SAFE SPACES FOR TEENAGE GIRLS IN A TIME OF CRISIS

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Abstract
Adolescent girls across low-income countries face disadvantages stemming from limited agency over their bodies and barriers to investing in their human capital. We study how these outcomes are shaped in times of aggregate crisis, in the context of the 2014–2016 Ebola epidemic in Sierra Leone. This is a setting in which adolescent girls have long faced disadvantage because of a high prevalence of sexual exploitation and violence towards them. Our study is based around an evaluation of a club-based intervention for young women implemented during the epidemic. We track 2,700 girls aged 12–18 from the eve of the epidemic in 2014 to just prior to when Sierra Leone was declared Ebola free in 2016. The club-based intervention provides a safe space where girls can spend time away from men, receive advice on reproductive health, vocational training, and/or microfinance. During the epidemic all schools were closed. We show that without the protection of time in school, in control villages teenage girls spent more time with men, pregnancy rates rose sharply, and their school enrolment dropped post-epidemic. The provision of a safe space breaks this causal chain: It enables girls in treated villages to allocate time away from men and reduce out-of-wedlock pregnancies. These effects are most pronounced in places where girls face the highest predicted pregnancy risks. In such locations, the intervention also increases school re-enrolment rates post-epidemic. To further pin down mechanisms, we exploit a second layer of randomization of input bundles offered by clubs. This reinforces the idea that the safe space component is critical to driving outcomes for teenage girls. Our analysis has implications for school closures during health crisis in contexts where young women face sexual violence, highlighting the protective and lasting role safe spaces can provide in such times. (JEL: J13, J24)

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1. Introduction

Gender inequalities in well-being are pronounced across the developing world. Some of the most important gender gaps stem from women having limited agency over their bodies and facing barriers to investing in their human capital (Field and Ambrus 2008; Duflo 2012; Jensen 2012). An established body of experimental evidence has evaluated interventions designed to empower girls and young women in terms of their reproductive health and skills. Nearly all of this work establishes impacts in periods of relative economic stability. What is far less known is how to protect girls and young women in times of aggregate economic crisis. This is a critical gap in knowledge both because low-income countries are more susceptible to aggregate shocks—say through commodity price fluctuations, conflict, climate change and viral epidemics—and because in times of crisis, previously hard-earned gains in women's empowerment are often quickly erased (Doepke, Tertilt, and Voena 2012; Duflo 2012; Jayachandran 2015).[1]

This paper brings together the study of these issues in the context of the 2014–2016 Ebola epidemic in Sierra Leone, described as the *"longest, largest, deadliest, and...most complex* [*Ebola outbreak*] *in history"* (UNDG 2015). The outbreak affected Sierra Leone, Guinea and Liberia, infecting 28,652 individuals, with 11,352 deaths (CDCP estimate, April 2016). Sierra Leone was the most affected country, hosting half of all cases, with severe consequences for the economy and public health infrastructure. Rapid contagion forced the government to implement now familiar social distancing

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1. Examples of studies evaluating interventions to improve the reproductive health and skills of girls and young women in low-income contexts include Baird, McIntosh, and Ozler (2011), Duflo, Dupas, and Kremer (2015), Ashraf et al. (2020), Bandiera et al. (2020), Dhar et al. (2022), Edmonds, Feigenberg, and Leight (2023), and Buchmann et al. (2023).

policies during the epidemic: village lock-downs and travel bans, and all primary and secondary schools were closed through the 2014–2015 academic year.

Sierra Leone is a setting in which young women have historically faced severe socioeconomic disadvantage. As Panel A of Online Appendix Figure A.1 shows, on the eve of the outbreak, Sierra Leone ranked near the global bottom of the UNDP Gender Inequality Index.[2] Relative to the Sub-Saharan Africa average, it has high rates of adolescent fertility (Panel B) and the highest rate of maternal mortality in any country for which data exists (Panel C). This is partly driven by the extremely low levels of public health care provision (Panel D): Pre-epidemic, there were 0.2 doctors and 3 nurses per 10,000 people (the corresponding figures for most OECD (Organisation for Economic Co-operation and Development) countries are 30+ doctors and 100+ nurses), in a country with an estimated 1.4 million women of child-bearing age and 1.1 million under-five children. According to the World Health Organization (WHO), teen pregnancy is one of the leading causes of death for mothers in Sierra Leone. It is also a setting where there is a high prevalence of sexual exploitation and violence towards young women. For example, the 2013 Demographic Health Survey (DHS) from Sierra Leone reported that 51 % of ever-married women aged 15–49 had experienced physical, sexual, or emotional violence committed by a husband or partner.

That girls aged 12–18 face a range of disadvantages in our setting is also starkly quantified in our baseline data: Pre-epidemic, around a third are in a relationship with 8% being married—the average age at marriage is just under 15 with husbands being almost twice as old. Despite their teenage years, 20% have children, 13% have children out-of-wedlock, and the average age at first pregnancy is 15. Half are sexually active, spending 3 hours/per week with sexual partners, and the minority using contraceptives. For those in relationships, around a third report having experienced some form of intimate partner violence. For girls both in and out of relationships, 7% of girls report experiencing unwanted sex in the year prior to baseline.

During the Ebola epidemic, the need to enforce social distancing measures through school closures could have especially acute consequences for teenage girls. Without the protection of time in school, they can become more exposed to sexual relationships with men and early pregnancy (Amnesty International 2015; Behrman, Peterman, and Palermo 2017; Evans et al. 2023). Furthermore, just before schools were due to reopen in April 2015, the Ministry of Education announced the continuation of a pre-Ebola policy that "visibly pregnant girls" would be unable to re-enrol. These factors combine to link short run school closures during the epidemic, pregnancy risk during the epidemic, and long run human capital accumulation for teenage girls, entrenching disadvantages.

It is in this context of vulnerability of young women and a fragile state dealing with aggregate health and economic crisis, that we evaluate an intervention targeted to girls and young women. The intervention is the Empowerment and Livelihood for

2. This index aggregates information on maternal mortality rates, adolescent fertility rates, education by gender, female held parliamentary seats, and gender inequality in labor market participation.

Adolescents (ELA) program, and is delivered by the Non-governmental organization, BRAC. It has two components: (1) the provision of a physical safe space—a venue for young women to safely gather and socialize away from men and (2) the delivery of life skills training, vocational training and microfinance from these safe spaces. Our randomized control trial and data collection exercise were planned well before the onset of the Ebola epidemic, intending to build on our earlier work showing positive effects of the ELA intervention in Uganda in economically stable times (Bandiera et al. 2020). The fact that our evaluation was underway at the time of the outbreak is coincidental: the intervention is not a response to the crisis.

The safe space component of the ELA intervention can have especially high lifetime returns for girls. Most directly, without the protection of time in school during the epidemic, ELA clubs offer girls a safe space where girls can meet and socialize, providing an alternative to spending time with men during the epidemic. This can reduce the likelihood of teen pregnancy, and as a result, girls are more likely to re-enrol in school post-epidemic. We study the causal chain of outcomes that form this link: time spent with male sexual partners, teen pregnancy, and re-enrollment back into school post-epidemic. The cohort of girls aged 12–18 at baseline are our primary focus because they are most affected by school closures and any subsequent loss of protection of time in school.

Our evaluation sample comprises 200 villages in four districts of Sierra Leone. We conducted a census of these villages in October 2013, to draw a random sample of girls aged 12–18 and thus eligible for ELA club membership. The intervention was randomly assigned to 150 villages with the other 50 held as controls. The experimental design includes three treatment arms: In T1, ELA clubs only provide life skills training; T2 is as T1 but clubs additionally provide vocational training; and T3 is as T2 but clubs additionally provide microfinance. Common to all treatment arms is that ELA clubs provide a safe space for girls and young women to meet in privacy from men.

Our baseline was conducted between February and May 2014. Fieldwork was completed a week prior to the first case of Ebola being reported in Sierra Leone. The baseline survey covered 3,350 girls aged 12–18, recording information on their pregnancies/risky behaviors, time use, schooling and labor market activities.

With fieldwork suspended during the crisis, we implemented phone surveys to gather information on club functioning in treated villages, and a leaders survey in all villages to record the localized health impacts of Ebola, and policy responses. Our monitoring data confirms there was an extensive roll out of the ELA program despite the crisis: 70% of clubs opened on time (by September 2014), although the provision of life skills is more patchy, and the roll out of vocational training only took off after travel quarantines were lifted in January 2015. There was also high demand to participate: 66% of girls in treated villages ever participated in an ELA club meeting or activity (versus 4% in control villages).

After fieldwork restrictions were lifted, our endline survey was fielded between February and May 2016, well after schools had reopened. We track 2, 779 teenage girls to endline, measuring post-epidemic outcomes related to pregnancies/risky behaviors, time use, schooling and labor market activities.

Our analysis exploits the timing of events and randomized roll out of ELA clubs to document: (1) changes in the economic lives of girls in control villages over the course of the epidemic and (2) whether the availability of ELA clubs mitigated these impacts in treated villages, focused on the key causal chain of teen pregnancy, time spent with men, and re-enrollment into school. We divide these two lines of inquiry into four batches of results.

First, we use our baseline and endline data to evidence how the epidemic impacted teen pregnancy and school enrolment for girls aged 12–18 at baseline in controls. We find the likelihood of pregnancy increased significantly during the epidemic relative to a counterfactual group with the same age composition 2 years prior to the Ebola outbreak.[3] In the 2 years pre-epidemic, 13% of young girls became pregnant. In the 2-year window of the crisis, 21% became pregnant. For this cohort, at endline (post-epidemic), when all schools had reopened, enrolment fell from 70% to 58%, with the largest falls in absolute enrolment rates being for those aged 15 at the onset of the epidemic. Pre-epidemic, 28% of girls listed pregnancy as the main cause of why they were no longer in school. Post-epidemic, 38% of girls listed pregnancy as the main reason for dropout. Finally, we establish a correlation between pregnancy and dropouts: Only 15% of girls who became pregnant during the epidemic enrolled in schools when they reopened. In contrast, for those who did not become pregnant enrolment rates remained over 70% in the post-Ebola period.[4]

Second, we establish the ITT impacts of ELA clubs at endline. We find the availability of ELA clubs for teenage girls in treated villages significantly reduces rates of out-of-wedlock pregnancy by 3.2 pp, or 23% of the baseline mean in controls. ELA clubs have pronounced impacts on girls' time use. Girls spend 3.13 hours/week attending ELA clubs and this comes from substituting away from other social activities. Most importantly, girls in villages with ELA clubs significantly reduce time spent with men by 0.54 hours/week, a 16% reduction over the baseline. However, on average across all treated villages, the presence of ELA clubs does not increase school enrolment at endline.

While these results measure the average impact of ELA clubs, a key intuition is that the impact of safe spaces will likely vary by the underlying pregnancy risk that girls face. In the Appendix, we develop a parsimonious model of girls' time allocation, where they choose between time in school, time at ELA clubs and time spent with men. The dynamic model endogenizes time allocations pre-epidemic, during the epidemic when schools are closed, and post-epidemic, and accounts for the fact that ELA clubs might offer returns beyond just a safe space. The framework makes precise how these time allocations vary with the underlying pregnancy risk that girls are exposed too,

3. For this exercise we use additional data collected from women aged 19–25 at baseline, from the same villages.

4. It is generally recognized that even if there was some degree of recovery in enrolment rates post-pandemic, they did not recover to their pre-pandemic levels. Following Malmendier and Willigrod (2023), we later replicate some of this descriptive evidence using the 2018 SLIHS, a nationally representative survey that records school enrolment from 2013/14 to 2017/8.

and how a temporary increase in pregnancy risk due to the loss of safe spaces during the epidemic can have persistent impacts on school enrolment post-epidemic. We operationalize the main idea underlying this framework to examine heterogeneous impacts of ELA clubs by pregnancy risk.

To create a holistic measure of pregnancy risk that girls face in the epidemic, we use an Elastic net procedure to select village-level characteristics that predict in controls, whether a girl became pregnant during the Ebola crisis. The set of potential covariates we consider is split into three categories: village infrastructure and economic activity, demographics, and Ebola incidence and relief efforts. This procedure selects a number of covariates as predictors of pregnancy risk. Most notably, this includes whether the Peripheral Health Units (PHUs) was ever closed, and whether its normal functioning was ever disrupted. This is insightful because in rural Sierra Leone, PHUs play a vital role in safeguarding adolescent girls from pregnancy risk because they provide adolescent-friendly spaces including dedicated areas for young women (Denney et al. 2016). This confirms the intuition that the availability of PHUs relates to pregnancy risk—either because they serve as safe spaces or provide contraceptives—but there are other relevant factors determining pregnancy risk.

We use this constructed pregnancy risk measure from controls to predict pregnancy risk for all girls (in treated and control villages), standardizing the pregnancy risk index in the sample as a whole (to have mean 0 and standard deviation 1). We then examine how the impacts of ELA clubs vary by the underlying pregnancy risk girls face during the Ebola epidemic.

We first establish that while the functioning of ELA clubs does not vary by the underlying pregnancy risk, participation to ELA clubs is significantly higher in villages where pregnancy risk is higher: 62% of eligible girls attend in low risk villages, rising to 72% participating in high risk villages ($p = .000$). We then document that ELA clubs reduce pregnancy rates in villages with higher predicted pregnancy risk. In villages with a pregnancy risk of 1.74σ above the mean, the presence of ELA clubs entirely offsets the likelihood of ever being pregnant. The protective effects of ELA clubs in higher risk villages are largely concentrated among out-of-wedlock teenage pregnancies. In villages with a pregnancy risk of 1.16σ above the mean, the presence of ELA clubs entirely offsets the increased out-of-wedlock pregnancy risk teenage girls face.

We then consider how ELA clubs impact girls' time allocation as their underlying pregnancy risk varies. In control villages, a one standard deviation increase in underlying pregnancy risk leads to girls spending 0.814 hours/week more time with men, and they spend 0.441 hours/week more time alone. Both effects are nearly entirely offset in higher risk treated villages when girls have access to the ELA safe space. Finally, To complete the causal chain, we examine how these time reallocations translate into activities at endline. In control villages, a one standard deviation increase in pregnancy risk leads to school enrolment falling by 9 pp post-epidemic. This fall is almost entirely offset in treated villages: In villages with a pregnancy risk of 1.22σ above the mean, the presence of ELA clubs lead to school enrolment rates being unchanged post-epidemic. Unlike in higher risk control villages that saw an increased transition from school to work for girls, in higher risk treated villages the protective effects of ELA clubs during the epidemic ensures girls enrol back into school post-epidemic, with no shift into work.

Our fourth batch of results digs deeper into mechanisms through which ELA clubs protect teenage girls, to try and isolate the impact of the safe space component. As life skills are part of the bundle in all treatment arms, we cannot experimentally separate out the value of safe spaces from life skills. To separate these components, we present two sets of results. First, we show that other outcomes related to the life skills curriculum are unaffected by the presence of ELA clubs. Second, we show that in higher risk villages, ELA clubs help girls maintain social ties—as a safe space might allow, rather than the life skills component of the intervention.

To establish whether the additional provision of vocational training and microfinance drives the documented effects of ELA clubs, we then exploit the second stage of randomization, where ELA clubs were assigned alternative input bundles for girls and young women. These additional activities could potentially increase the value of time at ELA clubs and thus further displace other activities, such as time spent with men. We find little evidence that outcomes for girls are differentially impacted across treatment arms. At endline, pregnancies, time spent at ELA clubs, time spent with men and in other socializing activities, school enrolment and transitions to work, do not significantly differ with the bundle of inputs provided at ELA clubs. Most notably, time spent at ELA clubs is the same across treatment arms suggesting the value of ELA clubs is not strongly related to the provision of vocational training or microfinance over and above life skills. Rather the safe space component is key to protecting girls in times of crisis in this context where teenage girls are vulnerable to sexual abuse even pre-epidemic.

