The Economic Lives of Young Women in the Time of Ebola: Lessons from an Empowerment Program*

Oriana Bandiera, Niklas Buehren, Markus Goldstein, Imran Rasul, Andrea Smurra†

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Abstract

We evaluate an intervention to raise young women's economic empowerment in Sierra Leone, where women frequently experience sexual violence and face multiple economic disadvantages. The intervention provides them with a protective space (a club) where they can find support, receive information on health/reproductive issues and vocational training. Unexpectedly, the post-baseline period coincided with the 2014 Ebola outbreak. Our analysis leverages quasi-random across-village variation in the severity of Ebola-related disruption, and random assignment of villages to the intervention to document the impact of the Ebola outbreak on the economic lives of 4,700 women tracked over the crisis, and any ameliorating role played by the intervention. In highly disrupted control villages, the crisis leads younger girls to spend significantly more time with men, out-of-wedlock pregnancies rise, and as a result, they experience a persistent 16pp drop in school enrolment post-crisis. These adverse effects are almost entirely reversed in treated villages because the intervention enables young girls to allocate time away from men, preventing out-of-wedlock pregnancies and enabling them to re-enrol in school post-crisis. In treated villages, the unavailability of young women leads some older girls to use transactional sex as a coping strategy. The intervention causes them to increase contraceptive use so this does not translate into higher fertility. Our analysis pinpoints the mechanisms through which the severity of the aggregate shock impacts the economic lives of young women, and shows how interventions in times of crisis can interlink outcomes across younger and older cohorts. *JEL Classification: I25, J13, J24.*

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†Bandiera: LSE, o.bandiera@lse.ac.uk; Buehren: World Bank, nbuehren@worldbank.org; Goldstein: World Bank, mgoldstein@worldbank.org; Rasul: UCL, i.rasul@ucl.ac.uk; Smurra: UCL, a.smurra.11@ucl.ac.uk.

1 Introduction

Nearly all low-income countries are susceptible to aggregate shocks of some sort, be they through commodity price fluctuations, conflict, epidemics or climate change. We study the economic impacts of one such aggregate shock in Sierra Leone. We are able to overlay this aggregate shock with a randomized control trial evaluation of a human capital intervention targeted to young women, designed to raise their reproductive knowledge and health, and improve their labor market prospects. By combining the two, we provide novel insights on the microeconomic mechanisms through which the severity of such an aggregate shock impacts the economic lives of young women in a low-income and fragile state.

The aggregate shock we study is the 2014-16 Ebola outbreak. This led to the, *"longest, largest, deadliest, and...most complex [Ebola outbreak] in history"* [UNDG 2015]. The outbreak affected Sierra Leone, Guinea and Liberia, spreading quickly through urban areas and infecting $28,652$ individuals, with $11,352$ deaths [CDCP estimate, April 2016]. There were more cases and deaths in this outbreak than all earlier outbreaks combined. Sierra Leone was the country most affected, hosting half of all cases. Rapid contagion forced the government to implement three main policy responses: (i) village lock-downs and travel bans; (ii) all primary and secondary schools were closed through the 2014-15 academic year; (iii) health workers were mobilized to record door-to-door cases and track contagion, and some health facilities were transformed into Ebola holding centers.

The aggregate shock severely curtailed economic activities and opportunities for all. There are however additional aspects of each policy response that might have had greater consequences for young women. For example, school closures would mean the loss of one year of human capital accumulation. For young girls this loss is non-trivial given their low levels of human capital to begin with. Moreover, without the protection of time in school, young women might have become more exposed to early pregnancy and sexual abuse. Furthermore, just before schools were due to re-open in April 2015, the Ministry of Education surprisingly announced the continuation of a pre-Ebola policy; that 'visibly pregnant girls' would be unable to re-enrol. Taken together, the consequences of these schooling policy responses could have done much to further increase stigma and discriminatory attitudes towards young women. The near collapse of public health provision would further have impacted teenagers and young women requiring antenatal care.[1]

Our study context represents not only a low-income fragile state, but is also one in which women face a range of social and economic disadvantages. As Panel A in Figure A1 shows, on the

[1]Sierra Leone is not unique in having such policies preventing pregnant girls from attending school: Tanzania recently announced a similar policy.

eve of the outbreak, Sierra Leone ranked near the global bottom of a 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-crisis there were 0.2 doctors and 3 nurses per 10,000 people (the corresponding figures for most OECD 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 WHO, teen pregnancy is one of the leading causes of death for mothers in Sierra Leone and illegal abortions are common. It is also a setting where there is a high prevalence of sexual exploitation and violence towards young women. For example, over half of women in Sierra Leone (56%) report having suffered some form of gender based violence during their lifetime [Amnesty International 2015].[3]

It was in the context of pre-crisis Sierra Leone that our data collection exercise was originally planned. This was for a randomized control trial evaluation of an intervention to empower young women along economic and social dimensions, building on our earlier work evaluating the same intervention in Uganda [Bandiera *et al.* 2018].[4] The program, known as the Empowerment and Livelihood for Adolescents (ELA) intervention, is delivered by the NGO BRAC. It provides clubs in which young women can meet, and offers a package of skills training. This training includes life skills, such as awareness of health and reproductive issues; financial literacy; and vocational skills. Older girls can also access microfinance to start micro-enterprises.

Fieldwork for our baseline survey was completed a week prior to the first cases of Ebola being reported in May 2014. The fact that our evaluation was underway at the time of the outbreak was entirely coincidental: the ELA program is not intended as a response to the crisis. We exploit the timing of events and randomized roll out of the ELA program to document: (i) how the severity of the Ebola shock correlates to changes in the economic lives of the 4,700 tracked girls and young women; (ii) whether the ELA intervention mitigated any of these impacts. Our work thus provides a rare opportunity to explore the overlay of a randomized intervention with an aggregate shock, in a sample tracked over pre- and post-crisis periods.

[2] Panel A of Figure A1 shows the UNDP Gender Inequality Index, that aggregates information on maternal mortality rates, adolescent fertility rates, education by gender, female held parliamentary seats, and gender inequality in labor market participation. The index ranges from 0 to 1, with 0 indicating perfect equality. Sierra Leone scores .65, while the average in Sub Saharan Africa is closer to .55.

[3] Reflecting these concerns, the Secretariat for the Reduction of Teenage Pregnancy was established in Sierra Leone in 2013. They developed the national strategy, *Let Girls be Girls, not Mothers!* The Sierra Leone Sexual Offences Act 2012 provides that a person below the age of 18 is not capable of giving consent, and that it is not a defence to any of the offences in the Act to show a child has consented.

[4] Bandiera *et al.* [2018] find that four years post-intervention, ELA significantly improved the economic empowerment of women, gave them greater control over their bodies in terms of contraceptive use, pregnancy knowledge and being able to avoid sex against their will, and raising aspired ages of marriage and childbearing.

The fact that women face a range of disadvantages in this setting is starkly quantified in our baseline data: respondents are on average 18 years old, yet 60% are in relationships, 28% are married (with a third of marriages being polygamous). While their age at marriage is close to 16, the average age at marriage of their husbands is almost double, at 31. Despite their young ages, nearly half have children. For those in relationships, 46% report being subject to intimate partner violence. These traits of early marriage, childbearing and exposure to violence all have obvious long term consequences on women's ability to acquire human capital and lead financially independent lives [e.g. Jayachandran 2015].

Our analysis is based on a 2×2 factorial design, where one dimension is the quasi-random assignment of the severity of Ebola-related disruption to villages, and the other dimension is the random assignment of villages to ELA treatment or control. We use retrospective data collected from village leaders at the tail end of the crisis to construct an index of village level disruption, proxying the loss in economic opportunity and health service provision that each village experienced. We make precise the four identifying assumptions for the factorial design and provide supportive evidence for each. On the assumption of the quasi-random assignment of disruption, we document how our disruption index is largely uncorrelated to contemporaneous village characteristics, and uncorrelated to past measures of health related behaviors, knowledge and state capacity. This is in line with existing work using spatiotemporal models to simulate the spread of Ebola and measure the local intensity of the shock. This body of work also suggests the geographic incidence of the outbreak is largely uncorrelated to economic, social or political characteristics of locations [Backer and Wallinga 2016, Maffioli 2017, Fluckinger *et al.* 2018].

Our monitoring data confirms there was an extensive roll out of the ELA program despite the circumstances: (i) 70% of clubs opened on time (by September 2014); (ii) the majority of clubs provided life skills training; (iii) vocational skills training took off after travel quarantines were lifted in January 2015. Moreover, there is high demand from women for accessing ELA clubs: 71% of survey respondents in treated villages *ever* participated in an ELA club meeting or activity (versus 4% in control villages). In terms of trainings received: (i) 82% participated in life skills; (ii) 25% received financial literacy training; (iii) 34% participated in vocational skills training; (iv) 13% received a microfinance loan from BRAC. The overall pattern of participation in activities is in line with what was reported in terms of club openings and training offered.

We conduct our analysis separately for young girls (aged 12-17 at baseline), and older girls (aged 18-25 at baseline) because (i) these cohorts differ in the economic activities they were engaged in at baseline: the majority of the younger cohort are engaged full time in schooling pre-crisis, while the majority of the older cohort are engaged in income generation; (ii) the policy responses to

Ebola impact these age groups differently: younger girls are relatively more impacted by school closures and barriers to re-enrolling, while the older cohort are more impacted by the disruption to economic and health facilities; (iii) an informal institution in rural Sierra Leone is gender specific 'secret societies': the role of the women's society is to initiate girls into adulthood, and there is a traditional separation of older and younger women in these institutions [Bledsoe 1990].

Our main results are as follows. On the impacts of the intensity of the Ebola shock in control villages (so absent ELA clubs), there are two key dimensions along which the economic lives of young women are impacted: economic activities engaged in, and time spent with men.

On the first dimension, we find that residing in a high disruption village leads younger girls to stay out of schools post crisis, i.e. long after schools have reopened and when our endline survey is conducted. This is a large extensive margin response: enrolment rates fall by 16pp in more disrupted villages, or 32% of the baseline mean. The result indicates that in high disruption villages there are persistent impacts of the shock so that it is harder for young girls to re-enrol even long after the policy of school closures ends. Their reallocation of activities is largely towards engagement in income generation: this rises by 19.1pp (or 238% of the baseline mean). This accelerated school-to-work transition is far higher than what we would have predicted at baseline as these girls become older.

On the second dimension, residing in a high disruption village absent ELA significantly increases the time young women spend with men. The magnitude of the impact is 1.27hrs/wk, or a near 48% increase over the baseline mean. As a consequence of this increased exposure to men, we see subsequent impacts on pregnancy and risky behaviors. Moving from a low to a high disruption village is associated with 10.7pp increase in the likelihood of becoming pregnant, a doubling from baseline. This is nearly all driven by out-of-wedlock pregnancies. These impacts occur at a time when health service provision has been significantly curtailed, and the dangers during childbirth to girls are likely to be even more severe than in normal times.

Our core results examine how the ELA program mitigates these two dimensions of impact.

First, the availability of ELA clubs counters the school-to-work transition among younger girls. More precisely, in high disruption villages randomly assigned to the ELA intervention, the 16pp fall in full time school enrolment is halved (to a 8.1pp fall). In those locations, the ELA clubs cause girls exclusive engagement in income generation to rise by only 5.8pp (compared to the 19.1pp rise absent ELA clubs), and ELA clubs also enable girls to be able to engage in both school and work activities simultaneously. We then show that by reversing the school-to-work transition caused by the aggregate shock, ELA clubs aid the accumulation of basic skills of numeracy and literacy for younger girls, especially in high disruption locations.

There are some limited improvements in other dimensions of human capital as a result of the ELA program. These dimensions include business skills, attitudes towards gender norms/roles, and health-related knowledge, and are part of life skills component of ELA. The gains to young women on these dimensions of human capital occur in both high and low disruption villages. Overall, the picture that emerges is that ELA clubs foster multiple dimensions of human capital accumulation in a time of aggregate crisis.

This all links to the potential role ELA clubs play in offering girls and women alternative uses of their time to spending it with men or in other leisure activities. Our remaining results examine this aspect more closely.

We find that women in ELA treatment villages significantly reduce time spent with men or time spent alone. These reductions occur for both age groups, and in low and high disruption villages. As a consequence of these effects on time use of ELA clubs, we observe subsequent impacts on pregnancy and risky behaviors. Most importantly, the impact on out-of-wedlock births is completely reversed in treated high disruption villages. The magnitude of the fall in out-of-wedlock pregnancies caused by ELA (7.5pp) closely matches the rise in school enrolment caused by ELA (8.5pp) in high disruption villages. This is as expected given the ban on visibly pregnant girls attending school that was in place post-crisis.

The protective time effects of ELA for young women have consequent impacts for older girls (those aged 18-25 at baseline). In particular, as the availability of younger girls is reduced in the presence of ELA, men likely shift attention to older girls and seek out alternative ways to satisfy their sexual demands. In treated villages, older girls report increases in unwanted sex (by 5.3pp or 40% of the baseline mean), and report engaging in more transactional sex (by 5.4pp, 120% of the baseline mean). As in Dupas and Robinson [2012], the use of transactional sex is thus one form of income generation available to women in a time of crisis when economic opportunities become scarce and the ability to use mechanisms to smooth consumption in the face of idiosyncratic shocks is limited. Reassuringly, ELA clubs prevent these changes translating into higher fertility because older girls take on the life skills provided by ELA and increase their use of female controlled forms of contraception.[5]

Taken together, our findings show how the Ebola crisis impacts the economic lives of women through time spent with men, and how interventions in a time of crisis might interlink human capital and fertility outcomes across younger and older cohorts.

[5]Dupas and Robinson [2012] study the impacts of political crisis of Kenya's 2007 elections, where civil unrest led to the closure of markets. They collected data from sex workers and other samples, shortly after the political and social upheaval (in Busia). They found large reductions in income and consumption expenditures among rural households. The main coping strategy for women was transactional sex and engaging in higher risk sex.

Our analysis provides novel contributions to two established literatures: on household responses to aggregate shocks, and on women's empowerment.

On household responses to shocks, a vast literature studies *ex ante* and *ex post* mechanisms to mitigate idiosyncratic risks [Townsend 1994]. A smaller literature examines responses to aggregate shocks, given greater identification challenges. Much of this has focused on financial crises [Fallon and Lucas 2002, McKenzie 2003], with a smaller literature studying shocks caused by epidemics or viral transmissions [Lee and McKibbin 2004, Adda 2016].[6] In the presence of aggregate shocks, coping strategies for dealing with idiosyncratic risk (such as temporary migration), often break down. Moreover, in aggregate crisis when the marginal utility of consumption is very high, households might be forced to engage in behaviors that do not maximize their long run welfare or permanent income, such as pulling children out of school [Jacoby and Skoufias 1997. Thomas *et al.* 2004, Ferreira and Schady 2009], or engaging in transactional sex [Dupas and Robinson 2012].[7]

Our analysis also contributes to work on women's empowerment. It has long been recognized that economic development and women's empowerment are closely linked [Doepke *et al.* 2012, Duflo 2012, Jayachandran 2015], and that core dimensions of disadvantage stem from women having limited agency over their bodies, facing barriers to investing in their human capital, and having poor labor market prospects [Field and Ambrus 2008, Dupas 2011, Jensen 2012, Kleven and Landais 2017]. Most importantly, hard-earned gains in women's empowerment can be quickly erased by aggregate economic shocks, and it is in times when households face the greatest crises, that gender differentials in outcomes are most likely to open up [Duflo 2012]. There is a long established literature from across disciplines discussing the issue using observational data [Goldin and Katz 2002, Doepke *et al.* 2012, Duflo 2012, Jayachandran 2015], and a nascent experimental literature evaluating interventions designed to empower women in periods of stability, not crisis [Ashraf *et al.* 2017, Buchmann *et al.* 2017, Bandiera *et al.* 2018, Dhar *et al.* 2018].[8]

[6] Existing work on the economics of Ebola has focused on monitoring impacts during the crisis through live trackers [Thomas *et al.* 2014, Glennerster *et al.* 2016], on the political economy of government responses [Maffioli 2017, Fluckiger *et al.* 2018], and on how formal sector firms were impacted [Bowles 2016, Casey *et al.* 2017].

[7] Fallon and Lucas [2002] review cross-country evidence from the 1990s financial crises in East Asia, and Mexico. The general pattern they find is that employment falls less than production, there is churning across sectors, large falls in real wages, reductions in school enrolment and the use of health facilities. In the context of the Mexican Peso crisis (a forced devaluation of the Peso in December 1994), McKenzie [2003] documents various coping strategies of strategies, including changes in household structure (fertility), schooling, labor supply, and interhousehold transfers. All these channels can break down in the face of an aggregate shock.

[8] Ashraf *et al.* [2017] evaluate the effects of interventions targeting adolescent girls enrolled in primary schools in Zambia, providing them with negotiation-skills training and a safe-space to meet. The negotiation skills training led to long-run improvements in human capital outcomes of treated girls, but the safe space program had no effect. Neither intervention affected pregnancy rates. They do not report effects on girls' labor market outcomes. Buchmann *et al.* [2017] evaluate an adolescent girls' empowerment program in Bangladesh. The content of is quite similar to the ELA program (establishing clubs for girls and providing life skills via peer mentoring), but without any vocational training. They cross-randomized the intervention with incentives to delay marriage (an in-kind

We contribute to both these strands of literature by evaluating an empowerment intervention during the time of an aggregate shock. This provides a rare opportunity to develop insights on the mechanisms through which such aggregate shocks impact the economic lives of young women, and on the role of policy interventions in times of crisis.[9]

The paper is organized as follows. Section 2 provides background on the Ebola epidemic and policy responses to the crisis. Section 3 describes the ELA program. Section 4 describes our data, the construction of the localized index of Ebola-related disruption, our research design, identifying assumptions and evidence to support them. Section 5 presents our main results on the impact of Ebola-related disruption and the mitigating effects of ELA clubs. Section 6 discusses policy implications and the knowledge gaps for future research to fill. Further results and robustness checks are in the Appendix.

2 Ebola

2.1 Background

Ebola Virus Disease (EVD or Ebola) is an acute hemorrhagic fever that can be fatal if untreated. Ebola first appeared in 1976 in two simultaneous outbreaks in South Sudan and the Democratic Republic of Congo. Figure A2 charts the history of earlier Ebola outbreaks in Sub-Saharan Africa, with fatality rates varying between 25 and 90%. The virus is transmitted from wild animals and spreads through human-to-human transmission via direct contact with the blood, secretions, organs or other bodily fluids of infected people, and with surfaces contaminated with these fluids (such as bedding or clothing). Transmission can also occur in burial ceremonies involving contact with the deceased body. Individuals remain infectious as long as their blood contains the virus.[10]

Sierra Leone was the country most affected by the 2014-16 outbreak, hosting about half of

transfer, conditional on remaining unmarried until the age of 18). They find the empowerment program on its own had no significant effect on child marriage or teenage childbearing but was effective in increasing schooling. In contrast, the conditional incentive was effective in reducing child marriage and teenage childbearing. Dhar *et al.* [2018] evaluate a school-based intervention for adolescents in Haryana, India, designed to reshape their gender attitudes. The intervention involved a series of 45 minute sessions where children discussed gender equality (and were prompted to think about their own views and societal norms on the matter). They find the intervention has a powerful impact in reshaping gender attitudes among their sample of both boys and girls.

[9] A related macro-orientated literature examines how income shocks drive conflict: for example, Bazzi and Blattman [2014] exploit commodity export price shocks to identify a causal link and mechanisms between income and the onset and persistence of civil conflict in a panel of developing countries from 1957 to 2007.

[10] There is currently no treatment proven to neutralize the virus but a range of therapies are under development. Ongoing vaccine trials have reported encouraging results [Huttner *et al.* 2018]. For example, during the 2018 Ebola outbreak in DRC, the rVSV-ZEBOV vaccine was effectively used. However, it is designed for use against the Zaire strain of Ebola, and the vaccine must be kept at -70C and hence is unsuitable for remote areas, or as a single shot vaccine for quick protection.

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 the country, with rapid contagion being 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, showing the number of weekly cases (confirmed and probable). The peak flow of weekly cases occurred in December 2014, but it was only in July 2015 that the epidemic started to slow down. Sierra Leone was declared Ebola free in November 2016, 42 days after the last patient was discharged. The WHO estimates there were 14,124 cases in the country (including suspected, probable and confirmed cases), resulting in 3956 deaths. Hence the 28% fatality rate is lower than in other outbreaks, but the scale and spread of the outbreak in Sierra Leone was unprecedented.[11]

2.2 Policy Responses

The government of Sierra Leone implemented three core policies to combat rapid contagion: (i) village lock-downs and travel bans, severely curtailing economic activity; (ii) all primary and secondary schools were closed through the 2014-15 academic year; (iii) health workers were mobilized to record door-to-door cases and track contagion, and some health facilities were transformed into Ebola holding centers. The lower part of Figure 1 shows the timeline of polices enacted.[12]

In a year, GDP growth plummeted from 8.9% to −2.0%: border closures shut down international trade (predominantly in agriculture), internal travel bans resulted in the breakdown of domestic trade, and all periodic markets were forced to close. The self-employment sector, which accounts 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 [Thomas *et al.* 2014, 2015, Evans *et al.* 2015, Himelein *et al.* 2015, Casey *et al.* 2016]. Food security became an issue by December 2014. In terms of food price impacts, the best data comes from a series of tracker surveys conducted at 200 markets during the crisis [Glennerster *et al.* 2016]. They document relatively modest food price increases (e.g. for rice), but more pronounced impacts on price dispersion, with increases and decreases back to normalcy during the crisis. This is as expected given transportation restrictions but also offsetting government efforts to distribute rice.

The second key policy response related to the education system. Schools were closed in May 2014 and re-opened in April 2015 as the epidemic began to slow down (the school year runs from

[11] For the 2014-16 outbreak, the WHO estimates Liberia had 10675 cases and 4809 deaths (a 45% fatality rate), and Guinea had 3811 cases with 2543 deaths (a 67% fatality rate). WHO case data exists by district, but not any finer geography: this prevents us examining responses across villages impacted by the crisis at different times.

[12] As Adda [2016] notes, closing transportation networks or introducing quarantines is a common policy response dating back to plague epidemics in Europe and Asia during the Middle Ages. School closures are an equally common policy response to viral outbreaks, having been used in Japan, Bulgaria, China, UK and the US.

September to July). However, just before schools were due to re-open 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. Given the difficulty of correctly identifying a pregnant girl, school principals gained discretion in exactly how they enforced this ban.[13]

Finally, the epidemic had severe consequences for health care provision. As Panel D in Figure A1 shows, health care services pre-crisis were already very low. Ebola impacted the health system in two ways: (i) the human capital of health care workers; (ii) public trust in using health facilities. On the first dimension, health workers were under-equipped and under-prepared for the epidemic. Their inability to rapidly implement infection prevention and control measures left them exposed to infection during routine contact and enabled further transmission to other health workers. Evans *et al.* [2015] document how Ebola deaths were disproportionately concentrated among health personnel. For example, by May 2015, while .06% of the population had died from Ebola, 6.85% of health care workers had died from Ebola.[14] On the second dimension, health facilities became associated with Ebola as some were transformed into holding centers. Visits to health centres were thought to be among the largest causes of Ebola transmission. Combined with a lack of a cure and huge uncertainty, confidence in the health system was undermined, leading families to keep sick members at home, thus further spreading the virus.

The crisis impacted economic opportunities for all. However, each policy response might have had further unintended consequences on women. For example, they could have been relatively more impacted by this economic disruption because womens' labor force participation rates are higher than for men up until age 30 (this is confirmed in our pre-intervention census). Young women are especially reliant on self-employment, and were more exposed to agriculture (where 54% of working women are employed).

The schooling policy response had particularly acute impacts on young women. The loss of one year of human capital accumulation is non-trivial given their lower levels of human capital to begin with. For example, women aged over 24 have 1.8 years of completed schooling in our baseline census, while men have completed 4 years on average. As schools reopened, given the formal ban on pregnant girls, potentially large numbers of adolescent girls might have been unable to re-enrol, irrespective of their actual pregnancy status. This lower level of human capital accumulation worsens lifetime labor market earnings, and such schooling policies might also increase social

[13] 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.

[14] In absolute terms, this corresponded to 79 doctor, nurse, and midwife deaths. By the end of November there had been a further 179 confirmed Ebola cases among health workers.

stigma and discriminatory attitudes towards young women. Moreover, without the protection of time in school, young women might have become more vulnerable to sexual abuse, that would further limit their ability to accumulate human capital in future [Amnesty International 2015].[15]

Finally, the collapse of the health care system meant access to standard medical services, such as ante-natal and maternal care, was severely hampered during the outbreak. A combination of capacity constraints and fear of hospitals led to considerably fewer women accessing antenatal care or giving birth in health facilities during the crisis [UNICEF 2014].

These factors combine to create a tight link between dimensions of education and fertility in this context. We study key outcomes related to this: re-enrolment back into school at endline, time allocations with men spent engaging in sexual activities, teen pregnancy and engagement in risky sexual behaviors.

