability may have much larger impacts.

We conduct a variety of robustness tests (Table A3). Results are unchanged when using individual rather than household fixed effects, when focusing on sub-samples of adults more likely to be parent caregivers and engaged in work, and when defining *Post* not by the date schools reopened but by the date the potential reopening was announced. Impacts across treatment households are driven more by households with a child in grade 8 eligible to return than those with a child in grade 4 (Table A4). Though grade 4 children likely require more care than grade 8 children, they also likely

8. The first stage is significant with a Kleibergen-Paap Wald F statistic of 17.45.

contribute less to household agriculture and are more likely to have young siblings, mechanisms we explore in subsection 4.2. Impacts on work hours are smaller in magnitude and no longer significant if we expand our sample to include households with a child in grade 12 (also eligible to return to school) in the treatment group and households with a child in grades 10 or 11 in the control group (Table A4). The point estimate for the impact of the partial reopening among households with children in these grades is negative and highly imprecise—relatively few households have grade 12 children. This result is not surprising as grade 12 children are likely net providers of household childcare, so may increase rather than decrease childcare burdens when returning to school.

4.1 Heterogeneity

We test for heterogeneity in impacts by adult sex and different household characteristics by estimating Equation 1 and fully interacting a characteristic Z with all right-hand side variables other than the household fixed effects, focusing on total working hours (Table A5). Figure 3 displays estimated effects from regressions for sub-samples with particular characteristics.

Impacts of schools reopening on work hours are not significantly different for women (54% of the sample) relative to men. This contrasts with evidence from high-income countries during the pandemic (e.g., Collins et al. (2021) and Furman, Kearney, and Powell (2021)), which consistently report larger effects of the pandemic on mothers' labor supply relative to fathers' and other women's, pointing to school closures as the mechanism. But this result aligns with the data on childcare hours: responsibilities prior to the pandemic were less gendered than expected prior to the pandemic and both women's and men's hours increased by over one-third during school closures, though women's hours increased by more in absolute terms. It is reasonable then that both women and men should increase labor hours after the partial school reopening decreases household childcare needs. A childcare shock in this context thus affects both parents' labor participation. Different mechanisms may also underlie the similar increases for women and men, which we discuss further in subsection 4.2.

[Figure 3]

Results do not differ by whether households were engaged in agriculture the first time they were surveyed (64%), though the point estimate for the interaction of treatment with engagement in agriculture is positive as we would expect since effects on total hours are driven largely by household agriculture. The lack of significant difference may be due partly to some households that engaged in agriculture in the first months after the pandemic—perhaps as a way to earn income during the initial pandemic restrictions—no longer farming around the period of the partial school reopening. We also observe no differences in impacts between urban (46%) and rural households. This may be due to the relatively broad definition of 'urban' in the data, which includes many peri-urban areas. Over 35% of household classified as urban are engaged in agriculture.[9] The sample

9. We see the expected positive sign but the difference remains insignificant when restricting urban households to those in counties with the largest cities in Kenya, though even there 25% of 'urban' households engage in agriculture.

may also not be representative of all rural households with schoolchildren; sample households must have a mobile phone and are on average better off than the population (Pape et al. 2021). This may further blur the urban/rural distinction in these data. Beyond this, we observe low take-up of formal childcare services and low wage employment in the data, which would have been key reasons to expect heterogeneity in impacts by urban status.

Impacts of partial reopening on labor are driven almost entirely by less wealthy households, measuring wealth based on an index of housing and asset ownership. Wealthier households may have had resources to better absorb increased childcare burdens during school closures and thus been less affected by the reopening. Increased works hours in less wealthy households may also partly be driven by a greater need for income to pay school costs for returning children.

We also consider differences by household composition. Treated households with only one child (13%) should experience a larger reduction in childcare after the reopening than households where some children remain at home. Households with young children aged 0-4 (41%) may face particularly increased childcare burdens relative to households without due to lost childcare when an older sibling returns to school. Adults in households with more than two adults (34%) may have experienced smaller individual childcare increases during the closures, particularly if the third adult is a grandparent or another non-working adult, meaning they would experience less childcare relief from a child returning to school. Though none of the differences are statistically significant, point estimates do suggest some heterogeneity which may relate to different childcare impacts of the partial reopening across households.

The partial reopening may have different effects depending on the type of work the individual is engaged in. Table A6 presents results for additional tests of heterogeneity in treatment impacts by individual work participation both prior to the pandemic and school closures and during the school closures period, by sector. None of the differences are statistically significant. The point estimates for the differential effect of having worked for wage prior to the pandemic is positive, consistent with these individuals experiencing greater disruption during school closures and thus relief with the partial reopening.[10] Wage work during school closures has a negative point estimate, suggesting individuals able to keep employment were those less susceptible to a childcare shock. These patterns do not hold for household agriculture or enterprise work, perhaps because individuals are better able to continue participating in these sectors after a childcare shock by varying their hours while wage employment is likely less flexible. But as none of the differences are statistically significant, we are hesitant to make any conclusions.

4.2 Mechanisms

We directly test for impacts of the partial school reopening on childcare using Equation 1 with respondent childcare hours as the dependent variable. Given the childcare economies of scale we observe and the role of siblings as childcare providers, we test for differences in childcare impacts by the presence of other children and of young children aged 0-4 in particular. Adults must allocate

10. Few adults in the sample were engaged in wage work before or during the pandemic.

their limited time across work in different activities, childcare, other domestic tasks, and leisure. The partial reopening may therefore affect their time allocation by changing household childcare needs. Table 2 column 1 shows that respondent childcare hours in the last 7 days do not change significantly for treatment households after the partial school reopening. This is not surprising as most households have multiple children and we observe significant economies of scale in household childcare hours by number of children. Removing one child, particularly an older one in grade 4 or 8, will thus not significantly reduce childcare hours in many households.

[Table 2]

Column 2 shows a large significant decrease in childcare hours in treatment households where the eligible child is the only child: no other children remained home during school days to require continued high levels of childcare. Surprisingly, adults in these households do not increase work hours by more despite their reduced childcare hours (Figure 3), though this is a small sample so it is difficult to make definitive conclusions.

Sibling care provision may explain the positive point estimates of treatment impacts in households with multiple children. Household children provide 15-20 hours of childcare per week to their siblings in the period after schools fully reopen (Figure 2) and likely provided more during school closures. Children in grades 4 and 8 may thus have been net providers of childcare when home from school, *increasing* the childcare burden when returning after the partial reopening. Column 3 of Table 2 supports this, showing that adults in treatment households with young children aged 0-4—who would require the most care and so potentially most benefit from an additional sibling caregiver–increase their childcare hours after the partial reopening, while hours decrease for those with no young children. Adults in treatment households with a grade 4 child and no young children reduce their childcare hours by more, while those that have young children increase their childcare hours by less (column 4), indicating that grade 4 children require more care and provide less to their siblings than children in grade 8. Labor effects of the partial school reopening by presence of young children are consistent with these childcare differences. The impact of treatment on work hours is much smaller in households with children age 0-4; positive impacts of the partial school reopening are driven by households without such young children (Figure 3). These results highlight the importance of sibling-provided childcare.

Limited reductions in childcare hours on average may help explain the lack of significant difference in impacts of the partial school reopening by sex. Since women are typically the primary caregivers and spend more time on childcare, a small reduction may not be sufficient for many to increase their labor supply. In this context, more of the benefit of reduced childcare needs could accrue to male supplementary caregivers in the household. Larger reductions in childcare needs could be expected to benefit women relatively more than men, though given men's pre-pandemic childcare hours they would benefit as well.