Our findings suggest that during the epidemic crisis, the provision of a safe space–such as ELA clubs–when alternative safe spaces such as schools are closed—is sufficient to prevent kick-starting a causal chain for teenage girls of time spent with men, out-of-wedlock pregnancy, and school dropout. Our results echo the concerns of the international community (Amnesty International 2015), that teenage pregnancies represent one of the key channels through which the crisis permanently shifted young women's socioeconomic trajectories, entrenching disadvantages for women in this context.

Our analysis breaks new ground on the link between aggregate economic shocks and adolescent girl outcomes, identifying a simple but powerful intervention that can mitigate risks girls face in such times of crisis.

Prior to COVID-19, a nascent literature had begun to study behavioral responses of individuals, firms and governments during epidemics (Rasul 2020).[5] A key insight

5. This includes Adda (2016) on flu, Agüero and Beleche (2017) on H1N1, and Bennett, Chiang, and Malani (2015) on SARS; and Junior and Rasul (2020) and Rangel, Nobles, and Hamoudi (2020) on Zika. Work on the Ebola epidemic in West Africa has focused on measuring real time impacts of the crisis on households and firms (Thomas et al. 2015; Bowles et al. 2016; Glennerster, Suri, and Bhogale 2016; Casey, Glennerster, and Suri 2017), or exploiting quasi-experimental variation in the geographic

from research during the COVID-19 pandemic has been the severity and distributional consequences of learning losses for children from school closures (Agostinelli et al. 2022; Moscoviz and Evans 2022; Fuchs-Schündeln et al. 2020). Our work builds on this but highlights an even more basic concern in settings where gender inequalities are severe, that is relevant to much of the developing world: Losing protective time in school exposes girls to pregnancy risk, that has severe consequences for their ability to return to school and accumulate human capital. Unlike learning losses that at least have the potential to be remedied, shifts into pregnancy, child bearing and school dropout likely have more irreversible impacts on the lifetime welfare of teenage girls (Field and Ambrus 2008; Buchmann et al. 2023).[6]

Our analysis in the context of Sierra Leone during the Ebola epidemic crisis is relevant for future work because viruses remain a major threat to human health. Over the last century, more deaths have been caused by viruses than all armed conflict combined (Adda 2016). Given the long run incidence of highly infectious diseases is determined by urbanization driving closer contact between human and animal populations, and rising global temperatures, we can expect them to remain a global threat for the foreseeable future. A common policy response to viral outbreaks is to use school closures as part of social distancing measures. Absent protective time in school, our findings show the importance of providing alternative safe spaces during such times for teenage girls in contexts where they are most vulnerable to begin with. This insight has direct relevance for ongoing discussions of whether optimal policy responses to viral outbreaks should differ in low- and high-income countries given differing trade-offs and state capacities, as well as issues that many countries are grappling with in terms of how health crisis can have hugely differential impacts across generations.

Although the importance of safe spaces has been discussed outside of economics (Ager et al. 2013), to the best of our knowledge causal evidence on the impacts of safe spaces in times of crisis remains scarce. This is despite mounting evidence of increases in violence against women during COVID-19 due to lockdown measures (Boserup et al. 2020; Leslie and Wilson 2020; Ravindran and Shah 2023), and pre-existing evidence on how women and children are vulnerable to violence in times of aggregate economic crisis more generally (Behrman and Weitzman 2016; Fraser 2020). As we discuss in the final Section, this gives a new motivation for the provision of club-based activities beyond arguments related to them generating higher returns than individual-based activities through social interactions of members

incidence of Ebola to understand government responses (Fluckiger, Ludwig, and Onder 2019; Maffoli 2021).

6. To the best of our knowledge, Archibong and Annan (2020) is the only other study that documents how gender gaps open up in such times, in the context of the 1986 meningitis epidemic in Niger. They show a significant reduction in years of education for school-aged girls relative to boys following the epidemic, driven by households marrying off daughters in order to claim bride prices. Methodologically, the paper closest to ours is Christensen et al. (2021). They also overlay a pre-planned RCT in Sierra Leone with the epidemic shock. They document how interventions implemented pre-epidemic to improve accountability of health facilities, led to those facilities functioning better through the epidemic.

and providing a platform for intervention delivery at-scale (Diaz-Martin et al. 2022).

By evaluating the exact same ELA intervention in stable economic times (Bandiera et al. 2020) and in times of crisis, we add to discussions of the external validity of intervention evaluations when returns to interventions interact with aggregate shocks (Rosenzweig and Udry 2020). We show there are positive returns to the ELA intervention in good times and bad, but the mechanisms through which these returns are generated differ: In good times, the life skills and vocational training components both generate valuable returns to teenage girls and young women, while in times of crisis and without the protection of time in school, the basic safe space component of the intervention is critical to protecting girls.

Section 2 describes the Ebola epidemic and how its timing relates to our data collection. We then use our data from controls to document the rise in teen pregnancies over the epidemic. Section 3 describes the ELA intervention. Section 4 presents ITT estimates on how the availability of ELA clubs impacted teen pregnancy, time use and school enrolment. Section 5 examines how these impacts vary depending on the underlying pregnancy risk faced by girls. Section 6 uses the second layer of randomization of bundles of services within ELA clubs to pin down the mechanism through which ELA clubs have protective impacts on girls. Section 7 concludes by discussing avenues for future research. The Appendix develops a model of safe spaces and time use before, during and after the epidemic, providing a lens through which to interpret the results, and presents additional empirical robustness checks.

2. Context

2.1. The Ebola Epidemic

Ebola Virus Disease (Ebola) is an acute hemorrhagic fever that can be fatal if untreated. Ebola first appeared in simultaneous outbreaks in South Sudan and the Democratic Republic of Congo in 1976. The virus is transmitted from wild animals and human-to-human transmission takes place via direct contact with the blood, secretions, organs or other bodily fluids of infected people, or with surfaces contaminated with these fluids (such as bedding or clothing). Transmission can also occur in burial ceremonies involving contact with the deceased body.

Sierra Leone was the country most affected by the 2014–2016 epidemic, hosting about half of all cases. The virus is thought to have been brought into the country by an individual entering from Guinea around May 2014. By October 2014, it had spread to all 14 districts in Sierra Leone, with rapid contagion caused by high rates of geographic mobility and the use of traditional burial practices. Figure 1 charts the timeline of the epidemic from May 2014. The peak flow of cases occurred in December 2014, and it was only in July 2015 that the epidemic started to slow. Sierra Leone was declared

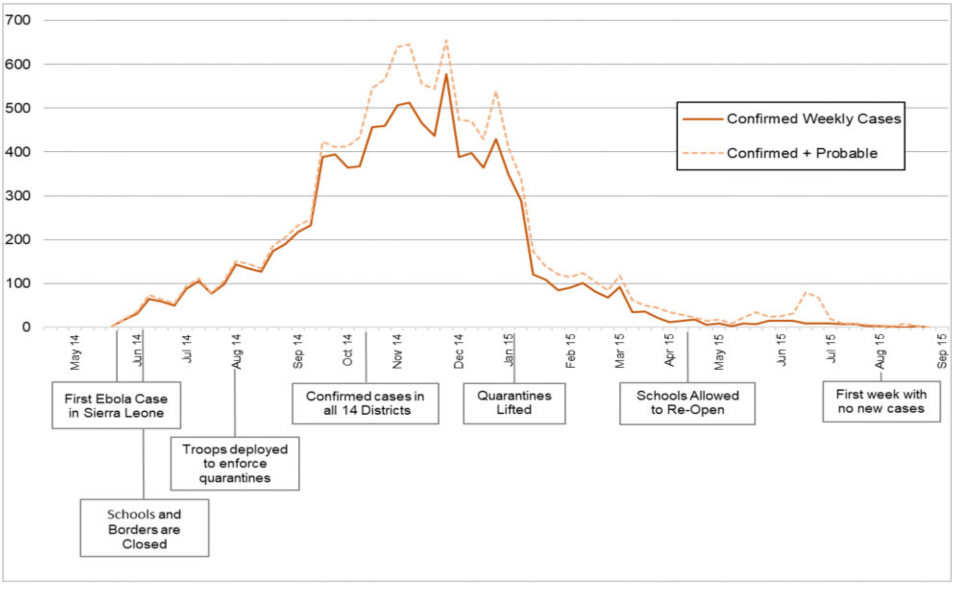

FIGURE 1. Timeline of the Ebola epidemic in Sierra Leone. Data retrieved from World Health Organization's Situation Reports (WHO 2016). Confirmed cases refer to lab tested patients, while probable cases refer to cases diagnosed by clinical staff and but not tested.

Ebola free in November 2016, 42 days after the last patient was discharged. The WHO estimates there were 14,124 cases in the country resulting in 3,956 deaths. Hence, the 28% fatality rate is lower than in some earlier outbreaks, but the scale and spread of the outbreak in Sierra Leone was unprecedented.[7]

The epidemic had severe consequences for health care provision. The crisis eroded the human capital of health workers, shifted public trust in using health facilities (Evans, Goldstein, and Popova 2015; Christensen et al. 2021) and forced the closure of some PHUs, the first point of contact with the health care system for many in rural areas. The economic consequences were equally severe. In a year, GDP growth plummeted from +8.9% to −2.0%: border closures shut down international trade, internal travel bans resulted in the breakdown of domestic trade, and all periodic markets closed. The self-employment sector, accounting for 91% of the labor force, shed around 170,000 jobs (with revenues for surviving enterprises falling 40%), and a further 9,000 jobs were lost in wage employment (Evans, Goldstein, and Popova 2015; Thomas et al. 2015; Casey, Glennerster, and Suri 2017).

7. For the 2014–2016 outbreak, the WHO estimates Liberia had 10,675 cases and 4,809 deaths (a 45% fatality rate), and Guinea had 3,811 cases with 2,543 deaths (a 67% fatality rate). Funereal practices are argued to have played a major role in the spread of Ebola in Sierra Leone [Malmendier and Willigrod (2023) and references therein].

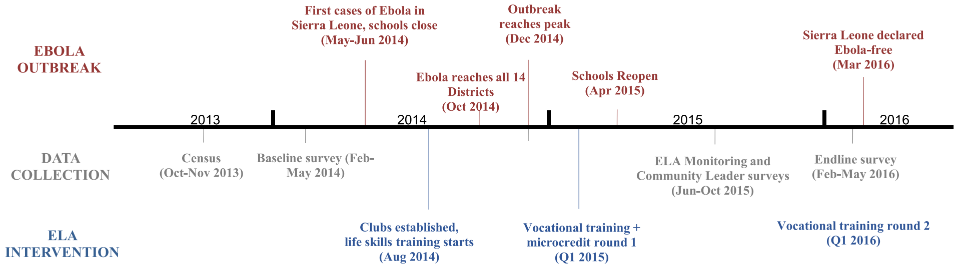

FIGURE 2. Study timeline.

2.2. *Policy Responses*

The Sierra Leoneon government used three policies to combat rapid contagion, all of which are now also familiar responses to COVID: (1) health workers were mobilized to record door-to-door cases and track contagion, and some health facilities were transformed into Ebola holding centers; (2) social distancing measures were used, including village lock-downs and travel bans; and (3) primary and secondary schools were closed through the 2014–2015 academic year. As shown on Figure 1, schools were closed in May 2014 and reopened in April 2015 as the epidemic began to slow (the school year runs from September to July).

School closures might have particularly acute impacts on girls. Without the protection of time in school, they can become more vulnerable to sexual abuse in the short run, thus limiting their longer term accumulation of human capital (Amnesty International 2015; Behrman, Peterman, and Palermo 2017; UNICEF 2021; Evans et al. 2023). These gender-specific consequences of school closures were compounded by the fact that just before schools were due to reopen in April 2015, the Ministry of Education, Science and Technology announced the continuation of a pre-Ebola policy, that 'visibly pregnant girls' would be unable to re-enrol—a policy that further increased the long run cost of school closures for teenage girls due to heightened pregnancy risk without the protection of time in school.[8]

2.3. *Data and Descriptives*

Figure 2 shows the timeline of data collection, and how this relates to the timing of the epidemic and rollout of ELA clubs. Our data comes from 200 villages across

8. In May 2015, it was announced that an alternative 'bridging' education system would be established to allow pregnant girls to continue schooling, but in different premises or times to their peers. Other temporary measures, such as community learning centres and home-based approaches, were also implemented. At best, this bridging system varied in effectiveness, and did nothing to help pregnant girls find an alternative way to take national exams. A body of evidence has developed over the COVID pandemic to better understand remedial actions that can be taken to reduce learning losses when schools close (Moscoviz and Evans 2022).

four districts: Port Loko, Kambia, Moyamba, and Pujehun, where 20% of the Sierra Leonean population resided pre-crisis. Villages in our sample are small and remote: On average, they comprise 90 households and are more than eight miles to the nearest market, or two miles to the nearest PHU.

We first conducted a census in the 200 sample villages in October 2013, covering 94,338 individuals in 17,233 households. This was used to draw a random sample of girls aged 12–25 and thus eligible for ELA club membership. For the bulk of our analysis, we focus on girls aged 12–18 because they are are most impacted by school closures. Our baseline was conducted between February and May 2014, ending just as the first cases of Ebola were being reported in Sierra Leone. The baseline survey covered 2, 783 girls aged 12–18, corresponding to 27% of all those eligible to participate in ELA clubs, and recorded information on their pregnancies/risky behaviors, time use, schooling and labor market activities.

Time use data plays an important role in our analysis because time spent at ELA clubs can displace other activities. To minimize measurement error in time use, we gave respondents a finite number of objects (beans) representing the hours in a day and asked them to allocate hours to different activities including work, school, household chores, and leisure. For leisure activities, we asked respondents to split this further into time spent alone, time engaged in sexual relations with men, with friends (outside of ELA clubs), and at ELA clubs. The baseline and endline surveys took place during the school year so respondents could feasibly have been attending school in the week of the survey.[9]

With the onset of the crisis and all fieldwork suspended, we implemented two phone surveys. The first was a monitoring survey to ELA club mentors in treatment villages conducted in June/July 2015, designed to provide information on club functioning. The second was a village leaders survey administered between June and October 2015, to provide information on attitudes towards girls and pregnancy, Ebola impacts on the village (the number of households quarantined, Ebola cases and deaths), and policy responses (such as the functioning of schools, health facilities, and other relief efforts).[10]

9. The question wording for the broader categories is *"Now I would like you to do a simple exercise. Here on these cards are some ways you can spend your time in a typical week. Here are 25 beans. Please divide these beans between the cards according to how much time you spend in each activity."* For time use related to socializing, the question wording is *"Here are the 25 beans again. Here on these cards are some ways you can spend your free (leisure) time. Please divide these beans between the cards according to how much time you spend in each activity." If there are any other activities not listed on these cards, you can write them on these blank cards."* The credibility of the time use data is underpinned by the fact that (1) the number of beans recorded across categories summed correctly up to the initial allocation for 90% (99%) of respondents at baseline (endline) and (2) 87% of respondents report sleeping 5–10 hours/night. We convert time use measures into hours per week.

10. The village leader survey collects data coded from focus group discussions. Prominent members of the socioeconomic and administrative life of the community attended these meetings, with the average focus group involving 11 participants (the minimum (maximum) was 5 (18)). 85% of these meetings were attended by a Chief (either a Paramount, Section, Regent, or Village Chief). Village elders, women's and youth leaders, imams, pastors, head teachers, nurses and ELA club mentors were also invited.

The village leaders survey reveals them to be extremely conservative, with stigma against teen pregnancy: The vast majority (over 95%) strongly agreed with the statement that “Girls who are visibly pregnant have a bad influence on their non-pregnant peers”; only 12% strongly agreed with the statement “Girls should be allowed to continue their education while pregnant.”