3 The ELA Intervention

The empowerment and livelihood for adolescents (ELA) intervention aims to kickstart young womens' socioeconomic empowerment through the provision of life skills, vocational skills and microfinance. The ELA program thus offers a multifaceted approach to simultaneously tackle multiple disadvantages young women face, related to having agency over their bodies and barriers to accumulating human capital. All program activities are delivered out of ELA clubs, a fixed (rented) location in each village. This is a physical space jointly 'owned' by club members. Clubs are open five days a week during after-school hours, with no attendance fee. A cornerstone of the program is that ELA clubs offer a space where young women can gather and socialize, and thus provides an alternative time use to spending time with men or other leisure activities.[16]

During the crisis, ELA clubs can also serve as a partial substitute for schools: they provide human capital when schools are closed, but even if open, they provide forms of knowledge, on reproductive health for example, that are not supplied by the education system. ELA clubs also interlink with informal institutions of secret societies that exist for men and women in Sierra Leone [MacCormack 1979, Bledsoe 1990, M'Cormack-Hale 2018]. The primary role of these womens' 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.[17] These societies

[15] Additional measures were put into place to prevent activities and people congregating (such as closing bars and restaurants). The extent to which this could be enforced outside of big cities is questionable, and does not appear to have impacted participation in ELA clubs.

[16] A strength of the ELA approach is to simultaneously tackle interlinked constraints related to agency over the body, human capital, and labor market prospects. Evaluations of other multifaceted interventions targeting adolescents include Baird *et al.* [2011], Duflo *et al.* [2015], Acevedo *et al.* [2017] and Buchmann *et al.* [2017].

[17] Sierra Leone has some of the highest levels of FGM, indicating the pervasiveness of secret societies. The 2013

create distinctions between women who have experienced the secrets of childbirth and those who have not, and society leaders typically further attempt to separate girls undergoing initiation from their uninitiated peers. Secret societies also instill notions of morality and norms over sexual behavior, they promote women's social/political interests, and express solidarity among women vis-à-vis secret societies for men. These context features need to be borne in mind throughout.[18]

The ELA program was originally designed and implemented by the NGO BRAC in Bangladesh, where female disempowerment is also a major issue. Since 1993, BRAC has established 9,000 ELA clubs, reaching over a million young women. The program has proved to be scalable and cost-effective across countries. In earlier work, we collaborated with BRAC to evaluate the program in Uganda [Bandiera *et al.* 2018], and based on the encouraging four-year impacts documented, we designed a follow-up evaluation with BRAC in another Sub Saharan context.[19]

An older girl from each club is selected and trained to be a mentor. Her primary responsibility is to manage the club activities and facilitate the life skills training courses. Table A1 details the curriculum for the 10 life skills modules, that covers reproductive health, menstruation, pregnancy, STDs, HIV, family planning, rape, legal knowledge on bride price, child marriage and violence against women. As sex education is not obligatory in schools, the life skills provided through ELA give young women access to information they might not have been able to receive from other formal and informal sources.[20]

Girls aged 17 and above are eligible for the vocational skills component, delivered by BRAC professionals. Skills provided include tailoring, soap making, hairdressing, and tie dying. Clubs provide 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. In many cases, participants were also provided rudimentary supplies that could aid them in school (e.g. pens). Each course was offered daily and generally lasted six hours per day, with courses varying in length depending on the human capital investment required.[21]

DHS reports 90% of women aged 15 to 49 have been circumcised. During the outbreak the government introduced a moratorium on FGM, but this is not thought to have been enforced.

[18] There has long been discussion over whether the gradual expansion of formal schooling has crowded out some role of secret societies. Bledsoe [1990] argues that many rural girls see education as the key route out of the village and becoming urban career women and monogamous wives.

[19] The program has also started in Tanzania, where 200 clubs have over 7,000 adolescents enrolled in them, 120 clubs have been set up in South Sudan. To date BRAC has started 1200 clubs in Uganda, reaching 50,000 girls. Ongoing pilots are taking place in Afghanistan and Liberia.

[20] A course titled *Family Life Education*, used to be taught at schools but this was stopped after the civil war ended in 2002. Pre-crisis, although some schools provided information, sometimes via a non-governmental organization, there was no consistent nationwide provision.

[21] Tailoring courses lasted 240 hours (two months, six hours per day, five days a week); hairdressing courses lasted 120 hours; soap making courses lasted 30 hours.

Finally, for the microfinance component, those aged 18 or older were eligible for loan sizes up to $100, repayable over a year, with a weekly repayment schedule and a 30% interest rate. Loans were renewable on repayment. The first loan cycle started in April 2015, with credit initially being disbursed to fewer than 10 women per village, and demanded loan sizes around $80.

There is recognized variation across villages in the extent to which they were impacted by the aggregate shock. Villages more severely impacted are those in which the economic and social disruptions described above were greater or longer lasting. For both men and women in more severely disrupted villages, there would have been a greater loss in economic opportunity, and thus less time to spend engaged in income generating activities.

ELA clubs then interact with the severity of the aggregate shock through two channels. First, by offering young women an alternative time use to socializing with men, ELA can reduce young women's (voluntary) risk of pregnancy, or their involuntary exposure to gender-based violence or demands for sex. Second, ELA allows young women to invest into their human capital at a time when alternatives such as schools, were highly disrupted. The fact that ELA clubs provide different forms of human capital than what schools provide changes the relative returns across economic activities for young women. This might then alter the rates at which young girls transition towards engagement in income generating activities post-crisis.

There are strong interlinkages between the two channels: most directly, if ELA reduces the likelihood of pregnancy – either because it offers alternatives to spending time with men, or by the provision of life skills and knowledge on reproductive health that encourages contraceptive use – it is more likely beneficiaries can re-enrol when schools re-opened post-epidemic. This is especially so given the ban on pregnant girls being able to re-enrol post-crisis.

4 Data, Implementation and Research Design

4.1 Data Sources

Our data was collected before, during and after the Ebola outbreak. Figure 2 shows the timeline of data collection activities, and how these relate to the timing of the crisis, and ELA club openings/activities. Our evaluation takes place in four districts: Port Loko, Kambia, Moyamba and Pujehun, where 20% of the population resided pre-crisis. In preparation for our evaluation of ELA, in October 2013 we conducted a census in the 200 sample villages in these districts, covering 94,338 individuals in 17,233 households. This recorded information on demographics, education, occupation, dwelling and allows us to construct a pre-crisis poverty score for each household. This census was used to draw a sample of women aged 12 to 25 and thus eligible for ELA.

The baseline survey was conducted between February and May 2014, thus ending just as the first cases of Ebola were being reported. This covered 5,775 young women, corresponding to 27% of all eligibles, and recorded information on their time use, education and skills, labor market activities, risky behaviors, marriage/pregnancies, empowerment and aspirations, expenditure/finances, and social networks.

Time use data plays an important role in our analysis. To elicit reliable information, rather than just asking about hours, we asked respondents to use a physical representation of time (beans) to show how they divided their time over the past week. We did so for broad activities (education, income generation, household chores, leisure), and also specifically for time devoted to leisure (sexual relationships with men, with friends, social activities, alone).[22] The survey took place during the school year so respondents could feasibly have been attending school on survey dates. The credibility of the time use data is underpinned by the fact that: (i) the number of beans recorded across categories summed up to 25 for 90% (99%) of respondents at baseline (endline); (ii) 87% of respondents report sleeping 5 to 10 hours per night; (iii) the average number of hours spent per week at ELA clubs is three, which is realistic. We convert time use measures into hours per week.

With the onset of the crisis and all fieldwork suspended, we implemented two village-level surveys. The first was a monitoring survey to ELA club mentors in treatment villages conducted in June/July 2015. It provides information on club functioning, activities and participation. The second was a village leaders survey administered between June and October 2015. It provides information on village characteristics, public facilities, impacts of Ebola (in terms of the number of households quarantined, Ebola related cases and deaths), and policy responses (such as the functioning of schools and health facilities, and other relief efforts).[23]

After fieldwork restrictions were lifted, the endline survey was fielded between February and May 2016 (so like the baseline, taking place during the school year). As Figure 1 shows, this is around six months after cases of Ebola declined to near zero, and well after schools and markets

[22] The exact wording of the question used 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 leisure, the exact wording of the key question 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."*

[23] The village leader survey collects data coded from focus group discussions held in every village. 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.

had reopened (even among those schools whose opening was delayed). It was still before Sierra Leone was officially declared to be Ebola free (November 2016). The endline covered the same topics as the baseline survey with an additional module related to the crisis and experiences during it, such as if respondents' households were contacted by tracer teams, or quarantined.

The timing of the endline survey means that outcomes are measured post-crisis. Hence we do not claim that the *onset* of any changes in behavior always started during the crisis. Rather, the results should be interpreted as capturing *persistent* impacts into the post-crisis period of the severity of the shock, the provision of ELA and their interaction.

A concern is that respondents migrate in response to the crisis and then attrit. Encouragingly, 83% of our respondents were tracked from baseline to endline (4,790). Among tracked women, 81% (3,865) resided in the same village, while others were tracked to a different (but typically nearby) village. Hence although geographic mobility is high, it does not lead to severe attrition. In the Appendix Table A2 we present correlates of attrition and show that treatment assignment and the intensity of Ebola-related disruption do not predict attrition, nor does their interaction, and nor is there differential attrition on observables with treatment or disruption.

4.2 Randomization and Implementation

The ELA program was randomly assigned to 150 villages, with the other 50 remaining as control. Districts were the randomization strata. The original evaluation design was to randomly divide treated villages in three arms: ELA clubs in T1 would only provide life skills training; T2 villages would be as T1 but additionally provide vocational training, and T3 would be as T2 but additionally provide microfinance. This design was meant to unpack the impacts found in our earlier work on ELA in Uganda [Bandiera *et al.* 2018]. Given the crisis and imperfect program compliance with the design, we pool T1, T2 and T3 arms throughout. Common to all treatment arms is that ELA clubs provide alternative time uses and life skills to young girls and women.

A concern is whether ELA clubs were rolled out to any meaningful extent during the crisis. This is especially so given that BRAC's core field activities in microfinance were curtailed during the epidemic.[24] To provide evidence on the matter, Figure 3 summarizes the findings from our survey to ELA club mentors, conducted in June/July 2015 when weekly cases had dropped far from their peak. Panel A provides time series evidence on ELA club openings. This shows: (i) 70% of clubs opened on time (by September 2014) and by January 2015 all clubs in treated villages had opened; (ii) the majority of clubs were continuously open through the crisis. Panel B details ELA

[24] Concerns were first raised in March 2014 on BRAC field activities, with microfinance activities being suspended in August 2014. They restarted in March 2015. BRAC found huge demand for microfinance in response to the Ebola shock, credit being considered critical for household recovery.

activities. This shows: (i) the majority of clubs provided life skills training; (ii) vocational skills training took off after travel quarantines were lifted in January 2015 (these trainings are delivered by professionals, not club mentors). Microfinance began to be disbursed from April 2015. Panel C shows club membership: the median club has 30 members, implying membership rates of around 31% given the number of women aged 12 to 25 identified in the baseline census. Finally, Panel D shows the ratio of club attendance, based on an unannounced spot check in May 2015, to club membership. On any given day, ELA clubs can have many non-members present and participating in activities. All women can take advantage of the public good benefit ELA clubs provide in terms of a space in which they can socialize with other young women, and spend time away from men.

4.3 Pre-Crisis Characteristics

4.3.1 Villages

Panel A of Table 1 shows that treatment and control villages are well balanced on their size, mean poverty score across households, exposure to NGOs, religion, location and proximity to primary health units (PHUs) and secondary schools. Beyond the effective implementation of the program described above, this evidence suggests there was high fidelity with treatment-control randomization protocols.[25]

The remainder of the Table shows data from the village leader survey, conducted during the crisis. Panel B highlights the stigma associated with pregnant girls: there is near universal agreement among elders with the statement that "girls who are visibly pregnant have a bad influence on their non-pregnant peers." In control villages, only 12% of elders agree with statements that pregnant girls should be allowed to continue their education, or to take formal exams.

Panel C shows further details on village impacts and policy responses during the crisis. Few villages were quarantined (6%), and nearly all were visited by contact tracer teams. There are no differences between treatment and control villages in the receipt of assistance from NGOs in terms of food aid or school supplies (excluding BRAC). Control villages are more likely to have received some form of government relief. This mitigates against finding beneficial impacts of ELA.

4.3.2 Young Women

Table 2 shows pre-crisis characteristics of young women. On nearly all dimensions, the samples are balanced between those in treatment and control villages.

[25] There are some differences in means across treatment and control villages, even if these are not statistically significant. Most notably, control villages are 55% larger than treatment villages (as measured by the number of dwellings), and are 17% closer to the nearest secondary school. To mitigate biases from any such imbalances, all the village level covariates in Panel A are controlled for in our regression specifications.

Panel A shows our respondents are on average 18 years old, and 60% are in a relationship. While girls' age at marriage is close to 16, the average age at marriage of their husbands is almost double, at 31. Despite their young ages and the newly formed marriages, nearly half have children. For those in relationships, 46% report being subject to some form of intimate partner violence. These traits of early marriage, childbearing and exposure to violence all have long term consequences on the ability to acquire human capital and lead financially independent lives.[26]

Panel B shows other empowerment measures at baseline. We first construct an index of gender empowerment based on questions eliciting views on roles of men and women related to work and engagement in household chores. Higher values represent more egalitarian gender norms. On this index, adolescent girls themselves score very low with an average score of just 17, suggesting ingrained unequal gender attitudes pre-intervention. 75% are sexually active, with their age at debut being 15. The minority of sexually active girls report using contraception, and they report spending around 5hrs/wk with men (that they are engaged in sexual relations with). As a benchmark, they spend around 28hrs/wk in all learning activities (that can include schools, church-based school, or vocational training outside of ELA clubs). 10% report having experienced unwanted sex in the past year, and 4% have engaged in transactional sex.

Panel C highlights the low levels of human capital pre-crisis: only 23% of young women are literate (based on an assessment combining basic reading ability, reading comprehension and writing sentences); their knowledge of pregnancy causes is limited (the average score on a related test is 64/100), and the same applies to their knowledge related to HIV. This maps back to the low levels of contraceptive use and frequency of teenage pregnancy and childbearing.

The economic activities of young women that foster human capital are best described using a four-way type distribution: around 27% of young girls in control villages are in school; 34% are exclusively engaged in income generating activities; 18% are engaged in both schooling and income generation, while 20% report being engaged in neither activity, hence spending their time engaged in household chores or as caregivers.[27]

Figure 4A shows how these activities vary by age at baseline. The majority of girls aged 12-14 are in school at baseline, pre-Ebola. There are no sharp discontinuities in enrolment rates at key cut-off stages of the school system (ages 15 and 18) but rather gradual declines in age. Presumably this smoothing is partly due to grade retention. There is a steady increase in specialization in

[26] We can compare the characteristics of our sample to young women to those surveyed in the 2013 DHS data, in the same age range and resident in the same districts (although covering urban areas too). We find the samples have similar characteristics in terms of likelihood to be married, having children, being sexually active, age of sexual debut and the frequency of unwanted sex.

[27] The kinds of income generating activity conducted at baseline are all forms of self-employment, in line with the results in Casey *et al.* [2016]. The most frequent activities are small trade/business (40%), food processing (20%) and household land cultivation (15%).

income generation with age, with 17 being a critical cross over point: up until that age more girls are enrolled in education full time than are only working, and the situation reverses thereafter.[28]

Given these age profiles across activity, we split our analysis between girls aged 12-17 at baseline, and those aged 18-25. The Ebola outbreak also impacts these groups through different channels: younger girls are more impacted by school closures, older girls are more impacted by the loss of work opportunities, with both groups being impacted by the collapse of health infrastructure. Moreover, in terms of ELA, the older cohort are more subject to the provision of vocational skills and microfinance due to the program's eligibility criteria. Third, this split broadly aligns with the separation by age in secret societies in rural Sierra Leone: in turn this might limit information flows or spillovers between younger and older age cohorts.

The left side axis in Figure 4B shows how relationships and sexual activity vary with age. By age 17, the majority are in relationships and sexually active, with more being sexually active than in relationships at each age. The right side axis shows that among older girls, over 10% at each age experience unwanted sex, and there is a weak gradient in age of engaging in transactional sex. These outcomes might all be impacted by the crisis, as economic opportunities collapse, girls have alternative time uses in the presence of ELA, this placing upward pressure on the price of transactional sex.

4.4 Participation

Given the channels through which ELA clubs might mitigate the impacts of the crisis, we expect there to be high demand for ELA clubs. Table 3 describes membership and participation in ELA clubs. Panel A shows that on average, 31% of eligibles in treated villages are registered ELA club members. Panel B then reports statistics from the endline survey. There is widespread knowledge of ELA clubs: 89% of girls in treated villages have heard of them, as have 27% of girls in control villages. Participation rates are more than double membership rates: 71% of girls in treated villages have *ever* participated in an ELA club meeting or activity. This is only 4% of girls in control villages, so there are very limited spillovers in participation to control locations. In short, there is high demand among young women for access to ELA clubs.

Conditional on ever participating: (i) 82% of young women have participated in life skills (77%

[28]The key exam school stages are as follows. The Basic Education Certificate Examination (BECE), taken at age 15, is required for admission into senior secondary school. The West African Senior School Certificate Examinations (WASSCE), taken at age 18, is required for university/college admissions. The reported magnitude of time allocations across the age distribution are plausible: the youngest girls report spending around 60 hrs/wk on all forms of learning except ELA (formal schooling, other vocational training, church-based schools). Work hours rise to just over 35 hrs/wk for older women in our sample. At each age, respondents report on average spending at least 40 hrs/wk engaged in household chores.

report attending life skills training at least once a week and the majority can recall at least four of the topics covered in these courses); (ii) 25% have received financial literacy training; (iii) 34% have participated in vocational skills training (in T2/T3 treatment arms where such training was offered); (iv) only 13% report having received a microfinance loan from BRAC. The overall pattern of participation in activities is thus very much in line with what was reported earlier in Figure 3 in terms of club offerings.

As the remaining Columns show, these patterns of awareness and participation are very similar for those aged 12-17 at baseline, and those aged 18-25 at baseline (although the older cohort is more likely to have received microfinance). Hence the demand for ELA clubs comes both from girls enrolled full time in education pre-crisis, as well as older girls who were predominantly engaged in income generation pre-crisis.

4.5 Research Design

We use a 2×2 factorial research design, where one dimension is the quasi-random assignment of villages to high and low Ebola-related disruption, and the other dimension is the random assignment of villages to ELA. We study how outcomes are impacted by the intensity of the crisis, and how the ELA intervention mitigates these impacts in low and high disruption intensity villages. For outcome y for individual i in village v in district d we estimate the following ANCOVA specification:

$$y_{ivd} = \alpha y_{i0} + \beta_1 T_{vd} + \beta_2 E_{vd} + \beta_3 \left(T_{vd} \times E_{vd}\right) + \gamma_0 X_{ivd} + \gamma_1 X_{vd} + \lambda_d + u_{ivd}, \tag{1}$$

where y_{i0} is the outcome at baseline (if available), T_{vd} is a dummy equal to one if village v is assigned to treatment, E_{vd} is a dummy equal to one if village v is exposed to high disruption, X_{ivd} and X_{vd} are characteristics of i and her village v, λ_d are district fixed effects (the randomization strata), and u_{ivd} is an error term.[29] In the Appendix we examine the robustness of our core findings to: (i) using randomization inference to test the null of no treatment effects; (ii) adjusting for multiple hypothesis testing; (iii) only controlling for district fixed effects.

4.5.1 Localized Intensity of Ebola-Related Disruption

To operationalize this design we need to construct a localized measure of village level Ebola-related disruption, E_{vd}. As shown formally below, to establish causal impacts of the severity of disruption,

[29] The village controls include those shown in Panel A of Table 1, on baseline balance, and the individual controls (measured at baseline) are age, the household poverty score, household size and whether the individual is illiterate (where this last control is dropped for some specifications related to skills).

ELA assignment and their interaction, we require village level disruptions to be as good as random. Official WHO estimates show considerable variation in Ebola intensity across districts in Sierra Leone, but official data is unavailable at any finer level. The central map in Figure 5 shows WHO measured caseloads across the 14 districts, with the shading reflecting the quintile of caseloads for each. The highest intensity districts are Port Loko (close to, but not including the capital, Freetown), and Kailahun (where the initial outbreak occurred). Our study covers four districts: Port Loko, Kambia, Moyamba and Pujehun, where intensity levels are high, intermediate and low.

Given that WHO caseload data is unavailable at a lower level than by district, we use another approach to construct our village specific measure E_{vd}. We proceed in three steps.

First, we begin by noting that a body of earlier work has measured correlates of the local intensity of the Ebola crisis using spatiotemporal models to simulate the spread of the virus [Backer and Wallinga 2016, Maffioli 2017, Fluckinger *et al.* 2018]. These find that beyond covariates such as population, few observable characteristics of locations predict the severity of Ebola infection in those locations. Taken together this existing body of evidence suggests localized Ebola-related disruption might be as good as random.[30]

Second, we use information from the village leader survey to construct a proxy for E_{vd}. We focus on dimensions that: (i) are credibly unaffected by ELA clubs operating in treated villages; (ii) have geographic variation *within* district. Our disruption index combines data on the functioning of the nearest primary health unit (PHU) facility, and the nearest secondary school. Both serve multiple villages over a wide radius. For example, the lowest tier PHU facility typically serves a population of up to $5,000$ within a 3-mile radius covering 10 to 20 villages. In our evaluation sample, the average distance to the nearest PHU is 1.55 miles. Similarly, 83% of villages have no secondary school in them and the distance to the nearest one (conditional on not being in the village) is 4.91 miles. Hence the functioning of the nearest PHU and secondary school during the crisis is unlikely to be impacted by the presence of ELA clubs in treatment villages.[31]

[30] Fluckinger *et al.* [2018] construct a simulated measure of Ebola exposure at the district level. They simulate the spatiotemporal spread of the epidemic using a modified version of the simulation model in Backer and Wallinga [2016]. In such a simulation model, the outbreak is represented as a network of local epidemics that are interconnected across districts through a gravity model. Fluckinger *et al.* [2018] investigate the extent to which their simulation-derived predicted prevalence is correlated with time-invariant and time-varying district characteristics: they find that population predicts Ebola intensity. This is as expected given this is a key input into the gravity model. They do not find the intensity of the outbreak to correlate to distances to initial outbreaks, pre-epidemic public goods provision (schools, health clinics, police stations), the value of crop production per capita, the presence of minerals diamonds or gold, or changes in average rainfall, temperature and drought exposure between the pre- and post epidemic years. Maffioli [2017] reaches similar conclusions in the context of the outbreak in Liberia.

[31] PHUs comprise three tiers: community health posts (CHPs) community health centres (CHCs), and, maternal and child health posts (MCHPs). The MCHP is the first level of contact for patients. One or more MCH aides are posted at these centers serving a population up to 5000 within a 3-mile radius. The services provided include antenatal, delivery and postnatal care. At the next tier, the CHP is usually situated in a small town serving a population up to $10,000$ within 5-mile radius. This has similar functions to the MCHP with added curative

As part of the village leaders survey, respondents were collectively asked to recall information from July 14 to September 15 on whether the PHU was closed, disrupted, and an overall PHU functioning score. They were also asked about whether the nearest secondary school opened on time (many openings were delayed from April 2015 but all schools would have re-opened when our endline survey began in February 2016). We combine components to construct a village specific disruption index, following Anderson [2008] in using the data covariance matrix to construct a weighted sum of components, giving less weight to components that have less variation across villages and that are more correlated with each other.[32]

Panels A and B in Table 4 shows descriptive evidence on the components the index is constructed from. Each varies across villages, with there being substantial variation within and between districts (Column 2). Panel C shows the constructed disruption index, that by definition is standardized with mean zero and standard deviation one. To operationalize (1), we define a disruption dummy, E_{vd}, so that $E_{vd} = 1$ if the index is above its 75th percentile, and $E_{vd} = 0$ otherwise. We refer to these as high and low disruption villages, where 17% of villages are then defined to be high disruption locations.

To get a sense of what this classification means, low disruption villages never have their PHU ever closed, 18% have PHU disruptions, and their average PHU functioning score is 94. In contrast, 82% of high disruption villages have their PHU ever closed, all of them have the PHU ever disrupted and the PHU functioning score is 67. In low disruption locations, 88% of secondary schools opened on time, while this falls to 62% in high disruption locations.

Our E_{vd} construct is a proxy for all Ebola-related disruption experienced by village v. Hence we do not interpret moving from a low to high disruption village as literally *only* capturing the persistent impacts of having the nearest PHU more disrupted during the crisis, or having the nearest secondary school closed for a few months more. Rather we interpret the move from low to high disruption villages as measured by our index as proxying more widespread disruption in the economic lives of villagers far more generally, in terms of economic trade, labor market opportunities, and access to health care.

The outer district maps in Figure 5 show how the standardized disruption index varies over villages, by treatment and control. Three points are worth noting. First, the level of the disruption

functions. Finally, the CHCs have preventive, promotive and curative functions with a catchment population up to 30,000 within a 5-10 mile radius. These centres have inpatient care, as well as a laboratory and are managed by Community Health Officers and supported by nurses, midwives and technicians.

[32] More precisely, an Anderson [2008] index is constructed as follows. First define y_{vk} as the k-th of K Ebola measures for village v where we switch the sign of y_{vk} so that higher values imply higher exposure. We then standardize y_{vk}, denoted $\tilde{y}_{vk}$ and define a summary index $\bar{s}_v = \left(\mathbf{1'\hat{\Sigma}^{-1}1}\right)\left(\mathbf{1'\hat{\Sigma}^{-1}}\tilde{y}_v\right)$, where $\mathbf{1}$ is a K column vector, $\mathbf{\hat{\Sigma}^{-1}}$ is an estimate of the covariance matrix and $\tilde{y}_v$ is a K column vector of all measures for village v. We then re-standardize the summary index $\bar{s}_v$.

index by district matches the WHO estimate rankings for Ebola cases. In our sample, Port Loko has the highest disruption measure, Pujehun has the lowest. Second, a variance decomposition of the disruption index reveals that within district variation accounts for the majority (70%) of the overall variation. Using the dummy measure to refer to high and low disruption, we see that within all districts, there are both high and low disruption villages, with the greatest incidence of high disruption being in Port Loko.