School reopenings may also affect adult labor through the loss of child labor, particularly as the timing coincides with the main harvest season for most households in Kenya. Nearly 40% of

agricultural households with children in grades 3 through 9 report that their children contribute to household agriculture. Children combined to work an average of 4.6 hours per week on household farms during the school closures period, around 9% of total household agriculture hours. Part of treatment adults' increase in agriculture hours after partial reopening may therefore be driven by the need to make up for reduced child labor on the farm when a child returns to school.

Estimated impacts of schools reopening on child agricultural labor are negative and significant for treatment households (Table 2 Column 5). For a two-parent household, the reduction in child labor represents around 33% of the increase in adult labor on the household farm. Substitution for lost child agricultural labor could thus explain part of the impacts on adult work hours we observe. This second mechanism could help explain similar impacts of the partial reopening for women and men. If we assume that men are less responsive to childcare shocks than women but more responsive to changes in household agricultural labor, these two mechanisms could lead to similar positive impacts of the reopening for both women and men.

Finally, school reopenings may also increase labor supply as parents seek income to pay school-associated costs. These costs would be higher for children in grade 12 than in grades 4 or 8. Estimated impacts of the partial reopening are smaller when including households with grade 12 children in the sample, and negative (but very imprecise) when focusing on just households with children in grades 10-12 (Table A4). Given differences in school costs, net childcare burden, and agricultural labor supply by treatment child grade, smaller increases in parent work hours for a grade 12 child returning to school relative to a younger child suggest childcare needs are the main mechanism, rather than school costs and child agricultural labor.

5 Discussion

Using recall data on respondents' labor in February 2020, we find that labor participation across all adults age 18-64 fell from 70% before the pandemic to 59% in May-July.Average working hours in the last 7 days also fell, from 24.1 hours in February to 16.9 hours in May-July.[11]

To the extent that labor effects of a child being home after schools close and of that child returning after schools reopen are symmetric, our estimates of the impacts of the partial school reopening help us to understand the contribution of school closures to pandemic labor participation decreases in Kenya. For respondents age 18-64 in our analysis sample households, average weekly hours fell from 31.0 in February to 18.9 in May-July. Adult work hours in the last 7 days increased by 3.4 after the partial reopening (Table 1), corresponding to 28% of the pandemic reduction in labor hours in this sample.

Increasing labor hours for adults in households with school-age children (66.4% of households) during the school closure period by the amount they increased due to the partial reopening reduces the drop in average work hours from February to May-July among all adults nationally from 7.2 hours to 5 hours. We therefore estimate that school closures account for (at least) 30% of the

11. Among those working, hours fell from 39.9 to 29.3.

pandemic decrease in work hours. Across Kenya's labor force of 23.7 million (ILO 2021), a reduction of 2.2 work hours per week over the period of the school closures adds up to over 2.1 billion hours, or 2.3 billion USD at the average hourly income observed in our sample—2.4% of Kenya's 2019 GDP. This is a simplified back-of-the-envelope calculation making many assumptions and focusing just on labor supply of adults in the household, but provides a likely conservative rough estimate of the magnitude of the labor impact of Kenya's school closures. A better understanding of the labor impacts of school closures may inform discussion of school closures as a policy response to a resurgent COVID-19 or a future pandemic.

Although the childcare shock we analyze takes place in the context of a global pandemic, the results on labor impacts will continue to have relevance as the pandemic is unfortunately unlikely to be completely overcome in many countries in the immediate future. For example, after fully reopening schools in January 2021, Kenya closed them again in late March after a spike in COVID-19 cases before reopening again in mid-May. Further, although some pandemic-related restrictions were still in effect at the time schools partly reopened in Kenya in October 2020, many had been relaxed, so our results may generalize to similar settings with some ongoing COVID-19 caseloads and basic government policies around public health and safety—likely to be the new normal moving forward.

6 Conclusion

We present some of the first nationally-representative results for the impacts of childcare on labor in an African or LMIC setting, using pandemic-related school closure policy changes as exogenous childcare shocks. Having a child eligible to return to school increases adult labor supply in the weeks after schools partially reopen across a broad spectrum of households. Increases are driven by less wealthy households who may have been less able to cope with the shock of schools closing, but impacts do not differ by household participation in agriculture or rural/urban status. Based on our results we estimate that school closures account for at least 30% of the decrease in average work hours observed during the first few months after the first COVID-19 cases in Kenya and cost the economy 2.3 billion USD.

Unlike results from pandemic school closures in high-income countries, impacts of the partial school reopening in Kenya are not concentrated primarily among women. Men in our sample also contribute a large amount of time to childcare, and may also be responding to changes in child agricultural labor. The childcare reductions from one child returning to school may not be large enough for women to benefit significantly, as most households still have other children at home requiring care and women are the primary caregivers while men provide supplemental care. Some studies of childcare availability or cost in Africa report significant impacts for men as well as women (Bjorvatn et al. 2021; Martinez, Naudeau, and Pereira 2012), but others focus exclusively on women (Clark et al. 2019; Lokshin, Glinskaya, and Garcia 2000; Quisumbing, Hallman, and Ruel 2007). Better data on how childcare burdens are allocated across all household members and other providers

would help to shed light on the intra-household distributional impacts of childcare shocks.

Our study generates three main policy-relevant takeaways. First, parents in Kenya appear to have limited feasible options for dealing with an increase in their childcare burden beyond reducing their work hours or combining work and childcare. This is true despite many households having additional adults, many parents being engaged in potentially more flexible household farm and non-farm enterprises, and adults working just 24 hours a week on average (less than 'full-time') before the pandemic.

Second, cost of childcare may be a greater barrier than availability in this context. Several studies point to high costs as a main constraint to Kenyan parents in using formal childcare centres, and advocate for public subsidies to facilitate access (Clark et al. 2021; Murungi 2013). Low rates of return to school for eligible children after the sudden partial reopening suggest costs remain a constraint even following an increase in childcare availability. Larger impacts on labor supply among households whose children did return to school highlight the potential benefits when households can take advantage of increased childcare availability. Policies aiming to increase availability of childcare will therefore be less effective if they are not complemented by policies to reduce cost.

Third, changes in the Kenyan academic calendar over the next two years may affect agricultural production and child schooling. Increases in treatment adults' household agriculture hours after the partial school reopening are due in part to a substitution of adult hours for lost child labor hours.In each of the next two years, the timing of school terms and breaks in Kenya will shift relative to the agricultural cycle as the country works to move back toward the pre-pandemic academic calendar. These changes may affect children's attendance in agricultural households, demand for hired farm labor, and other household production decisions.

The results have relevance to other policies affecting household childcare burdens. If we expect that childcare needs are decreasing in child age, we would expect the impacts we observe to be lower bounds on the impact of a policy that gives households access to full-day childcare for young children during the working week (as schools implicitly provide for older children). Given the increase in childcare hours we observe in households with children age 0-4 when an older child returns to school, policies increasing access to childcare for young children—such as subsidies for childcare centres—could have positive impacts on adult labor supply and productivity.

Finally, the large magnitude of the labor effects of the partial school reopening highlights another point that is often underappreciated: universal primary school (now close to reality across the globe), pre-school, and other forms of childcare may play a substantial role in increasing adult labor supply and promoting economic growth, and are a key component of development.