After fieldwork restrictions were lifted, the endline survey was fielded in person between February and May 2016 (so like the baseline, taking place during the school year). As Figure 1 shows, this is around 6 months after the inflow of new reported cases of Ebola declined to near 0, well after schools had reopened, but still before Sierra Leone was declared to be Ebola free (November 2016). The endline covered the same topics as the baseline, but with additional modules related to the crisis and experiences during it.

2.4. The Ebola Epidemic, Teen Pregnancies, and School Enrolment

We use our baseline and endline data to present evidence on how the epidemic impacted teen pregnancy and school enrolment among girls in control villages.

Panel A of Figure 3 shows how the likelihood of teen pregnancy changed during the epidemic by comparing girls aged 12–18 on the eve of the epidemic to a counterfactual group with the same age composition 2 years prior to the Ebola outbreak (using data from older women also collected from controls). The horizontal axis represents time in months, from either May 2014 (the start of the epidemic) or May 2012 (the start of the counterfactual 2-year pre-epidemic period). At time zero, each sample includes only girls aged 12–18 in the reference year that had never been pregnant. The vertical axis measures survival rates, showing the share of girls in each group that have not experienced their first pregnancy, by month. For the epidemic sample, the first vertical dashed line shows when schools started to reopen and the second shows when Sierra Leone was declared Ebola free. Relative to the pre-epidemic counterfactual, pregnancy rates increase substantially for these girls, with the survival rates immediately diverging and doing so evenly over the crisis: A log-rank test of equality of the survival functions rejects the null of their equality ($p = .001$). In the 2 years pre-epidemic, 13% of young girls became pregnant. In the 2-year window of the crisis, this rises by nearly half, with around 21% becoming pregnant.

Panel B then shows school enrolment rates by age: (1) at baseline in 2014 (pre-epidemic) and (2) at endline in 2016 (post-epidemic), when schools had reopened. Aggregate enrolment fell from 70% to 58%, with falls observed at all ages. Falls in enrolment are non-monotonic in age, being largest in absolute terms for those aged 15 at the onset of the epidemic. In relative terms, falls in enrolment are generally increasing in age.

Panel C shows reasons given for dropout from school. We compare reasons given by girls aged 12–18 that had already dropped out at baseline pre-epidemic, to those in the same age group that dropped out between baseline and endline, i.e., those that did not re-enrol after schools reopened. Pre-epidemic, financial costs topped the reasons for dropout, with 52% of girls listing it as the main cause. Pregnancy was mentioned

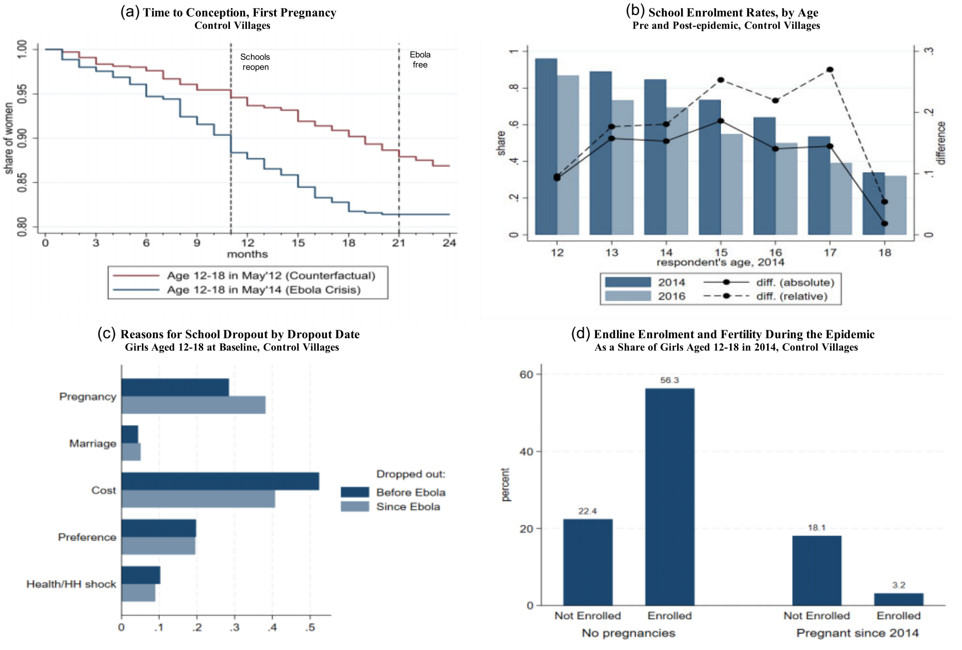

FIGURE 3. Schooling and pregnancy over the epidemic, controls. Every panel uses only data from control villages. Panel A depicts Kaplan–Meyer survival functions for respondents aged 12–18 at the beginning of the stated periods (May '12 or May '14) who did not experience any pregnancy before. The counterfactual sample is constructed using also data from older women in the same village, collected using the same survey instrument and sampling strategy. Respondents' pregnancy histories are used to generate a pseudo-panel with monthly observations where, in keeping with the terminology of survival analysis, each individual's failure variable switches to 1 when the respondent becomes pregnant for the first time. Panels B reports averages for the sample of young women aged 12–18 years old at baseline and tracked between baseline (2014) and endline (2016). Panel C reports the share of school dropouts in our sample who mentions each of the listed reasons as motivating their decision. Among the reasons for dropping out, the Preference category collects all those answers indicating that the respondent chose to leave school. Common answers in this category are "did not find it interesting" or "too difficult." The category Health/HH Shock includes all instances of non-financial shocks that affected respondents, such as sickness or family circumstances that forced the respondent out of schooling. The category HH Preference includes all those answers pointing to the decision of leaving school having been taken by the respondents' parents or guardians.

by 28% of girls. Post-epidemic, pregnancy becomes as important as costs as a reason for dropout: 38% versus 41%.

Panel D shows a strong correlation between pregnancy and dropouts: Only 3% of girls who got pregnant during the epidemic enrolled in school when they reopened. In contrast, enrolment rates for those who did not get pregnant are over 50%. Taken together, the evidence from control villages indicates that teenage pregnancies rose quickly during the epidemic and many of these girls did not return to school when these reopened.

Online Appendix Figure A.2 replicates this evidence using another data source: the 2018 Sierra Leone Integrated Household Survey (SLIHS), a nationally representative survey that records school enrolment from 2013/4 to 2017/8 (Statistics Sierra Leone 2018; Malmendier and Willigrod 2023). We restrict the sample to girls aged 12–18 in 2014 residing in our four study districts. To maintain sample sizes when we split by age, we retain both urban and rural areas (unlike our evaluation data that only covers rural areas). Using the SLIHS, Panel A of Online Appendix Figure A.2 again shows a large divergence in the hazard of becoming pregnant for teenage girls over the 2 years of the epidemic, relative to girls 2 years earlier: By the end of the 24 month period shown in Panel A, 17% of teenage girls had conceived their first child, against a counterfactual of 11%. Panel B shows aggregate enrolment rates fell between pre- and post-epidemic periods from 65% to 61%, with falls observed at all ages. Panel C shows reasons given for drop out in the SLIHS. As in our sample from control villages: (1) pre-epidemic, financial costs topped the list of reasons for dropout, with pregnancy being the second most common reason, mentioned by 27% of girls and (2) post-epidemic, the order reverses: pregnancy is the modal reason given by girls (57%) while less than one-third of girls state costs are the reason for dropout. Panel D again shows a strong correlation between pregnancy and dropping out of school.[11]

2.5. Taking Stock

Tieing together the results, the descriptive picture that emerges is that over the course of the epidemic, rates of teen pregnancy rose by nearly half, with nearly one in five teenage girls becoming pregnant. Post-epidemic, school enrolment rates fell from 70% to 58%, with falls being observed across all ages. These two outcomes are likely linked through school closures: Without the protection of time in school during the epidemic, young women might have become more vulnerable to sexual pressures or exploitation. Given school closures occurred nationwide, it is impossible to identify the protective role of schools. To causally study the impacts of safe spaces on girls outcomes, we thus layer onto our analysis the randomized introduction of ELA clubs: These serve as a club-based safe space for girls and young women and can thus potentially offset higher pregnancy risks faced during the epidemic.

3. The ELA Intervention

The ELA intervention aims to kick-start young women's socioeconomic empowerment through the provision of life skills, vocational training and microfinance. The

11. For completeness, Figure A.3 in the Online Appendix shows the same statistics for the 12 non-study districts in Sierra Leone: While the rise in teen pregnancies is less pronounced in these areas compared to our study districts, school re-enrolment rates are lower post-pandemic for older teenage girls, pregnancy becomes the most important reason for drop out post-pandemic, and enrolment rates plummet among those that become pregnant since the start of the epidemic.

ELA program was designed and implemented by the NGO BRAC in Bangladesh, where low rates of female empowerment are also a major concern. Since 1993, BRAC has established 9,000 ELA clubs worldwide, reaching over a million young women. Based on evaluations in stable economic times, the program has proved to be scalable and cost-effective in other contexts in Sub Saharan Africa (Bandiera et al. 2020).

The intervention has two components. The first is the establishment of a physical space for ELA clubs: a fixed (rented) location in each village. ELA clubs have no attendance fee, and are managed by a young woman from the village trained to be the local ELA mentor. This physical space is jointly ‘owned’ by club members and designed to be open 5 days a week after school hours, offering a venue for young women to safely gather and socialize away from men. Like PHUs, ELA clubs serve as a safe space for girls and young women. The second component is the programs delivered at ELA clubs: life skills training, vocational training and microfinance. These activities tackle constraints girls face related to reproductive health and skill accumulation.

Randomization. The ELA program was randomly assigned to 150 villages, stratified by district, with 50 remaining as controls. The design includes three treatment arms: In T1, ELA clubs only provide life skills training; T2 is as T1 but clubs additionally provide vocational training; and T3 is as T2 but clubs additionally provide microfinance. Common to all treatment arms is that ELA clubs provide life skills and a safe space for girls and young women to meet away from men.[12]

Implementation. We use our ELA club mentor survey to evidence the roll-out of ELA clubs during the epidemic. Panel A of Online Appendix Figure A.4 provides time series evidence that (1) 71% of clubs opened on time and all had opened by January 2015 and (2) the majority were continuously open through the epidemic. While the safe space offered by ELA clubs was thus always available, the extent to which other intervention components were delivered is more patchy. Panel B shows that in any given month, around 60% of open clubs provided life skills. By design, such training is not provided on a daily basis; vocational training took off after travel quarantines were lifted in January 2015 (these trainings are delivered by professionals, not club mentors).

12. Appendix Table A.1 shows the life skills modules covered. In treatment arms T2 and T3, vocational courses were organized based on beneficiaries’ demand, and covered tailoring, soap making, hairdressing, and tie dying. Clubs provided diversified courses rather than training all participants in one activity. All courses involved a financial literacy module, and upon completion, participants received basic business inputs, e.g., sewing machines were provided to those completing tailoring courses. Each course was offered daily for six hours per day, with courses varying in length depending on the human capital investment required. Eligibility for the livelihood components of the program was designed to be conditional on age: vocational training required beneficiaries to be at least 17 years old. In T3, microfinance loans were up to $100, repayable over a year, with a weekly repayment schedule and a 30% interest rate. The first loan cycle started in April 2015. Microfinance was targeted to those aged 18 and older.

TABLE 1. Village characteristics.

	Control (1)	Treatment (2)	p-value (3)
Number of villages	50	150	
A. Village characteristics			
Number households (census)	90.82	84.6	{.564}
	(72.4)	(45.5)	
PPI score, average (census)	38.3	37.5	{.400}
	(5.80)	(5.42)	
Distances (in miles) from:			
Peripheral health unit	1.76	1.85	{.725}
	(1.60)	(1.72)	
Secondary school	3.53	4.23	{.258}
	(3.34)	(5.10)	
Market	8.57	11.3	{.017}
	(6.30)	(9.02)	
Freetown	84.9	84.6	{.291}
	(41.3)	(38.9)	
Kahilaun	126.2	126.5	{.248}
	(31.6)	(29.8)	
B. Village leader survey			
"Girls who are visibly pregnant have a bad influence on their non-pregnant peers" [=1 if strongly agree]	.960	.967	{.873}
"Girls should be allowed to continue their education while pregnant" [=1 if strongly agree]	.120	.073	{.365}
C. Policy responses			
Village was quarantined	.060	.040	{.595}
Village visited by contact tracing team	.960	.933	{.455}
Received relief from NGO	.780	.873	{.139}
Day market ever closed	.364	.219	{.118}
Primary school re-opened on time	.740	.813	{.263}
Secondary school re-opened on time	.760	.847	{.165}

Notes: Data on village size and wealth was collected through a census of study villages carried out in 2013. Household wealth is measured via the Progress out of Poverty Index (PPI). Distance form Freetown and Kahilaun are computed using Global Positioning System (GPS) data. Data on the location and functioning of services and infrastructure were collected through a survey of village leaders in October 2015. All distances are measured in miles. Column (3) reports p-values from a test of equality of means carried out using an Ordinary Least Squares (OLS) regression of each village characteristic on a dummy for treatment assignment. All regressions include strata (district) fixed effects and robust standard errors.
Means, standard deviations in parentheses. p-value of t-test of equality of means in braces.

Balance. Table 1 shows village characteristics by treatment and control status. Villages are balanced so there was fidelity with randomization protocols even with an unfolding epidemic, even if not all components of the intervention were rolled out on time.

Table 2 shows balance on individual characteristics. Panel A reports characteristics of girls aged 12–18 at baseline. Respondents are on average 15 years old, with

TABLE 2. Characteristics of girls.

	Control (1)	Treatment (2)	p-value (3)
Number of girls	696	2,083	
A. Characteristics			
Age	14.8	14.8	{.763}
	(1.99)	(1.96)	
Enrolled in school	.724	.694	{.289}
In any relationship	.372	.374	{.791}
Married	.078	.085	{.485}
Age at marriage	14.8	14.5	{.271}
	(2.25)	(2.25)	
Age of husband at marriage	27.9	29.3	{.176}
	(5.94)	(6.30)	
Has children	.201	.198	{.859}
Has children, out-of-wedlock	.138	.127	{.371}
B. Time use (hours per week)			
Learning	46.2	43.7	{.192}
	(32.7)	(32.5)	
Household chores	44.7	44.0	{.547}
	(21.6)	(20.9)	
Working	17.2	17.0	{.907}
	(20.9)	(21.3)	
Engaged in sexual activities with men	3.27	3.17	{.818}
	(4.68)	(4.52)	
C. Sexual activity			
Sexually active	.517	.474	{.263}
If active: age at sexual debut	13.8	13.8	{.429}
	(2.07)	(1.76)	
If active: uses contraceptive (any, excluding condoms)	.417	.412	{.895}
	(.494)	(.492)	
If active: ever used condoms	.100	.093	{.582}
D. Violence against girls			
If in relationship: experienced any form of intimate partner violence	.336	.401	{.137}
Unwanted sex over past year	.079	.069	{.500}

Notes: All data is from the baseline survey. Column (3) reports p-values from a across treatment groups, carried out by OLS regression of each characteristic on a treatment. Regressions include strata (district) dummies and standard errors are clustered at the village level. Intimate partner violence is defined as the threat or use of physical violence from the respondent's partner. Time allocation data was collected both at baseline and endline. Respondents were provided a set of 25 beads and a board with six circles representing: "Education," "IGA," "Leisure," "Household Chores," "Sleep," and "Other." The Education category includes schooling, vocational training and study time. "IGA" includes paid and unpaid work of any kind. Respondents were then asked to allocate beads into each circle in a way that represents time allocation in an average week. Data on leisure time allocation was collected in a similar way. The recorded categories for leisure are "Friends," "Men," "Alone," "Church," "Volunteer," and "Other." The exact phrasing for the "Men" category is "With boys or men you have a sexual relationship with." Respondents were then asked to allocate beads into each circle in a way that represents time allocation in an average week. The data points were later converted into weekly hours using recorded total leisure time from the first exercise. Unwanted Sex is defined as, "Been involved in any sexual intercourse that you were not willing to do."
Means, standard deviations in parentheses. p-value of t-test of equality of means in braces.