As a third and final step, we provide evidence that the disruption measure picks up localized variation in the intensity of the aggregate shock, rather than capturing more permanent features of local infrastructure, economy or state capacity. Panel A of Figure A3 shows within district partial correlations between the disruption index and the village level covariates related to the location of the village, distance to key infrastructures, political alignment, poverty, size and exposure to NGOs (from Panel A in Table 1): we see insignificant correlations with all covariates although a standard deviation increase in village poverty increases the chance of being high disruption by 4.8pp. All these village covariates are conditioned on in throughout our analysis. Panel B of Figure A3 then shows within district partial correlations between the disruption index and historic measures of health services or knowledge, as measured at the Chiefdom level using DHS2013 data or the 2007 National Public Survey. Reassuringly, the dummy index of disruption is uncorrelated to multiple past health related measures, including actual health behaviors, health outcomes, access to health facilities, and state capacity related to the health sector.

Of course, the quantitative results are sensitive to the exact construction of the disruption dummy, E_{vd}. We later show our core results are qualitatively robust to three alternative constructions: (i) using the continuous disruption index; (ii) defining disruption to be within-district, so that a quarter of villages in all districts, by construction, are high-disruption; (iii) additionally using information on the disruption of daily and periodic markets to construct E_{vd}.

4.6 Identification

We use a potential outcomes framework to make precise the identifying assumptions under which the factorial design yields causal estimates of ELA, exposure to high disruption, and their interaction. For expositional ease we ignore covariates $(y_{i0}, X_{ivd}, X_{vd}, \lambda_d)$. Let Y_i^{TE} be the potential outcome for individual i, receiving ELA treatment $T \in \{0, 1\}$ and low/high Ebola-related disruption $E \in \{0, 1\}$ as defined above. One of the following potential outcomes is then observed,

assuming an additive structure between T and E:

$$\begin{aligned} Y_i^{00} &= \alpha + u_i, \\ Y_i^{10} &= \alpha + \tau_i + u_i, \\ Y_i^{01} &= \alpha + \eta_i + u_i, \\ Y_i^{11} &= \alpha + \tau_i + \eta_i + \gamma_i + u_i. \end{aligned} \tag{2}$$

τ_i is the causal impact of residing in an ELA village, η_i is the causal impact of high disruption, and γ_i is their interaction. We combine potential outcomes into a single equation:

$$Y_i = \alpha + \tau_i T_i + \eta_i E_i + \gamma_i \left(T_i \times E_i\right) + u_i. \tag{3}$$

Our maintained assumptions are random assignment of ELA clubs, so $\mathbb{E}\left[u_i|T\right] = 0$, and independence of E and T. Tables 1 and 2 provide evidence in support of random assignment holding. To investigate the independence of E and T, we regress the village disruption index on the village treatment dummy. Column 3 in Table 4 shows these partial correlations: none are statistically different from zero. This result continues to hold when: (i) we also condition on all the village characteristics shown in Panel A of Table 1 (Column 4); (ii) we allow the treatment dummy to interact with distances from key facilities (Column 5); (iii) we allow for model selection using an Elastic Net penalized regression (Column 6). As shown in the final row in Panel C, all these results continue to hold when we use the disruption dummy.

The OLS specification in (1) employs sample analogs of the following moments to estimate parameters of interest:

$$\mathbb{E}\left[Y_i|T_i = 1,\, E_i = 1\right] = \beta_0 + \beta_1 + \beta_2 + \beta_3 + \mathbb{E}\left[u_i|T_i = 1,\, E_i = 1\right], \tag{4}$$

$$\mathbb{E}\left[Y_i|T_i = 1,\, E_i = 0\right] = \beta_0 + \beta_1 + \mathbb{E}\left[u_i|T_i = 1,\, E_i = 0\right], \tag{5}$$

$$\mathbb{E}\left[Y_i|T_i = 0,\, E_i = 1\right] = \beta_0 + \beta_2 + \mathbb{E}\left[u_i|T_i = 0,\, E_i = 1\right], \tag{6}$$

$$\mathbb{E}\left[Y_i|T_i = 0,\, E_i = 0\right] = \beta_0 + \mathbb{E}\left[u_i|T_i = 0,\, E_i = 0\right]. \tag{7}$$

Random assignment and independence of and E and T implies:

$$\begin{aligned} \mathbb{E}\left[u_i|T_i = 1,\, E_i = 1\right] &= \mathbb{E}\left[u_i|T_i = 0,\, E_i = 1\right], \\ \mathbb{E}\left[u_i|T_i = 1,\, E_i = 0\right] &= \mathbb{E}\left[u_i|T_i = 0,\, E_i = 0\right]. \end{aligned}$$

We now establish how the OLS estimates $(\beta_1, \beta_2, \beta_3)$ map to the structural potential outcome

parameters $(\alpha, \tau_i, \eta_i, \gamma_i)$. β_1 measures the ITT of ELA in low disruption villages:

$$\begin{aligned}\mathbb{E}\left[Y_i|T_i=1,\, E_i=0\right]-\mathbb{E}\left[Y_i|T_i=0,\, E_i=0\right] &= \beta_1+\mathbb{E}\left[u_i|T_i=1,\, E_i=0\right]-\mathbb{E}\left[u_i|T_i=0,\, E_i=0\right],\\ \beta_1 &= \mathbb{E}\left[\tau_i|E_i=0\right],\end{aligned}$$

where the RHS uses random assignment of T and orthogonality of E and T. β_2 provides a biased estimate of the impact of high relative to low Ebola-related disruption ELA control villages. To see this, note that:

$$\begin{aligned}\mathbb{E}\left[Y_i|T_i=0,\, E_i=1\right]-\mathbb{E}\left[Y_i|T_i=0,\, E_i=0\right] &= \beta_2+\mathbb{E}\left[u_i|T_i=0,\, E_i=1\right]-\mathbb{E}\left[u_i|T_i=0,\, E_i=0\right],\\ \mathbb{E}[\eta_i|T_i &= 0] = \beta_2+\mathbb{E}\left[u_i|E_i=1\right]-\mathbb{E}\left[u_i|E_i=0\right],\\ \beta_2 &= \mathbb{E}[\eta_i|T_i=0]-(\mathbb{E}\left[u_i|E_i=1\right]-\mathbb{E}\left[u_i|E_i=0\right]),\end{aligned}$$

where the second term is a standard selection bias due to potential non-random incidence of high disruption. To investigate the possibility beyond what was already shown in Figure A3, Tables A3 and A4 compare characteristics of villages and young women between high and low disruption locations, as measured by our dummy index. On both sets of characteristics, the samples are well balanced across high and low disruption villages. As suggested in Figure 5, the within district variation in disruption intensity is as good as random. If there is quasi-random assignment of Ebola-related disruption, the second term in β_2 is close to zero in expectation.

Finally, the difference-in-difference in our design is:

$$\begin{aligned}\beta_3 &= (\mathbb{E}\left[Y_i|T_i=E_i=1\right]-\mathbb{E}\left[Y_i|T_i=1,\, E_i=0\right])-(\mathbb{E}\left[Y_i|T_i=0,\, E_i=1\right]-\mathbb{E}\left[Y_i|T_i=E_i=0\right]) \quad (8)\\ &= \mathbb{E}\left[\gamma_i|E_i=1\right]+(\mathbb{E}\left[\tau_i|E_i=1\right]-\mathbb{E}\left[\tau_i|E_i=0\right]). \quad (9)\end{aligned}$$

If program implementation varies across disruption intensities, this will be captured in the first term above. The second term is the standard selection on gains term capturing the fact that the returns to ELA might differ across disruption intensities, say because characteristics of participants into ELA differ by disruption. We provide evidence on each aspect in turn.

On variation in program implementation, Figure A4 shows ELA club functioning, split by high/low disruption. Panel A shows the share of clubs ever opened or continuously opened. Here there are slight differences, the most stark being that in high disruption villages a flurry of clubs opened when quarantine/travel restrictions were lifted. Panel B focuses on program components delivered (within the relevant treatment arms). Although in all locations ELA clubs provide protective space and time, we generally see that life skills training was offered to a greater

extent in high disruption villages. Vocational training appears to have been first rolled out in low disruption villages, but once quarantines were lifted, high disruption villages caught up and indeed overtook other clubs on this dimension of program delivery.

On variation in participant characteristics, Table A5 compares characteristics of ELA participants in high and low disruption villages: we do not see any strong evidence of differential selection into ELA across disruption intensities, in line with $\mathbb{E}[\tau_i|E_i = 1] \simeq \mathbb{E}[\tau_i|E_i = 0]$. Indeed, the fact that participation rates are 70%, as shown in Table 3, in itself eases concerns over selection on gains. Participants across high and low disruption villages do not differ in relationship or marital status, whether they experience intimate partner violence (and so might be preventing from attending ELA clubs), the various measures of empowerment, human capital and engagement in economic activities at baseline.

Overall, the evidence underpins the notion of a 2×2 factorial design, where one dimension is the random assignment of villages to ELA, and the other is the quasi-random assignment of villages to high and low levels of Ebola-related disruption.

Our focus is on documenting the impacts of the severity of aggregate shock on the economic lives of young women, and understanding whether the ELA intervention mitigated these impacts. The parameters of interest are: (i) $\widehat{\beta}_2$: the disruption effect, namely the impact of residing in a high disruption control village relative to a low disruption control village; (ii) $\widehat{\beta}_1 + \widehat{\beta}_3$: the treatment effect of ELA in high disruption villages; (iii) $\widehat{\beta}_1$, the treatment effect of ELA in low disruption villages; (iv) $\widehat{\beta}_3$, whether ELA has a differential impact in high and low disruption villages.

5 Results

5.1 Economic Activities

We first consider engagement in economic activities, following the classification in Figure 4A and so dividing between being enrolled in full time schooling, being exclusively engaged in income generation, or being engaged in both school and work (with engagement in neither being the omitted category). Figure 6 summarizes the results by age cohort, where each outcome has three bars: $\widehat{\beta}_2$ (red), $\widehat{\beta}_1 + \widehat{\beta}_3$ (dark blue) and $\widehat{\beta}_1$ (light blue). For each bar, we show the associated 90% confidence interval. The corresponding regression results are in Table 5, where we report the significance of $\widehat{\beta}_3$, so whether the ELA program has a differential impact in high and low disruption villages.

The first bar shows that $(\widehat{\beta}_2)$ show the disruption effect, i.e. moving from a low to a high disruption village absent ELA, is associated with a dramatic fall in school enrollment rates of

16pp, and a significant rise in exclusive engagement in income generation by 19pp. To reiterate, the fall in enrolment is measured well after the crisis, and hence there are persistent impacts of higher disruption on girl's ability to re-enrol. In short, absent ELA in control villages, increased disruption significantly accelerates the school-to-work transition for young girls.[33]

The next set of bars in yellow ($\widehat{\beta}_1 + \widehat{\beta}_3$) show the ELA program dramatically counters the school-to-work transition for young women in high disruption villages. In those locations, the 16pp fall in enrolment is halved in villages randomly assigned to ELA (to a 8.1pp fall). In high disruption villages with ELA we also observe reduced tendencies of young girls towards exclusively focusing on income generation: in those villages ELA causes girls exclusive engagement to rise by only 5.8pp (compared to the 19.1pp rise absent ELA). Moreover, ELA in high disruption villages allows younger girls to also combine school and work activities. As Table 5 shows, the incidence of this combination of activities rises by 9.5pp (and is significant at the 5% level). Hence, these combined channels fully offset the 16pp fall in enrolment moving from low to high disruption.

How do ELA clubs offset the school-work transition for younger girls and help them to re-enrol in schools in high disruption villages? Two potential channels are at play. First, ELA might raise the returns to schooling because it provides complementary skills, something we find supportive evidence for in the results below. Second, ELA clubs offer young women protective time away from men: if this helps prevent teen pregnancies during the crisis and gives them greater agency over their bodies, this leads to higher re-enrolment rates of young women. The interlinkage between pregnancy and schooling is made even more acute in this specific context given policies towards pregnant girls enforced after schools re-opened.

The final set of bars ($\widehat{\beta}_1$) show that in low disruption villages, the ELA intervention reduces school enrolment by 5.2pp. This suggests that to some extent ELA clubs substitute demand for schools because they provide more valuable forms of human capital, or because they provide safer spaces for young girls to spend time at rather than travelling to the nearest secondary school. For outcomes of engaging only in education or only in work, the impact of ELA is significantly different in high and low disruption villages (so $\widehat{\beta}_3 \neq 0$ in each case, $p = .020, .020$ respectively).

The right hand panels in Figure 6 and Table 5 show changes in economic activities for the older cohort (those aged 18-25 at baseline). For this older cohort, the ELA intervention, in both low and high disruption villages, has generally muted impacts on the extensive margin choice of economic activities. This is to be expected if older girls' choices are more costly to reverse. The

[33] In results not shown, we find the movement into income generation for younger girls is driven by their engagement into self-employment. This is not surprising, given that most women are engaged in self-employment activities pre-crisis [Casey *et al.* 2016], wage employment opportunities would have been severely curtailed during the crisis, and because the ELA program mostly relaxes human and physical capital constraints related to transitions into self-employment.

most significant extensive margin changes are that in high disruption villages, the share of older girls combining education and work significantly falls, by 3.7pp (or 70% of the baseline mean). This is more than offset in high disruption villages randomly assigned to ELA, so clubs enable older girls to continue combining work and school.

5.2 Skills

We trace through the impacts on school enrolment (especially for younger girls) by next examining outcomes related to human capital accumulation. Table 6 first shows basic skill outcomes of literacy and numeracy, that formal education provides.

We again begin by noting the destructive impacts the intensity of the Ebola shock has on human capital formation among young girls and women. Moving from a low to high disruption village has large negative association with both forms of human capital accumulation. For younger girls, their literacy skills fall by 12 points on a (0,100) skills index (already from a very low level of 24.6 at baseline), and their numeracy skills fall by 7 points on a (0,100) skills index (again, from a low level of 42 at baseline). For older girls, we still see significant reductions in numeracy skills by 8 points, presumably driven by the earlier fall in older girls able to combine school and work.[34]

In line with the results on economic activities, ELA protects the accumulation of these basic skills for both younger and older cohorts, especially in high disruption villages. More precisely, for younger women, ELA offsets around 73% (99%) of the reduction in literacy (numeracy) skills. For older girls, 93% of the loss in numeracy skills is offset by ELA. In short, in terms of human capital accumulation, which is likely to be pivotal for future labor market opportunities, ELA mitigates the impacts of higher Ebola-related disruption. These results reinforce the idea that time spent in school represents a productive human capital investment for young women relative to the next best alternative, even though school quality is low.

The remaining Columns in Table 6 examine two margins of human capital accumulation the ELA intervention targets: entrepreneurial confidence and financial literacy. The entrepreneurial confidence index measures respondent's self-reported ability to run a business, identify business opportunities, obtain credit, save and invest, manage financial accounts, bargain prices, manage employees and search for jobs. There are some limited improvements in human capital as a result of the ELA intervention along dimensions of entrepreneurial confidence and financial literacy for the older cohort. However, the magnitudes are modest, even if statistically different from zero.

This places relatively greater weight on interpreting the role of ELA clubs through the lens of

[34]Note that the girls in our sample were born before, during or shortly after the civil war, when schools were closed for a decade. This likely explains why on numeracy, older girls actually start from a slightly lower baseline score than younger girls.

offering an alternative to time with men, that might ultimately be driving the schooling and basic skills impacts. We thus next examine how girls allocate their time across activities in more detail.

5.3 Time Use

We consider how time is split across the following activities: any form of learning, income generation, household chores, leisure, volunteering/church activities, and ELA club attendance. Learning corresponds to all forms of education-related activities except ELA (formal schooling, other vocational training, church-based schools). To account for interlinkages in allocations across activities, we estimate a SUR model across specifications that allows error terms to be clustered by village. All estimates include zeroes and so should be interpreted as the total effects margin. Figure 7 summarizes the results with the full set of regression results in Table 7.

The broad pattern of results by age groups is consistent with the extensive margin changes in economic activities documented above. To begin with the results show the stark impacts of increased Ebola-related disruption: among younger girls, moving from a low to a high disruption village is associated with a significant decline in time devoted to learning. The magnitude of this is 12.7hrs/wk, corresponding to 24% of the baseline mean. Time away from learning is reallocated towards income generation (that increases by 6.03hrs/wk, or 41%), and household chores (that increase by 5.69hrs/wk, or 13%). As we document below, this partly reflects young women looking after new born children, as rates of pregnancy rise significantly for young girls in high disruption villages absent ELA.

ELA largely reverses this reallocation of time in high disruption villages, critically maintaining girls in learning activities post-crisis. ELA offsets the reduction in hours of schooling by 9.69hrs/wk (or 76% of the effect of high disruption). ELA offsets the increase in time spent on household chores by 4.74hrs/wk (or 83% of the effect of high disruption), and this impact of ELA clubs is significantly different in low and high disruption villages ($p = .010$).

The last two categories of time use shown in Figure 7 and Table 7 relate to time spent engaged in leisure, and time spent at ELA clubs. On leisure time, in both high or low disruption villages, the provision of ELA clubs allows young girls to reallocate time away from leisure and towards participation in ELA activities. In all cases, around 3hrs/week are spent at ELA clubs, a plausible magnitude and in line with the participation results in Table 4. Consistent with there being no selection on gains for young girls, the impacts on ELA hours are the same in low and high disruption villages ($p = .528$).

The right hand panels in Figure 7 and Table 7 show changes in time use for older girls. We again see a pattern of protective effects of ELA in high disruption villages: the program helps maintain

time spent learning, and keeps older girls away from devoting time to household chores. Older girls in ELA villages also experience a significant reduction in leisure hours, which is substituted by time spent at ELA clubs. Leisure time falls by 2.97 and 4.01hrs/wk in low (high) disruption villages, corresponding to 10% (14%) reductions relative to the baseline mean. Offsetting this is the time devoted to ELA clubs, this is just under 3hrs/week in all villages. In line with there being no selection on gains among older girls, the impacts on ELA hours are the same in low and high disruption villages ($p = .741$).

We next explore whether this time away from leisure and towards ELA substitutes time spent with men, and ultimately increases their agency over their bodies.

5.4 Leisure Activities

We split leisure into time spent with men (where the wording of our question clearly referred to time spent with men they were sexually active with), with friends, spent alone, and in social activities (such as volunteering/church). These categories exclude time at ELA clubs, so reductions in time spent alone/with friends might be compensated for by socializing at ELA clubs instead. We continue estimating (1) for each activity using a SUR specification that allows error terms to be correlated across leisure activities. The results are summarized in Figure 8. Table 8 shows the underlying regression results. We see the earlier effects of Ebola-related disruption, ELA and their interaction on aggregate leisure time mask some dramatic changes for women: central to this are changes in time spent with men.

5.4.1 Time Spent With Men

Focusing on younger girls to begin with, in high Ebola-related disruption villages that do not have ELA clubs, younger girls face large increases in exposure to men for sexual relations: at endline the magnitude is 1.27hrs/wk, or a near 48% increase over the baseline mean. However, the presence of ELA clubs helps to largely offset this increased exposure, and they do so both in low and high disruption ELA villages: these offsetting effects are 1.86hrs/wk in high disruption villages (or 146% of the effect of moving from low to high disruption control villages), or .60hrs/wk in low disruption villages (or 47% of the effect of moving from low to high disruption control villages).

For the older cohort, greater Ebola-related disruption is also associated with spending more time with men, but the presence of ELA clubs again provide an alternative time use in all treated villages: these offsetting effects are 1.65hrs/wk in high disruption villages, and the offsetting effect is 1.32hrs/wk in low disruption villages.

Taken together, these results reinforce the notion that the ELA program provides an alternative

for women to spending time with men with whom they are sexually active, and this is more so for younger girls in villages struck by high levels of disruption. This has implications related to fertility and risky behaviors, that we come to below after examining the impacts of ELA on the social ties of young girls and women.

5.4.2 Social Networks

As Figure 8 and Table 8 show, the reallocation of leisure time caused by ELA is not just from time spent with men, but also from time spent with friends, alone or engaged in volunteering/church activities: this is the case for both age cohorts and in low and high disruption villages.

The reduction in time spent with friends can have one of two interpretations. Girls might be substituting this with time spent at ELA clubs, or there might be an overall weakening of social ties between girls that persists post-crisis. Given the different implications of each, we probe further by exploiting a network survey module fielded at baseline and endline. This asked about the number (and identity) of ties to other girls in the village along four dimensions: friendship, for business (income generation), who intimate topics are discussed with, and for credit/finance.

Given network ties are censored at zero, we estimate (1) using a Tobit model. The results in Table 9 reveal the following. The estimates show that for older girls, high Ebola-related disruption weaken networks along two dimensions: business and credit ties. Such weakening of social network structures due to the aggregate shock has both micro and macro implications in the long run [Fogli and Veldkamp 2016].[35]

However, ELA clubs curb the loss in social ties for both younger and older cohorts along multiple dimensions in high disruption villages. For younger girls, these offsetting impacts are .337 friendship ties (16% of the baseline mean), .459 for business ties (63% of the baseline mean), and .579 for credit ties (66% of the baseline mean). We see similarly protective effects of ELA clubs on the social ties of older girls along three dimensions. The reported p-values on the significance of $\widehat{\beta}_3$ confirm the impacts of ELA clubs on social networks do not significantly differ between low and high disruption villages with two exceptions: for the older age group, there is a significantly greater protective effect in fostering ties for discussing intimate topics or for credit in high disruption villages relative to low disruption villages ($p = .046$, .003 respectively).

The fact the ELA intervention might help protect social ties is a strong marker of the longer run benefits of the intervention and the ability of young women to recover from the aggregate shock. Our findings on the impact of the intensity of an aggregate shock on networks are novel,

[35] For each cohort, around 75% of ties on each dimension are to others in the same age bracket. This further limits informational or behavioral spillovers occurring between age cohorts.

adding to a nascent literature on how development interventions impact the structure of networks [Banerjee *et al.* 2018, Heβ *et al.* 2018].

5.5 Fertility and Risky Behaviors

In the absence of ELA clubs, a central impact of the aggregate shock is to cause young women to spend more time with men. It is natural to follow up on this by examining outcomes over the crisis related to pregnancy and risky sexual behaviors. ELA clubs might be able to mitigate any such consequences given they provide an alternative time use for young women, and a key component of the life skills training is to empower young women to have increased agency over their bodies.

5.5.1 Younger Cohort

Table 10 examines outcomes for the younger cohort. As background we note that around 25% of this cohort report being in a relationship at baseline. Hence changes over time on these margins reflect both the consequences of newly formed relationships, as well as changes in behavior for intact relationships over the crisis.[36]

Beginning with contraceptive use, Column 1 shows no persistent change in reported condom use (despite this being a form of contraception offering some limited protection from one potential channel of Ebola transmission). However in high disruption villages, there is a persistent decrease in the use of other contraceptives (Column 2).[37] There is no evidence that ELA impacts contraceptive use among younger girls, despite this being a core component of the life skills training.

Given a primary form of Ebola transmission is through bodily fluids, we might also expect the frequency of sexual activity to fall during the crisis. Our endline data allows us to establish whether any such change persists post-crisis. Column 3 shows the frequency of intercourse does not fall persistently (measured as the number of times per month) in low disruption control villages, but it does fall in the presence of ELA clubs in high disruption villages. Combined with the earlier results on contraceptive use, Column 4 summarizes impacts on the frequency of unprotected sex, that is most relevant for policy: this rises with higher Ebola disruption in control villages, but falls in high disruption villages with ELA. The program offsets the rise in unprotected sex in high disruption villages by 43%. If this ITT program impact represents a permanent shift in post-crisis behavior, this could serve to reduce STDs in future.

[36] Given that in this context men pay dowries to the bride's family, there is a possibility that households sell off daughters as a coping strategy during the crisis. We find no evidence that the aggregate shock impacts rates of (child) marriage.

[37] Among non-condom forms of contraception, the most commonly reported are injections (22% at baseline), implants (14%), and the contraceptive pill (10%)

Contraceptive use might reflect outcomes bargained between men and women [Ashraf *et al.* 2014]. Linking more directly to men's actions, Columns 5 and 6 examine the frequency of unwanted or transactional sex, as reported as occurring over the past year. Hence at endline this can potentially capture changes in outcomes that started to occur during the crisis. For both outcomes, we do not see any change with higher levels of disruption, nor are there any impacts of ELA on this margin for the younger cohort.[38]

From the perspective of lifetime welfare, the key outcome for this cohort is teen pregnancy. On the frequency of pregnancies *between* baseline and endline, Column 7 shows that moving from low to a high disruption control village is associated with a 10.7pp increase in the likelihood of becoming pregnant over the crisis. Hence the crisis intensity speeds up transitions into childbearing for teenagers, in exactly those locations where health service provision has collapsed, and dangers during childbirth to girls are likely to be even more severe than in pre-crisis times. This pattern of results follows from the earlier findings that in higher disruption villages absent ELA, the school-to-work transition is accelerated, and these girls spend much more time with men.