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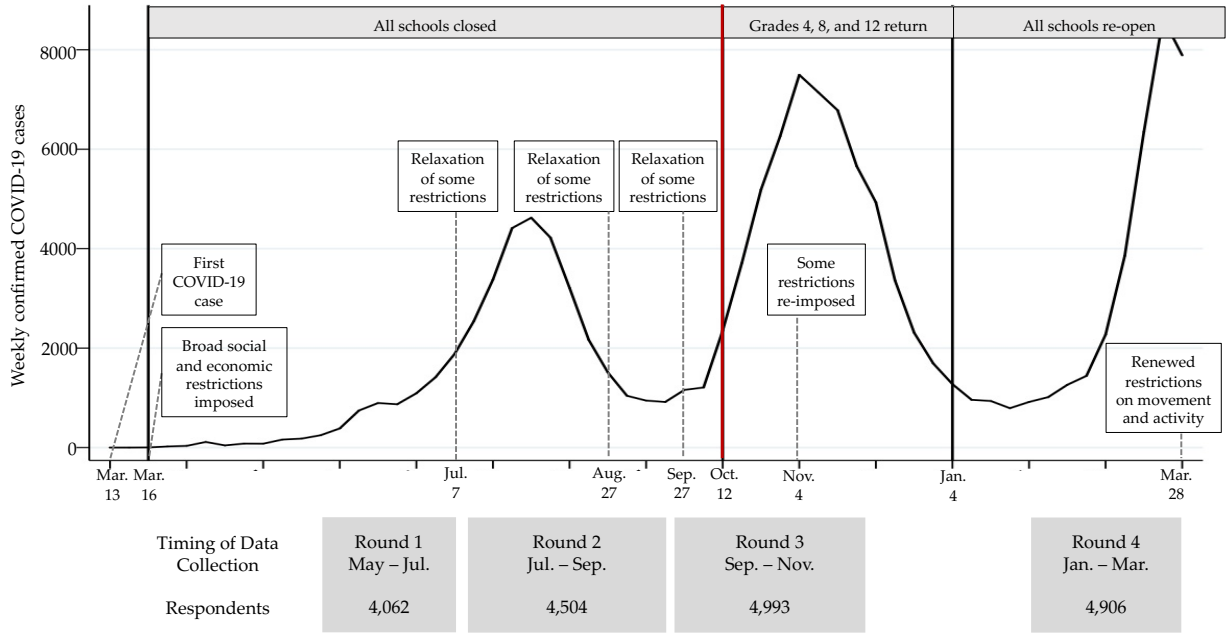
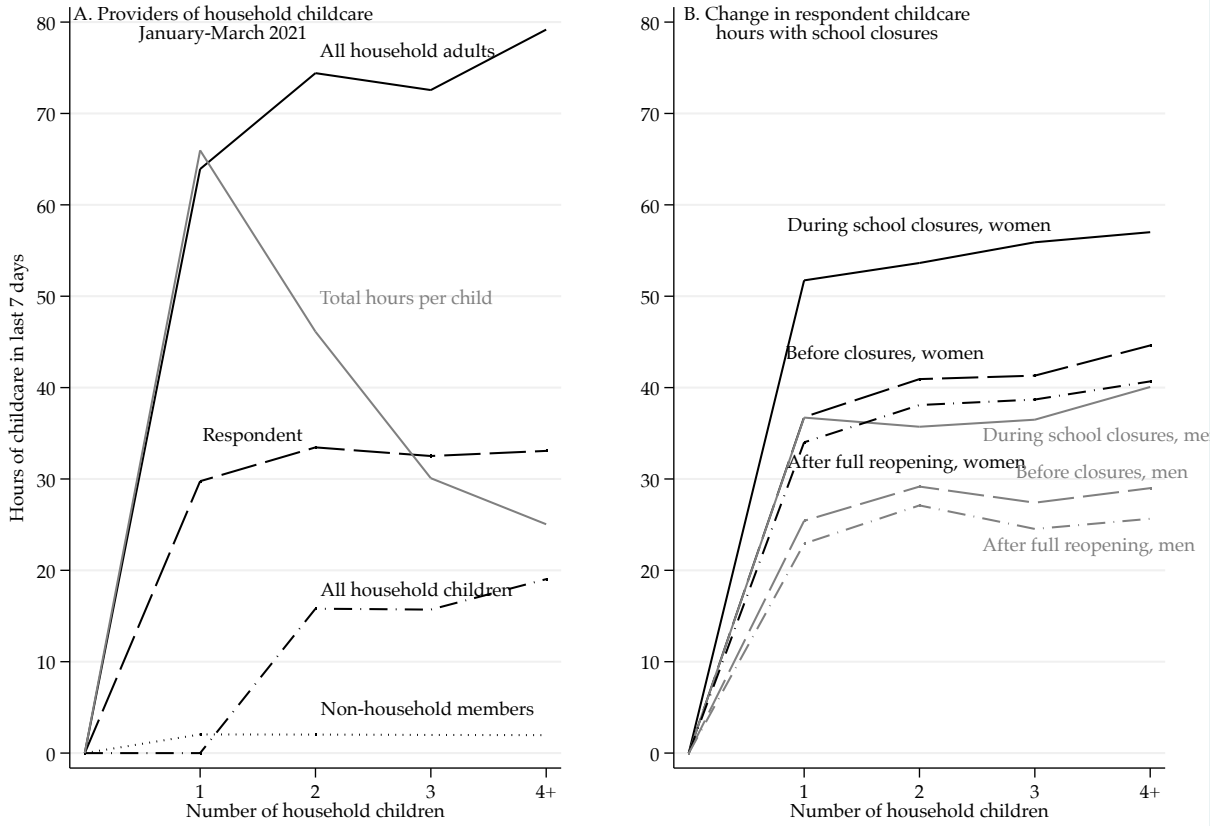
Figures