70% being enrolled in school. Around a third are in a relationship with 8% being married—the average age at marriage is just under 15 with husbands being almost twice as old. Despite their teenage years, 20% have children, 14% have children out of wedlock.

Panel B focuses on girls' time use. School and household chores take most of their time: the average girl reports spending between 6 and 7 hours learning per day and devoting a similar amount of time to household chores. Girls report spending 3 hours/week engaged in sexual activities with men. Panel C details further sexual activity of girls. Nearly half are sexually active (because on average they start having sex at age 14), with the minority using contraceptives. Finally, Panel D presents statistics related to violence against girls. For those in relationships, around a third report having experienced some form of intimate partner violence. For girls both in and out of relationships, around 8% of girls report experiencing unwanted sex in the year prior to baseline.

Attrition. We track 83% of teenage girls from baseline to endline (2,779). Among those tracked, 78% (2,174) resided in the same village, while others were typically tracked to a nearby village. Hence, although geographic mobility is high, it does not lead to severe attrition. Online Appendix Table A.2 shows that treatment assignment does not predict attrition (column 1), and that this remains the case once we also condition on individual and village controls (column 2).

4. Results

4.1. Demand for ELA Clubs

Table 3 reports ELA club functioning and participation rates. For completeness, we do so by treatment arm. Information on club functioning is recorded from the ELA mentors survey in June/July 2015. Panel A shows that the supply of clubs was the same across treatment arms. ELA clubs were open on average 8 months by the time of the mentor survey. Information on participation is recorded using endline data. Panel B shows high participation rates at ELA clubs. Around 66% of girls attended ELA clubs. A total of 54% of all girls participated in life skills training (i.e., 82% of club members). In villages where ELA clubs delivered livelihood components (targeted to older girls and young women), 23% of girls attended vocational training and 7% took up a microfinance loan. Importantly, (columns 4 and 5) show that ELA club attendance is not significantly different across treatment arms. This suggests that girls valued time at the clubs above and beyond the returns from specific activities—the common feature across treatment arms being that ELA clubs serve as safe spaces and provided life skills.

TABLE 3. ELA clubs functioning and participation.

	T1 (1)	T2 (2)	T3 (3)	[T1=T2] (4)	[T2=T3] (5)
A. Functioning					
Months ELA clubs are open (Sep'14–May'15)	7.92	7.78	7.78	{.675}	{.964}
B. Participation					
Share of girls attending	.666	.669	.656	{.996}	{.859}
Share of girls attending life skills training	.540	.541	.551	{.925}	{.811}
Share of girls attending vocational training	–	.208	.232	–	{.438}
Share of girls accessing microfinance	–	–	.066	–	–

Notes: Data on club functioning was collected from ELA mentors in June and July 2015. Data on participation in ELA club activities and Life Skill Training was collected for all respondents in treated communities at endline in 2016. Participation in Vocational Training was recorded only for respondents in villages assigned to treated arm T2 and T3. Data on the location and functioning of Peripheral Health Units (PHU) serving each village, and other services such as markets and schools, were collected through a survey of village leaders in October 2015. Each PHU is considered closed if it did not operate for at least 1 month between July 2014 and September 2015. The *p*-values refer to a test of equality of conditional means carried out via OLS regression of the outcome of interest on a dummies for treatment assignment and strata fixed effects. Standard errors are robust in panel A, and clustered at the village level in Panel B. Sample averages, *p*-values in braces.

4.2. Protective Impacts of ELA Clubs

We exploit the random assignment of ELA clubs to establish their impacts at endline on teen pregnancy, time use and school enrolment for girl i in village v in district d. We do so using the following Analysis of Covariance (ANCOVA) specification:

$$y^1_{ivd} = \alpha_0 + \alpha_1 y^0_{ivd} + \beta_1 T_{vd} + \gamma X_{ivd} + \upsilon X_{vd} \lambda_d + u_{ivd}, \tag{1}$$

where we control for the baseline outcome (y^0_{ivd}) whenever available. T_{vd} is a dummy equal to 1, if an ELA club was randomly assigned to village v. Individual and household controls in X_{ivd} include age dummies, a dummy equal to 1, if the respondent is illiterate, a household poverty score and household size. Village-level controls in X_{vd} include the number of dwellings, the average household poverty score (constructed from the census), a dummy equal to 1, if the paramount chief resides in the village, and distances from the closest PHU, market, secondary school, Freetown and Kailahun (the location of the first reported Ebola case). All specifications include district fixed effects (λ_d) and standard errors are clustered by village.

The results are in Table 4. On average, the availability of ELA clubs does not impact whether girls ever become pregnant (column 1) but significantly reduces rates of out-of-wedlock pregnancy by 3.2 pp, or 23% of the baseline mean in controls (column 2). ELA clubs also have pronounced impacts on girls' time use, in ways that largely replicate how such outcomes are also impacted in stable economic times (Bandiera et al. 2020). More precisely, girls spend around 3.13 hours/week attending ELA clubs (column 3) and this mostly comes from substituting away from other forms of social activity. Most importantly, girls in villages with ELA clubs significantly reduce time spent with men by 0.54 hours/week, corresponding to a 16% reduction over the baseline. They also significantly reduce time spent alone, with friends (outside

TABLE 4. ELA clubs.

	Pregnancy		Time use: ELA clubs and socializing (hours/week)					Activities	
	Ever pregnant (1)	Pregnant out of wedlock (2)	ELA Club (3)	Men (4)	Alone (5)	Friends (6)	Volunteer/Church (7)	Enrolled in school (8)	Work (9)
ELA	−.015	−.032**	3.13***	−.539***	−.656***	−.523***	−1.55***	.002	.022
	(.018)	(.016)	(.153)	(.190)	(.192)	(.197)	(.262)	(.022)	(.028)
Control mean at baseline	.201	.138	–	3.27	6.01	6.26	10.7	.724	.430
Individual controls	✓	✓	✓	✓	✓	✓	✓	✓	✓
Village controls	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	2,779	2,779	2,779	2,779	2,779	2,779	2,779	2,779	2,779

Outcomes: All pregnancy outcomes refer to conceptions after baseline data was collected. Time use outcomes measured in hours per week. Respondents were provided a set of 25 beads and a board with six circles representing: "Education," "IGA," "Leisure," "Household Chores," "Sleep," and "Other." The Education category includes schooling, vocational training and study time. "IGA" includes paid and unpaid work of any kind. Respondents were then asked to allocate beads into each circle in a way that represents time allocation in an average week. Data on leisure time allocation was collected in a similar way. The recorded categories for leisure are "Friends," "Men," "Alone," "Church," "Volunteer," "ELA club," and "Other." "Friends" refers to socializing taking place outside of the ELA club. The exact phrasing for the "Men" category is "With boys or men you have a sexual relationship with." Respondents were then asked to allocate beads into each circle in a way that represents time allocation in an average week. The data points were later converted into weekly hours using recorded total leisure time from the first exercise. Column (8) captures school enrolment and (column 9) captures engagement in any income generating activity - whether self-employment or wage, occasional or stable, paid or unpaid. The two outcomes are not mutually exclusive, and respondents can engage in both.

Notes: ***, **, and * denote significance at the 1%, 5%, and 10% levels. Individual control variables include age dummies, wealth measured through the Progress of Poverty Index (PPI), household size and a dummy equal to 1 if the respondent is illiterate. Village-level controls include the number of dwellings, average PPI, a dummy equal to 1 if the paramount chief resides in the village, as well as distances from: closest market, secondary school and primary health unit (PHU), as well as the capital Freetown and Kailahun (the location of the first reported Ebola case). All specifications include district fixed effects (randomization strata), and standard errors are clustered at the unit of randomization (village).

Outcomes measured post-epidemic (2016). ANCOVA estimates, standard errors in parentheses.

of ELA clubs), and time spent volunteering/at church. The total time reduction in these activities amounts to 3.27 hours/week, so close to the 3.13 hours/week reallocated to ELA clubs in treated villages. Finally we note that on average, the presence of ELA clubs does not increase school enrolment at endline.[13]

While these results measure the average impact of ELA clubs, a key intuition is that the impact of safe spaces will likely vary by the underlying pregnancy risk that girls face. In the Appendix, we develop a parsimonious model of girls' time allocation, where they choose between time in school, time at ELA clubs and time spent with men. Unlike in a Becker-style model of fertility, in our context it is more appropriate to model girls as facing pregnancy risk related to the amount of time they spend outside of school or at ELA clubs—and so they are not able to entirely control the timing of pregnancy. The dynamic model endogenizes time allocations pre-epidemic, during the epidemic when schools are closed, and post-epidemic, accounting for the fact that ELA clubs might offer returns beyond just a safe space. The framework makes precise how time allocations vary with the underlying pregnancy risk girls are exposed too, and how a temporary increase in pregnancy risk due to the loss of safe spaces during the epidemic can have persistent impacts on school enrolment post-epidemic. We now operationalize the main idea underlying this framework to examine heterogeneous of ELA clubs by pregnancy risk.

5. Heterogeneity by Pregnancy Risk

We approach the measurement of pregnancy risk in two steps: first considering PHU closures as a specific proxy for this risk, and then moving to our (preferred) more holistic measure of pregnancy risk that is constructed using an Elastic net procedure based on data from control villages.

5.1. Availability of PHUs

In rural Sierra Leone, PHUs play a vital role in safeguarding girls from pregnancy risk because they provide adolescent-friendly spaces including a dedicated room for young women. These facilities are supposed to be set aside for sexual and reproductive health counseling, distributing contraceptives, as well as providing a space for girls to spend their leisure time (Denney et al. 2016). As shown in Table 1, PHUs are not often located within villages but are around 2 miles away.[14]

13. ELA clubs can also crowd out time spent at informal institutions such as secret societies, that exist for men and women in Sierra Leone (MacCormack 1979). The primary role of these women's societies (known as *Bondo* in the North and *Sande* in the South) is to initiate girls into adulthood through various rituals that have historically included female genital mutilation. Secret societies are often the main source of reproductive health knowledge for young women, which is purposefully withheld from them until initiation.

14. PHUs serve all villages within a few miles of them, so covering populations of 500-5000. As villages in our sample comprise less than 100 households, each PHU serves between five and fifty villages.

TABLE 5. Village characteristics, by PHU closure.

	Peripheral health unit open (1)	Peripheral health unit closed (2)	Difference p-value (3)
Number of villages	43	7	
A. Village characteristics			
Number households (census)	94.0	71.1	{.103}
	(77.0)	(27.9)	
PPI score, average (census)	38.0	40.3	{.578}
	(6.01)	(4.03)	
Distances (in miles) from:			
Peripheral health unit	1.58	2.86	{.044}
	(1.44)	(2.21)	
Secondary school	3.73	2.29	{.175}
	(3.53)	(1.41)	
Market	8.26	10.5	{.712}
	(5.85)	(8.89)	
Freetown	90.9	48.1	{.580}
	(41.6)	(5.67)	
Kahilaun	121.4	155.9	{.621}
	(31.2)	(11.7)	
B. Policy responses			
Village was quarantined	.047	.143	{.306}
Village visited by contact tracing team	.953	1.00	{1.00}
Received relief from NGO	.791	.714	{.488}
Day market ever closed	.370	.333	{.377}
Primary school re-opened on time	.767	.571	{1.00}
Secondary school re-opened on time	.791	.571	{1.00}

Notes: Sample restricted to control villages. Data on village size and wealth collected through a census of study villages carried out in 2013. Household wealth measured via the Progress out of Poverty Index (PPI). Distance form Freetown and Kahilaun are computed using GPS data. Data on the location and functioning of Peripheral Health Units (PHU) serving each village, and other services such as markets and schools, were collected through a survey of village leaders in October 2015. A PHU is considered closed, if it did not operate for at least one month between July 2014 and September 2015. All distances are measured in miles. Column (3) reports p-values from a test of equality of means carried out by OLS regression of each village characteristic on a dummy for PHU closure. Regressions include strata (district) fixed effects and robust standard errors.
Sample: Control villages only. Means, standard deviations in parentheses. p-value of t-test of equality of means in braces.

To measure whether girls retained access to a PHU safe spaces and/or services during the epidemic, when the health infrastructure throughout Sierra Leone was under extreme pressure and schools were closed, we use information on disruptions to the nearest PHU collected as part of the village leader survey administered between June and October 2015. Respondents were asked to recall monthly information from July 2014 on whether the local PHU was closed or disrupted. This recall period this covers the key 15 months of the epidemic (Figure 1). A PHU is considered closed during the epidemic if it did not operate for at least one month between July 2014 and September 2015. A total of 14% of control villages had their PHU close. Over 50% of PHUs are closed for more than one month, conditional on some closure the average number of months of closure is four, with 14% of PHUs being closed for 11 or 12 months.[15]

Table 5 shows village characteristics between those where the PHU remained open throughout the epidemic and those where the PHU was closed. Panel A shows the main correlate of PHU closure is remoteness ($p = .044$). This is perhaps not surprising as exactly those PHUs would have come under the greatest pressures because of the epidemic. Other village characteristics such as their poverty, the number of NGOs operating there, or distance from Freetown do not correlate with PHU closures. Panel B confirms policy responses to Ebola were not different in villages with and without PHU closures. Moreover, other infrastructure—such as markets, primary and secondary schools—all functioned similarly during the epidemic.

We first examine, how the loss of services and safe spaces due to PHU closures correlates to outcomes for girls. We do so by estimating the following ANCOVA specification for endline outcome y^1_{ivd} for girl i in village v in district d using only control villages:

$$y^1_{ivd} = \alpha y^0_{ivd} + \beta \pi_{vd} + \gamma X_{ivd} + \upsilon X_{vd} + \lambda_d + u_{ivd}. \tag{2}$$

We condition on the outcome at baseline, y^0_{ivd}, and π_{vd} is a dummy equal to 1, if the village PHU closed during the epidemic, and the individual, household, and village controls are as in (1). All specifications include district fixed effects (λ_d) and standard errors are clustered by village.

Panel A of Table 6 shows the results based on girls in control villages. We find that girls in villages exposed to PHU closures during the epidemic are 14 pp more likely to ever be pregnant between baseline and endline (column 1)—a 70% increase over the baseline level. Column (2) shows this is largely driven by out-of-wedlock pregnancies: these increase by 10.3 pp for girls that lose access to PHUs, corresponding to a 75% increase over the baseline. We find no differential shift into marriage between girls with and without access to PHUs during the epidemic (not shown), which is important given that entry into early marriage likely reduces girls well-being (Field and Ambrus 2008; Chari et al. 2017).

Columns (3–6) then examine girls' time use in socializing activities. We find that among girls losing access to PHUs during the epidemic at endline: (1) , they report spending 1.24 more hours/week with men than girls in villages that maintained access to PHUs, a 38% increase over the baseline; (2) they spend 1.41 hours/week alone, an increase of 24%; and (3) their time with friends or volunteering/church activities do not differ to girls in villages that retained access to PHUs over the epidemic.

Finally, to highlight the potential link between teen pregnancy and re-enrollment into school post-epidemic, the last two columns examine how exposure to PHU

15. The 2013 DHS data from Sierra Leone asks respondents about visiting health facilities (not limited to PHUs). In our four districts, 47% of those aged 15–25 report visiting a health facility in the 12 months prior to survey; among those aged 15–18 and using contraceptives, 41% report accessing them through some government health center (other sources include a mix of private facilities, shops and outreach workers).