Column 8 shows this increase in teen pregnancy is driven by out-of-wedlock pregnancies: absent ELA, these rise by 7.2pp in high disruption villages relative to low disruption villages. However, this impact on out-of-wedlock births is completely reversed in high disruption villages that are randomly assigned to ELA. Given the post-crisis policies towards pregnant girls not being able to attend schools described in Section 2, the fact that ELA clubs reduce the likelihood of teen pregnancy underpins the earlier result that girls in ELA villages are more likely to re-enrol into education when schools re-opened towards the end of the epidemic. Indeed, the magnitude of the fall in out-of-wedlock pregnancies (7.5pp) closely matches the rise in school enrolment (8.5pp). Hence one reason why ELA clubs help girls to be able to re-enrol post-crisis in high disruption villages is that the program helps them to avoid time with men, avoid out-of-wedlock births, and thus they are not barred from re-enrolling.

5.5.2 Older Cohort

The same sequence of results for the older cohort is shown in Table 11. 90% of this cohort are in relationships at baseline already, so the pattern of results below predominantly reflects changes in behavior among intact partnerships.

Column 1 shows that in highly disrupted villages with ELA, the reproductive health skills training kicks in and older girls report a large increase in the use of non-condom contraceptives:

[38] When asking about transactional sex, we mention multiple forms of in-kind gifts that might be provided by partners, including help with school fees. This has long been argued to be part of transactional sexual arrangements in place for younger girls in this context [Bledsoe 1990].

this increases by 13.7pp, or 29% of the baseline mean, and highlights the availability of some forms of contraceptive is not altogether impacted by health services collapse. Importantly, these skills do not seem to be learned or imitated by younger girls in ELA treated villages facing high disruption. This is in line with the traditional age separation of girls in secret societies in rural Sierra Leone.

Column 3 shows that post-crisis the frequency of sex is essentially unchanged for this older cohort. These small impacts combine with the slight increases in contraception use to leave the frequency of unprotected sex unchanged overall (Column 4).

The remaining results on risky sexual behaviors and pregnancy differ starkly from those for the younger cohort. In high disruption villages with ELA clubs, older girls report significantly more unwanted sex and transactional sex. These are large increases: unwanted sex increases by 5.4pp, corresponding to 34% of the baseline mean; transactional sex increases also by 5.4pp, corresponding to 114% of the baseline mean.[39]

Columns 7 and 8 show that ELA prevents these behavioral changes translating into higher fertility because older girls increase their use of female controlled contraceptives. This impact of ELA is obviously reassuring in the short term, as delaying childbearing can help improve the lifetime welfare trajectory of women. It also shows that behavioral change among older girls is consistent with them taking on board some the life skills provided by ELA in high disruption locations. It is because of these changes in contraceptive behavior that they can compensate for some risks if they start to engage in transactional sex.

Pulling together the findings across age cohorts, the common impact of ELA is to allow all young girls to allocate time away from men. This ultimately means that in treated villages, young women spend less time engaging in sexual activities. For the younger cohort aged 12-17, this leads to less sex, less unprotected sex, lower rates of out-of-wedlock fertility, that then map almost completely to higher rates of re-enrolment in school.

However, in providing younger women an alternative to spending time with men, a necessary consequence is this reduces the availability of younger women to men. Men thus shift attention to older girls and seek out alternative ways to satisfy their sexual demands. This is compounded by the fact that economic opportunities for men have also been decimated during the crisis, and so they have fewer work related activities to devote time towards in the first place. All these forces combine to place upward pressure on the price of transactional sex in these villages. As Figure 4B

[39] Risk preferences can be impacted by aggregate shocks [Malmendier and Nagel 2011, Callen *et al.* 2014, Cameron and Shah 2015]. Much of this literature is consistent with the concept of risk vulnerability so shocks lead to *higher* levels of risk aversion, as individuals might update their beliefs over the background risk they face [Gollier and Pratt 1996]. However, one exception is Eckel *et al.* [2009] who examine risk-aversion in the context of Hurricane Katrina evacuees in the United States. They find evacuees exhibit more risk loving behavior, and subscribe such behavior to the emotional state of individuals shortly after the hurricane. This is in line with Loewenstein *et al.* [2001] on risk preferences being driven by psychological mindsets.

showed up front, engagement in transactional sex is not uncommon in this context, and steadily increases with age. As the price of transactional sex rises, it becomes more profitable for older girls to engage in such behaviors. As in Dupas and Robinson [2012] and many other crisis contexts, engagement in transactional sex by older girls might then represent a form of income generation in a time of aggregate crisis, when economic opportunities are extremely limited and mechanisms used to smooth consumption in the face of idiosyncratic shocks are unavailable.[40]

These findings show how interventions can create interlinked outcomes across different groups of women: by offering younger girls and alternative to spending time with men during the crisis, ELA clubs cause the financial returns to engaging in transactional sex to rise for older girls. Of course such price effects might also impact the behavior of women older than 25 at baseline: such women are not in our sample.

Two aspects of the use of transactional sex in ELA villages are somewhat reassuring though. First, this behavior is matched by increases in contraceptive use among the older cohort of women, that helps protect women's reproductive health [Shah 2013].[41] Second, as with the results on contraception, we do not see younger women learning or imitating the behavior of the older cohort in moving into transactional sex.

An earlier literature in economics has emphasized how the voluntary supply of transactional sex is impacted by opportunity costs in the marriage market [Edlund and Korn 2002] or the labor market [Lee and Persson 2013]. Our setting combines both with recent insights from Brodeur *et al.* [2018] who document how supply shocks partly led to the formation of the Thai sex industry (where supply shocks are generated through changes in agricultural prices that lead to large inflows of women to urban areas). In our context, there is a collapse in labor market opportunities, ELA clubs reduce the availability of younger girls, thus raising the price of transactional sex.

An obvious concern with the outcomes considered on fertility and risky sexual behaviors is that responses might be driven by experimenter demand effects where ELA clubs are established, or that respondents might be more willing to truthfully report some outcomes – such as transactional sex – in the presence of ELA. The pattern of results from Tables 10 and 11 do not fit easily with such an interpretation because the estimated impacts of ELA: (i) differ across age groups; (ii) differ with the levels of Ebola-related disruption for some outcomes for both cohorts.

[40] Entry into sex work has been argued to be a coping strategy for women in times of other economic crisis: such as post-WW2 in Germany, Italy and Japan [Bullough and Bullough 1987], during the 1930s depression in the US [Allen 2004] and in the turmoil of 1990s Russia [Atlani *et al.* 2000, Aral *et al.* 2003].

[41] As Shah [2013] discusses, research shows that sex workers in low-income settings are paid substantial premia for non-condom sex [Rao *et al.* 2003, Gertler *et al.* 2005, Robinson and Yeh 2011], and this risk premium is best understood as a compensating differential for increased disease risk [Arunachalam and Shah 2008].

5.6 Robustness

In the Appendix we discuss the robustness of our core results for each age cohort to: (i) using randomization inference to test the null of no treatment effects; (ii) adjusting for multiple hypothesis testing; (iii) only controlling for district fixed effects (that are the randomization strata); (iv) using alternative measures of the intensity of Ebola-related disruption. Our core pattern of results are robust to these checks and permutations.

6 Discussion

Viruses are 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 that the long run incidence of highly infectious diseases will be shaped by urbanization and rising global temperatures (and offset by advancement in medical technologies), they are expected to remain a worldwide threat.[42] In this paper, given the nature of timing between our pre-planned evaluation of ELA, and the coincidental outbreak of Ebola just as our baseline survey was completing, our study presents a unique opportunity to understand the microeconomic mechanisms through which this kind of aggregate shock impacts the economic lives of young women.

We conclude by discussing three open issues for future research: the impacts of the intervention on health outcomes related to the epidemic, the behavior of men during the crisis, and policy implications going forward.

6.1 Health

Community engagement is one important component in successfully controlling disease outbreaks. As such, the crisis might open up new forms of community organization, such as ELA clubs, to help organize and coordinate actions to control the epidemic. Does this have any measurable impact on Ebola related health outcomes? Table 12 examines the possibility, where impacts are identified from the endline cross-section because only then did we ask respondents about Ebola experiences, and so we do not control for baseline outcomes.[43]

[42] Smallpox has caused the deaths of 300mn individuals worldwide, influenza 100mn and HIV 30mn. Alongside viruses, climate driven aggregate shocks are also becoming increasing commonplace. As Cameron and Shah [2015] note, over the last decade, direct losses from natural disasters in the developing world averaged US$35 billion annually. These losses are increasing and are more than eight times greater than the losses suffered as a result of natural disasters during the 1960s. The issue is becoming increasingly important as climate change scientists have predicted an increase in the frequency of disasters like floods and tropical cyclones [IPCC 2001].

[43] To improve precision, the sample is the same set of individuals tracked from baseline to endline used throughout, but we also add in respondents from the refresher sample collected at endline, that were resident in the village since before the outbreak. The results are near identical not using this second group.

We elicited information about whether any Ebola cases had occurred in the household, extended family or friendship network. In control low disruption villages, the reported Ebola incidence among these groups is 3%, 13% and 16% respectively, as reported by both age cohorts. Reassuringly they do increase in the size of the network. For both age cohorts, we see generally negative point estimates of ELA in low and high intensity villages, but there are only significant declines in reported Ebola cases by younger girls among their extended family network (by 4.5pp or 30%) and friendship networks (by 5.0pp or 28%). An area for future study is to understand whether ELA clubs have persistent health impacts.

6.2 Men

Clearly much remains to be understood on the behavior of men during times of such crisis. Our data collection was never designed to survey men, and our findings can only hint at how their behavior was impacted during the Ebola outbreak, when their economic opportunities disintegrated. Our findings hint at some possible male-driven outcomes changing over the crisis: most obviously the increase in unwanted and transactional sex among older girls in the presence of ELA clubs.

Perhaps the clearest marker of men's behavior in our survey is reported intimate partner violence, although the direction of expected impact is unclear, given simultaneous changes in income, the human capital of young women and other factors. We focus on this outcome for the older cohort because the vast majority of them are in the same relationship between baseline and endline. The result is reported in Column 7 of Table 12: we see IPV falls as the intensity of disruption increases, and a potential backlash against older girls in the presence of ELA in high disruption villages. IPV is one example of a large potential number of ways in which men might change behavior or backlash against women's empowerment interventions in times of severe economic disruption. These are open research questions, that we aim to pursue in any longer term follow-up.[44]

[44]Haushofer *et al.* [2018] report results from an evaluation of an unconditional cash transfer program, finding positive income shocks reduce IPV both in terms of physical and sexual violence, especially if the woman in a household is the recipient. Others experimental papers have found increases IPV in response to women's empowerment interventions [Tankard 2016]. Relatedly, Cunningham and Shah [2017] find a reduction in violence as transactional sex is decriminalized in Rhode Island. Guarniera and Rainer [2018] address the issue of male backlash using a natural experiment in Cameroon, whereby territories were arbitrarily divided between France and the UK, whose regimes opened up divergent economic opportunities for women. Using a geographical regression discontinuity design, they show that women in former British territories (that are generally thought to have been economically empowered) are 30% more likely to IPV than women in former French territories.

6.3 Policy Implications

Our results provide three broad lessons for the design of women's empowerment interventions and building resilience to aggregate shocks. Underpinning these implications is the fact that our evidence indicates policy interventions can be implemented even in the most challenging circumstances. Indeed, our ITT estimates of the ELA program are likely underestimated relative to the case of perfect implementation because: (i) there were supply side delays in program implementation; (ii) some tracked girls moved away from treated villages between baseline and endline, and so were not fully exposed to ELA.[45]

First, we have made no attempt to examine the separate components of the ELA program, as was our original design. A key aspect of ELA clubs utilized by younger girls is the alternative use of time if offers to spending time with men. To the extent that life skills are costly to supply, the same outcomes could have been obtained at a lower cost to the social planner. For older girls, there is more consistent evidence of life skills impacts, including entrepreneurial confidence, financial literacy and greater contraceptive use. This gets to the tension at the heart of the analysis: that by offering alternative time uses for younger girls, such programs necessarily have externalities on other women in the same communities – say, through raising the price of transactional sex. Finding ways to break this interlinkage in future interventions is key to minimizing adverse distributional consequences of interventions in times of crisis. This also points to the need for age-specific life skills curricula to be developed in future ELA scale-ups.[46]

Second, the muted life skills impacts on younger girls might be due to the established norms set by secret societies over information supplied on reproductive health to younger girls. these institutions might also hinder knowledge spillovers occurring from older girls. Understanding the coevolution of informal secret societies, formal schooling and development interventions remains a large open question for future research throughout West Africa, in economics and other social sciences.[47]

[45] Recent violence in Southern parts of the Democratic Republic of the Congo has led to thousands of violent sexual assaults: Médecins Sans Frontières have recently reported that between May 2017 and September 2018, they treated 2600 victims of sexual violence in Kasai Central province. DRC is also in the midst of an insurgency and an outbreak of Ebola. The 2018 Nobel Peace Prize was co-awarded to Denis Mukwege, who founded and runs the Panzi hospital in Eastern DRC. He has cared for victims of sexual assault in conflicts in DRC.

[46] On vocational training, it might take time for the returns to such human capital investments to be realized, as economic opportunities rebuild in the crisis aftermath. Indeed, our earlier evaluation of ELA and other training programs in Uganda suggest the returns to vocational training take time to evolve [Alfonsi *et al.* 2018, Bandiera *et al.* 2018]. As with behavioral change among men, this can be examined in any longer run follow-up.

[47] Ours is not the only study to find it hard to drive institutional change through development interventions in Sierra Leone. For example, Casey *et al.* [2012] evaluate a community driven development program in rural Sierra Leone (that provided block grants to communities, alongside technical training and other governance reforms). They find that such kinds of institutional reform have little long lasting impact on the functioning of local institutions.

Finally, would a similar program be equally protective in another context and type of aggregate crisis? Preliminary analysis from an impact evaluation of the ELA program in South Sudan (also implemented by BRAC) suggests similar crisis-offsetting effects, even though the nature of the aggregate shock, conflict, is different, and the conflict occurred after a more sustained period of club implementation [Buehren *et al.* 2018]. Nonetheless, the analysis indicates that many of the pernicious effects of conflict on young women are offset by having participated in ELA clubs.

Understanding all these issues, and designing effective low-cost interventions to ameliorate the root causes of disadvantages faced by women, can help protect slow but steady gains in women's empowerment to external aggregate shocks. This will become increasingly important as nearly all low-income states are susceptible to such shocks in one form or another, be they through commodity price fluctuations, conflict, viral epidemics or climate change.

A Appendix

A.1 Attrition

Attrition is low given the circumstances: 83% of our respondents were tracked from baseline to endline (4790). Among tracked women, 81% (3865) resided in the same village, while others were tracked to a different (but typically nearby) village. Hence although geographic mobility is high, it does not lead to severe attrition. For those originally in a treated village and then tracked to another village, we can use the approximate date of their move to understand the extent to which they were exposed to ELA clubs. At least 60% of tracked movers have been partially exposed to ELA clubs in their original village. Finally, 922 (16%) of girls attrited out of the sample (only 12 were due to death).[48]

Table A2 presents correlates of attrition. Columns 1 and 2 show that treatment assignment, and exposure to high disruption do not separately predict attrition. Column 3 shows this continues to hold when controlling for both together, and their interaction. This continues to hold when: (i) we additionally control for characteristics of girls, households and villages (Column 4); (ii) allow there to be differential attrition between treatment, Ebola disruption, and their interaction with baseline characteristics such as enrollment, employment, age and household poverty.[49]

[48] Attriters were replaced by a refresher sample of 1415 girls surveyed only at endline. Around 44% of this sample resided in the same village at baseline and endline.

[49] Of course individual characteristics of girls jointly predict attrition (such as baseline economic activities engaged in, marital status and household size), but not differentially so in treated villages, in high disruption villages, and villages with both (the F-statistics at the foot of each Column report this to be the case).

A.2 Robustness

We examine the robustness of our core results for each age cohort: Table A6 shows the outcomes that are central to understand the impact of the Ebola shock on the economic lives of young women, and the mechanisms through which ELA interacts with these impacts. The outcomes shown are weekly hours spent on learning activities (Panel A), weekly hours with men (Panel B), out of wedlock pregnancies for the younger age cohort (Panel C), and the supply of transactional sex for the older age cohort (Panel D). For each parameter of interest, we show the baseline estimate as previously reported. We then consider the following checks.

First, we use randomization inference to test the null of no treatment effects, following the methods set out in Young [2018] and Heβ *et al.* [2018]. The resulting p-values are shown in braces in Table A6: we see that of the 12 significant coefficients in the baseline specifications, 11 remain statistically significant at conventional levels once we account for randomization inference. This is reassuring and suggests our findings are not driven by outliers.

Second, given the large number of outcomes considered, some adjustment for multiple hypothesis testing can be considered. To be clear, the economic activities outcomes in Panel A sum to one by construction (so we are not measuring impacts on a latent outcome with alternative proxies), and the total effects time allocation results in Panel B are already estimated using a SUR model accounting for correlation across outcomes. The larger concern is that we have multiple ITT estimates in each specification: at the foot of each Column in Table A6 we thus also show the p-value on the F-test of the joint significance of the parameters of interest. In four out of six cases these are highly significant.

To address multiple hypothesis testing in the most conservative way, we also report p-values computed using the step-down procedure of Romano and Wolf [2016] (based on $1,000$ bootstrap iterations). Five coefficients remain significant: moreover, for the ITT estimate of ELA in high disruption villages ($\widehat{\beta}_1 + \widehat{\beta}_3$), three of the five coefficients remain significant. This is to be expected given the factorial design estimated goes well beyond the original evaluation design.

We next address the concern that the number of treatment and control villages is relatively small, and the balancing tests in Tables 1 and 2 might not be especially powerful. Indeed, our baseline specification controlled for the village characteristics shown in Panel A of Table 1 to address any potential imbalance. Table A6 then shows how our results vary if we only control for district fixed effects (that are the randomization strata): of the 12 significant coefficients in the baseline specifications, 10 remain statistically significant.

Our fourth set of checks examine alternative measures of the intensity of Ebola-related disruption. Our baseline results exploited the dummy index measure of Ebola-related disruptions: this

defined high disruption villages to be at the 75th or higher percentiles of our overall Ebola-related disruption index. Clearly, some judgement must be made about how to define high intensity, and the quantitative results will always be a function of exact choice made. To show the qualitative robustness of our core results to small alternations in this definition, we examine how the results vary using different thresholds of the disruption index. Figure 9 shows the results, by age cohort and for two summary outcomes: (i) hrs/wk spent in productive activities of learning, income generation or ELA clubs (Panel A); (ii) hrs/week spent with men (Panel B). The omitted category are villages in the first six deciles of the disruption index. The impacts on time in learning activities and time spent with men both vary depending on the intensity of disruption, where we show cutoffs at the 60th, 70th, 80th, 90th percentile of the index. Reassuringly, for both outcomes, we observe impacts of Ebola-related disruption across deciles, and offsetting impacts of ELA clubs, as the measured intensity of the Ebola outbreak varies.

A second facet of the disruption measure used is that it is defined in absolute terms, and so measures the most disrupted villages in any of the four districts included in our evaluation sample. As Figure 5 shows, this inevitably leads to most high-disruption villages being defined in Port Loko, the district with the highest incidence of health related Ebola disruption. For our research questions, it is the absolute level of Ebola related disruption that we are concerned with. However, this raises the concern of whether the impacts of higher versus low disruption instead pick up something specific to Port Loko relative to other districts. To probe this further we redefine the high disruption dummy to be district specific, so that villages in each district that lie in the highest quartile of the continuous disruption index are classified as high disruption. This is the final row of results shown for our main outcomes in Table A6: of the 12 significant coefficients in the baseline specifications, 9 remain statistically significant at conventional levels once we consider high disruption to be within-district rather than in absolute terms across the evaluation sample (with some point estimates being larger in absolute value than in the baseline specification).

As a final check, we reconstruct E_{vd} by additionally using information on the disruption of daily and periodic markets. This again uses data from the village leader survey, where we consider daily markets as disrupted or closed if reported as such by village leaders for at least one month between July 2014 and September 2015. However, a significant number of villages ($n = 62$) do not have a daily market. Hence we make the extreme assumption that both dummies for disruption and closure are equal to one in those cases. This gives the most conservative measure of disruptions and, if the assumption is incorrect, will bias estimated impacts of disruptions towards zero. Table A7 then shows statistics related to the components of this modified index: the two additional components related to markets shown in Panel C have considerable within district

variation (Column 2), and remain uncorrelated to treatment assignment (as shown under various specifications in Columns 3 to 6). The overall disruption dummy E_{vd} is then equal to one for 25% of villages, and again remains orthogonal to treatment assignment.

In the robustness check Table A6, the last row in each panel then shows the main results under this alternative construction for E_{vd}. We see that of the 12 significant coefficients in the baseline specifications, 9 remain statistically significant, and with similar point estimates.

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Table 1: Baseline Balance for Village Characteristics

Means, clustered standard errors from OLS regressions in parentheses
P-value of t-test of equality of means with relevant control group in braces

	Control	Treatment	Difference	Normalized Difference
	(1)	(2)	(3)	(4)
A. Village Characteristics				
Number of villages	50	150		
Number of dwellings	167	108	{.362}	-.121
	[462]	[148]		
Number of sampled adolescent girls	28.6	28.4	{.943}	-.013
	[13.4]	[9.30]		
Poverty score (Mean across households)	.353	.346	{.394}	-.094
	[.055]	[.054]		
Number of pre-existing NGOs	2.32	2.17	{.610}	-.054
	[2.09]	[1.74]		
Christians as a share of village population	.140	.140	{.952}	-.002
	[.204]	[.219]		
Distance from Freetown (miles)	52.8	52.6	{.291}	-.005
	[25.7]	[24.2]		
Distance from Kailahun (miles)	78.4	78.6	{.248}	.005
	[19.6]	[18.5]		
Distance from nearest PHU (miles)	1.89	1.86	{.940}	-.012
	[1.71]	[1.77]		
Distance from nearest secondary school (miles)	3.53	4.23	{.258}	.115
	[3.34]	[5.10]		
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}	.025
"Girls should be allowed to continue their education while pregnant" [=1 if strongly agree]	.120	.073	{.365}	-.111
Pregnant girls allowed to sit exams in the nearest secondary school	.239	.319	{.270}	.132
C. Policy Responses				
Village was quarantined	.060	.040	{.595}	-.065
Village visited by contact tracing team	.960	.933	{.455}	-.084
Received Relief from NGO	.780	.873	{.139}	.174
Village received food aid	.260	.213	{.504}	-.077
Village received school supplies (excl. BRAC)	.220	.207	{.818}	-.023
Received relief from Government	.800	.653	{.005}	-.234

Notes: Data sources are the Village Census (Panel A), and the Village Leader Surveys (distance measures in Panel A, all outcomes in Panels B and C). Column 3 reports p-values from a test of equality of means carried out by OLS regression of each characteristic on a dummy for assignment to treatment. All regressions include strata (district) dummies and calculate robust standard errors. Normalized differences in Column 4 are computed following Imbens and Wooldridge [2009]. The Poverty Score (PPI) is calculated through scorecards and its value, ranging from 0 to 100, represents the likelihood of a household being below the poverty line. The number of pre-existing NGOs includes all organizations apart from BRAC. Distance from Freetown and Kailahun are computed from GPS data.

Table 2: Baseline Balance for Individual Characteristics

Means, clustered standard errors from OLS regressions in parentheses
P-value of t-test of equality of means with relevant control group in braces

	Control	Treatment	Difference	Normalized Difference
	(1)	(2)	(3)	(4)
A. Basic Characteristics				
Number of Adolescent Girls	1,198	3,592		
Age	17.7	17.5	{.412}	-.025
	[3.76]	[3.74]		
In any relationship	.596	.596	{.893}	-.000
Married	.283	.283	{.825}	.001
Age at marriage	16.1	16.4	{.378}	.060
	[2.82]	[2.87]		
Age of husband at marriage	31.0	31.8	{.095}	.078
	[6.88]	[7.42]		
Has Children	.492	.486	{.820}	-.007
If in relationship: experienced any form of intimate partner violence	.464	.486	{.491}	.032
B. Empowerment and Aspirations				
Gender Empowerment Index [0-100]	17.4	16.6	{.506}	-.030
	[21.8]	[20.2]		
Sexually active	.747	.712	{.103}	-.056
If active: Age at sexual debut	14.7	14.6	{.348}	-.026
	[2.26]	[2.09]		
If active: Uses contraceptive	.440	.422	{.390}	-.026
(any, excluding condoms)	[.497]	[.494]		
If active: Ever used condoms	.104	.095	{.375}	-.021
Leisure activity: Engaged in sexual activities with men (weekly hours)	5.08	5.14	{.705}	.009
	[5.33]	[5.46]		
Time use: Learning activities (weekly hours)	28.6	28.2	{.805}	-.009
	[34.1]	[33.6]		
Unwanted sex over past year	.106	.101	{.739}	-.012
Transactional sex over past year	.041	.035	{.346}	.022
C. Human Capital and Economic Activities				
Skills: Literacy [0-100]	22.6	22.0	{.689}	-.016
	[27.5]	[27.2]		
Pregnancy Knowledge [0-100]	64.4	64.5	{.745}	.003
	[27.0]	[27.4]		
HIV Knowledge [0-100]	58.5	57.7	.647	-.026
	[20.7]	[20.0]		
Enrolled only	.274	.277	{.984}	.005
Engaged in income generation only	.342	.332	{.771}	-.016
Engaged in both	.183	.163	{.446}	-.037
Engaged in neither	.201	.228	{.292}	.047

Notes: Column 3 reports p-values from a test of equality of means carried out by OLS regression of each characteristic on a dummy for assignment to treatment. Regressions include strata (district) dummies and standard errors are clustered at the village level. Column 4 reports normalized differences are computed following Imbens and Wooldridge [2009]. Intimate partner violence is defined as the threat or use of physical violence from the respondent's partner. For the Empowerment Index, respondents were asked whether men, women or both should be responsible for the following activities: earn money for the family; have a higher level of education; do washing, cleaning and cooking; fetch water if there is no water pump or tap; feeding and bathing children; help the children in their studies at home; look after ill persons. The index is the share of questions to which the answer was both/same. Therefore, higher values represent more egalitarian gender norms. 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". Transactional Sex is defined as, "Receiving anything such as money, gifts, help with schoolwork or something else in exchange for sexual intercourse". Literacy is assessed based on respondent's ability to read simple things like labels on containers (basic), and reading comprehension and writing of complete sentence (advanced). The score representing respondent's proficiency with these tasks is then rescaled to range between 0 and 100. Pregnancy and HIV knowledge represent the number of correct answers to the following true/false questions: "A women cannot become pregnant at first intercourse or with occasional sexual relation"; "A woman who is breastfeeding can become pregnant."; "From one menstrual period to the next, there days when a woman is more likely to become pregnant if she has sexual relations."; "A person who has HIV is different from a person who is ill with AIDS"; "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"; "A Pregnant woman with HIV can give the virus to her unborn baby".