Figure 1: Kenya COVID-19 cases, pandemic policy, and data collection timeline



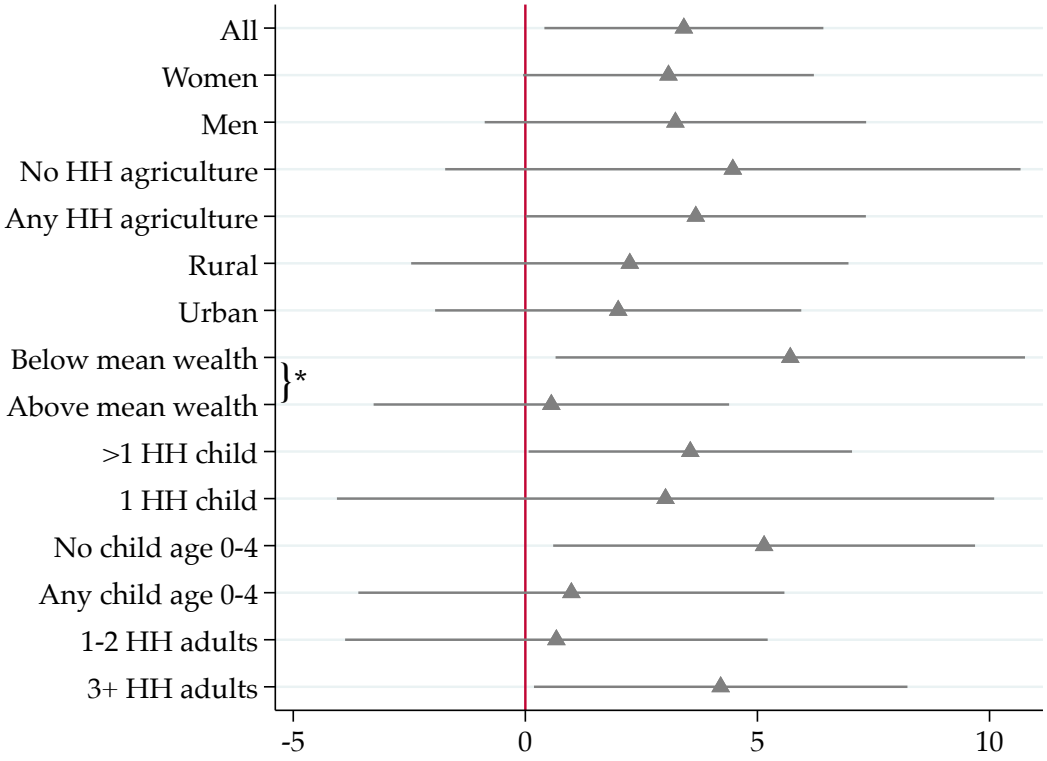
The figure shows the evolution of weekly confirmed COVID-19 cases in Kenya over time, along with the timing of key pandemic policy changes. The red bar indicates the partial school reopening on 12 October, the focus of the analysis. 'Relaxation of some restrictions' indicates that one or more of the initial pandemic constraints were at least partially reduced. Specific policy changes are outlined in Appendix C.
Sources: COVID-19 government response timeline for Kenya; Kenya COVID Tracker; Presidency of Kenya; Kenya Ministry of Education Twitter feed; COVID-19 Data Repository by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University

Figure 2: Count of children and childcare hours in the last 7 days, by provider of care and school closure status



The figures show mean childcare hours in the last 7 days by number of household children (ages 0-17).
Panel A presents data from survey round 4 (January-March 2021) which asked about childcare hours for each household adult, for all children in total, and for all non-household members in total. Previous rounds only ask about childcare hours for the respondent. The hours for 'all household adults' include the respondent's hours. Total hours per child is the sum of all childcare hours divided by the number of children.
Panel B presents data for female and male *respondent* childcare hours before school closures (dashed lines, recall data from survey round 4 about January-early March 2020), during school closures (solid lines, survey rounds 1-3 covering May-November 2020), and after schools fully reopened (dash-dot lines, survey round 4 covering January-March 2021). Data on childcare hours before and during the school closures period for other care providers are not available.

Figure 3: Heterogeneity in impacts on total work hours



The figure summarizes the point estimates and 95% confidence intervals for the effect of $Post * Treat$ from Equation 1 estimated for sub-samples with specified characteristics. Brackets indicate significant differences between pairs of characteristics. Household characteristics are from the first time they are observed. Wealth is measured by an index based on housing and asset ownership. Total work hours are measured over the 7 days prior to the interview, with individuals not working coded as having worked 0 hours. Data include observations from May-November 2020 for households with children in grade 3-9. Treatment households have a child in grade 4 or 8, eligible to return after the partial school reopening in October. All regressions include household and county by month fixed effects and individual and household controls. SEs clustered at household level.

Tables

Table 1: Impacts of partial school reopening on adult labor supply

	N	Control Mean (SD)	Post (SE)	Post x Treat (SE)	Post x Mixed (SE)
Engaged in any work in last 7 days	8717	0.588	0.014	0.037	0.024
		(0.492)	(0.042)	(0.036)	(0.034)
Engaged in wage employment in last 7 days	8717	0.062	0.004	0.005	-0.015
		(0.241)	(0.019)	(0.012)	(0.012)
Engaged in HH agriculture in last 7 days	8717	0.511	0.030	0.036	0.012
		(0.500)	(0.038)	(0.037)	(0.032)
Engaged in HH non-ag enterprise in last 7 days	8717	0.073	-0.006	0.009	0.019
		(0.260)	(0.019)	(0.017)	(0.015)
Total work hours, last 7 days	8717	16.504	0.613	3.415**	-0.871
		(20.139)	(2.045)	(1.532)	(1.507)
Wage hours, last 7 days	8717	2.077	0.369	-0.098	-0.694
		(9.934)	(0.782)	(0.562)	(0.590)
Ag hours, last 7 days	8717	11.921	0.743	2.891**	-0.406
		(15.465)	(1.549)	(1.266)	(1.249)
Enterprise hours, last 7 days	8717	2.562	-0.305	0.623	0.052
		(10.669)	(0.735)	(0.652)	(0.655)

This table presents estimates of Equation 1 for individual labor supply. Individuals not working in a given sector are coded as working 0 hours. From left to right, the columns show the dependent variable, number of observations, the control mean prior to the partial reopening, and the impacts of being in the partial reopening period for control households (Post), treatment households (Post x Treat), and mixed households (Post x Mixed). Control households have a child in grades 3, 5, 6, 7, or 9, treatment households have a child in grades 4 or 8, and mixed households have both. 'Post' is a dummy for being observed on or after the partial school reopening on October 12. Regressions include household and county by month fixed effects and controls for individual and household characteristics. Standard errors are clustered at the household level. Data include observations for adults age 18-64 from May to November 2020. Significant treatment impacts on total and agricultural work hours are robust to multiple testing adjustment using FDR q-values.

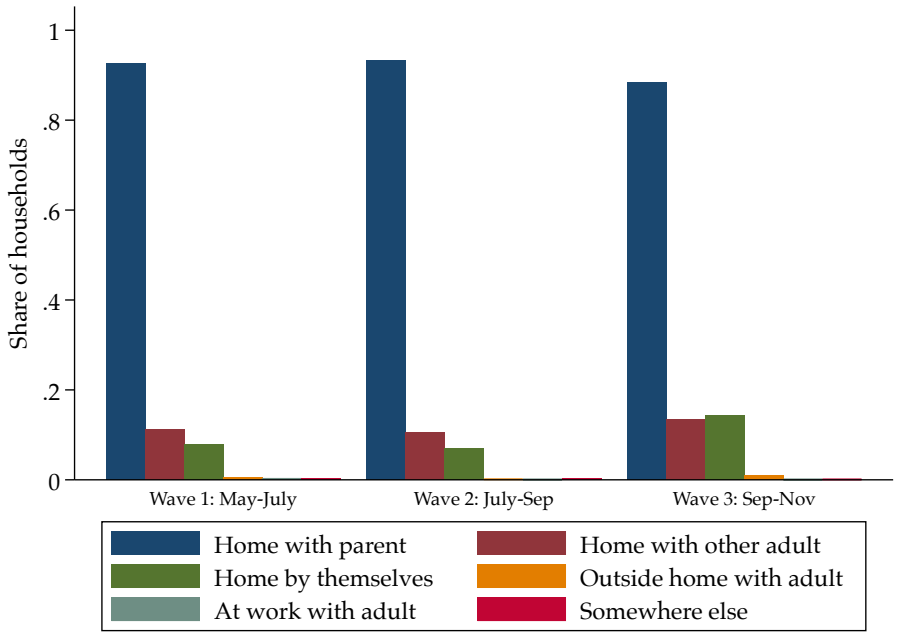
Table 2: Impacts of partial school reopening on respondent childcare hours and child agricultural labor