TABLE 6. Pregnancy risk.

	Pregnancy		Time use socializing (hours/week)				Activities	
	Ever pregnant (1)	Pregnant out of wedlock (2)	Men (3)	Alone (4)	Friends (5)	Volunteer/Church (6)	Enrolled in school (7)	Work (8)
A. Closure								
PHU closed	.140***	.103**	1.24***	1.41***	−.452	.136	−.182***	.216**
	(.028)	(.041)	(.430)	(.383)	(.414)	(.650)	(.053)	(.053)
B. Elastic net								
Pregnancy risk	.082***	.061***	.796***	.754***	.414**	.237	−.091***	.102***
	(.017)	(.019)	(.185)	(.195)	(.263)	(.392)	(.028)	(.026)
Control mean at baseline	.201	.138	3.27	6.01	6.26	10.7	.724	.430
Individual controls	✓	✓	✓	✓	✓	✓	✓	✓
Village controls	✓	✓	✓	✓	✓	✓	✓	✓
Observations	696	696	696	696	696	696	696	696

Outcomes: All pregnancy outcomes in this table refer to conceptions after baseline data was collected. Time use outcomes measured in hours per week. Respondents were provided a set of 25 beads and a board with six circles representing: “Education,” “Income Generating Activities (IGA),” “Leisure,” “Household Chores,” “Sleep,” and “Other.” The Education category includes schooling, vocational training and study time. “IGA” includes paid and unpaid work of any kind. Respondents were then asked to allocate beads into each circle in a way that represents time allocation in an average week. Data on leisure time allocation was collected in a similar way. The recorded categories for leisure are “Friends,” “Men,” “Alone,” “Church,” “Volunteer,” “ELA club,” and “Other.” “Friends” refers to socializing taking place outside of the ELA club. The exact phrasing for the “Men” category is “With boys or men you have a sexual relationship with”. Respondents were then asked to allocate beads into each circle in a way that represents time allocation in an average week. The data points were later converted into weekly hours using recorded total leisure time from the first exercise. Column (7) captures school enrolment and (column 8) captures engagement in any income generating activity—whether self-employment or wage work, occasional or stable, paid or unpaid. The two outcomes are not mutually exclusive.

Notes: ***, **, and * denote significance at the 1%, 5%, and 10% levels. In Panel B, the pregnancy risk measure is constructed using an Elastic net procedure to select village-level characteristics that predict in controls, whether a girl became pregnant during the Ebola crisis. The set of potential covariates we consider split into three categories: village infrastructure and economic activity, demographics, and Ebola incidence and relief efforts. The selected variables are used to predict pregnancy risk for all girls (in treated and control villages), and the measure is standardized in the sample as a whole (to have mean 0 and standard deviation 1). Individual control variables include age dummies, wealth measured through the Progress of Poverty Index (PPI), household size and a dummy equal to 1 if the respondent is illiterate. Village-level controls include the number of dwellings, average PPI, a dummy equal to 1 if the paramount chief resides in the village, as well as distances from: closest market, secondary school and primary health unit (PHU), as well as the capital Freetown and Kailahun (the location of the first reported Ebola case). All specifications include district fixed effects (randomization strata), and standard errors are clustered at the village.

Sample: Control villages only. Outcomes measured post-epidemic (2016). ANCOVA estimates, standard errors in parentheses.

closures impacts activities at endline. Girls without access to PHUs during the epidemic are 18 p less likely to be enrolled in school at endline, and 12 pp more likely to report being in work. As such, exposure to PHU closures thus correlates to a speeding up the school-to-work transition for girls—in line with pregnant girls being unable to return to school.

5.2. Predicting Underlying Pregnancy Risk

To create a more holistic measure of pregnancy risk that girls face in the epidemic, we proceed as follows. Using data only from controls, we estimate a probit regression where the outcome is a dummy equal to 1, if the respondent became pregnant during the Ebola crisis, i.e., between our baseline and endline surveys. The control variables are selected using an Elastic net procedure, where the parameters of the procedure are selected through cross-validation. The set of potential covariates we consider only includes village-level characteristics split into three categories: village infrastructure and economic activity, demographics, and Ebola incidence and relief efforts. Online Appendix Table A.3 shows the nine covariates selected. Most notably, this includes whether the PHU was ever closed, and whether its normal functioning was ever disrupted. This confirms the intuition that the availability of PHUs relates to pregnancy risk—either because they serve as safe spaces or provide contraceptives—but there are other relevant factors determining pregnancy risk.

Panel B of Table 6 the repeats the earlier analysis, examining how this holistic measure of pregnancy risk correlates to endline outcomes for girls in control villages: Although the magnitude of impacts are smaller than using PHU closures, only to proxy pregnancy risk, the results remain precisely estimated throughout. Girls in villages with greater pregnancy risk are significantly more likely to ever be pregnant at endline, to be pregnant out of wedlock, to spend more time with men and more time alone, and to be significantly less likely to be enrolled in school and more likely to be working.

We thus use this measure of pregnancy risk from controls to predict pregnancy risk for all girls (in treated and control villages), standardizing the pregnancy risk index in the sample as a whole (to have mean 0 and standard deviation 1). This is our preferred measure to explore whether and how the impacts of ELA clubs vary by the underlying pregnancy risk girls face during the Ebola epidemic.[16]

16. Online Appendix Table A.2 confirms that attrition between baseline and endline is unconditionally uncorrelated with our measure of pregnancy risk (column 3) and this remains the case once we also condition on individual and village characteristics (column 4). Column (5) shows that attrition does not vary differentially by the presence of ELA clubs and pregnancy risk. Online Appendix Table A.4 confirms that village characteristics are largely balanced across treatment and control villages with low (below median) and high (above median) predicted pregnancy risk. Hence the presence of ELA clubs in treated villages is unlikely to have a direct impact on whether PHUs are open or closed. Online Appendix Table A.5 shows that individual characteristics of girls are largely balanced as well within high and low pregnancy risk villages.

TABLE 7. ELA clubs participation and pregnancy risk.

Pregnancy risk	Low (1)	High (2)	p-value (3)
A. Functioning			
Months ELA clubs are open (Sep'14–May'15)	8.03	7.60	{.268}
B. Participation			
Share of girls attending	.600	.751	{.000}
Share of girls attending life skills training	.477	.637	{.000}
Share of girls attending vocational training	.177	.282	{.006}
Share of girls accessing microfinance	.048	.082	{.203}

Notes: Data on club functioning was collected from ELA mentors in June and July 2015. Data on participation in ELA club activities and Life Skill Training was collected for all respondents in treated communities at endline in 2016. Participation in Vocational Training was recorded only for respondents in villages assigned to treated arm T2 and T3. The pregnancy risk measure is constructed using an Elastic net procedure to select village-level characteristics that predict in controls, whether a girl became pregnant during the Ebola crisis. The set of potential covariates we consider split into three categories: village infrastructure and economic activity, demographics, and Ebola incidence and relief efforts. The selected variables are used to predict pregnancy risk for all girls (in treated and control villages). Low (high) pregnancy risk refers to whether the measure is below (above) the median. In (column 3), the p-values refer to a test of equality of conditional means carried out via OLS regression of the outcome of interest on a dummies for treatment assignment on a dummy for high/low pregnancy risk, and strata fixed effects. Standard errors are robust in Panel A, and clustered at the village level in Panel B.
Sample averages, p-values in braces.

5.3. *Results*

Table 7 shows that while the functioning of ELA clubs does not vary by the underlying pregnancy risk (Panel A), participation to ELA clubs is significantly higher in villages where pregnancy risk is higher: 60% of eligible girls attend in low risk villages, rising to 75% participating in high risk villages ($p = .000$). Participation to life skills and vocational training components of ELA are also both significantly higher in high-risk areas. We next estimate the heterogeneous impact of ELA clubs as girls' underlying pregnancy risk varies using the following specification:

$$y^1_{ivd} = \alpha_0 + \alpha_1 y^0_{ivd} + \beta_1 \pi_{vd} + \beta_2 T_{vd} + \beta_3 T_{vd}\pi_{vd} + \gamma X_{ivd} + \upsilon X_{vd} + \lambda_d + u_{ivd}, \quad (3)$$

where π_{vd} is our measure of pregnancy risk, and all other controls are as previously defined. As the pregnancy risk measure is normalized, its marginal effect is interpreted in effect sizes.

The results are in Table 8. Focusing first on pregnancy outcomes, (column 1) shows that ELA clubs reduce pregnancy rates in villages with higher predicted pregnancy risk. In villages with a pregnancy risk of 1.74σ above the mean, the presence of ELA clubs entirely offset the likelihood of ever being pregnant. Column (2) shows the protective effects of ELA clubs in higher risk villages are largely concentrated among out-of-wedlock teenage pregnancies. In villages with a pregnancy risk of 1.16σ above the mean, the presence of ELA clubs entirely offsets the increased out-of-wedlock pregnancy risk teenage girls face.

TABLE 8. ELA clubs and pregnancy risk.

	Pregnancy		Time use: ELA clubs and socializing (hours/week)					Activities	
	Ever pregnant (1)	Pregnant out of wedlock (2)	ELA Club (3)	Men (4)	Alone (5)	Friends (6)	Volunteer/Church (7)	Enrolled in School (8)	Work (9)
ELA	.002	−.020	3.14***	−.373**	−.566***	−.472**	−1.57***	−.017	.033
	(.017)	(.014)	(.136)	(.173)	(.190)	(.199)	(.272)	(.018)	(.027)
ELA x pregnancy risk	−.043***	−.050***	.351**	−.751***	−.410**	−.267	−.298	.074***	−.038
	(.015)	(.015)	(.146)	(.184)	(.175)	(.202)	(.266)	(.023)	(.024)
Pregnancy risk	.075***	.058***		.814***	.441***	.256	−.013	−.090***	.052**
	(.014)	(.016)		(.167)	(.165)	(.203)	(.267)	(.024)	(.025)
Control mean at baseline	.201	.138	.000	3.27	6.01	6.26	10.7	.724	.430
Individual controls	✓	✓	✓	✓	✓	✓	✓	✓	✓
Village controls	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	2,779	2,779	2,779	2,779	2,779	2,779	2,779	2,779	2,779

Outcomes: All pregnancy outcomes refer to conceptions after baseline data was collected. Time use outcomes measured in hours per week. Respondents were provided a set of 25 beads and a board with six circles representing: “Education,” “IGA,” “Leisure,” “Household Chores,” “Sleep,” and “Other.” The Education category includes schooling, vocational training and study time. “IGA” includes paid and unpaid work of any kind. Respondents were then asked to allocate beads into each circle in a way that represents time allocation in an average week. Data on leisure time allocation was collected in a similar way. The recorded categories for leisure are “Friends,” “Men,” “Alone,” “Church,” “Volunteer,” “ELA club,” and “Other.” “Friends” refers to socializing taking place outside of the ELA club. The exact phrasing for the “Men” category is “With boys or men you have a sexual relationship with”. Respondents were then asked to allocate beads into each circle in a way that represents time allocation in an average week. The data points were later converted into weekly hours using recorded total leisure time from the first exercise. Column (8) captures school enrolment and (column 9) captures engagement in any income generating activity—whether self-employment or wage, occasional or stable, and paid or unpaid. The two outcomes are not mutually exclusive, and respondents can engage in both.

Notes: ***, **, and * denote significance at the 1%, 5%, and 10% levels. The pregnancy risk measure is constructed using an Elastic net procedure to select village-level characteristics that predict in controls, whether a girl became pregnant during the Ebola crisis. The set of potential covariates we consider split into three categories: village infrastructure and economic activity; demographics; and Ebola incidence and relief efforts. The selected variables are used to predict pregnancy risk for all girls (in treated and control villages), and the measure is standardized in the sample as a whole (to have mean 0 and standard deviation 1). Individual control variables include age dummies, wealth measured through the Progress of Poverty Index (PPI), household size and a dummy equal to 1 if the respondent is illiterate. Village-level controls include the number of dwellings, average PPI, a dummy equal to 1 if the paramount chief resides in the village, as well as distances from: closest market, secondary school and primary health unit (PHU), as well as the capital Freetown and Kailahun (the location of the first reported Ebola case). All specifications include district fixed effects (randomization strata), and standard errors are clustered at the unit of randomization (village).

Outcomes measured post-epidemic (2016). ANCOVA estimates, standard errors in parentheses.

Columns (3–7) show how ELA clubs impact girls' time allocation as their underlying pregnancy risk varies. To begin with, we note that (column 3) shows time spent at ELA clubs is significantly higher in higher risk villages, consistent with the earlier evidence on the extensive margin of participation in Table 7. How this time is reallocated away from socializing activities differs markedly with predicted pregnancy risk. In control villages, a one standard deviation increase in underlying pregnancy risk leads to girls spending 0.814 hours/week more time with men, and they spend 0.441 hours/week more time alone. Both effects are nearly entirely offset in higher risk treated villages when girls have access to the ELA safe space. In treated villages, the amount of time girls spend with friends on volunteering/at church significantly decrease, and neither effect varies with the underlying pregnancy risk faced.[17]

The final two outcomes in Table 8 show how these time reallocations translate into activities at endline. In control villages, a one standard deviation increase in pregnancy risk leads to school enrolment falling by 9 pp post-epidemic. This fall is almost entirely offset in treated villages: In villages with a pregnancy risk of 1.22σ above the mean, the presence of ELA clubs lead to school enrolment rates being unchanged post-epidemic. Unlike in higher risk control villages that saw an increased transition from school to work for girls, in higher risk treated villages the protective effects of ELA clubs during the epidemic ensures girls enrol back into school post-epidemic, with no shift into work.

In short, when ELA clubs are available and girls face a high risk of pregnancy during the epidemic, teenage girls experience lower rates of pregnancy, enabling more of them to return to school after the epidemic. The provision of safe spaces through ELA clubs therefore has important and long-lasting implications for the welfare of teenage girls in a context where young women are vulnerable, and a fragile state is dealing with an aggregate health and economic crisis. The lack of safe spaces that leads to shifts into teen pregnancy, child bearing and school dropout likely have irreversible impacts on the lifetime welfare of teenage girls and their children (Field and Ambrus 2008).

Moreover, treating dropout in teenage years as an absorbing state, the total lost years of schooling can be substantial. Our data is not best suited to calculate this total loss, but using SLIHS data, Malmendier and Willigrod (2023) show enrolment rates were on a strong upward trajectory pre-Ebola. Examining impacts by age, we find post-epidemic falls in enrolment to be most pronounced among those aged 13–17 at baseline, suggesting anything up to five years of lost schooling for some teenage girls. Given estimates of annual private returns to schooling for girls in Sub Saharan Africa of 14% (Filmer et al. 2018), this loss of human capital is substantial and entrenches

17. We also examined whether the availability of ELA clubs impacts behavior within relationships. To do so we focus on the subsample of girls that report being in a relationship and examine whether the incidence of intimate partner violence is affected by ELA clubs, pregnancy risk and their interaction. We find no evidence of changes in violence within relationships. this further reinforces the notion that ELA clubs provide a safe space for girls from men outside of their relationships.

disadvantage for young girls, over any above the effects of teen pregnancy and early childbearing.

5.4. Robustness Checks

In the Online Appendix, we report robustness checks on our central causal chain of core outcomes: out-of-wedlock teen pregnancies, time spent with men, and school enrolment. We first present a sequence of checks to examine whether these results remain unaltered: (1) when using alternative approaches to estimating standard errors and (2) varying the choice of control variables. Given that villages where PHUs closed are slightly smaller that those where they remained open, we also show the robustness of our results to narrowing the sample to villages that belong to the common support of the village size distribution. Our second class of checks address concerns that the impact of ELA clubs is confounded by differential rates of Ebola in treated villages, or by other village shocks that affect outcomes for teenage girls but have nothing to do with the loss of safe spaces—such as when villages are in quarantine and girls might be more exposed to men. Finally, we document whether closures of more remote PHUs (where alternative safe spaces might be even more lacking) have more severe impacts on time spent with men.