Table 3: ELA Participation

Means, standard deviations in brackets
P-value of t-test of equality of means with control group in braces

	All			Age 12-17 at Baseline			Age 18-25 at Baseline		
	Control	Treatment	Difference	Control	Treatment	Difference	Control	Treatment	Difference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
A. Membership									
Number of potential ELA members per village	136.6	129.9	{.738}						
	[132.1]	[9.5]							
(Club Members) / (pop aged 12-25)		.307							
		[.175]							
B. Participation									
Have you ever heard about ELA clubs?	.272	.890	{.000}	.241	0.883	{.000}	.301	.897	{.000}
Have you ever participated in any ELA club activities?	.041	.708	{.000}	.041	.761	{.000}	.041	.657	{.000}
Have you ever participated in Life Skills training organized through the club?		.824			.832			.815	
Participated in Life Skills training at least weekly		.772			.804			.734	
Could recount at least 4 major topics (out of 8) that were covered in the Life Skills curriculum		.512			.488			.540	
Did you ever received training in financial literacy?		.247			.217			.281	
Have you ever participated in Vocational Training organized through the club?		.337			.319			.358	
Did you take a microfinance loan from BRAC?		.127			.088			.169	
Observations	1,197	3,592		590	1,796		608	1,796	

Notes: Data on potential ELA club members in each village is obtained from the village census administered prior to the intervention, while data on club membership was collected during the ELA Monitoring Survey in 2015. Equality of means is tested by OLS regression of the variable of interest on treatment assignment and district fixed effects, with standard errors clustered at the village level. Data on participation in financial literacy training, livelihood skills training and microfinance is conditional on being assigned to the treatment arm that offered those specific programs.

Table 4: Ebola-Related Disruption Index

Standard deviations in brackets, standard errors in parentheses

	Mean	Between district variation (share of total)	Unconditional coeff on ELA	Conditional coeff on ELA	Conditional coeff on ELA with distance interaction	Conditional coeff on ELA with distance interaction and model selection
A. Health Policy Components	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
PHU Ever Closed	.140	.254	.001	-.000	.046	.076
	[.348]		(.049)	(.050)	(.075)	(.075)
PHU Ever Disrupted	.320	.212	.000	-.006	-.077	-.069
	[.468]		(.065)	(.065)	(.098)	(.096)
PHU Functioning Score	89.6	.485	-1.19	-1.02	-1.00	-.342
	[19.8]		(2.58)	(2.55)	(3.90)	(3.98)
B. School Policy Component						
Nearest Secondary School Re-Opened on Time	.825	.132	.085	.106	.072	.080
	[.381]		(.061)	(.059)	(.079)	(.081)
C. Index						
Disruption Index	0	.303	-.096	-.132	.094	.111
	[1]		(.132)	(.129)	(.235)	(.248)
Disruption Dummy	.170	.299	-.039	-.042	-.013	.009
[=1 if disruption index greater than 75th percentile]			(.050)	(.051)	(.103)	(.108)
N (villages)	200	200	200	200	200	200

Notes: All data comes from the Village Leaders Survey, collected in October 2015. The between group variation reported in Column 2 is computed through a one-way ANOVA analysis of the dependent variable across districts. For each measure of disruptions, Columns 3 through to 6 report estimated coefficients on assignment to treatment from regressions that use incrementally larger sets of village-level covariates. All regressions include district fixed effects and calculate robust standard errors. Column 3 reports the coefficient on ELA from a regression of the Ebola measure of interest on treatment assignment. The coefficient in Column 4 is obtained controlling for: number of dwellings, whether the village is a political stronghold (i.e. it is the residence of a chief), number of NGOs active pre-Ebola, average PPI score, share of Christians, distance from Freetown and distance from Kailahun (where the first Ebola case was recorded). In Column 5 distance from the nearest facility of interest (PHU in Panel A, Secondary School in Panel B, both in Panel C) and interaction between ELA assignment and these distances are added as regressors. None of the coefficients on the interaction between ELA and distance from each facility is statistically significant (not shown). Column 6 includes all regressors and interactions employed in Column 5, plus features selected by a penalized regression (Elastic Net) of the Policy index (dummy) on all village characteristics and their interactions. The Primary Health Unit functioning score is assessed on a monthly basis between July 2014 and September 2015, and later aggregated into an index ranging between 0 and 100. Secondary schools were considered as having re-opened on time if they were open in April 2015. The Disruption Index is constructed following Anderson [2008]. It aggregates variables in Panel A and B, and assigns higher values to communities more exposed to disruptions.

Table 5: Engagement in Economic Activities

OLS estimates, standard errors in parentheses, p-values in braces

	Aged 12-17 at BL			Aged 18-25 at BL		
	Enrolment Only	Engaged in IGA Only	Engaged in Both	Enrolment Only	Engaged in IGA Only	Engaged in Both
	(1)	(2)	(3)	(4)	(5)	(6)
Disruption Effect	-.166***	.191***	-.058	-.004	-.038	-.037**
	(.044)	(.062)	(.043)	(.024)	(.056)	(.018)
Treatment Effect in High Disruption	.085*	-.133**	.095**	-.007	.028	.051**
	(.049)	(.064)	(.038)	(.024)	(.060)	(.020)
Treatment Effect in Low Disruption	-.052*	.023	.008	-.021	.031	.001
	(.030)	(.019)	(.027)	(.015)	(.031)	(.010)
Difference [β_3, p-value]	{.020}	{.020}	{.062}	{.599}	{.966}	{.023}
Control Mean at BL	.519	.080	.296	.091	.576	.053
Observations	2,382	2,382	2,382	2,400	2,400	2,400

Notes: ***, ** and * denote significance at the 1%, 5%, and 10% levels. Income Generating Activities (IGA) include both self-employment and wage labor. The main results are estimated with an ANCOVA specification. Control variables include: age, PPI score, household size, illiteracy, village size (nr of dwellings), village average PPI score, distances form key facilities (clinic, secondary school and market), a dummy equal to one if the village is a political stronghold (i.e. has a resident paramount and/or section chief), the number of NGOs active within the village before the Ebola outbreak (excluding BRAC), share of Christian households, distance from Freetown and distance from Kailahun. All specifications include dummies for the randomization strata (district) and errors are clustered at the unit of randomization (village).

Table 6: Skills

OLS estimates, standard errors in parentheses, p-values in braces

	Aged 12-17 at BL		Aged 18-25 at BL		Aged 12-17 at BL		Aged 18-25 at BL	
	Literacy [0-100]	Numeracy [0-100]	Literacy [0-100]	Numeracy [0-100]	Entrepreneurial Confidence [0-100]	Financial Literacy [0-100]	Entrepreneurial Confidence [0-100]	Financial Literacy [0-100]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Disruption Effect	-12.1***	-7.34***	.964	-8.01***	.342	-5.00*	.962	-2.24
	(3.50)	(2.79)	(2.67)	(2.65)	(2.27)	(2.96)	(2.08)	(2.13)
Treatment Effect in High Disruption	8.85***	7.25***	2.48	7.46***	1.45	4.72	2.69	3.36*
	(3.26)	(2.70)	(2.51)	(2.08)	(2.12)	(2.98)	(1.90)	(1.84)
Treatment Effect in Low Disruption	-4.86**	-1.41	2.25	-.596	.968	-1.47	2.59**	.271
	(2.09)	(1.55)	(1.45)	(1.44)	(1.37)	(1.66)	(1.16)	(1.78)
Difference [β_3, p-value]	{.001}	{.006}	{.934}	{.002}	{.846}	{.073}	{.960}	{.254}
Control Mean at BL	24.6	42.4	21.3	33.1	60.5	58.8	78.2	63.6
Observations	2,382	2,382	2,401	2,401	2,381	2,382	2,400	2,400

Notes: ***, ** and * denote significance at the 1%, 5%, and 10% levels. Literacy and Numeracy are self-reported abilities to perform: "Basic counting, simple addition/subtractions, and measurement"; "Working with fractions, multiplying and dividing, doing algebra or basic bookkeeping "; "Reading simple things like labels on containers"; "Reading comprehension, writing complete sentences or longer passages". Answers to the skill self-assessments are then aggregated and rescaled in a measure that ranges from 0 to 100, with the latter indicating more advanced proficiency. Entrepreneurial Confidence is an index that measures respondents' self-reported ability to: run a business, identify business opportunities, obtain credit, save and invest, manage financial accounts, bargain prices, manage employees and search for jobs. Financial Literacy is assessed through 8 simple problems relating to market prices, interest rates, borrowing and budgeting. The number of correct answers is rescaled in an index ranging from 0 to 100. The main results are estimated with an ANCOVA specification. Control variables include: age, PPI score, household size, village size (nr of dwellings), village average PPI score, distances form key facilities (clinic, secondary school and market), a dummy equal to one if the village is a political stronghold (i.e. has a resident paramount and/or section chief), the number of NGOs active within the village before the Ebola outbreak (excluding BRAC), share of Christian households, distance from Freetown and distance from Kailahun. Columns (5) through (8) control also for illiteracy. All specifications include dummies for the randomization strata (district) and errors are clustered at the unit of randomization (village).

Table 7: Total Effects Margin on Time Use (weekly hours)

SUR estimates, standard errors in parentheses

	Aged 12-17 at BL					Aged 18-25 at BL				
	Learning	**IGA**	**Chores**	**Leisure**	**ELA Club**	**Learning**	**IGA**	**Chores**	**Leisure**	**ELA Club**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
Disruption Effect	-12.2***	6.07**	5.62***	1.76	-	-2.50	-3.10	3.37*	2.56*	-
	(2.37)	(3.10)	(1.89)	(1.63)		(1.54)	(2.50)	(1.87)	(1.55)	
Treatment Effect in High Disruption	9.84***	-2.35	-4.68**	-4.70***	3.02***	2.42*	3.03	-3.09*	-4.08***	2.83***
	(2.62)	(3.26)	(1.91)	(1.51)	(.265)	(1.41)	(2.49)	(1.74)	(1.42)	(.252)
Treatment Effect in Low Disruption	-3.03**	1.72	.480	-2.77***	3.19***	-.978	1.46	.325	-2.97***	2.74***
	(1.30)	(1.20)	(.790)	(.810)	(.157)	(.931)	(1.84)	(1.18)	(.868)	(.145)
Difference [β_3, p-value]	{.000}	{.239}	{.012}	{.262}	{.528}	{.051}	{.613}	{.114}	{.510}	{.741}
Control Mean at BL	48.8	15.1	42.3	26.4	-	8.02	32.5	59.6	30.9	-
Observations	2,381	2,381	2,381	2,381	2,381	2,400	2,400	2,400	2,400	2,400

Notes: ***, ** and * denote significance at the 1%, 5%, and 10% levels. Time allocation data was collected both at Baseline and Endline. Respondents were provided a set of 25 beads and a board with 6 circles representing: "Learning Activities", "IGA", "Leisure", "Household Chores", "Sleep" and "Other". The Learning category includes schooling, vocational training and study time. "IGA" includes paid and unpaid work of any kind. Respondent were then asked to allocate beads into each circle in a way that represents time allocation in an average day, and data points were later converted into weekly hours. The main results are estimated with an ANCOVA specification where the estimated SUR system includes six time allocation variables, the "Other Time Use" category is not reported. Control variables include: age, PPI score, household size, illiteracy, village size (nr of dwellings), village average PPI score, distances form key facilities (clinic, secondary school and market), a dummy equal to one if the village is a political stronghold (i.e. has a resident paramount and/or section chief), the number of NGOs active within the village before the Ebola outbreak (excluding BRAC), share of Christian households, distance from Freetown and distance from Kailahun. All specifications include dummies for the randomization strata (district) and errors are clustered at the unit of randomization (village).

Table 8: Leisure, Time Use Over Activities (weekly hours)

SUR estimates, standard errors in parentheses, p-values in braces

	Aged 12-17 at Baseline				Aged 18-25 at Baseline			
	Friends	Men	Alone	Volunteer/ Church	Friends	Men	Alone	Volunteer/ Church
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Disruption Effect	.251	1.27***	.641	-.058	.608*	.613	1.15**	.609
	(.430)	(.444)	(.458)	(.660)	(.354)	(.550)	(.475)	(.401)
Treatment Effect in High Disruption	-1.42***	-1.86***	-1.55***	-2.48***	-.894***	-1.65***	-1.71***	-2.30***
	(.403)	(.452)	(.443)	(.585)	(.310)	(.474)	(.479)	(.372)
Treatment Effect in Low Disruption	-1.11***	-.602***	-1.11***	-2.43***	-.746***	-1.32***	-1.05***	-2.05***
	(.240)	(.211)	(.233)	(.334)	(.250)	(.327)	(.214)	(.285)
Difference [β_3, p-value]	{.507}	{.012}	{.385}	{.942}	{.696}	{.543}	{.206}	{.580}
Control Mean at BL	6.57	2.52	6.35	10.8	6.40	7.70	5.77	11.0
Observations	2,379	2,379	2,379	2,379	2,400	2,400	2,400	2,400

Notes: ***, ** and * denote significance at the 1%, 5%, and 10% levels. Leisure time allocation data was collected both at Baseline and Endline in a similar way. The leisure categories recorded were: "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. The main results are estimated with an ANCOVA specification. Control variables include: age, PPI score, household size, illiteracy, village size (nr of dwellings), village average PPI score, distances form key facilities (clinic, secondary school and market), a dummy equal to one if the village is a political stronghold (i.e. has a resident paramount and/or section chief), the number of NGOs active within the village before the Ebola outbreak (excluding BRAC), share of Christian households, distance from Freetown and distance from Kailahun. All specifications include dummies for the randomization strata (district) and errors are clustered at the unit of randomization (village).

Table 9: Networks

Tobit estimates, standard errors in parentheses, p-values in braces

	Age 12-17 at BL				Age 18-25 at BL			
	Friendship	Business	Intimate Topic	Credit/Finance	Friendship	Business	Intimate Topic	Credit/Finance
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Disruption Effect	-.210	-.093	.026	-.207	-.359	-.348*	-.261	-.683***
	(.163)	(.195)	(.208)	(.306)	(.248)	(.207)	(.172)	(.264)
Treatment Effect in High Disruption	.337*	.459**	.199	.579*	.231	.386*	.370**	.939***
	(.175)	(.189)	(.207)	(.312)	(.243)	(.201)	(.174)	(.262)
Treatment Effect in Low Disruption	.169*	.104	.046	.048	-.012	.059	-.003	.066
	(.097)	(.129)	(.113)	(.142)	(.072)	(.104)	(.071)	(.128)
Difference [β_3, p-value]	{.401}	{.131}	{.527}	{.122}	{.341}	{.155}	{.046}	{.003}
Control Mean at BL	2.17	.724	.803	.876	1.50	.969	.976	.930
Observations	1,599	1,599	1,599	1,599	1,628	1,628	1,628	1,628

Notes: ***, ** and * denote significance at the 1%, 5%, and 10% levels. The outcome variable in each column is the respondent's network degree for each category. The main results are estimated with an ANCOVA specification. Control variables include: age, PPI score, household size, illiteracy, village size (nr of dwellings), village average PPI score, distances form key facilities (clinic, secondary school and market), a dummy equal to one if the village is a political stronghold (i.e. has a resident paramount and/or section chief), the number of NGOs active within the village before the Ebola outbreak (excluding BRAC), share of Christian households, distance from Freetown and distance from Kailahun. All specifications include dummies for the randomization strata (district) and errors are clustered at the unit of randomization (village).

Table 10: Fertility and Risky Behaviors, Among Girls Aged 12-17 at Baseline

OLS estimates, standard errors in parentheses, p-values in braces

	Condom use: Often/Always	Other Contraceptive	Frequency of Sex	Frequency of Unprotected Sex	Unwanted Sex	Transactional Sex	Pregnancy	Out-of-Wedlock Pregnancy
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Disruption Effect	-.003	-.120*	.868	1.99***	.011	.023	.107***	.072*
	(.015)	(.070)	(.678)	(.734)	(.037)	(.027)	(.036)	(.039)
Treatment Effect in High Disruption	.013	.102	-1.01*	-1.13*	-.003	-.024	-.043	-.075**
	(.016)	(.083)	(.560)	(.738)	(.035)	(.028)	(.039)	(.038)
Treatment Effect in Low Disruption	-.005	-.010	.320	.377	-.004	.013	.006	-.010
	(.011)	(.039)	(.520)	(.399)	(.020)	(.012)	(.020)	(.017)
Difference [β_3, p-value]	{.333}	{.221}	{.082}	{.066}	{.976}	{.237}	{.258}	{.122}
Control Mean at BL	.062	.404	5.25	3.41	.067	.030	.115	.091
Observations	1,456	1,456	1,390	1,046	1,869	1,869	2,382	2,382

Notes: ***, ** and * denote significance at the 1%, 5%, and 10% levels. The Other Contraceptive category includes all methods other than condoms. Frequency of sex is measured over a 30 day period. Frequency of unprotected sex is defined as intercourse frequency for respondents that do not use any form of contraceptive, and equal to zero for those that do (to provide conservative estimates, respondents that ever use condoms are assumed to engage in protected sex). Unwanted Sex is defined as, "Been involved in any sexual intercourse that you were not willing to do". Transactional Sex is defined as, "Receiving anything such as money, gifts, help with school work or something else in exchange for sexual intercourse". Columns 1 through 4 do not control for baseline outcome values, while all other specifications do. Columns 7 and 8 control for any pregnancy at baseline (in or out-of-wedlock). The main results are estimated with an ANCOVA specification. Control variables for all specifications include: age, PPI score, household size, illiteracy, village size (nr of dwellings), village average PPI score, distances form key facilities (clinic, secondary school and market), a dummy equal to one if the village is a political stronghold (i.e. has a resident paramount and/or section chief), the number of NGOs active within the village before the Ebola outbreak (excluding BRAC), share of Christian households, distance from Freetown and distance from Kailahun. All specifications include dummies for the randomization strata (district) and errors are clustered at the unit of randomization (village).

Table 11: Fertility and Risky Behaviors, Among Women Aged 18-25 at Baseline

OLS estimates, standard errors in parentheses, p-values in braces

	Condom use: Often/Always	Other Contraceptive	Frequency of Sex	Frequency of Unprotected Sex	Unwanted Sex	Transactional Sex	Pregnancy	Out-of-Wedlock Pregnancy
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Disruption Effect	-.009	-.027	-.794	-.046	-.038	-.002	.017	.053
	(.011)	(.062)	(1.01)	(.818)	(.024)	(.018)	(.049)	(.035)
Treatment Effect in High Disruption	.008	.137**	-.577	-.950	.054**	.054***	-.047	-.051
	(.010)	(.063)	(.825)	(.730)	(.023)	(.020)	(.048)	(.032)
Treatment Effect in Low Disruption	-.000	.034	-.053	-.142	.004	.017	.008	.024
	(.009)	(.030)	(.542)	(.388)	(.013)	(.011)	(.028)	(.018)
Difference [β_3, p-value]	{.525}	{.150}	{.596}	{.331}	{.063}	{.125}	{.333}	{.042}
Control Mean at BL	.049	.468	7.31	3.96	.154	.047	.844	.369
Observations	2,314	2,314	2,196	2,171	2,243	2,243	2,400	2,400

Notes: ***, ** and * denote significance at the 1%, 5%, and 10% levels. The Other Contraceptive category includes all methods other than condoms. Frequency of sex is measured over a 30 day period. Frequency of unprotected sex is defined as intercourse frequency for respondents that do not use any form of contraceptive, and equal to zero for those that do (to provide conservative estimates, respondents that ever use condoms are assumed to engage in protected sex). Unwanted Sex is defined as, "Been involved in any sexual intercourse that you were not willing to do". Transactional Sex is defined as, "Receiving anything such as money, gifts, help with school work or something else in exchange for sexual intercourse". Columns 1 through 4 do not control for baseline outcome values, while all other specifications do. Columns 7 and 8 control for any pregnancy at baseline (in or out-of-wedlock). The main results are estimated with an ANCOVA specification. Control variables for all specifications include: age, PPI score, household size, illiteracy, village size (nr of dwellings), village average PPI score, distances form key facilities (clinic, secondary school and market), a dummy equal to one if the village is a political stronghold (i.e. has a resident paramount and/or section chief), the number of NGOs active within the village before the Ebola outbreak (excluding BRAC), share of Christian households, distance from Freetown and distance from Kailahun. All specifications include dummies for the randomization strata (district) and errors are clustered at the unit of randomization (village).

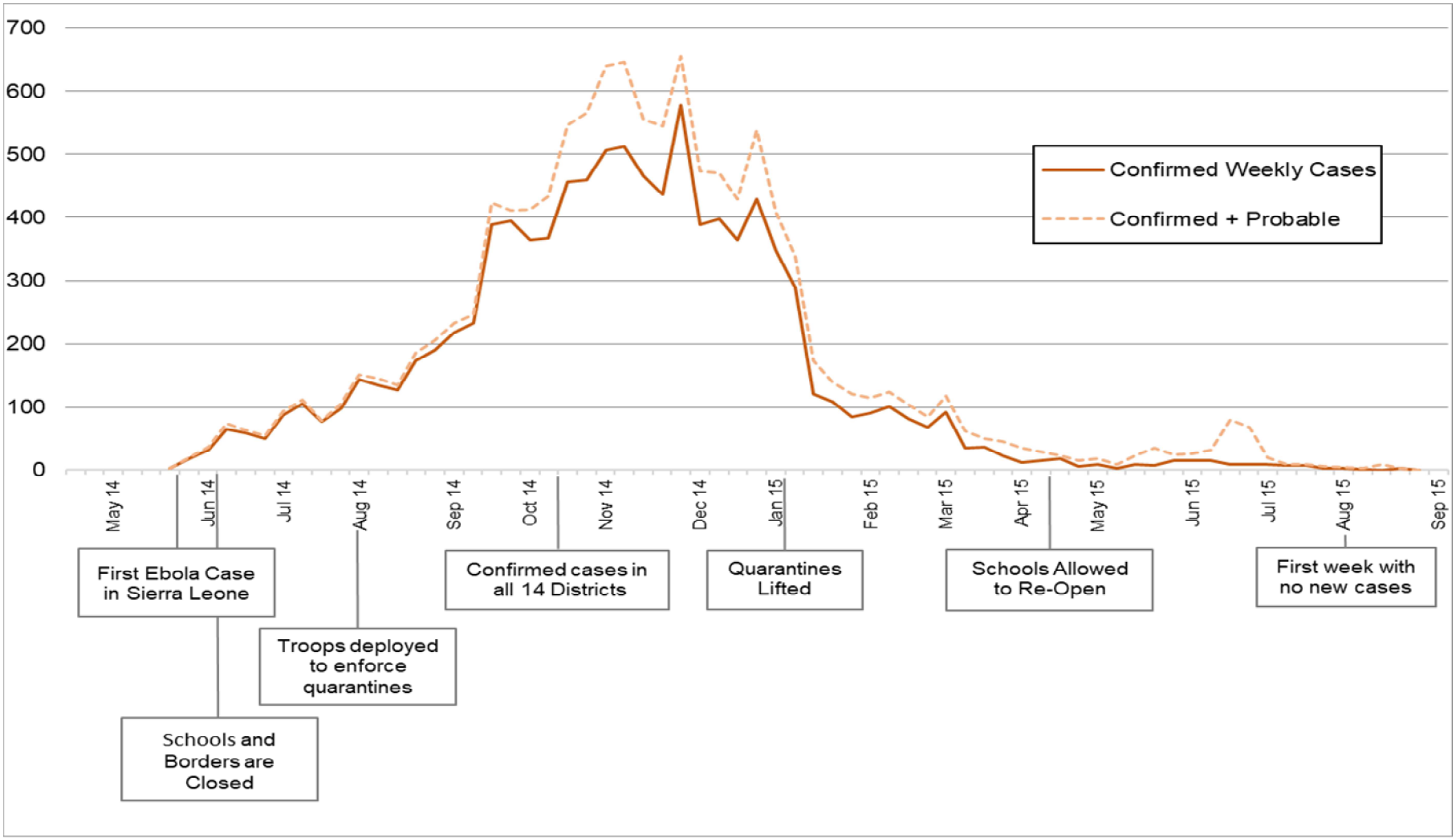
Table 12: Health

OLS estimates, standard errors in parentheses, p-values in braces

	Aged 12-17 at BL			Aged 18-25 at BL			
Any Ebola Case Within:	**Household**	**Family Network**	**Friends Network**	**Household**	**Family Network**	**Friends Network**	**IPV (same relationship)**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Disruption Effect	-.008	-.007	-.004	.004	.043	.055	-.116*
	(.026)	(.071)	(.074)	(.023)	(.057)	(.061)	(.060)
Treatment Effect in High Disruption	.011	-.008	-.014	.006	-.018	-.025	.106*
	(.033)	(.075)	(.079)	(.029)	(.057)	(.063)	(.054)
Treatment Effect in Low Disruption	-.023	-.045*	-.050*	-.016	-.020	-.021	-.025
	(.014)	(.025)	(.028)	(.017)	(.032)	(.035)	(.034)
Difference [β_3, p-value]	{.365}	{.645}	{.675}	{.535}	{.978}	{.952}	{.046}
Control Mean at BL	.034	.152	.178	.032	.144	.139	.531
Observations	2,657	2,894	2,894	2,617	2,617	2,617	1,899

Notes: ***, ** and * denote significance at the 1%, 5%, and 10% levels. The sample includes those individuals tracked from Baseline to Endline plus respondents resampled at endline that have been residing in the same village since before the Ebola outbreak. For Column 7, the estimation sample includes all women that were tracked between baseline and midline and did not change partner during the study period. Control variables include: age, PPI score, household size, illiteracy, village size (nr of dwellings), village average PPI score, distances form key facilities (clinic, secondary school and market), a dummy equal to one if the village is a political stronghold (i.e. has a resident paramount and/or section chief), the number of NGOs active within the village before the Ebola outbreak (excluding BRAC), share of Christian households, distance from Freetown and distance from Kailahun. Only Column 7 controls for baseline value of the outcome variable. All specifications include dummies for the randomization strata (district) and errors are clustered at the unit of randomization (village).