	Respondent Childcare Hours				Child Ag. Hours
	(1)	(2)	(3)	(4)	(5)
Post × Treat	1.308	3.065	-5.952	-9.231	-1.914**
	(5.231)	(6.242)	(6.877)	(7.806)	(0.963)
Post × Treat × Only 1 HH child		-23.159*			
		(12.101)			
Post × Treat × Any child age 0-4			14.668	12.102	
			(11.561)	(11.924)	
Observations	2969	2969	2969	1741	2942
Mean, pre-reopen control	52.515	52.515	52.515	52.608	3.967
Treated Grades	Both grades	Both grades	Both grades	Grade 4	Both grades

This table presents estimates of Equation 1 for respondent childcare hours (columns 1-4) and total household child agriculture hours (columns 5). Dependent variables are defined over the last 7 days. Childcare hours are not measured for household adults besides the respondent in these survey rounds. Households not engaged in agriculture are coded as having 0 child hours. Treated households have a child in grades 4 or 8 and control households have a child in grades 3, 5, 6, 7, or 9. We do not show impacts for mixed households with children in both grade groups. 'Post' is a dummy for being observed on or after October 12. All regressions include household and county by month fixed effects, and additional household and individual controls. SEs clustered at household level. Data include observations from May to November 2020.

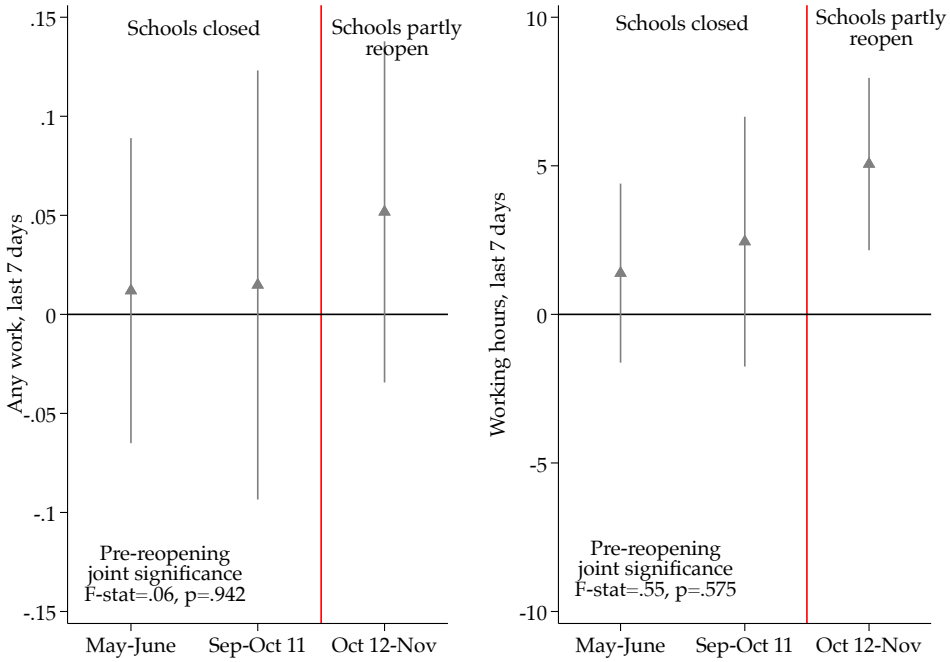
Appendix A: Additional Figures

Figure A1: Childcare arrangements when out of school



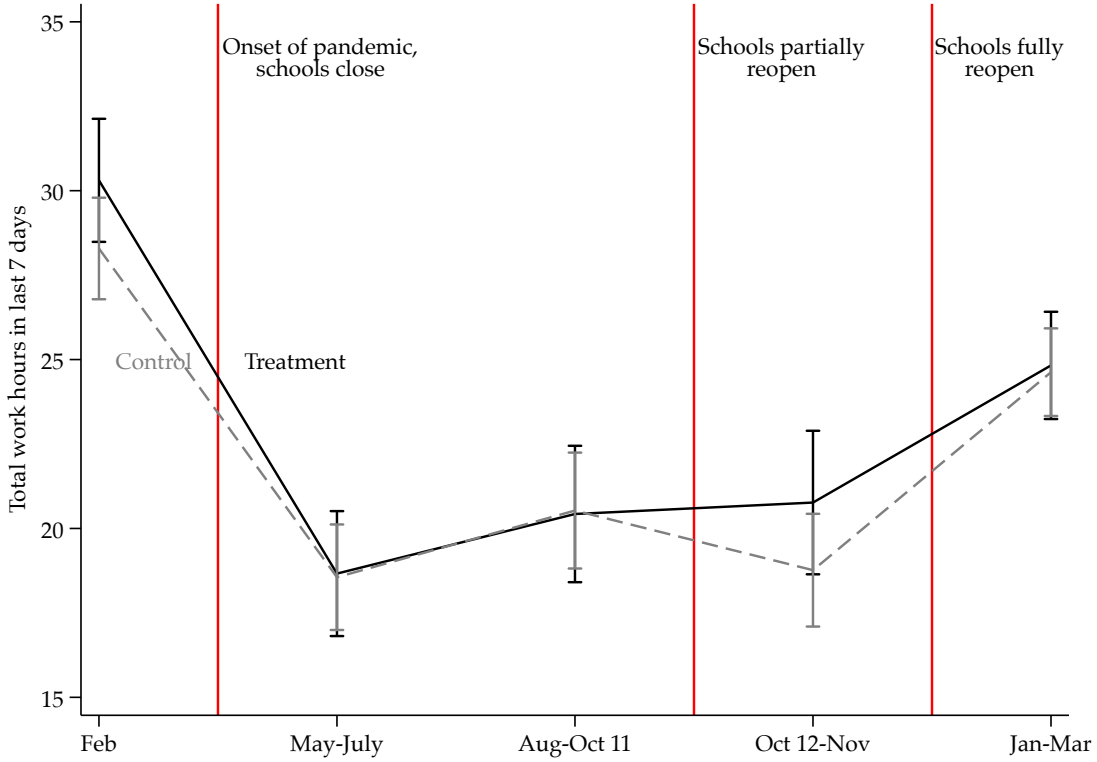
Respondents are asked to specify all of the situations where a randomly selected child spent at least some time when out of school in the past week. The respondent answers naturally and then all relevant responses are checked by the surveyor. 'Somewhere else' combines 'daycare/other childcare' and 'at home with a maid/domestic helper.'

Figure A2: Impact of treatment on labor participation in the last 7 days, by time period



The figures show estimated coefficients and 95% confidence intervals for the interaction between treatment and time period from Equation 1, where *Post* is replaced with time period dummies. Outcomes are any work participation and total work hours in the 7 days prior to the interview. Treatment households have a child enrolled in grades 4 or 8, and control households have a child enrolled in grades 3, 5, 6, 7, or 9. We do not show differences for households with children in both grade groups. The reference period is July-August, while schools were closed and before the partial reopening was announced. The red bars indicate the timing of Kenya's partial school reopening.

Figure A3: Work hours in the last 7 days by survey round and treatment status



The figure shows raw means and 95% confidence intervals for household respondents' total work hours in the last 7 days by treatment status in each time period. Outcomes are measured for the respondent only due to missing data on pre-pandemic working hours for other household adults. Treatment households have a child enrolled in grades 4 or 8, and control households have a child enrolled in grades 3, 5, 6, 7, or 9. We do not show means for households with children in both grade groups. Data for February are based on recall from the first time a respondent is surveyed. We combine observations from the first two weeks of survey round 3, before the partial school reopening, with data from round 2. The red bars indicate changes in Kenya's school closures policy.