6. Mechanisms

The results so far point to the key role of ELA clubs in breaking the chain from teen pregnancy to school drop out post-epidemic that otherwise occurred during the Ebola epidemic. ELA clubs fulfill this role in locations where girls faced the highest pregnancy risks. To dig further into mechanisms through which ELA clubs protect teenage girls, we exploit the second stage of randomization, where ELA clubs were assigned alternative bundles of services, corresponding to treatment arms T1, T2, and T3. In T1, ELA clubs only provide life skills training; T2 is as T1 but clubs additionally provide vocational training; and T3 is as T2 but clubs additionally provide microfinance.

Life Skills. As life skills are part of the bundle in all treatment arms, we cannot experimentally separate out the value of safe spaces from life skills. We therefore present two further sets of results that help separate potential impacts of these two components of ELA clubs.

First, we consider outcomes related directly to the modules covered in the life skills curriculum shown in Table A.1 in the Online Appendix, beyond the single module related to teenage pregnancy. Columns (1–5) in Table 9 show that in villages at the mean level of pregnancy risk, the presence of ELA clubs does not change contraceptive use, pregnancy knowledge, knowledge on HIV or sexual activity. This remains largely true irrespective of the background pregnancy risk to girls during the epidemic except on two margins: (1) while contraceptive use significantly falls in areas with higher

TABLE 9. ELA clubs, pregnancy risk, life skills, and social ties.

	Sexual behavior and knowledge					Social ties			
	Ever used condom (1)	Currently using other contraceptives (2)	Pregnancy knowledge index (3)	HIV Knowledge Index (4)	Sexually active (5)	Friends (6)	Income generating activities (7)	Credit (8)	Intimate topics (9)
ELA	−.015	.002	.007	.006	−.017	.158**	.125***	.082*	.079
	(.020)	(.033)	(.014)	(.011)	(.017)	(.062)	(.042)	(.049)	(.049)
ELA x pregnancy risk	.021	.074**	.015	.012	−.061***	.000	−.029	.003	−.001
	(.016)	(.036)	(.016)	(.009)	(0.021)	(.057)	(.049)	(.055)	(.056)
Pregnancy risk	−.029*	−.092***	−.004	−.003	.050**	−.066	.018	−.020	−.013
	(.015)	(.035)	(.016)	(.008)	(.021)	(.048)	(.040)	(.042)	(.042)

TABLE 9. Continued

	Sexual behavior and knowledge					Social ties			
	Ever used condom (1)	Currently using other contraceptives (2)	Pregnancy knowledge index (3)	HIV Knowledge Index (4)	Sexually active (5)	Friends (6)	Income generating activities (7)	Credit (8)	Intimate topics (9)
Control mean at baseline	.101	.423	.609	.580	.529	2.09	.846	.936	.848
Individual controls	✓	✓	✓	✓	✓	✓	✓	✓	✓
Village controls	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	1,664	1,664	2,779	2,779	2,276	1,854	1,854	1,854	1,854

Outcomes: Data on sexual behaviors was collected only from those teenage girls that consented to answering this specific survey module. Of the 2,779 respondents in our estimation sample, 476 opted to not answer the module at endline, and this explains the difference in sample size between (column 4), using the full estimation sample, and (column 5). Respondents were then asked whether they are sexually active. Follow-up questions, such as those on contraceptive use, were asked only to sexually active young women. Hence, the differences in sample size (columns 5) and (columns 1 and 2). All outcomes in this table are measured at endline. The outcome in (column 1) is a dummy equal to 1 if the respondent has ever used condoms during intercourse. The outcome in (column 2) captures usage of any form of contraceptive other than condoms, that is contraceptive pill, IUDs or implants, sterilization/partner's vasectomy. The outcome in (column 3) is the share of correct answers to a set of three true/false questions on reproductive health: "A women cannot become pregnant at first intercourse or with occasional sexual relation"; "A woman who is breastfeeding can become pregnant"; and "From one menstrual period to the next, there days when a woman is more likely to become pregnant if she has sexual relations." The HIV knowledge index in (column 4) is constructed from answers to the following true/false questions: "During vaginal sex, it is easier for a woman to receive the HIV virus than for a man"; "During vaginal sex, it is easier for a woman to receive the HIV virus than for a man"; "Pulling out the penis before a man climaxes keeps a woman from getting HIV during sex"; "A women cannot get HIV if she has sex during her period"; "Taking a test for HIV one week after having sex will tell a person if she or he has HIV"; and "A Pregnant woman with HIV can give the virus to her unborn baby". Data on social networks was collected both at baseline and endline for a random subsample of study participants. Respondents were asked to separately list friends (column 6) as well as people with whom they discuss "issues related to income-generating activities, for example concerning your employer, your business, agriculture, use of resources, etc." (column 7), "finance and credit" (column 8), and "intimate topics such as relationships with boys and men (husband, boyfriend, partner), gender-based violence, personal hygiene, etc." (column 9). The outcomes used in these four columns is the number of social ties listed under each category.

Notes: ***, **, and * denote significance at the 1%, 5%, and 10% levels. The pregnancy risk measure is constructed using an Elastic net procedure to select village-level characteristics that predict in controls, whether a girl became pregnant during the Ebola crisis. The set of potential covariates we consider split into three categories: village infrastructure and economic activity; demographics; and Ebola incidence and relief efforts. The selected variables are used to predict pregnancy risk for all girls (in treated and control villages), and the measure is standardized in the sample as a whole (to have mean 0 and standard deviation 1). Individual control variables include age dummies, wealth measured through the Progress of Poverty Index (PPI), household size and a dummy equal to 1 if the respondent is illiterate. Village-level controls include the number of dwellings, average PPI, a dummy equal to 1 if the paramount chief resides in the village, as well as distances from: closest market, secondary school and primary health unit (PHU), as well as the capital Freetown and Kailahun (the location of the first reported Ebola case). All specifications, control for baseline values of the outcome variable, with the only exception being (columns 1 and 2). Since sexual behaviors data was collected only for sexually active women, in the first two columns we control instead for whether the respondent was sexually active at baseline. All regressions include district fixed effects (randomization strata), and standard errors are clustered at the unit of randomization (village).
Outcomes measured post-epidemic (2016). ANCOVA estimates, standard errors in parentheses.

predicted pregnancy risk, this effect is partially offset in treated villages (column 2) and (2) while sexual activity is significantly higher in villages with higher pregnancy risk, this effect is entirely offset in treated villages (column 5).

Second, ELA clubs help girls maintain social ties—as a safe space might allow, rather than the life skills component of the intervention (column 6). When ELA clubs are available girls also form significantly more social ties relevant for income generating activities and credit provision (columns 7 and 8). The retention of social networks in high-risk treated villages can feedback to our key outcomes if they help foster young women's agency (Diaz-Martin et al. 2022), encourage sustained club attendance, and increase the desire to stay in school (Edmonds, Feigenberg, and Leight 2023).

Vocational Training or Microfinance. We next use the experimental design to establish whether over and above the safe space and life skills component embedded within T1, the additional provision of vocational training and microfinance drive the documented effects of ELA clubs. These additional activities can potentially increase the value of time spent at ELA clubs and thus further displace other activities, such as time spent with men, and so help strengthen the causal chain linking teen pregnancy and school drop out post-epidemic.

To examine whether intervention components differentially impact outcomes for girls, we extend the specification in (1) to consider the impacts of treatment arm $j = 1, 2, 3$ as follows:

$$y^1_{ivd} = \alpha_0 + \alpha_1 y^0_{ivd} + \sum\nolimits_j \beta_{1j} T^j_{vd} + \gamma X_{ivd} + \upsilon X_{vd}\lambda_d + u_{ivd}, \tag{4}$$

where T^j_{vd} is set equal to 1, if village v in district d receives ELA club intervention j, and all other controls are as previously defined.

Table 10 shows the results: For each treatment arm, these are largely in line with the earlier findings when we pooled all treatment arms. At endline, pregnancies, time spent at ELA clubs, time spent with men and in other socializing activities, school enrolment and transitions to work, do not significantly differ with the bundle of inputs provided at ELA clubs. This is confirmed by the p-values reported at the foot of each column on the equality of ITT effects between T1 and T2, and between T1 and T3.

Most notably, time spent at ELA clubs is the same across treatment arms suggesting the value of club attendance is not strongly related to the provision of vocational training or microfinance over and above the provision of a safe space and life skills. The earlier finding that ELA participation rates were higher in high-risk villages (Table 7) is thus more in line with girls attending ELA clubs as a safe space rather than because of these activities per se.[18]

18. Column (6) in Online Appendix Table A.2 shows no differential attrition by treatment arm. The results in Table A.6 in the Online Appendix further confirm no impacts in any treatment arm on outcomes associated with the life skills component of the intervention.

TABLE 10. Mechanisms.

	Pregnancy		Time use: ELA clubs and socializing (hours/week)					Activities	
	Ever pregnant (1)	Pregnant out of wedlock (2)	ELA Club (3)	Men (4)	Alone (5)	Friends (6)	Volun-teer/Church (7)	Enrolled in School (8)	Work (9)
ELA T1: safe space + life skills	−.014	−.030	3.24***	−.565**	−.718***	−.412*	−1.53***	.002	.009
	(.024)	(.019)	(.198)	(.253)	(.229)	(.233)	(.305)	(.026)	(.036)
ELA T2: safe space + life	−.043**	−.055***	3.01***	−.635**	−.564**	−.564**	−1.52***	.032	.010
skills + vocational training	(.021)	(.017)	(.213)	(.252)	(.239)	(.233)	(.282)	(.026)	(.040)
ELA T3: safe space + life skills	.012	−.014	3.13***	−.425**	−.685***	−.589***	−1.62***	−.027	.044
+ vocational training + microfinance	(.022)	(.019)	(.254)	(.211)	(.227)	(.222)	(.326)	(.026)	(.031)
Control mean at baseline	.201	.138	–	3.27	6.01	6.26	10.7	.724	.430
t-test: T1==T2	{.180}	{.111}	{.384}	{.801}	{.468}	{.468}	{.960}	{.235}	{.986}
t-test: T1==T3	{.238}	{.388}	{.694}	{.559}	{.884}	{.369}	{.765}	{.250}	{.295}
Individual controls	✓	✓	✓	✓	✓	✓	✓	✓	✓
Village controls	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	2,779	2,779	2,779	2,779	2,779	2,779	2,779	2,779	2,779

Outcomes: All pregnancy outcomes in this table refer to conceptions after baseline data was collected. Time use outcomes measured in hours per week. Respondents were provided a set of 25 beads and a board with six circles representing: “Education,” “Income Generating Activities (IGA),” “Leisure,” “Household Chores,” “Sleep,” and “Other.” The Education category includes schooling, vocational training and study time. “IGA” includes paid and unpaid work of any kind. Respondents were then asked to allocate beads into each circle in a way that represents time allocation in an average week. Data on leisure time allocation was collected in a similar way. The recorded categories for leisure are “Friends,” “Men,” “Alone,” “Church,” “Volunteer,” “ELA club,” and “Other.” The exact phrasing for the “Men” category is “With boys or men you have a sexual relationship with.” Respondents were then asked to allocate beads into each circle in a way that represents time allocation in an average week. The data points were later converted into weekly hours using recorded total leisure time from the first exercise. Column (7) captures school enrolment and (column 8) captures engagement in any income generating activity—whether self-employment or wage work, occasional or stable, paid or unpaid. The two outcomes are not mutually exclusive, and respondents can engage in both.

Notes: ***, **, and * denote significance at the 1%, 5%, and 10% levels. Individual control variables include age dummies, wealth measured through the Progress of Poverty Index (PPI), household size and a dummy equal to 1 if the respondent is illiterate. Village-level controls include the number of dwellings, average PPI, a dummy equal to 1 if the paramount chief resides in the village, as well as distances from: closest market, secondary school and primary health unit (PHU), as well as the capital Freetown and Kailahun (the location of the first reported Ebola case). All specifications include district fixed effects (randomization strata), and standard errors are clustered at the unit of randomization (village).

Outcomes measured post-epidemic (2016). ANCOVA estimates, standard errors in parentheses.

To build on this argument, we extend (4) to consider the heterogeneous impacts of ELA treatment arm $j = 1, 2, 3$ across different pregnancy risk that girls face during the epidemic due to the availability of PHU safe spaces:

$$y^1_{ivd} = \alpha_0 + \alpha_1 y^0_{ivd} + \beta_1 \Pi_{vd} + \sum\nolimits_j \beta_{2j} T^j_{vd} \Pi_{vd} + \sum\nolimits_j \beta_{3j} T^j_{vd} (1 - \Pi_{vd}) + \gamma X_{ivd} + \upsilon X_{vd} + \lambda_d + u_{ivd}, \quad (5)$$

where Π_{vd} is a dummy equal to 1, if the village has high (above median) predicted pregnancy risk. The results are summarized in Figures 4A–4C.

These show the heterogeneous treatment effects for out-of-wedlock teen pregnancies, time spent with men, and school enrolment respectively. Each Figure reports three estimates: (1) $\widehat{\beta_1}$, the partial correlation with pregnancy risk in controls; (2) $\widehat{\beta_{2j}}$, the ITT estimate of ELA clubs in treatment arm j in villages with high pregnancy risk, and in the lighter dashed bar we show $\widehat{\beta_1} + \widehat{\beta_{2j}}$, namely the net impact on outcomes in high-risk treated villages from treatment arm j; and (3) $\widehat{\beta_{3j}}$, the ITT impact of ELA clubs in treatment arm j in villages with low pregnancy risk.

Across all three outcomes, the treatment effects of ELA clubs in high-risk villages do not significantly differ across treatment arms (middle panels). Moreover, the treatment effects of ELA clubs in low-risk villages also do not significantly differ across treatment arms (right hand panels). Finally, the *net* effect of ELA clubs in high-risk villages is very similar to their effect in low-risk villages, namely we cannot reject the null that $\widehat{\beta_1} + \widehat{\beta_{2j}} = \widehat{\beta_{3j}}$ in each arm j as shown by the nine p-values reported across the panels.

Overall, these results are consistent with the provision of a safe space through ELA clubs being sufficient to prevent kick-starting a causal chain between teen pregnancy, time spent with men and school dropout; and that these impacts are much more pronounced for girls in higher pregnancy risk villages during the crisis. Our results echo the concerns of the international community (Amnesty International 2015): Teen pregnancies represent one of the key channels through which the crisis permanently shifted young women's socioeconomic trajectories. This increase in fertility is concentrated among young women who found themselves isolated by the closure of schools. However, the random allocation of ELA club safe spaces to villages is entirely sufficient to break this causal chain.

7. Discussion

Adolescent girls face severe disadvantages across the developing world stemming from limited agency over their bodies and barriers to investing in their human capital. We study how these outcomes are impacted in times of aggregate crisis, in the context of the 2014–2016 Ebola epidemic in Sierra Leone. Our study is based around an evaluation of a club-based intervention targeting young women that was implemented during the epidemic. The intervention provided them a protective safe space where they can spend time away from men. Due to the epidemic, schools were closed throughout 2014/15.