Figure 1: Timeline of the Ebola Epidemic in Sierra Leone



Notes: Data retrieved from World Health Organization's Situation Reports (last update 11 May 2016). Confirmed cases refer to lab tested patients, while probable cases refer to cases diagnosed by clinical staff and but not tested.

Figure 2: Study Timeline

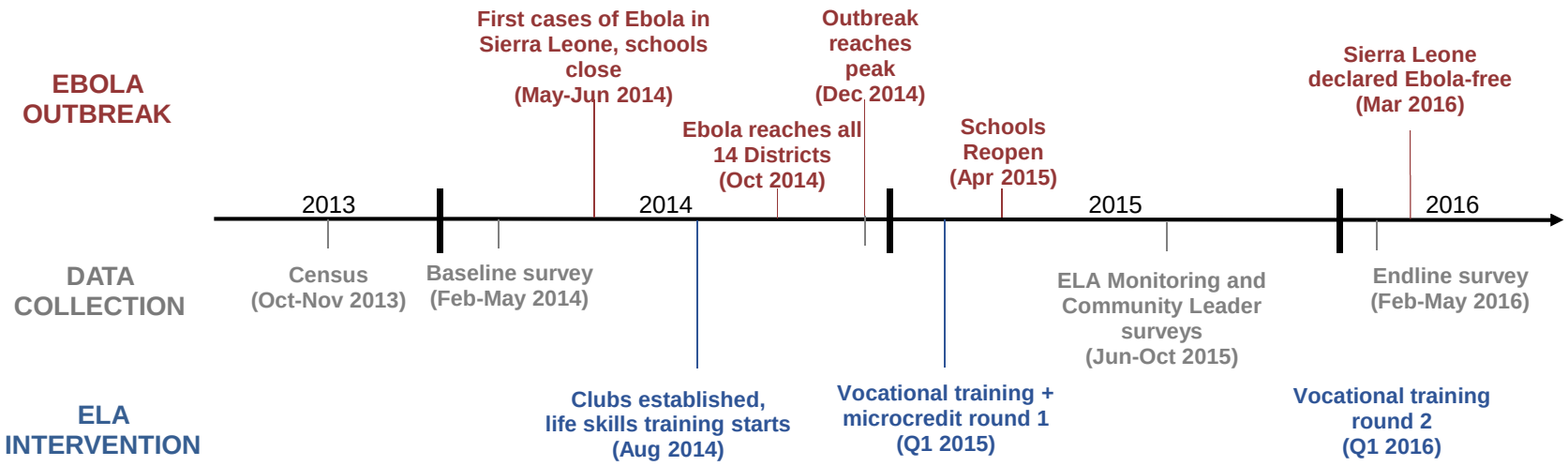
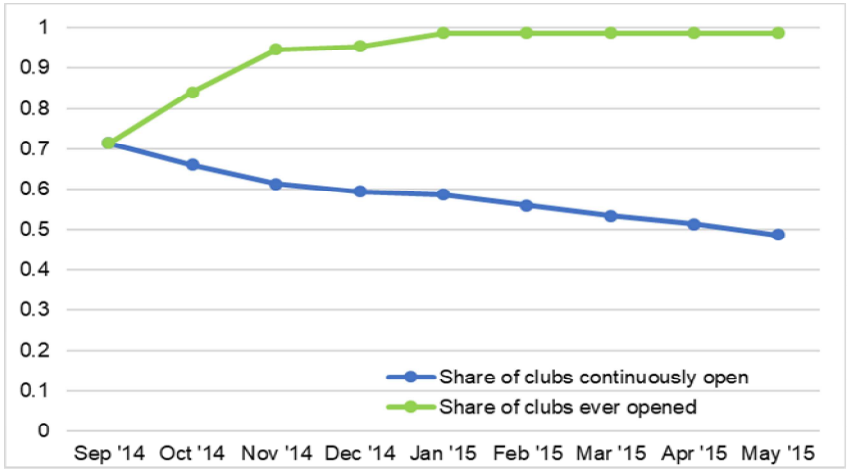
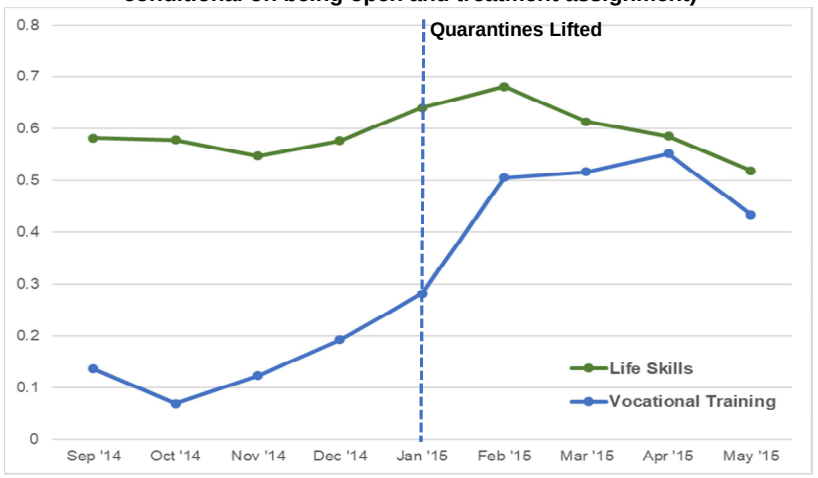


Figure 3: ELA Implementation

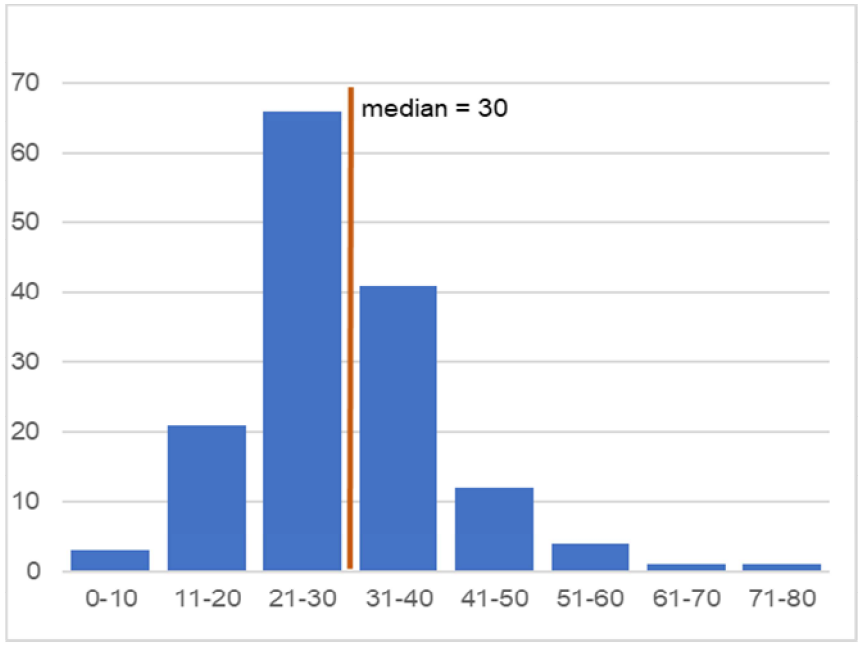
A. Share of ELA Clubs Continuously, Ever Open



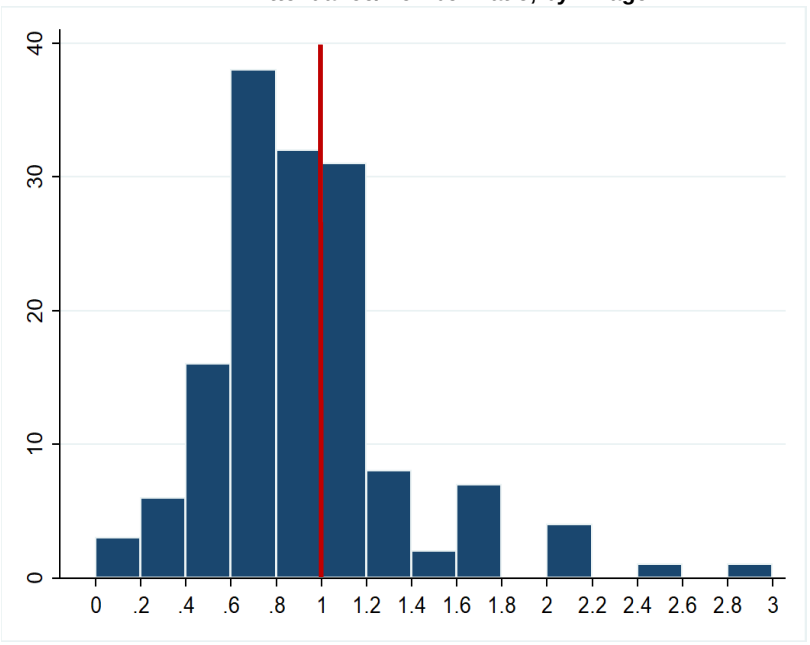
B. ELA Program Delivery (Share of clubs offering a particular service, conditional on being open and treatment assignment)



C. ELA Club Membership, by Village



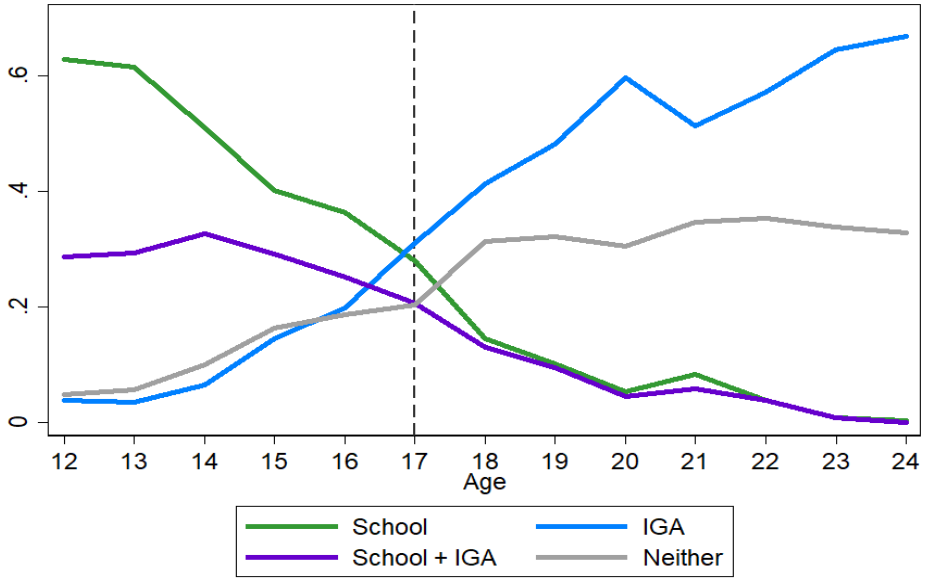
D. ELA Attendance/Member Ratio, by Village



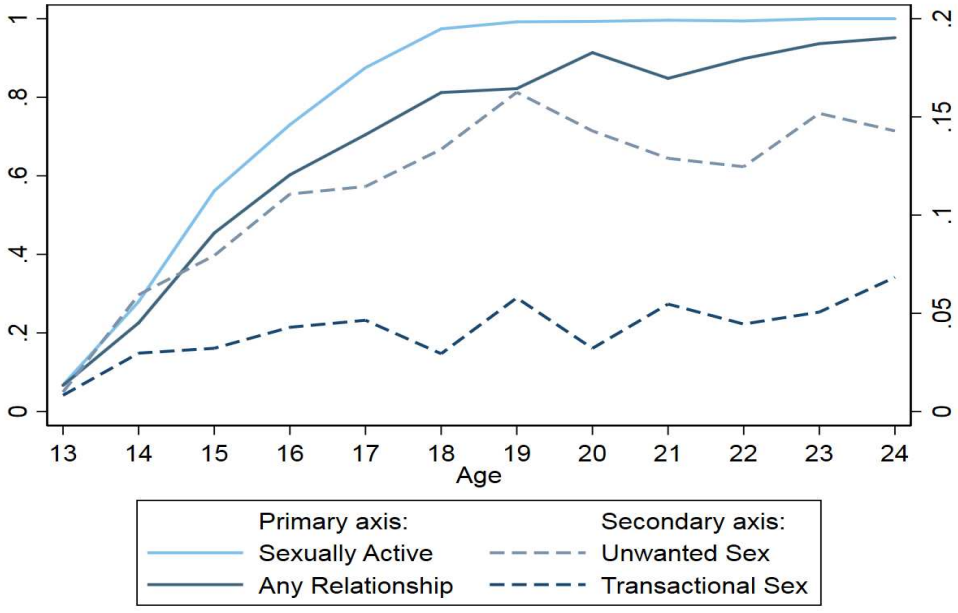
Notes: All panels report data from the ELA Club Monitoring Survey administered in June and July 2015 to club mentors. Panel C reports the number of girls in each village that registered as ELA members when the club first opened. In Panel D, attendance is measured at the time of the monitoring survey.

Figure 4: Age Profiles for Economic Activity, Relationships and Sex, Pre-Crisis

A. Economic Activities



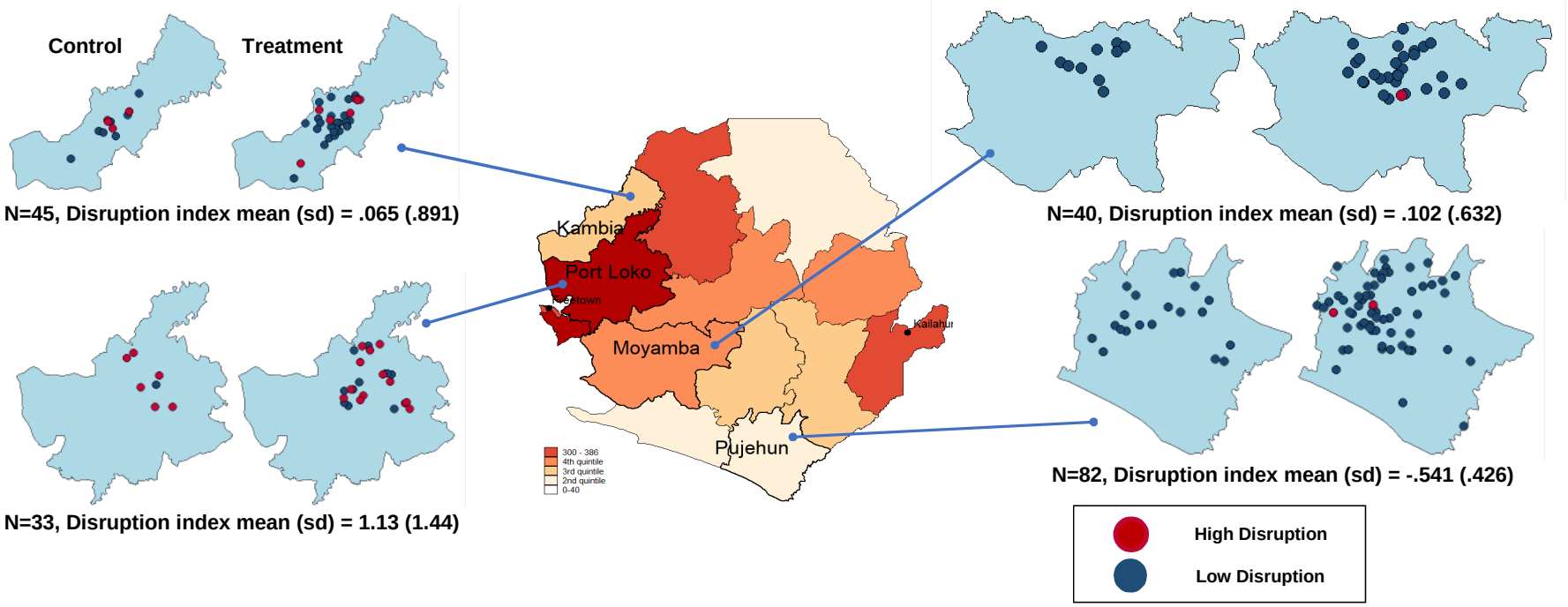
B. Relationships and Sex



Notes: Panel A: School refers to formal schooling and IGA refers to both wage employment and self-employment. Panel B: Unwanted Sex is defined as, "Been involved in any sexual intercourse that you were not willing to do". Transactional Sex is defined as, "Receiving anything such as money, gifts, help with school work or something else in exchange for sexual intercourse". Both panels use the entire baseline sample of young women.

Figure 5: Geographic Variation of Ebola Epidemic in Sierra Leone

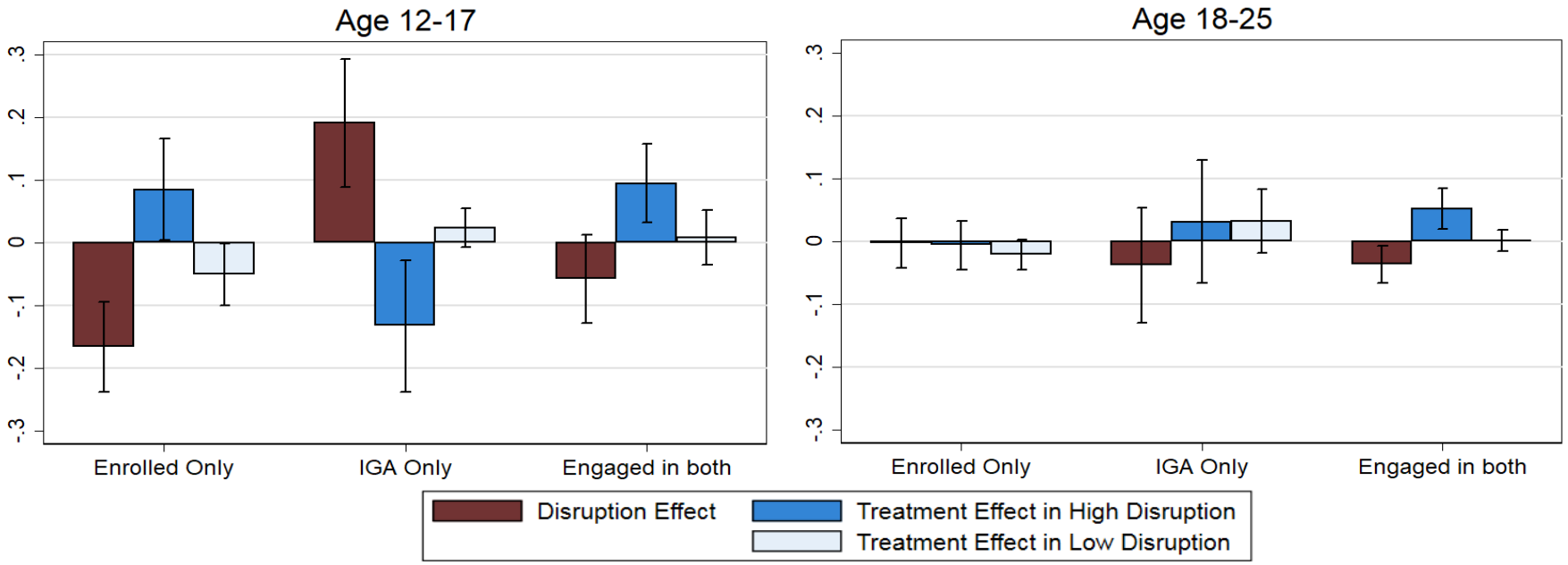
Confirmed and Probable Ebola Cases per 100,000 - Constructed Ebola Index



Notes: Data for the central map is retrieved from World Health Organization's Situation Reports (last updated 11 May 2016). Confirmed cases refer to lab tested patients, while probable cases refer to cases diagnosed by clinical staff and but not tested. Data for district level subpanels from the Community Leader survey administered in all study villages in October 2015. In the outer district maps, for each district, we show the number of sample villages, and the mean and standard deviation of the Ebola-related disruption index. The villages most exposed to Ebola-related disruption (in the top quartile of the index) are depicted in red.

Figure 6: Engagement in Economic Activities

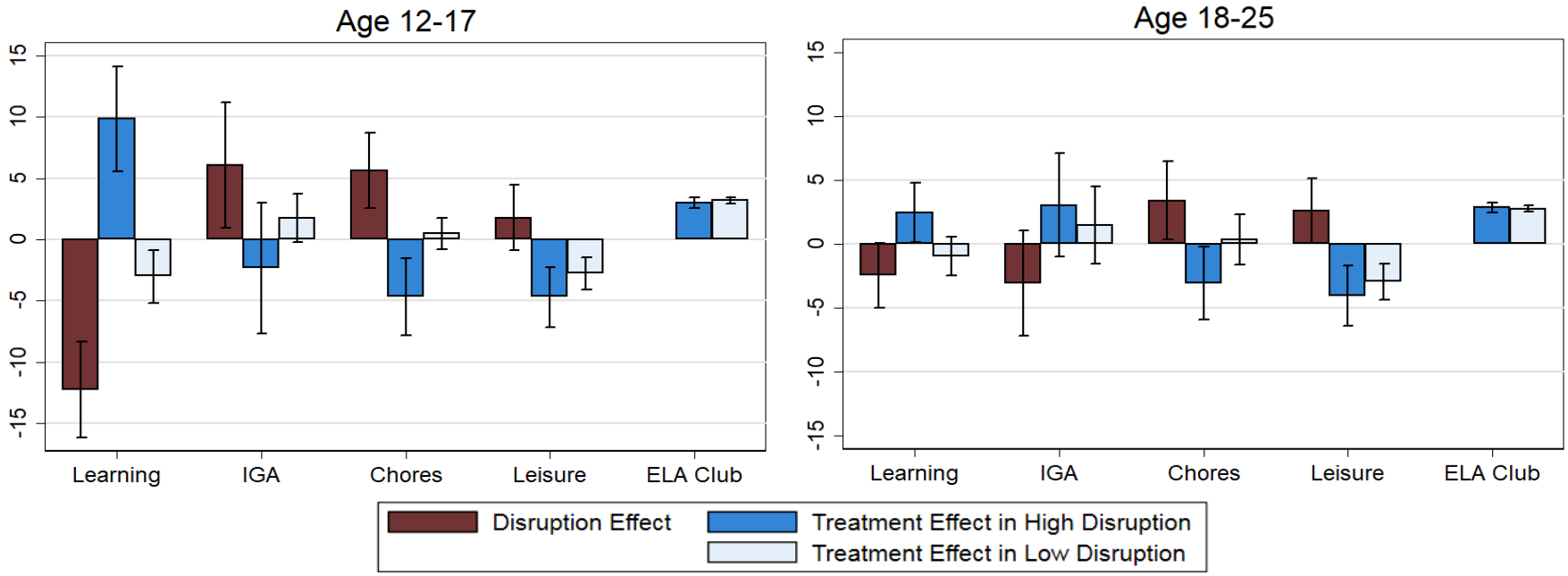
90% Confidence Intervals



Notes: The first bar of each set (in gray) represents the estimated before-after variation in outcomes, conditional on age and controls, for young women in control villages that experienced low disruptions. These parameters are estimated from a DD specification. The remaining bars represent the main results estimated with an ANCOVA specification. Control variables include: age, PPI score, household size, illiteracy, village size (nr of dwellings), village average PPI score, distances form key facilities (clinic, secondary school and market), a dummy equal to one if the village is a political stronghold (i.e. has a resident paramount and/or section chief), the number of NGOs active within the village before the Ebola outbreak (excluding BRAC), share of Christian households, distance from Freetown and distance from Kailahun. All specifications include dummies for the randomization strata (district) and errors are clustered at the unit of randomization (village). Error bars represent 90% confidence intervals.