Appendix B: Additional Tables

Table A1: Baseline balance: Treatment v. control households

	Control Mean	N	Treatment Mean	N	Difference	p-value
Respondent characteristics						
Age	40.12	934	41.36	327	-1.24	0.108
Female	0.58	934	0.57	327	0.01	0.669
Completed primary school	0.88	934	0.86	327	0.02	0.477
Completed secondary school	0.48	934	0.49	327	-0.01	0.739
Completed school beyond secondary	0.15	934	0.17	327	-0.02	0.415
Married	0.75	927	0.73	323	0.02	0.461
Is the household head	0.64	934	0.64	327	-0.00	0.950
Household characteristics						
Female household head	0.29	934	0.30	327	-0.01	0.746
Age of household head	44.49	934	46.11	327	-1.62	0.036
Count adults	2.54	934	2.61	327	-0.07	0.352
More than 2 household adults	0.40	934	0.40	327	-0.00	0.937
Only 1 household child	0.15	934	0.17	327	-0.02	0.442
Any young (0-4) children	0.42	934	0.37	327	0.05	0.098
Count young (0-4) children	0.56	934	0.48	327	0.08	0.101
Count school (5-17) children	2.47	934	2.31	327	0.15	0.059
Count adolescent (10-17) children	1.57	934	1.50	327	0.07	0.187
Household wealth index	-0.06	934	0.03	327	-0.09	0.137
Connected to electricity grid	0.45	934	0.51	327	-0.05	0.095
Urban household, dashboard definition	0.46	934	0.47	327	-0.01	0.647
Household engaged in agriculture	0.64	934	0.63	327	0.01	0.771
Household engaged in enterprise	0.15	934	0.19	327	-0.04	0.118
Respondent labor participation						
Engaged in any work in last 7 days	0.70	934	0.71	327	-0.01	0.670
Engaged in wage employment in last 7 days	0.10	934	0.13	327	-0.03	0.204
Engaged in HH agriculture in last 7 days	0.57	934	0.54	327	0.03	0.374
Engaged in HH non-ag enterprise in last 7 days	0.09	934	0.13	327	-0.03	0.119
Engaged in any work in February 2020	0.76	934	0.75	327	0.00	0.866

Treatment households have a child in grade 4 or 8 while control households have a child in grade 3, 5, 6, 7, or 9. 'Mixed' households with a child in both grade groups are omitted from this comparison. Data are from the first time a given household is observed in the RRPS data, typically in the May-early July survey round while schools were fully closed. Individual-level data are for the survey respondent. The joint F-stat for differences across the groups is 0.98, with p-value 0.489.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A2: IV Results: Partial reopening return eligibility as instrument for any child returned

	(1) Any work	(2) Wage work	(3) HH ag.	(4) HH ent.	(5) Total hrs	(6) Wage hrs	(7) HH ag hrs	(8) HH ent hrs
Post × Treat	0.144	0.040	0.158	0.016	16.044**	0.610	13.260**	2.479
	(0.148)	(0.051)	(0.157)	(0.072)	(6.804)	(2.285)	(5.487)	(2.765)
Observations	8700	8700	8700	8700	8700	8700	8700	8700
Mean, pre-reopen control	0.588	0.059	0.514	0.070	16.475	2.025	12.032	2.521

This table presents estimates of Equation 1 but using whether the household had at least 1 child eligible to return (based on their grade) as an instrument for whether any household children returned to school after the partial reopening. The p-value for the Kleibergen-Paap underidentification test LM statistic is < 0.001, and the Kleibergen-Paap weak identification test Wald F statistic is 20.49.
Observations include data from May to November 2020, and include treatment households with children in grades 4 or 8 and control households with children in an adjacent grade. Mixed households are treated as controls in this analysis. Dependent variables are defined over the last 7 days, and take a value of 0 for individuals not working in a particular activity. Regressions include household and county by month fixed effects, and additional household and individual controls. SEs clustered at household level.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A3: Robustness of results

Panel A: Individual fixed effects

	(1) Any work	(2) Wage work	(3) HH ag.	(4) HH ent.	(5) Total hrs	(6) Wage hrs	(7) HH ag hrs	(8) HH ent hrs
Post × Treat	0.035	0.004	0.034	0.010	3.429**	-0.108	2.879**	0.671
	(0.036)	(0.012)	(0.038)	(0.017)	(1.540)	(0.567)	(1.271)	(0.651)
Observations	7953	7953	7953	7953	7953	7953	7953	7953
Mean, pre-reopen control	0.596	0.061	0.520	0.065	16.467	2.137	12.119	2.322

Panel B: Adults age 25-50

	(1) Any work	(2) Wage work	(3) HH ag.	(4) HH ent.	(5) Total hrs	(6) Wage hrs	(7) HH ag hrs	(8) HH ent hrs
Post × Treat	0.012	-0.006	0.041	0.027	4.025**	-0.737	3.695***	1.200
	(0.036)	(0.018)	(0.035)	(0.018)	(1.633)	(0.771)	(1.261)	(0.789)
Observations	5451	5451	5451	5451	5451	5451	5451	5451
Mean, pre-reopen control	0.602	0.082	0.500	0.084	17.674	2.803	11.840	3.166

Panel C: Potential parents and sole caregivers

	(1) Any work	(2) Wage work	(3) HH ag.	(4) HH ent.	(5) Total hrs	(6) Wage hrs	(7) HH ag hrs	(8) HH ent hrs
Post × Treat	0.018	0.004	0.038	0.006	3.476**	-0.153	3.028**	0.600
	(0.035)	(0.016)	(0.035)	(0.016)	(1.589)	(0.702)	(1.267)	(0.704)
Observations	6191	6191	6191	6191	6191	6191	6191	6191
Mean, pre-reopen control	0.609	0.078	0.517	0.076	17.734	2.703	12.351	2.797

Panel D: Post defined by timing of reopening announcement, 21 Sept 2020

	(1) Any work	(2) Wage work	(3) HH ag.	(4) HH ent.	(5) Total hrs	(6) Wage hrs	(7) HH ag hrs	(8) HH ent hrs
Post × Treat	0.028	0.005	0.031	0.011	3.269**	0.054	2.586**	0.632
	(0.032)	(0.011)	(0.032)	(0.015)	(1.354)	(0.511)	(1.088)	(0.598)
Observations	8717	8717	8717	8717	8717	8717	8717	8717
Mean, pre-reopen control	0.604	0.062	0.530	0.065	16.784	2.139	12.455	2.306

This table presents estimates of variations of Equation 1. Panel A replaces individual with household fixed effects. Panel B focuses on adults age 25-50—the most likely to be parent caregivers and engaged in work. Panel C includes only adults identified as potential parents—between 14 and 55 years older than the oldest household child—or sole caregivers (the only household adult). Panel D defines *Post* not by the date schools reopened on 12 October 2020 but by the timing it was announced, 27 September.