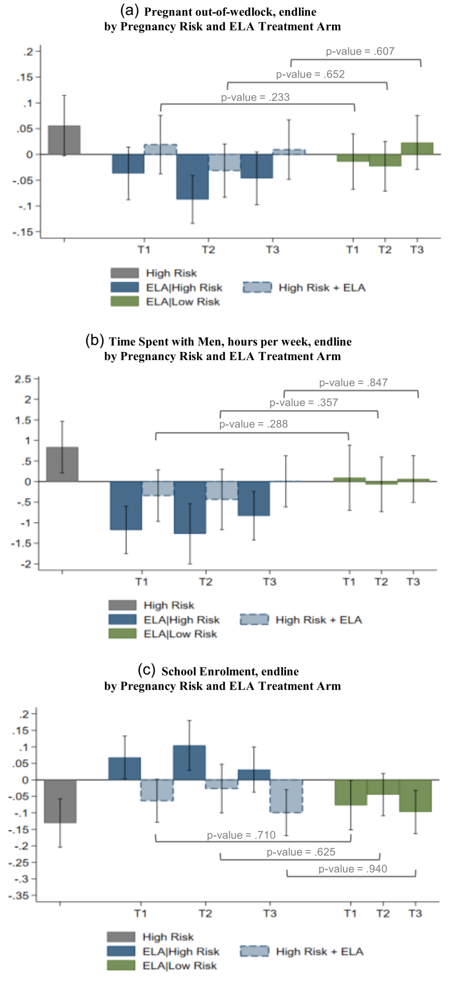

FIGURE 4. Heterogeneous Effects of ELA clubs. Figures report coefficient estimates from regressions that split treatment assignment by treatment arm. The pregnancy risk measure is constructed using an Elastic net procedure to select village-level characteristics that predict in controls, whether a girl became pregnant during the Ebola crisis. The set of potential covariates we consider split into three categories: village infrastructure and economic activity, demographics, and Ebola incidence and relief efforts. The selected variables are used to predict pregnancy risk for all girls (in treated and control villages), and the measure is standardized in the sample as a whole (to have mean 0 and standard deviation 1). Low (high) pregnancy risk refers to whether the measure is below (above) the median. Individual control variables include age dummies, wealth measured through the Progress of Poverty Index (PPI), household size and a dummy equal to 1 if the respondent is illiterate. Village-level controls include the number of dwellings, average PPI, a dummy equal to 1 if the paramount chief resides in the village, as well as distances from closest market, secondary school and primary health unit (PHU), as well as the capital Freetown and Kailahun (the location of the first reported Ebola case). All specifications control for baseline values of the outcome variable and include district fixed effects (randomization strata). Standard errors are clustered at the unit of randomization (village). Additionally, the figure reports (1) 95% confidence intervals for each coefficient (vertical black lines) and (2) p-values from t-tests of equality of each treatment effect across levels of PHU functioning.

We show that without the protection of time in school, in control villages, young girls spent significantly more time with men, teen pregnancies rose sharply, and school enrolment dropped post-epidemic, long after schools had re-opened, with these effects being even more pronounced for girls that lost access to other available safe spaces during the epidemic.

The combination of experimental and non-experimental evidence we provide shows the provision of safe spaces via ELA clubs breaks this causal chain: It enables girls to allocate time away from men, reduces out-of-wedlock pregnancies, and increases their school re-enrolment rates post-epidemic. The effects of ELA club safe spaces are most pronounced where girls face the highest underlying pregnancy risks, in part because they lose access to other available PHU safe spaces during the epidemic. To pin down mechanisms, we show other outcomes associated with the life skills component of the intervention do not shift, and exploit the second layer of randomization of the input bundle offered by clubs. This reinforces the idea that the safe space component offered by clubs is critical to driving outcomes for teenage girls, rather than the vocational training or micorfinance components. Our analysis has important implications for school closures in response to the aggregate health crisis in contexts where young women face sexual violence, highlighting the protective and lasting role safe spaces can provide in such times.

We conclude by discussing two further issues. First, given that future epidemics and pandemics are almost inevitable, we outline a future research agenda on gender inequality and aggregate crisis, building on the body of related work produced on the COVID-19 pandemic. Second, we discuss how our work fits into the wider literature emphasizing the benefits of club-based interventions.

7.1. Agenda

7.1.1. COVID-19 and Future Epidemics. Viruses continue to shape human history. Between 1980 and 2013, there were over 12,000 recorded outbreaks of 215 human infectious diseases, comprising 44 million cases across 219 countries, with the frequency and diversity of viral outbreaks increasing over time (Smith et al. 2014). The underlying drivers of more recurrent outbreaks have been an increase in the connectivity of human populations, closer contact between human and animal species, mass displacements arising from conflict, and climate change. None of these drivers are likely to dissipate, so it remains vital to understand how to protect the most vulnerable in societies facing challenges from aggregate health and economic shocks.

COVID-19 of course brought these issues to the fore. One of the major lessons from the pandemic, across high- and low-income settings, was the gendered nature of impacts, stemming from lockdowns and school closures because (1) women's labour force participation was more affected because the sectors they engage in are more sensitive to social distancing (Alon et al. 2022) and (2) the unequal distribution of housework and care duties (Adams-Prassl et al. 2020; Andrew et al. 2022); and (3) an increase in intimate partner violence against women (Boserup et al. 2020; Leslie and Wilson 2020; Ravindran and Shah 2023).

More directly in line with our analysis in the context of the Ebola epidemic, during COVID-19 it became widely recognized that school closures again put millions of girls across low-income countries at risk of pregnancy and early marriage (UNICEF 2021). Our evidence highlights that an important lesson for the future is that stigmatization and discrimination against pregnant girls remain a pervasive barrier to girls resuming education post-lockdowns throughout Sub-Saharan Africa. Countries such as Uganda and Tanzania have such explicit restrictions in place, while others retain ambiguous policy statements on the issue (Birungi et al. 2015). It is therefore hugely significant that as Sierra Leone in 2020 was struck by COVID-19, the government announced it would overturn the law barring pregnant girls from going to school. Our results show the importance of other countries following suit, and more broadly, for future studies to better understand the dynamics across these aggregate health crisis for young women.[19]

7.1.2. Club-Based Interventions. Our work adds to a growing evidence base using club-based interventions to foster young women's socioeconomic empowerment. Diaz-Martin et al. (2022) provide a thorough review of this evidence, and highlight two key advantages of group-based intervention delivery relative to targeting individuals. First, clubs serve as a platform for intervention delivery at-scale. Second, interactions among club members can be a strong mechanism through which intervention impacts are enhanced—say because fostering social ties can provide information, material and moral support to targeted beneficiaries.[20]

While much of this work establishes the benefits of club-based interventions in periods of economic stability, we show in times of crisis, such interventions have an additional benefit that generates persistent improvements in well-being: they provide a safe space that protects women from teen pregnancy and early childbearing, reducing school-to-work transitions and thus fostering their long run human development. It is natural to ask whether a similar program would be equally protective in another context and type of aggregate crisis. Analysis from an impact evaluation of the BRAC's Adolescent Girl Initiative program in South Sudan (essentially the same implementation model as ELA) suggests similar interrelated effects in time of crisis, even though the nature of the aggregate shock, conflict, is different, and the conflict occurred after the 2-year implementation period of the program had already ended (Buehren et al. 2017). Nonetheless, the analysis indicates that direct exposure to

19. The government of Sierra Leone had originally been challenged over the policy in a legal case brought to the Economic Community of West African States' Community Court of Justice: In December 2019, they ruled that the ban should be revoked. The case challenging the ban was brought by Sierra Leonean NGO (WAVES) in partnership with Equality Now and the Institute for Human Rights and Development in Africa.

20. Examples of contributions in this group-based literature include evaluations of conditional cash transfers (Baird, McIntosh, and Ozler 2011), school subsidies (Duflo, Dupas, and Kremer 2015), microfinance (Feigenberg, Field, and Pande 2013), the provision of negotiation skills (Ashraf et al. 2020), school-based training on life skills (Edmonds, Feigenberg, and Leight 2023), and gender equality training (Dhar et al. 2022).

the conflict offset many of the favorable effects of having participated in the ELA clubs.[21]

These are important insights because low-income countries remain more susceptible to aggregate shocks to begin with, and gender inequalities are more pronounced in poorer settings. Simple but powerful safe space interventions might then do much to prevent hard-earned gains to female empowerment being quickly eroded in such contexts in times of crisis, ultimately enabling societies hit by aggregate shocks to recover more quickly from them, rather than aggregate but temporary shocks casting a long shadow over the future lives of young women.

Appendix

A.1. Framework

A.1.1. Set Up. We use a three period model to map to our data collection: (1) $t = 0$ is the baseline pre-epidemic period; (2) $t = 1$ is when the Ebola epidemic occurs, with school closures in place; and (3) $t = 2$ is the endline period after schools reopen. Each period t, girls allocate their time between schooling s_t, a safe space such as ELA clubs c_t, and socializing l_t that includes time spent with men. Preferences are described by a CES utility function:

$$u(s, c, l) = \left[\alpha_s s^\eta + \alpha_c c^\eta + \alpha_l l^\eta\right]^{1/\eta}, \tag{A.1}$$

where taste parameters are such that $\alpha_s + \alpha_c + \alpha_l = 1$ and the elasticity of substitution between time uses is $\sigma = 1/(1-\eta)$. The taste for schooling parameter α_s captures (in reduced form) both the contemporaneous utility from attending school and the expected returns to schooling on future wages. Likewise, α_c captures the contemporaneous utility from attending ELA safe spaces, and the expected future returns from doing so–say through the acquisition of life skills, vocational training or microfinance.

The state variable $z_t \in \{0, 1\}$ captures a girl's motherhood status with $z_t = 1$ indicating she starts period t having had a child. We focus on girls who have no children at baseline, assume girls are not pregnant at $t = 0$ ($z_0 = 0$), and have a time endowment scaled to unity: $s_0 + c_0 + l_0 = 1$. At the end of each period a girl can become pregnant. As time spent socializing includes time with men, each unit of l_t can result in a pregnancy at the end of the period with probability $\pi \in [0, 1]$:

$$\mathbb{P}[z_{t+1} = 1 | l_t, z_t = 0] = \pi l_t. \tag{A.2}$$

21. Relateldly, Gulesci, Puente-Beccar, and Ubfal (2021) find that a female empowerment intervention delivered in Bolivia during COVID-19, providing life skills, mentoring and job finding assistance reduced violence against women. The main mechanisms through which the treatment was mediated is increased earnings of women (that could then improve their bargaining position within relationships), and spending more time out of the home through increased labor supply.

π thus captures pregnancy risk that girls face, that depends in part on the availability of safe spaces. We model pregnancy, $z_t = 1$, as an absorbing state:

$$\mathbb{P}[z_{t+1} = 1 | l_t, z_t = 1] = 1. \tag{A.3}$$

Hence, being pregnant and having a child represent the same state, and we do not model having multiple children. Having a child entails a time cost $\psi \in [0, 1]$.[22]

Girls thus face an intertemporal trade-off between the utility of socializing today and the risk of getting pregnant and hence facing a more binding time constraint next period. Given fertility status z_t, the time constraint can be rewritten as: $s_t + c_t + l_t = 1 - \psi z_t$.

A.1.2. Pre-Epidemic. At baseline pre-epidemic, both the future Ebola epidemic and availability of ELA clubs are unknown. Thus, $c_t = 0 \ \forall \ t$ and the time allocation problem across periods is

$$\begin{aligned} V_t(z_t) &= \max_{s_t, l_t} u(s_t, 0, l_t) + \beta \mathbb{E}_z[V_{t+1}(z_{t+1})] \text{ for } t = 0, 1 \\ V_2(z_2) &= \max_{s_2, l_2} u(s_2, 0, l_2), \end{aligned} \tag{A.4}$$

subject to $s_t + l_t = 1 - \psi z_t$, $s_t, l_t \in [0, 1]$ and (A.2). The FOCs at $t = 0$ and 1 make clear that girls face an intertemporal trade-off:

$$\frac{\partial u}{\partial s_t} + \beta \pi [V_{t+1}(0) - V_{t+1}(1)] = \frac{\partial u}{\partial l_t}, \ t = 0, 1. \tag{A.5}$$

The marginal benefit to schooling today is the flow utility of schooling (first term on the LHS) as well as the effect that time in school has on the likelihood of pregnancy, which determines the time constraint tomorrow. At the optimum the sum of the two equals the marginal utility of leisure (RHS). The time allocated to schooling and socializing is summarized by policy functions for $z_t = 0, 1$ with the following characteristics:

$$\begin{array}{ll} s_0^*(0) > s_1^*(0) > s_2^*(0) = \omega_s, & l_0^*(0) < l_1^*(0) < l_2^*(0) = \omega_l \\ s_t(1) = \omega_s(1 - \psi) & l_t(1) = \omega_l(1 - \psi). \end{array} \tag{A.6}$$

A.1.3. During the Epidemic. School closures during the epidemic imply $s_1 = 0$. As the epidemic is unexpected at time $t = 0$, choices are the same as above, but at $t = 1$, school closures reduce the opportunity cost of spending time with men. Choices at $t = 2$ will then be constrained by fertility outcomes at $t = 1$, as in the FOCs above. Higher pregnancy risk π during the epidemic makes the time constraint post-epidemic more binding in expectation, thus decreasing average time in school post-epidemic

22. The time endowment is net of household chores, which we assume to behave as an exogenous lump-sum tax on young women's total time. In our data, the average respondent who is single and has no children reports spending 40 hours/week on household chores. Over the cross-section, this rises by 18 hours when the first child is born, and does not change significantly when a second or third children are born. This is in line with our modelling assumption of $z_t = 1$ being an absorbing state, and not needing to track the actual number of children in terms of time cost incurred.

at $t = 2$. This is the mechanism through which temporary school closures can have permanent effects on time in school. During the epidemic, in our study context, PHU closures and disruptions proxy one part of an increase in pregnancy risk π.

With $T \in \{0, 1\}$ representing treatment assignment, the constraint $c_t \in [0, T]$ captures the availability of ELA clubs. A girl's time allocation problem during and post-epidemic can thus be rewritten as:

$$\begin{aligned} V_1(0) &= \max_{c_1, l_1} u(0, c_1, l_1) + \beta \mathbb{E}_z[V_2(z_2)] \\ V_2(z_2) &= \max_{s_2, c_2, l_2} u(s_2, c_2, l_2), \end{aligned} \tag{A.7}$$

subject to (1) $c_1 + l_1 = 1$; (2) $s_2 + c_2 + l_2 = 1 - \psi z_2$; and (3) $s_2, l_1, l_2 \in [0, 1]$; $c_1, c_2 \in [0, T]$. Demand for ELA clubs is driven both by the direct utility of attendance and future returns from attendance. In addition, ELA club attendance displaces time spent with men, thus reducing the likelihood of pregnancy. The epidemic strengthens this last motive: With schools closed, ELA clubs are a safe space available to girls, and are therefore crucial for avoiding pregnancies and returning to school post-epidemic. The FOC for the time spent in ELA clubs during the epidemic makes this clear:

$$\frac{\partial u}{\partial c_1} + \beta \pi [V_2(0) - V_2(1)] = \frac{\partial u}{\partial l_1}, \tag{A.8}$$

where the first term is the standard demand for ELA clubs, which is increasing in α_c, and the second term is the future value of not getting pregnant today, i.e., the value of the safe space, that appears also in (A.5). This value is increasing in pregnancy risk π and, under some straightforward conditions on preferences, is also increasing in the returns to schooling α_s.[23]

A.1.4. Post-Epidemic. Time allocations in the final period $t = 2$ have no intertemporal implications, and so choices are determined by the FOC setting the marginal rate of substitution between schooling and socializing equal to the shadow cost of time. Time allocated to school and socializing are then just shares of the total time available at $t = 2$:

$$\begin{aligned} s_2^*(z_2) &= \omega_s(1 - \psi z_2) \\ l_2^*(z_2) &= \omega_l(1 - \psi z_2), \end{aligned} \tag{A.9}$$

where the shares are functions of the underlying taste parameters: $\omega_s = ({\alpha_s}^{\sigma})/({\alpha_s}^{\sigma} + {\alpha_l}^{\sigma})$, $\omega_l = 1 - \omega_s$.