Figure 7: Total Hours Margin on Time Use

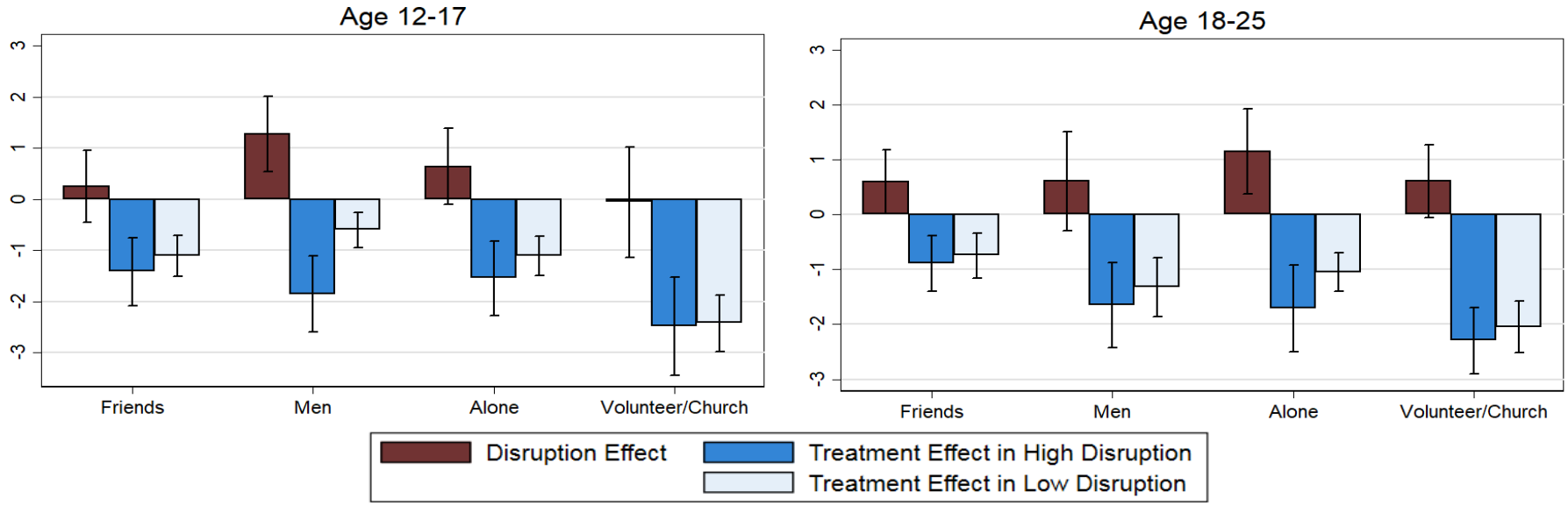
Weekly Hours, 90% Confidence Intervals



Notes: Respondents were provided a set of 25 beads and a board with 6 circles representing: "Education", "IGA", "Leisure", "Household Chores", "Sleep" and "Other". The Learning category includes schooling, vocational training and study time. "IGA" includes paid and unpaid work of any kind. Respondent were then asked to allocate beads into each circle in a way that represents time allocation in an average day. Data points were later converted into weekly hours. The first bar of each set represents the estimated before-after variation in outcomes, conditional on age and controls, for young women in control villages that experienced low disruptions. These parameters are estimated from a DD specification. The remaining bars represent the main results estimated from a system of SUR using all time use categories excluding "other". Control variables for all specifications include: age, PPI score, household size, illiteracy, village size (nr of dwellings), village average PPI score, distances form key facilities (clinic, secondary school and market), a dummy equal to one if the village is a political stronghold (i.e. has a resident paramount and/or section chief), the number of NGOs active within the village before the Ebola outbreak (excluding BRAC), share of Christian households, distance from Freetown and distance from Kailahun. All specifications include dummies for the randomization strata (district) and errors are clustered at the unit of randomization (village). Error bars represent 90% confidence intervals.

Figure 8: Leisure Time Allocation

Weekly Hours, 90% Confidence Intervals



Notes: Respondents were provided a set of 25 beads and a board with 6 circles representing: "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 time use data to derive total leisure. The first bar of each set represents the estimated before-after variation in outcomes, conditional on age and controls, for young women in control villages that experienced low disruptions. These parameters are estimated from a DD specification. The remaining bars represent the main results estimated from a system of SUR of all time use categories excluding "other". Control variables include: age, PPI score, household size, illiteracy, village size (nr of dwellings), village average PPI score, distances form key facilities (clinic, secondary school and market), a dummy equal to one if the village is a political stronghold (i.e. has a resident paramount and/or section chief), the number of NGOs active within the village before the Ebola outbreak (excluding BRAC), share of Christian households, distance from Freetown and distance from Kailahun. All specifications include dummies for the randomization strata (district) and errors are clustered at the unit of randomization (village). Error bars represent 90% confidence intervals.

Table A1: ELA Life Skills Modules

Module 1 - Adolescence and Puberty
Topics: Adolescence, Hormones, Puberty, Body changes during puberty, Reproductive organs

Overall aims: Define adolescence and describe characteristics and body changes associated with it; understand issues typically associated with adolescence

Module 2 - Menstruation
Topics: Menstruation and menstrual cycle, Menarche and menopause, Hygiene during menstruation, Menstrual disorders

Overall aims: Define menstruation; discuss pain and changes during menstruation, and care of a woman's body; understand premenstrual syndrome

Module 3 - Family planning
Topics: Family planning, Fertility regulation, Contraceptive methods

Overall aims: Define family planning and the various methods of contraception; explain the value of fertility regulation and issues pertaining abortion; discuss the reasons for non-use of contraceptives

Module 4 - Sexually Transmitted Infections (STIs)
Overall aims: Discuss the effects of various STIs, how they are transmitted and how to prevent them

Module 5 - HIV/AIDS
Overall aims: Define HIV/AIDS and understand the difference, identify risky behaviour, discuss effects and prevention

Module 6 - (Teenage) pregnancy
Overall aims: Define (teenage) pregnancy, describe factors that can lead to teenage pregnancy and the associated problems, discuss prevention and ante-natal/maternal care

Module 7 - Gender & Marriage
Topics: Gender, Gender roles & gender inequality, (Early) marriage, Bride price

Overall aims: Understand the meaning of and issues with gender, gender roles, gender issues, bride price and early marriage

Module 8 - Rape
Overall aims: Define and understand rape, know how to report, identify risky situations and understand the consequences of rape

Module 9 - Leadership among adolescents
Topics: Leadership, Qualities of leaders, Behaviours of leaders

Overall aims: Define leadership and describe the qualities of a good leader, identify leaders in their community, discuss how one can become a good leader/mentor.

Module 10 - Adolescent responsibility to family and community
Overall aims: Define responsibility, family and community, describe adolescents' responsibility to their family and community

Table A2: Attrition

Dependent Variable = 1 if girl is tracked from baseline to endline
OLS estimates, standard errors in parentheses
P-values of joint-significance test in braces

	(1)	(2)	(3)	(4)	(5)
Treatment	.007		.011	.001	.035
	(.016)		(.018)	(.018)	(.101)
High Disruption		.024	.040	.029	.015
		(.023)	(.029)	(.029)	(.161)
Treatment x High Disruption			-.021	-.013	.014
			(.032)	(.032)	(.190)
Individual Controls	No	No	No	Yes	Yes
F-Test				{.000}	{.000}
Village Controls	No	No	No	Yes	Yes
F-Test				{.065}	{.062}
Interactions	No	No	No	No	Yes
F-Test					{.180}
Mean of outcome variable			.829		
Adjusted R-squared	.004	.005	.005	.012	.018
Observations	5,734	5,734	5,734	5,734	5,734

Notes: *** denotes significance at 1%, ** at 5%, and * at 10%. Data is all from the baseline survey, except PPI scores which were compiled during the village census prior to collection of the baseline survey. All regressions include dummies for each randomization strata (district) and errors are clustered at the unit of randomization (village). Individual controls include: age, enrolment at baseline, employment, PPI score, marital status, household size. Village controls include: village size (nr of dwellings), distance from secondary school, distance from PHU, whether the village is a political stronghold, number of NGOs active, average PPI score, share of Christians, whether the village received food or school relief, distance from Freetown and from Kailahun. Interactions include: enrolment, employment, age and PPI score.

Table A3 Balance by Ebola-Related Disruption, Village Characteristics

Means, clustered standard errors from OLS regressions in parentheses
P-value of t-test of equality of means with relevant control group in braces

	Ebola Disruption: Low	Ebola Disruption: High	Difference
	(1)	(2)	(3)
A. Village Characteristics			
Number of villages	166	34	
Number of dwellings	135	60	{.191}
	[287]	[49.0]	
Number of sampled adolescent girls	28.3	28.8	{.328}
	[11.1]	[6.08]	
Poverty score (Mean across households)	.345	.359	{.035}
	[.053]	[.059]	
Number of pre-existing NGOs	3.08	2.44	{.252}
	[1.92]	[1.81]	
Christians as a share of village population	.153	.075	{.133}
	[.230]	[.095]	
Distance from Freetown (miles)	56.6	33.5	{.271}
	[24.6]	[11.8]	
Distance from Kailahun (miles)	75.41	93.8	{.597}
	[18.5]	[10.9]	
Distance from nearest PHU (miles)	1.81	2.13	{.453}
	[1.70]	[1.96]	
Distance from nearest secondary school (miles)	4.32	2.77	{.578}
	[5.00]	[2.72]	
B. Village Leader Survey			
"Girls who are visibly pregnant have a bad influence on their non-pregnant peers" [=1 if strongly agree]	.970	.941	{.413}
"Girls should be allowed to continue their education while pregnant" [=1 if strongly agree]	.096	.029	{.045}
Pregnant girls allowed to sit exams in the nearest secondary school	28.3	37.9	{.938}
C. Policy Responses			
Village was quarantined	.030	.118	{.119}
Village visited by contact tracing team	.928	1	{.088}
Received Relief from NGO	.849	.853	{.103}
Village received food aid	.199	.353	{.986}
Village received school supplies (excl. BRAC)	.355	.500	{.690}
Received Relief from Government	.687	.706	{.140}

Notes: Data sources are the Village Census (Panel A), and the Village Leader Surveys (distance measures in Panel A, all outcomes in Panels B and C). Column 3 reports p-values from a test of equality of means carried out by OLS regression of each characteristic on a dummy for assignment to treatment. All regressions include strata (district) dummies and calculate robust standard errors. The Poverty Score (PPI) is calculated through scorecards and its value, ranging from 0 to 100, represents the likelihood of a household being below the poverty line. The number of pre-existing NGOs includes all organizations apart from BRAC. Distance from Freetown and Kailahun are computed from GPS data.

Table A4: Balance by Ebola-Related Disruption, Individual Characteristics

Means, clustered standard errors from OLS regressions in parentheses
P-value of t-test of equality of means with relevant control group in braces

	Ebola Disruption: Low	Ebola Disruption: High	Difference
	(1)	(2)	(3)
A. Basic Characteristics			
Number of Adolescent Girls	1,198	3,592	
Age	17.5	17.8	{.127}
	[3.74]	[3.80]	
In any relationship	.578	.681	{.313}
Married	.272	.339	{.505}
Age at marriage	16.3	16.2	{.973}
	[2.91]	[2.65]	
Age of husband at marriage	31.7	31.3	{.634}
	[7.46]	[6.68]	
Has Children	.486	.497	{.505}
If in relationship: Experienced any form of conjugal violence	.477	0.498	{.200}
B. Empowerment and Aspirations			
Empowerment Index [0-100]	17.1	15.2	{.776}
	[20.6]	[20.7]	
Sexually active	.715	.745	{.648}
If active: Age at sexual debut	14.6	14.6	{.061}
	[2.17]	[2.02]	
If active: Uses contraceptive	.434	.396	{.163}
(any, excluding condoms)	.496	.489	
If active: Ever used condoms	.100	.084	{.351}
Leisure activity: Men (weekly hours)	5.00	5.73	{.501}
	[5.43]	[5.36]	
Time use: Learning Activities (weekly hours)	29.2	24.0	{.058}
	[34.2]	[3.8]	
Unwanted sex over past year	.107	.0805	{.076}
Transactional sex over past year	.037	.036	{.944}
C. Human Capital and Economic Activities			
Skills: Literacy [0-100]	22.3	21.3	{.248}
	[27.5]	[26.2]	
Pregnancy Knowledge [0-100]	64.0	66.8	{.084}
	[27.5]	[26.4]	
HIV Knowledge [0-100]	57.2	61.1	{.736}
	[20.0]	[20.7]	
Enrolled only	.295	.189	{.017}
Engaged in Income generating activity only	.326	.371	{.276}
Engaged in both	.159	.210	{.721}
Engaged in neither	.220	.230	{.578}

Notes: Column 3 reports p-values from a test of equality of means carried out by OLS regression of each characteristic. 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. For the Empowerment Index, respondents were asked whether men, women or both should be responsible for the following activities: earn money for the family; have a higher level of education; do washing, cleaning and cooking; fetch water if there is no water pump or tap; feeding and bathing children; help the children in their studies at home; look after ill persons. The index is the share of questions to which the answer was both/same. Therefore, higher values represent more egalitarian gender norms. 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". Transactional Sex is defined as, "Receiving anything such as money, gifts, help with schoolwork or something else in exchange for sexual intercourse". Literacy is assessed based on respondent's ability to read simple things like labels on containers (basic), and reading comprehension and writing of complete sentence (advanced). The score representing respondent's proficiency with these tasks is then rescaled to range between 0 and 100. Pregnancy and HIV knowledge represent the number of correct answers to the following true/false questions: "A women cannot become pregnant at first intercourse or with occasional sexual relation"; "A woman who is breastfeeding can become pregnant."; "From one menstrual period to the next, there days when a woman is more likely to become pregnant if she has sexual relations."; "A person who has HIV is different from a person who is ill with AIDS"; "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"; "A Pregnant woman with HIV can give the virus to her unborn baby".

Table A6: Characteristics of ELA Participants

Means, clustered standard errors from OLS regressions in parentheses
P-value of t-test of equality of means with relevant control group in braces

	Participants		
	Low Disruption (1)	High Disruption (2)	Difference (3)
A. Basic Characteristics			
Age	17.3	17.2	{.594}
	[3.73]	[3.79]	
In any relationship	.565	.631	{.982}
Married	.268	.272	{.324}
Age at marriage	16.3	16.6	{.415}
	[2.82]	[2.64]	
Age of husband at marriage	31.82	31.29	{.553}
	[7.62]	[5.86]	
Has children	0.478	0.434	{.275}
If in relationship: Experienced any form of intimate partner violence	0.492	0.535	{.128}
B. Empowerment and Aspirations			
Gender Empowerment Index [0-100]	.175	.145	{.497}
	[.204]	[.209]	
Sexually active	.696	.671	{.364}
If active: Age at sexual debut	14.5	14.6	{.223}
	[2.21]	[1.84]	
If active: Uses contraceptive	.425	.408	{.383}
(any, excluding condoms)	[.495]	[.492]	
If active: Ever used condoms	.093	.098	{.584}
Leisure activity: Men (weekly hours)	4.89	5.20	{.380}
	[5.27]	[5.19]	
Time use: Learning Activities (weekly hours)	29.4	27.2	{.804}
	[34.2]	[30.1]	
Unwanted sex over past year	.121	.086	{.138}
Transactional sex over past year	.039	.043	{.941}
C. Human Capital and Economic Activities			
Skills: Literacy [0,1]	.209	.232	{.818}
	[.262]	[.254]	
Pregnancy Knowledge [0-100]	.648	.661	{.477}
	[.278]	[.272]	
HIV Knowledge [0-100]	.573	.607	{.911}
	[.199]	[.198]	
Enrolled only	.289	.223	{.363}
Engaged in income generation only	.334	.325	{.606}
Engaged in both	.166	.240	{.152}
Engaged in neither	.210	.211	{.764}

Notes: Column 3 reports p-values from a test of equality of means carried out by OLS regression of each characteristic. 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. For the Empowerment Index, respondents were asked whether men, women or both should be responsible for the following activities: earn money for the family; have a higher level of education; do washing, cleaning and cooking; fetch water if there is no water pump or tap; feeding and bathing children; help the children in their studies at home; look after ill persons. The index is the share of questions to which the answer was both/same. Therefore, higher values represent more egalitarian gender norms. 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". Transactional Sex is defined as, "Receiving anything such as money, gifts, help with schoolwork or something else in exchange for sexual intercourse". Literacy is assessed based on respondent's ability to read simple things like labels on containers (basic), and reading comprehension and writing of complete sentence (advanced). The score representing respondent's proficiency with these tasks is then rescaled to range between 0 and 100. Pregnancy and HIV knowledge represent the number of correct answers to the following true/false questions: "A women cannot become pregnant at first intercourse or with occasional sexual relation"; "A woman who is breastfeeding can become pregnant."; "From one menstrual period to the next, there days when a woman is more likely to become pregnant if she has sexual relations."; "A person who has HIV is different from a person who is ill with AIDS"; "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"; "A Pregnant woman with HIV can give the virus to her unborn baby".

Table A6: Robustness

Coefficient estimates , standard errors in parentheses, p-values in braces

	A. Learning Activities (h/week)		B. Leisure Time Spent with Men (h/week)		C. Out of Wedlock Pregnancy	D. Transactional Sex
Age Cohort:	**12-17**	**18-25**	**12-17**	**18-25**	**12-17**	**18-25**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Disruption Effect	-12.2***	-2.37	1.27***	.620	.072*	-.002
	(2.35)	(1.54)	(.444)	(.551)	(.039)	(.018)
Baseline, RI	{.003}	{.106}	{.037}	{.404}	{.064}	{.949}
Baseline, MHT	{.002}	{.526}	{.128}	{.730}	{.490}	{.896}
No controls	-12.7***	-4.16***	.966	.529	.064	-.014
	(2.81)	(1.48)	(.595)	(532)	(.042)	(.017)
Baseline, within district disruption dummy	-8.51**	.351	2.01***	.032	.100	.000
	(3.42)	(2.22)	(.621)	(.546)	(.040)	(.022)
Baseline, alternative construction disruption dummy	-9.55***	-1.99	.886**	.793	.038	-.018
	(2.37)	(1.59)	(.396)	(.508)	(.036)	(.017)
Treatment Effect in High Disruption	9.69***	2.42*	-1.86***	-1.68***	-.075**	.054***
	(2.61)	(1.41)	(.452)	(.475)	(.038)	(.021)
Baseline, RI	{.012}	{.154}	{.003}	{.004}	{.043}	{.098}
Baseline, MHT	{.015}	{.503}	{.009}	{.027}	{.416}	{.156}
No controls	8.72***	3.44**	-1.59***	-1.75***	-.066*	.054**
	(3.02)	(1.39)	(.533)	(.466)	(.040)	(.022)
Baseline, within district disruption dummy	7.46**	.140	-2.59**	-1.32**	-.131***	.047**
	(3.41)	(2.29)	(.661)	(.530)	(.041)	(.023)
Baseline, alternative construction disruption dummy	7.08***	1.23	-1.49***	-1.73***	-.041	.058***
	(2.35)	(1.54)	(.384)	(.410)	(.033)	(.018)
Treatment Effect in Low Disruption	-2.96**	-.839	-.602***	-1.32***	-.010	.018
	(1.30)	(.929)	(.211)	(.328)	(.017)	(.011)
Baseline, RI	{.062}	{.386}	{.012}	{.000}	{.583}	{.151}
Baseline, MHT	{.284}	{.730}	{.128}	{.009}	{.796}	{.526}
No controls	-4.12**	-1.77	-.505*	-1.33***	.001	.014
	(1.72)	(1.19)	(.269)	(.326)	(.018)	(.011)
Baseline, within district disruption dummy	-1.41	-.294	-.662***	-1.43***	-.010	.021**
	(1.41)	(.859)	(.188)	(.306)	(.016)	(.011)
Baseline, alternative construction disruption dummy	-3.71**	-.659	-.596**	-1.31***	-.012	.013
	(1.43)	(.938)	(.233)	(.342)	(.017)	(.012)
F-statistic [p-value], Baseline	{.000}	{.280}	{.000}	{.000}	{.168}	{.022}
Observations	2,345	2,367	2,379	2,401	2,382	2,244

Notes: ***, ** and * denote significance at the 1%, 5%, and 10% levels. Respondents were provided a set of 25 beads and a board with 6 circles representing: "Education", "IGA", "Leisure", "Household Chores", "Sleep" and "Other". The Learning category includes schooling, vocational training and study time. "IGA" includes paid and unpaid work of any kind. Respondent were then asked to allocate beads into each circle in a way that represents time allocation in an average day. Data points were later converted into weekly hours. Estimates obtained from a system of SUR using all time use categories excluding "other". ITT effects estimated via SUR on all time use categories excluding "other". A similar approach is used to estimate ITTs for time spent with men, which was recorded together with other forms of leisure. The exact phrasing for the "Men" category is, "With boys or men you have a sexual relationship with". Transactional Sex is defined as, "Receiving anything such as money, gifts, help with school work or something else in exchange for sexual intercourse." Control variables include: age, PPI score, household size, illiteracy, village size (nr of dwellings), village average PPI score, distances form key facilities (clinic, secondary school and market), a dummy equal to one if the village is a political stronghold (i.e. has a resident paramount and/or section chief), the number of NGOs active within the village before the Ebola outbreak (excluding BRAC), share of Christian households, distance from Freetown and distance from Kailahun. All specifications control for baseline values of the outcome, with Column 5 controlling for any pregnancy at baseline. All specifications include dummies for the randomization strata (district), and errors are clustered at the community level. Randomization Inference preformed by comparing the parameters from benchmark specifications to the estimated distribution of each parameter under the null hypothesis of ELA's ITT being zero ($\beta2=\beta3=0$). To estimate this distribution, treatment villages are randomly resampled with probability equal to the original treatment allocation, and parameters estimated using these placebo treatments (1,000 permutations). Reported p-values test the null hypothesis of the parameters being zero using this empirically estimated parameter distribution. P-values adjusted for multiple hypothesis testing are computed using the step-down procedure of Romano and Wolf [2016] (1,000 bootstrap iteration) . The No Control rows control include baseline outcome values, district FE and standard errors are clustered at the village level. The last two robustness checks for each outcome employ different measures of disruptions. The first measure ("within district") is a dummy equal to 1 if the village is in the top quartile of the distribution of disruptions within each district, while the core measure of disruption is defined at the national level. The second measure ("alternative construction") also uses characteristics of local markets to construct the index. The F-test at the foot of each Column is reported for the null hypothesis of joint insignificance ($\beta1=\beta2=\beta3=0$).