Dependent variables are defined over the last 7 days, and take a value of 0 for individuals not working in a particular activity. Observations include data from May to November 2020, and include treatment households with children in grades 4 or 8 and control households with children in an adjacent grade. Results for 'mixed' households with both are not shown. All regressions include household (or individual in Panel A) and county by month fixed effects, and additional household and individual controls. SEs clustered at household level.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A4: Heterogeneity in impacts by grade of child eligible to return to school

Panel A: All analysis households

	(1) Any work	(2) Wage work	(3) HH ag.	(4) HH ent.	(5) Total hrs	(6) Wage hrs	(7) HH ag hrs	(8) HH ent hrs
Post × Treat	0.037	0.005	0.036	0.009	3.415**	-0.098	2.891**	0.623
	(0.036)	(0.012)	(0.037)	(0.017)	(1.532)	(0.562)	(1.266)	(0.652)
Observations	8717	8717	8717	8717	8717	8717	8717	8717
Mean, pre-reopen control	0.595	0.062	0.519	0.065	16.586	2.190	12.154	2.344

Panel B: Analysis households with a child in grades 2-6

	(1) Any work	(2) Wage work	(3) HH ag.	(4) HH ent.	(5) Total hrs	(6) Wage hrs	(7) HH ag hrs	(8) HH ent hrs
Post × Treat	0.024	0.001	0.008	0.031	2.041	0.067	1.596	0.315
	(0.043)	(0.018)	(0.044)	(0.020)	(1.834)	(0.839)	(1.458)	(0.885)
Observations	6883	6883	6883	6883	6883	6883	6883	6883
Mean, pre-reopen control	0.592	0.065	0.511	0.070	16.789	2.265	12.041	2.580

Panel C: Analysis households with a child in grades 6-10

	(1) Any work	(2) Wage work	(3) HH ag.	(4) HH ent.	(5) Total hrs	(6) Wage hrs	(7) HH ag hrs	(8) HH ent hrs
Post × Treat	-0.002	-0.002	0.034	-0.001	3.694*	-0.641	4.048**	0.397
	(0.048)	(0.016)	(0.049)	(0.022)	(2.097)	(0.713)	(1.780)	(0.762)
Observations	6408	6408	6408	6408	6408	6408	6408	6408
Mean, pre-reopen control	0.601	0.059	0.531	0.062	16.796	2.020	12.640	2.275

Panel D: Include grade 12 in treatment definition

	(1) Any work	(2) Wage work	(3) HH ag.	(4) HH ent.	(5) Total hrs	(6) Wage hrs	(7) HH ag hrs	(8) HH ent hrs
Post × Treat	0.018	0.005	0.025	0.006	2.291	0.094	1.787	0.384
	(0.038)	(0.013)	(0.039)	(0.018)	(1.676)	(0.573)	(1.416)	(0.681)
Observations	9597	9597	9597	9597	9597	9597	9597	9597
Mean, pre-reopen control	0.586	0.062	0.509	0.063	16.102	2.174	11.808	2.206

Panel E: Analysis households with a child in grades 10-12

	(1) Any work	(2) Wage work	(3) HH ag.	(4) HH ent.	(5) Total hrs	(6) Wage hrs	(7) HH ag hrs	(8) HH ent hrs
Post × Treat	-0.196*	-0.040	-0.159	0.019	-4.603	-0.008	-3.377	-1.249
	(0.115)	(0.052)	(0.127)	(0.051)	(5.518)	(2.016)	(4.985)	(1.653)
Observations	2600	2600	2600	2600	2600	2600	2600	2600
Mean, pre-reopen control	0.652	0.054	0.570	0.082	18.511	2.174	13.486	2.915

This table presents estimates of Equation 1 for different sub-samples. Panel A includes all households in the analysis sample (with children in grades 3-9) and is identical to the results in Table 1. Panel B focuses on the subset of analysis households with a child in grades 2-6, for which treatment means having a child in grade 4 eligible to return to school. Panel C focuses on the subset of analysis households with a child in grades 6-10, for which treatment means having a child in grade 8 eligible to return to school. Panel D expands the sample to include households with a child in grade 12 in the treatment group and households with a child in grades 10 or 11 in the control group. Panel E focuses on the households within this sample with a child in grades 10-12, for which treatment meaans having a child in grade 12 eligible to return to school. In panels B, C, and E, households with a child in another treated grade outside the focus range are categorized as 'mixed' (results not shown).
Dependent variables are defined over the last 7 days, and take a value of 0 for individuals not working in a particular activity. Observations include data from May to November 2020. Results for 'mixed' households with children eligible to return to school as well as other children in nearby grades are not shown. All regressions include household and county by month fixed effects, and additional household and individual controls. SEs clustered at household level.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A5: Heterogeneity in impacts on working hours by individual/household characteristics

Interaction term Z	(1) Sex	(2) Ag HH	(3) Urban	(4) Large Urban	(5) Above Mean Wealth	(6) Only 1 HH Child	(7) Any Kids Aged 0-4	(8) >2 HH Adults
Post	-0.710	-0.319	2.420	2.845	0.448	-0.283	0.391	-4.018
	(2.526)	(2.836)	(3.848)	(3.845)	(3.164)	(2.318)	(2.983)	(3.042)
Post × Treat	3.394*	3.315	2.462	2.220	6.149**	3.585**	5.103**	1.095
	(1.970)	(2.232)	(2.446)	(2.418)	(2.594)	(1.782)	(2.322)	(2.260)
Post × Z=1	2.550	1.807	-1.412	-0.362	1.367	2.880	-1.816	8.344**
	(1.833)	(4.131)	(4.618)	(5.795)	(4.291)	(6.753)	(4.055)	(4.161)
Post × Treat × Z=1	-0.496	1.927	-0.359	1.965	-6.210*	-0.026	-4.092	3.381
	(1.756)	(3.398)	(3.152)	(3.902)	(3.232)	(3.772)	(3.268)	(3.046)
Observations	8717	8717	8717	5300	8717	8717	8717	8717
Mean, pre-reopen control	16.578	16.578	16.578	16.578	16.578	16.578	16.578	16.578

This table presents estimates of Equation 1 but interacting a characteristic Z with all right-hand side variables except the household fixed effects. The column label indicates which characteristic Z is being used. Values for household characteristics are from the first time they are observed in the data. 'Large Urban' is a dummy for location in one of Kenya's largest urban areas (Nairobi, Mombasa, Nakuru, Kisumu, Kiambu) relative to any rural area, while 'Urban' is a dummy for location in any urban area. 'Above Mean Wealth' is a dummy for whether and index of household wealth, based on housing and asset ownership, is above the sample mean.
The dependent variable is total working hours over the last 7 days, with individuals not working coded as working 0 hours. Observations include data from May to November 2020, and include treatment households with children in grades 4 or 8 and control households with children in an adjacent grade. Results for 'mixed' households with both are not shown. Regressions include household and county by month fixed effects, and additional household and individual controls. SEs clustered at household level.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A6: Heterogeneity in impacts on working hours by prior work

Interaction term Z	(1) Baseline Any	(2) Baseline Wage	(3) Baseline HH Ag	(4) Baseline HH Ent	(5) Closures Any	(6) Closures Wage	(7) Closures HH Ag	(8) Closures HH Ent
Post	2.166	0.873	-3.769	-1.088	-0.620	0.009	1.196	-0.604
	(2.838)	(2.120)	(4.286)	(2.962)	(2.492)	(2.017)	(2.534)	(1.997)
Post × Treat	4.720*	2.921*	2.592	4.143*	1.088	3.070*	2.192	3.601**
	(2.520)	(1.610)	(3.230)	(2.246)	(2.007)	(1.576)	(1.923)	(1.589)
Post × Z=1	-0.942	-4.908	3.282	-7.213	1.723	15.473**	-0.502	10.397
	(3.253)	(6.068)	(5.600)	(7.886)	(3.476)	(6.142)	(3.490)	(7.377)
Post × Treat × Z=1	-2.425	3.968	1.724	-6.665	1.833	-2.427	1.023	3.041
	(2.848)	(5.156)	(4.219)	(7.005)	(2.651)	(5.736)	(2.808)	(5.751)
Observations	8673	8673	2961	2961	8297	8297	8297	8297
Mean, pre-reopen control	16.578	16.578	16.578	16.578	16.578	16.578	16.578	16.578