23. Note $V_2(0) - V_2(1) = \psi V_2(0)$. Using the envelope theorem it can be shown that this quantity is increasing in α_s if and only if $1/\eta[\omega_s^{\eta} + (d\alpha_c)/(d\alpha_s)\omega_c^{\eta} + (d\alpha_l)/(d\alpha_s)\omega_l^{\eta}] > 0$, where $d\alpha_s + d\alpha_c + d\alpha_l = 0$ since the preference parameters sum to 1. In our setting, the share of time devoted to schooling ω_s is the largest among the three activities, and we assume an elasticity of substitution greater than or equal to 1, i.e., $\eta \in [0, 1]$. Therefore, if the taste for schooling is the only parameter that increases - both $d\alpha_c$ and $d\alpha_l$ are non-positive. This is sufficient for the above condition to be satisfied.

To understand the effect of the epidemic on time in schooling, we start from expected demands in period $t = 2$ across treatment and control villages:

$$\begin{aligned} \text{Treatment: } & S_2^T = \mathbb{E}_z[s_2^*(z_2)|T = 1] = \omega_s^T \left(1 - \pi\psi\left(1 - C_1^T\right)\right) \\ \text{Control: } & S_2^C = \mathbb{E}_z[s_2^*(z_2)|T = 0] = \omega_s(1 - \pi\psi), \end{aligned} \tag{A.10}$$

where expectations are taken over the distribution of the state variable. Denote $\omega_s = (\alpha_s^\sigma)/(\alpha_s^\sigma + \alpha_l^\sigma) \geq \omega_s^T = (\alpha_s^\sigma)/(\alpha_s^\sigma + \alpha_c^\sigma + \alpha_l^\sigma)$, and $\pi\psi$ is the expected cost of pregnancy risk.

In control villages, the epidemic leaves girls without access to school or ELA clubs. As a result, a share π of girls in control villages become pregnant, bearing the time cost ψ and limiting time available for schooling post-epidemic. The number of girls becoming pregnant, and the resulting fall in enrolment post-epidemic, are proportional to pregnancy risk, so varying with PHU closures.

In treated villages, ELA clubs are available both during and after the epidemic. The treatment effect on time in school once they reopen post-epidemic is

$$TE = S_2^T - S_2^C = -(1 - \pi\psi)\left(\omega_s - \omega_s^T\right) + \pi\psi C_1^T \omega_s^T. \tag{A.11}$$

The first term is the *contemporaneous* channel, where the share of time allocated to school falls because clubs might substitute for time in school ($\alpha_c > 0$). The second term is the *intertemporal* channel where the use of safe spaces during the epidemic (C_1^T) reduces the likelihood of becoming pregnant, relaxing the post-epidemic time constraint and so increasing time in school post-epidemic ($\alpha_s > 0$). These move the treatment effect on post-epidemic schooling in opposite directions and can help explain the overall null impact of ELA clubs on school enrolment found in Table 4.[24]

Pregnancy risk π matters for time in school in both treatment and control villages, but to different extents. If the epidemic differentially shocks the degree of pregnancy risk girls face (because of PHU closures), we have that

$$\frac{dTE}{d\pi} = \psi\omega_s^T\left(C_1^T + \pi\frac{\partial C_1^T}{\partial\pi}\right) + \psi\left(\omega_s - \omega_s^T\right) \geq 0. \tag{A.12}$$

Hence, the treatment effect on schooling increases in pregnancy risk π (we see this from the FOC and the fact that C_1^T is increasing in π). Therefore, while the sign of treatment effects of ELA clubs on time in school is a priori ambiguous, it increases with pregnancy risk. This is exactly what is mapped to the data using specification (3).

24. The treatment effect can be signed in extreme cases of $\pi\psi = 0$ or 1. If either there is no risk of pregnancy ($\pi = 0$) or no time cost associated with having children ($\psi = 0$). Then $TE = -(\omega_s - \omega_s^T) < 0$, as clubs only act as a substitute for schooling. In the other extreme case of $\pi\psi = 1$ the treatment effect is unambiguously positive as $TE = C_1^T\omega_s^T > 0$.

References

Adams-Prassl, A., T. Boneva, M. Golin, and C. Rauh (2020). “Inequality in the Impact of the Coronavirus Shock: Evidence from Real Time Surveys.” *Journal of Public Economics*, 189, 104245.

Adda, J. (2016). “Economic Activity and the Spread of Viral Diseases: Evidence from High Frequency Data.” *Quarterly Journal of Economics*, 131, 891–941.

Ager, A., J. Metzler, M. Vojta, and K. Savage (2013). “Child Friendly Spaces: A Systematic Review of the Current Evidence Base on Outcomes and Impact.” *Intervention*, 11, 133–147.

Agostinelli, C., M. Doepke, G. Sorrenti, and F. Zilibotti (2022). “When the Great Equalizer Shuts Down: Schools, Peers, and Parents in Pandemic Times.” *Journal of Public Economics*, 206, 104574.

Agüero, J. M. and T. Beleche (2017). “Health Shocks and Their Long-Lasting Impact on Health Behaviors: Evidence from the 2009 H1N1 Pandemic in Mexico.” *Journal of Health Economics*, 54, 40–55.

Alon, T., S. Coskun, M. Doepke, D. Koll, and M. Tertilt (2022). “From Mancession to Shecession: Women’s Employment in Regular and Pandemic Recessions.” *NBER Macroeconomics Annual*, 36, 83–151.

Amnesty International (2015). *Shamed and Blamed: Pregnant Girls’ Rights at Risk in Sierra Leone*. Amnesty International Publications.

Andrew, A., S. Cattan, M. Costa Dias, C. Farquharson, L. Kraftman, S. Krutikova, and A. Sevilla (2022). “The Gendered Division of Paid and Domestic Work under Lockdown.” *Fiscal Studies*, 43, 325–340.

Archibong, B. and F. Annan (2020). “Schooling in Sickness and in Health: The Effects of Epidemic Disease on Gender Inequality.” Working paper, Barnard College.

Ashraf, N., N. Bau, C. Low, and K. McGinn (2020). “Negotiating a Better Future: How Interpersonal Skills Facilitate Inter-Generational Investment.” *Quarterly Journal of Economics*, 135, 1095–1151.

Baird, S. J., C. T. McIntosh, and B. Ozler (2011). “Cash or Condition: Evidence from a Cash Transfer Experiment.” *Quarterly Journal of Economics*, 126, 1709–1753.

Bandiera, O., N. Buehren, R. Burgess, M. Goldstein, S. Gulesci, and M. Sulaiman (2020). “Women’s Empowerment in Action: Evidence from a Randomized Control Trial in Africa.” *American Economic Journal: Applied Economics*, 12, 210–259.

Behrman, J. A., A. Peterman, and T. Palermo (2017). “Does Keeping Adolescent Girls in School Protect Against Sexual Violence? Quasi-Experimental Evidence from East and Southern Africa.” *Journal of Adolescent Health*, 60, 184–190.

Behrman, J. A. and A. Weitzman (2016). “Effects of the 2010 Haiti Earthquake on Women’s Reproductive Health.” *Studies in Family Planning*, 47, 3–17.

Bennett, D., C. F. Chiang, and A. Malani (2015). “Learning During a Crisis: The SARS Epidemic in Taiwan.” *Journal of Development Economics*, 112, 1–18.

Birungi, H. et al. (2015). “Education Sector Response to Early and Unintended Pregnancy: A Review of Country Experiences in Sub-Saharan Africa.” Report.

Boserup, B., M. McKenney, and A. Elkbuli (2020). “Alarming Trends in US Domestic Violence During the COVID-19 Pandemic.” *American Journal of Emergency Medicine*, 38, 2753–2755.

Bowles, J., J. Hjort, T. Melvin, and E. Werker (2016). “Ebola, Jobs and Economic Activity in Liberia.” *Journal of Epidemiology and Community Health*, 70, 271–277.

Buchmann, N., E. Field, R. Glennerster, S. Nazneen, and X. Y. Wang (2023). “A Signal to End Child Marriage: Theory and Experimental Evidence from Bangladesh.” *American Economic Review*, 113, 2645–2688.

Buehren, N., S. Chakravarty, M. Goldstein, V. Slavchevska, and M. Sulaiman (2017). “Adolescent Girls’ Empowerment in Conflict-Affected Settings: Experimental Evidence from South Sudan.” CSA Conference Paper, Oxford, United Kingdom.

Casey, K., R. Glennerster, and T. Suri (2017). “The Economic Impacts of Ebola on Firms in Sierra Leone.” International Growth Centre (IGC) Report F-39204-SLE-1.

Chari, A. V., R. Heath, A. Maertens, and F. Fatima (2017). "The Causal Effect of Maternal Age at Marriage on Child Wellbeing: Evidence from India." *Journal of Development Economics*, 127, 42–55.

Christensen, D., O. Dube, J. Haushofer, B. Siddiqi, and M. Voors (2021). "Building Resilient Health Systems: Experimental Evidence from Sierra Leone and the 2014 Ebola Outbreak." *Quarterly Journal of Economics*, 136, 1145–1198.

Denney, L., R. Gordon, A. Kamara, and P. Lebby (2016). "Change the Context not the Girls: Improving Efforts to Reduce Teenage Pregnancy in Sierra Leone." Secure Livelihoods Research Consortium, Report 11

Dhar, D., T. Jain, and S. Jayachandran (2022). "Reshaping Adolescents' Gender Attitudes: Evidence from a School-based Experiment in India." *American Economic Review*, 112, 899–927.

Diaz-Martin, L., A. Gopalan, E. Guarnieri, and S. Jayachandran (2022). "Greater than the Sum of the Parts? Evidence on Mechanisms Operating in Women's Groups." *World Bank Research Observer*, 38, 1–35.

Doepke, M., M. Tertilt, and A. Voena (2012). "The Economics and Politics of Women's Rights." *Annual Review of Economics*, 4, 339–372.

Duflo, E. (2012). "Women Empowerment and Economic Development." *Journal of Economic Literature*, 50, 1051–1079.

Duflo, E., P. Dupas, and M. Kremer (2015). "Education, HIV, and Early Fertility: Experimental Evidence from Kenya." *American Economic Review*, 105, 2757–2797.

Edmonds, E., B. Feigenberg, and J. Leight (2023). "Advancing the Agency of Adolescent Girls." *Review of Economics and Statistics*, 105, 852–866.

Evans, D. K., M. P. Goldstein, and A. Popova (2015). "Health-Care Worker Mortality and the Legacy of the Ebola Epidemic." *Lancet Global Health*, 3, e439–e440.

Evans, D. K., S. Hares, P. A. Holland, and A. Mendez Acosta (2023). "Adolescent Girls' Safety in and out of School: Evidence on Physical and Sexual Violence from across Sub-Saharan Africa." *Journal of Development Studies*, 59, 739–757.

Feigenberg, B., E. Field, and R. Pande (2013). "The Economic Returns to Social Interaction: Experimental Evidence from Microfinance." *Review of Economic Studies*, 80, 1459–1483.

Field, E. and A. Ambrus (2008). "Early Marriage, Age of Menarche, and Female Schooling Attainment in Bangladesh." *Journal of Political Economy*, 116, 881–930.

Filmer, D., M. Langthaler, R. Stehrer, and T. Vogel (2018). *World Development Report 2018-LEARNING to Realize Education's Promise*. World Bank.

Fluckiger, M., M. Ludwig, and A. Sina Onder (2019). "Ebola and State Legitimacy." *Economic Journal*, 129, 2064–2089.

Fraser, E. (2020). "Impact of COVID-19 Pandemic on Violence against Women and Girls." VAWG Helpdesk Research Report No. 284.

Fuchs-Schündeln, N., D. Krueger, A. Ludwig, and I. Popova (2020). "The Long-Term Distributional and Welfare Effects of Covid-19 School Closures." Working Paper No. 27773, National Bureau of Economic Research.

Glennerster, R., T. Suri, and S. Bhogale (2016). "The Implications of the Ebola Outbreak on Markets, Traders, and Food Security in Sierra Leone." Policy Brief, International Growth Centre (IGC).

Gulesci, S., M. Puente-Beccar, and D. Ubfal (2021). "Can Youth Empowerment Programs Reduce Violence against Girls during the COVID-19 Pandemic?" *Journal of Development Economics*, 153, 102716.

Jayachandran, S. (2015). "The Roots of Gender Inequality in Developing Countries." *Annual Review of Economics*, 7, 63–88.

Jensen, R. (2012). "Do Labor Market Opportunities Affect Young Women's Work and Family Decisions? Experimental Evidence from India." *Quarterly Journal of Economics*, 127, 753–792.

Junior, I. Lautharte and I. Rasul (2020). "The Anatomy of a Public Health Crisis: Household Responses over the Course of the Zika Epidemic in Brazil." Working paper, UCL.

Leslie, E. and R. Wilson (2020). "Sheltering in Place and Domestic Violence: Evidence from Calls for Service during Covid-19." *Journal of Public Economics*, 189, 104241.

MacCormack, C. P. (1979). "Sande: The Public Face of a Secret Society." in Jules-Rosette, *The New Religions of Africa*, New Jersey, pp. 27–37.
Maffoli, E. M. (2021). "The Political Economy of Health Epidemics: Evidence from the Ebola Outbreak." *Journal of Development Economics*, 151, 102651.
Malmendier, U. and D. Willigrod (2023). "The Impact of Quarantining on School Enrollment: Evidence from the Ebola Epidemic in Sierra Leone." Working paper, UC Berkeley.
Moscoviz, L. and D. Evans (2022). "Learning Loss and Student Dropouts during the COVID-19 Pandemic: A Review of the Evidence Two Years after Schools Shut Down."
Rangel, M. A., J. Nobles, and A. Hamoudi (2020). "Brazil's Missing Infants: Zika Risk Changes Reproductive Behavior." *Demography*, 57, 1647–1680.
Rasul, I. (2020). "The Economics of Viral Outbreaks." *AEA P&P*, 110, 265–268.
Ravindran, S. and M. Shah (2023). "Unintended Consequences of Lockdowns, COVID-19 and the Shadow Pandemic in India." *Nature Human Behaviour*, 7, 323–331.
Rosenzweig, M. R. and C. Udry (2020). "External Validity in a Stochastic World: Evidence from Low Income Countries." *Review of Economic Studies*, 87, 343–381.
Smith, K. F., M. Goldberg, S. Rosenthal, L. Carlson, J. Chen, C. Chen, and S. Ramachandran (2014). "Global Rise in Human Infectious Disease Outbreaks." *Journal of the Royal Society Interface*, 11, 20140950.
Statistics Sierra Leone (2018). "Sierra Leone Integrated Household Survey." https://www.statistics.sl/index.php/sierra-leone-integrated-household-survey-slihs.html.
Thomas, M. R., G. Smith, F. H. G. Ferreira, D. Evans, M. Maliszewska, M. Aliszewska, M. Cruz, K. Himelein, and M. Over (2015). "The Economic Impact of Ebola on Sub Saharan Africa: Updated Estimates for 2015." Technical Report, World Bank
UNDP (2015). "Socio-Economic Impact of Ebola Virus Disease in West African Countries: A Call for National and Regional Containment, Recovery and Prevention." UNDP Africa Policy Notes 2015-04, United Nations Development Programme, Regional Bureau for Africa.
UNICEF (2021). "COVID-19: A Threat to Progress against Child Marriage." UNICEF, New York
WHO (2016). "Ebola Situation Report—Sierra Leone." updated 11 May 2016, World Health Organization

Supplementary Data

Supplementary data are available at *JEEA* online.

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