Table A7: Alternative Construction for the Ebola-Related Disruption Index

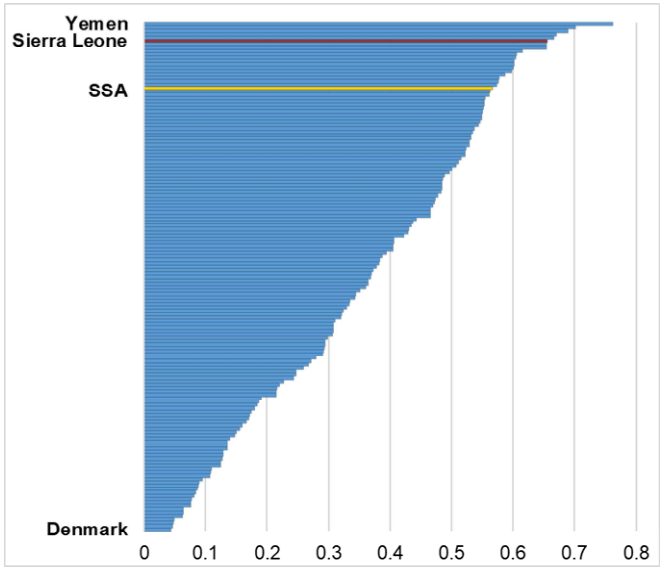
Standard deviations in brackets, standard errors in parentheses

	Mean	Between district variation (share of total)	Unconditional coeff on ELA	Conditional coeff on ELA	Conditional coeff on ELA with distance interaction	Conditional coeff on ELA with distance interaction and model selection
A. Health Policy Components	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
PHU Ever Closed	.140	.254	.001	-.000	.046	.076
	[.348]		(.049)	(.050)	(.075)	(.075)
PHU Ever Disrupted	.320	.212	.000	-.006	-.077	-.069
	[.468]		(.065)	(.065)	(.098)	(.096)
PHU Functioning Score	89.6	.327	-1.19	-1.02	-1.00	-.342
	[19.8]		(2.58)	(2.55)	(3.90)	(3.98)
B. School Policy Component						
Nearest Secondary School Re-Opened on Time	.825	.132	.085	.106	.072	.080
	[.381]		(.061)	(.059)	(.079)	(.081)
C. Economic Market Component						
Daily Market Ever Disrupted	.485	.129	-.124	-.111	-.127	-.076
	[.501]		(.076)	(.069)	(.134)	(.130)
Daily Market Ever Closed	.755	.088	-.038	-.046	.053	.057
	[.431]		(.067)	(.065)	(.132)	(.130)
Periodic (Luma) Market Functioning Score	6.60	.179	.272	0.091	1.04	.124
	[5.89]		(.806)	(.812)	(1.41)	(1.42)
D. Index						
Disruption Index	0	.320	-.219	-.227	-.036	.127
	[1]		(.146)	(.140)	(.309)	(.320)
Disruption Dummy	.250	.215	-.066	-.084	-.133	-.079
[=1 if disruption index greater than 75th percentile]	[.434]		(.062)	(.062)	(.124)	(.129)
N (villages)	200	200	200	200	200	200

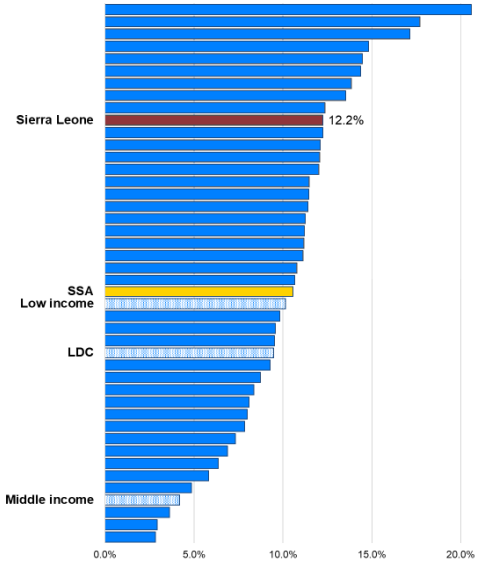
Notes: All data comes from the Village Leaders Survey, collected in October 2015. Both PHUs and Daily Markets are considered as disrupted or closed if reported as such by village leaders for at least one month for the period between July 2014 and September 2015. For those villages that do not have a daily market (n=62), both dummies for disruption and closure are assumed as equal to one. The between group variation reported in Column 2 is computed through a one-way ANOVA analysis of the dependent variable across districts. For each measure of disruptions, Columns 3 through to 6 report estimated coefficients on assignment to treatment from regressions that use incrementally larger sets of village-level covariates. All regressions include district fixed effects and calculate robust standard errors. Column 3 reports the coefficient on ELA from a regression of the Ebola measure of interest on treatment assignment. The coefficient in Column 4 is obtained controlling for: number of dwellings, whether the village is a political stronghold (i.e. it is the residence of a chief), number of NGOs active pre-Ebola, average PPI score, share of Christians, distance from Freetown and distance from Kailahun (where the first Ebola case was recorded). In Column 5 distance from the nearest facility of interest (PHU in Panel A, Secondary School in Panel B, market structure in Panel C, all in panel D) and interaction between ELA assignment and these distances are added as regressors. None of the coefficients on the interaction between ELA and distance from each facility is statistically significant (not shown). Column 6 includes all regressors and interactions employed in Column 5, plus features selected by a penalized regression (Elastic Net) of the Policy index (dummy) on all village characteristics and their interactions. The Primary Health Unit functioning score is assessed on a monthly basis between July 2014 and September 2015, and later aggregated into an index ranging between 0 and 100. Secondary schools were considered as having re-opened on time if they were open in April 2015. The Disruption Index is constructed following Anderson [2008]. It aggregates variables in Panel A and B, and assigns higher values to communities more exposed to disruptions.

Figure A1: Sierra Leoneon Context

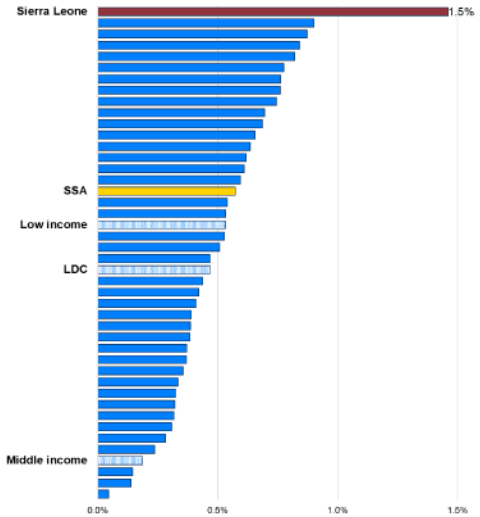
Panel A. Gender Inequality Index 2013



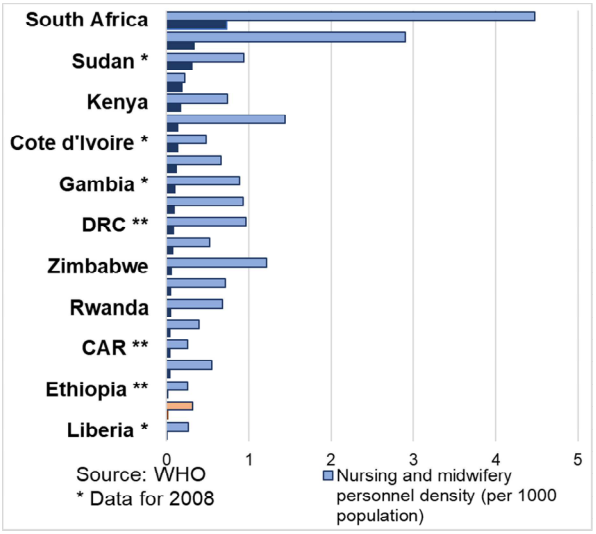
Panel B. Adolescent Fertility Rate, Ages 15-19, 2013 (%)



Panel C. Maternal Mortality Ratio, 2013 (%)



Panel D. Physicians and Nurses per 1,000 population



Notes

Panel A : Source: UNDP. The Gender Inequality Index aggregates information on: maternal mortality rates, adolescent fertility rates, education by gender, female held parliamentary seats, and inequality in labor market participation. The index ranges from 0 to 1, with a value of 0 indicating perfect equality.

Panel B : Source World Bank WDI

Panel C : Source World Bank WDI, modelled estimates of maternal mortality per 100 live births.

*Panel D : Source WHO, Brighter colored bars represent nurses and the darker bars represent doctors per 1,000 population. * Data for 2008, ** Data for 2009, the remaining data points are for 2010.*

Figure A2: Ebola in Sub Saharan Africa

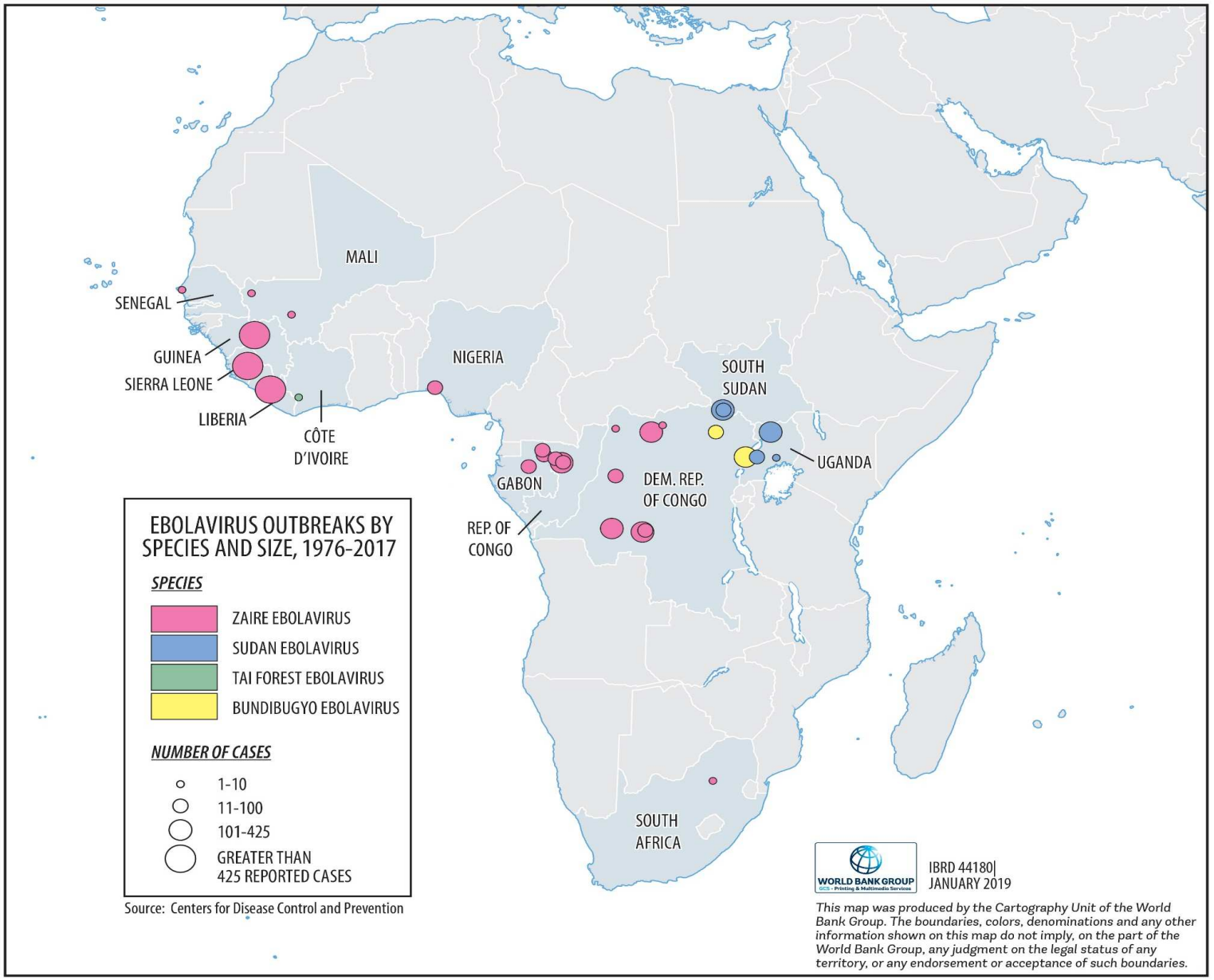
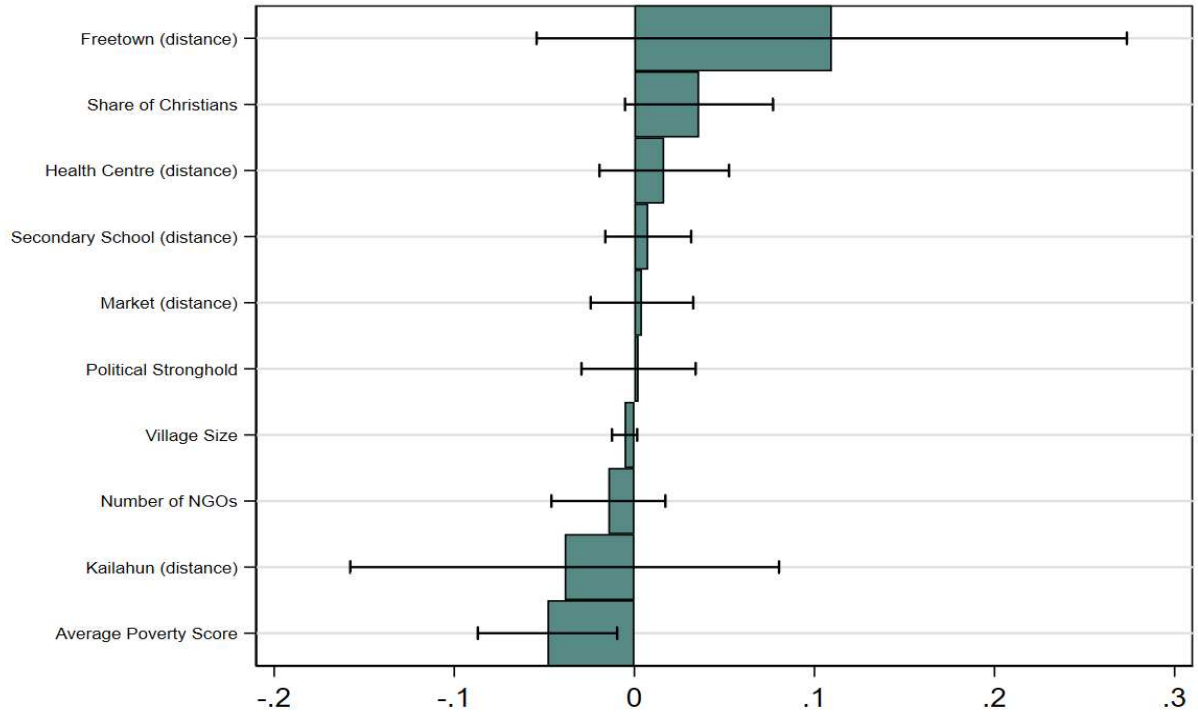
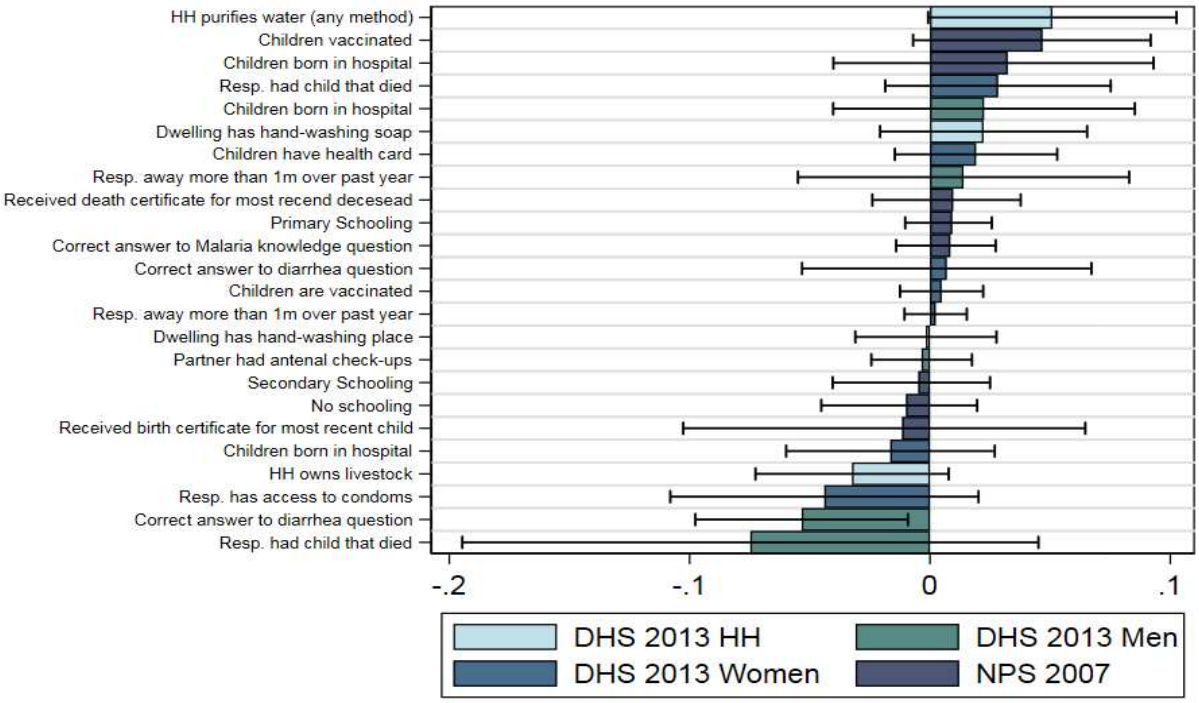


Figure A3: Ebola Disruption Dummy and Local Area Covariates

A: Village Characteristics



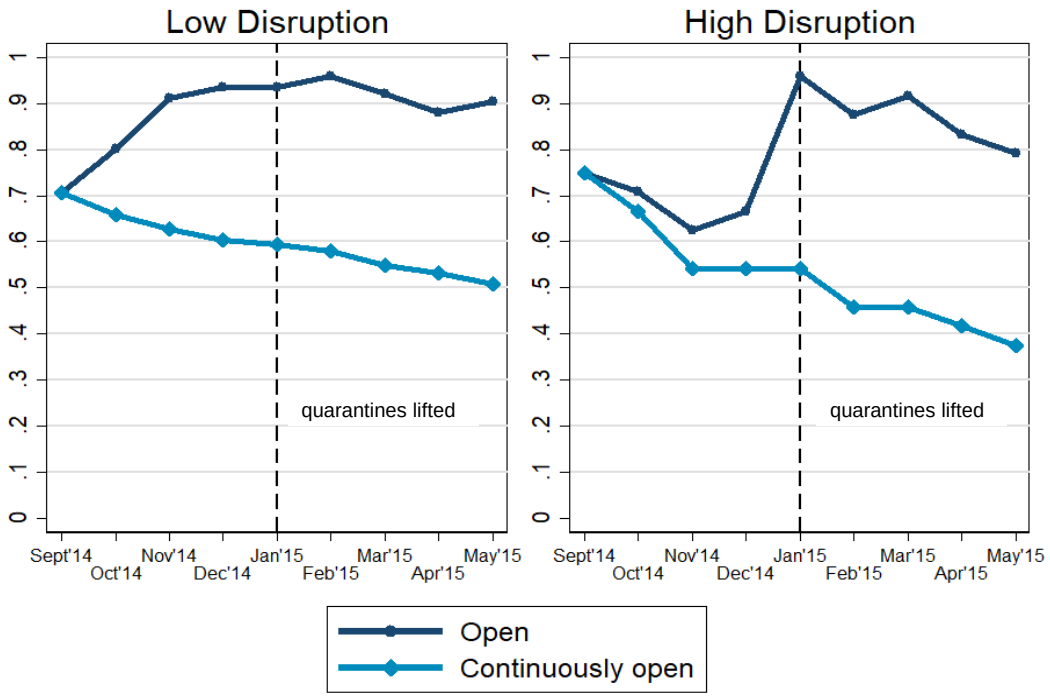
B: Chiefdom Characteristics



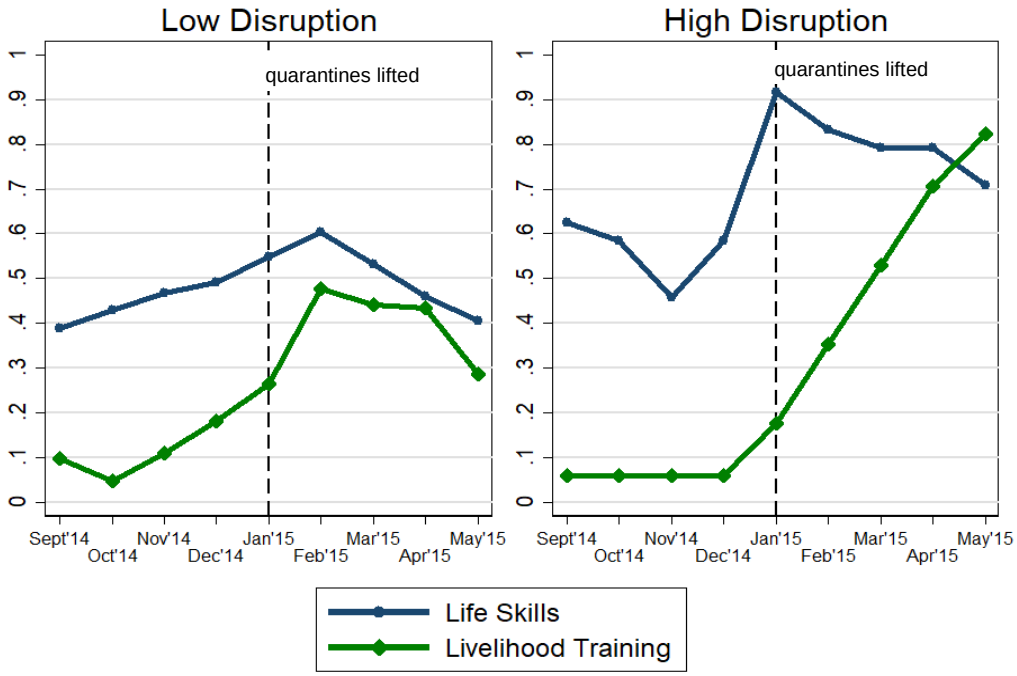
Note: Each partial correlation is estimated by regressing the village-level disruption dummy on each variable of interest, with district (strata) fixed effects and robust standard errors. Data from the 2013 Demographic and Health Survey, a nationally representative survey administered to 12,629 respondents, and from the 2007 National Public Service Survey, a nationally representative survey collected by the Decentralization Secretariat to monitor satisfaction with public service provision. The sample includes 6,300 households.

Figure A4: ELA Club Functioning, by Ebola Disruption

Panel A: Share of ELA Clubs Continuously, Ever Open



Panel B: ELA Program Delivery (Share of clubs offering a particular training, conditional on treatment assignment)



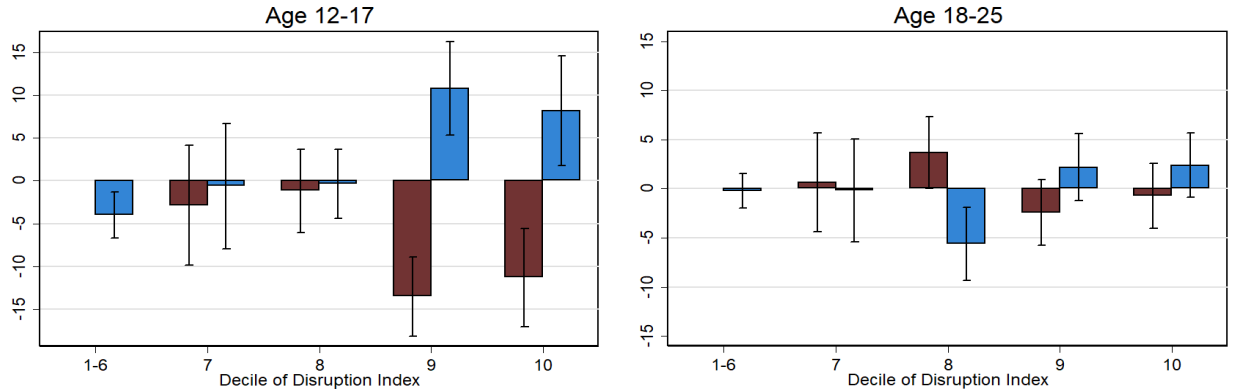
Notes: Data from the ELA Club monitoring survey were collected in October 2015. In January 2015, quarantines were officially lifted by the Sierra Leonean Government. In Panel B, the share of clubs delivering livelihood training is computed relative to the number of clubs randomly assigned to treatment arms T2 and T3 (n=100). All clubs were supposed to deliver Life Skills training (n=150).

Figure A5: ELA Impacts by Intensity of Ebola-Related Disruption

Panel A: Time Spent in Learning, Income Generation or ELA

Weekly Hours, 90% Confidence Interval

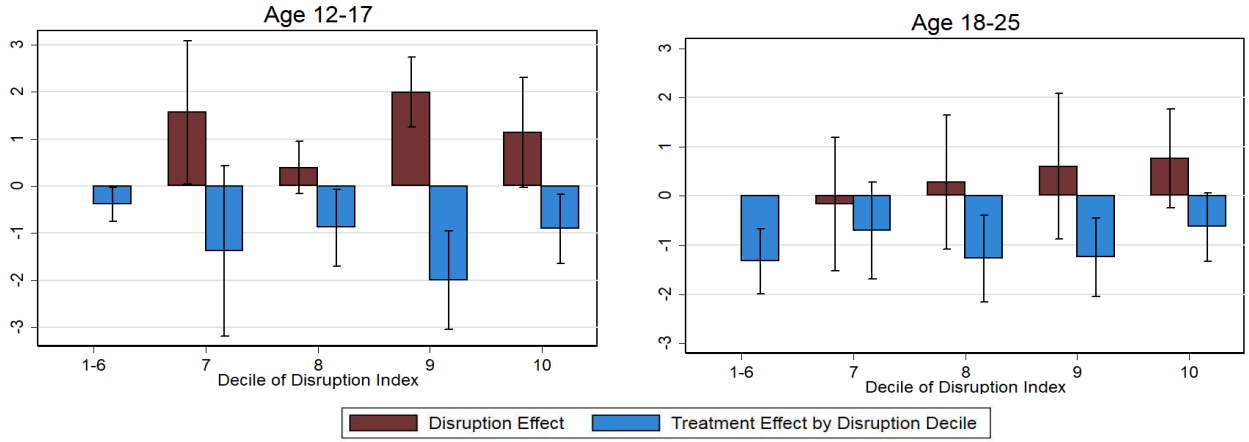
Reference Group: Bottom 60% of Disruptions' Distribution



Panel B: Time Spent with Men

Weekly Hours, 90% Confidence Interval

Reference Group: Bottom 60% of Disruptions' Distribution



Notes: Deciles of the distribution of Ebola-induced disruptions are on the X-axis. Error bars represent 90% confidence intervals. The dependent variable for the results in Panel A is the sum of weekly hours spent in learning activities, IGAs or at the ELA Club. Time allocation data was collected both at Baseline and Endline. Respondents were provided a set of 25 beads and a board with 6 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. Respondent were then asked to allocate beads into each circle in a way that represents time allocation in an average day. Leisure time allocation data was collected both at Baseline and Endline in a similar way. The leisure categories recorded were: "Friends", "Men", "Alone", "Church", "Volunteer" and "Other". 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 form the first exercise. The first bar represents the estimated before-after variation in outcomes, conditional on age and controls, for young women in control villages that experienced low disruptions. These parameters are estimated from a DD specification. The remaining bars represent the main results estimated via SUR regression on all time use/leisure categories excluding "other". Control variables include: age, PPI score, household size, illiteracy, village size (nr of dwellings), village average PPI score, distances form key facilities (clinic, secondary school and market), a dummy equal to one if the village is a political stronghold (i.e. has a resident paramount and/or section chief), the number of NGOs active within the village before the Ebola outbreak (excluding BRAC), share of Christian households, distance from Freetown and distance from Kailahun. All specifications include dummies for the randomization strata (district) and errors are clustered at the unit of randomization (village). Error bars represent 90% confidence intervals.