This table presents estimates of Equation 1 but interacting a characteristic Z with all right-hand side variables except the household fixed effects. The column label indicates which characteristic Z is being used. 'Baseline' work participation is based on recall for February 2020, and is limited to the respondent for household agriculture and enterprise. 'Closures' work participation is based on any participation in a given sector from May-October 2020.
The dependent variable is total working hours over the last 7 days, with individuals not working coded as working 0 hours. Observations include data from May to November 2020, and include treatment households with children in grades 4 or 8 and control households with children in an adjacent grade. Results for 'mixed' households with both are not shown. Regressions include household and county by month fixed effects, and additional household and individual controls. SEs clustered at household level.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Appendix C: Major Pandemic Policy Changes in Kenya

The following list summarizes when major nation-wide pandemic-related policies were implemented and relaxed over the course of 2020 after the first COVID-19 case in Kenya on March 13.

The dates for the announcements of new restrictive policies are in *italics* and the dates when policies were relaxed or ended are in **bold**. We also include announcements related to school closures, even though policies did not necessarily change with these announcements. Most policies were extended multiple times after first being imposed; we do not list the dates of policy extensions, except for school closures.

- *March 13-20*
  - Suspend all public gatherings, meetings, games, events
  - Ban on gatherings of more than 10 people
  - All schools closed
  - Recommend working from home where possible
  - Ban on foreigner entry; quarantine requirements for entry of nationals and visa holders
  - Public transport asked to reduce to 60% of capacity
- *March 24-27*
  - Ban on national and international flights
  - Closure of bars and restaurants for in-person service
  - Direct cash payments implemented for vulnerable citizens
  - Stay at home requirements imposed, except for 'essential' trips
  - Curfew imposed from 1700 to 0500 hours
  - Public transit closed between 'infected' and 'not infected' areas
- April 26: School closures extended to June 4
- **April 27**: Partial reopening of restaurants for take-out service
- June 6: School closures extended until further guidance from the Ministry of Health
- **June 7**: Nightly curfew revised to between 2100 and 0400 hours
- June 24: Announcement that school might reopen on September 1
- **July 7**
  - Phased reopening of religious gatherings
  - Up to 100 people permitted to attend weddings and funerals
  - Local air travel within Kenya to resume July 15
  - International air travel to resume August 1
- July 7: Announcement that schools will remain closed until January 2021, final exams are cancelled, and students would repeat the year; colleges and universities following strict guidelines might reopen in September
- ***July 27***
  - Restaurants reopened, must close by 1900 hours
  - Ban on sale of alcoholic drinks and beverages in eateries and restaurants
- **August 27**
  - Restaurants may remain open until 2000 hours
  - Ban on sale of secondhand clothing lifted
  - Licensed hotels may sell alcohol
- September 15: Ministry of Education releases guidelines for safe reopening of schools

- September 21: Ministry of Education calls all teachers to report back to schools by September 28
- **September 27**
  - Nightly curfew revised to between 2300 and 0400 hours
  - Bars may reopen; restaurants and eateries may sell alcohol; bars, restaurants, and eateries may remain open until 2200 hours
  - Religious gatherings may open for up to 1/3 of capacity
  - Up to 200 people may attend funerals and weddings
- October 6: Ministry of Education announces that students in examination grades (4, 8, and 12) shall return to classes on October 12
- **October 12**: Students in examination grades (4, 8, and 12) to return to classes
- *November 4*
  - Requests for government work to be done remotely when possible
  - Political gatherings suspended
  - Nightly curfew revised to between 2200 and 0400 hours
  - Bars, restaurants, and eateries must close by 2100 hours
- November 4: Announcement that schools to fully reopen in January 2021
- **January 4**: Schools fully reopen

Other policies were implemented that specifically affected certain parts of the country. For example, on April 6 the government instituted a 21 day movement ban/lockdown for Nairobi, Kilifi, Kwale, and Mombasa, and Mandera was added soon after. This lockdown was extended multiple times. These were the only counties affected. The lockdowns for Kilifi and Kwale ended on June 7 and those for Nairobi, Mombasa, and Mandera ended on July 8.

Sources: COVID-19 government response timeline for Kenya; Kenya COVID Tracker; Presidency of Kenya; Kenya Ministry of Education Twitter feed

Appendix D: Data

Data come from the Kenya COVID-19 Rapid Response Phone Surveys (RRPS), collected by the Kenya National Bureau of Statistics with support from the World Bank. Pape et al. (2021) describe the survey methodology and implementation in detail.

The main RRPS sample is drawn from the nationally representative Kenya Integrated Household Budget Survey (KIHBS) conducted in 2015-2016: 9,009 households that were interviewed and provided a phone number served as the primary sampling frame for the RRPS. All households in the sample were targeted in each round regardless of whether they were reached in a previous round. By the fourth round of the RRPS, 5,499 KIHBS households had been successfully surveyed at least once. The KIHBS sample is supplemented by random digit dialing (RDD). From a sampling frame of 5,000 randomly selected numbers, of which 4,075 were active, 1,554 households had completed at least one survey by round four.

The sample is intended to be representative of the population of Kenya using cell phones. In the 2019 Kenya Continuous Household Survey 80% of households nationally report owning a mobile phone, though certain counties—notably in the northeast—have much lower mobile phone penetration. Pape et al. (2021) report that KIHBS households that provided a phone number and those that were successfully surveyed in the RRPS have better socioeconomic conditions—measured by housing materials and asset ownership—than households that did not provide a phone number or that did but were not reached for the RRPS.

The RRPS data include household survey weights adjusting for selection and differential response rates across counties and rural/urban strata, attempting to recover national representativeness. We do not apply these household weights for our individual-level regression analyses, but do apply them for population-level inference based on our results.

The surveys include information on household composition, labor outcomes for household adults, and child schooling and care, as well as more general household information and COVID-specific modules. We use data from the first four rounds of the RRPS, covering May 2020-March 2021 and also construct measures for February 2020, before the first COVID-19 cases in Kenya, using recall questions from the first time a household was surveyed. Each round lasted approximately 2.5 months and covered a representative cross-section of households each week within each wave.

Data on childcare arrangements for a randomly selected child include questions on which household member has primary responsibility for the child's care, which household member was with the child in the last 15 minutes, and where and in whose company the child stayed during the day when out of school (from a set of general categories).[12] The surveys also ask respondents for their hours spent on childcare in the last 7 days.[13] Childcare hours from other providers, including other household adults, all household children combined, and all non-household members combined are included in round 4 only.

12. Respondents are instructed to select all childcare arrangements used. Nevertheless, respondents might omit types of childcare that are used less frequently or that are seen as less socially acceptable (e.g., leaving a child at home by themselves).

13. The survey asks "In the last 7 days, how many hours did you spend doing childcare?" and does not distinguish between time actively spent caring for a child and time spent on other activities while responsible for a child. We topcode reported childcare hours at 140, or 20 hours a day. Over 15% of respondents in our analysis sample indicate spending at least this many hours on childcare.