

Evidence That Classroom-Based Behavioral Interventions Reduce Pregnancy-Related School Dropout Among Nairobi Adolescents

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Abstract

Purpose. To evaluate the effect of behavioral, empowerment-focused interventions on the incidence of pregnancy-related school dropout among girls in Nairobi's informal settlements. **Method.** Retrospective data on pregnancy-related school dropout from two cohorts were analyzed using a matched-pairs quasi-experimental design. The primary outcome was the change in the number of school dropouts due to pregnancy from 1 year before to 1 year after the interventions. **Results.** Annual incidence of school dropout due to pregnancy decreased by 46% in the intervention schools (from 3.9% at baseline to 2.1% at follow-up), whereas the comparison schools remained essentially unchanged ($p < .029$). Sensitivity analysis shows that the findings are robust to small levels of unobserved bias. **Conclusions.** Results suggest that these behavioral interventions significantly reduced the number of school dropouts due to pregnancy. As there are limited promising studies on behavioral interventions that decrease adolescent pregnancy in low-income settings, this intervention may be an important addition to this toolkit.

Keywords

adolescent, behavioral intervention, global health, pregnancy

Adolescent pregnancy is a global challenge. In low- and middle-income countries, 19% of women become pregnant before age 18, and 95% of births to adolescents worldwide occur in low- and middle-income countries (UNFPA, 2013). In Kenya, 36.6% of adolescents aged 13 to 19 have begun child-bearing, and 40% to 50% of those pregnancies are unplanned or mistimed (Beguy, Mumah, & Gottschalk, 2014; Kenya National Bureau of Statistics & ICF Macro, 2010). Independent of intentions, adolescent pregnancy can have negative health outcomes for the mother and infant, including increased risk of maternal and infant death and disability (Nove, Matthews, Neal, & Camacho, 2014; World Health Organization [WHO], 2014) as well as lifelong lost educational opportunities and reduced earning potential (Lloyd & Young, 2009; UNFPA, 2013). Therefore, preventing adolescent pregnancy, and pregnancy-related dropout, is essential to improve the status of and opportunities for adolescent girls in Kenya and many other countries around the world.

In sub-Saharan Africa, interventions as diverse as helping girls attend school through mechanisms such as cash transfers

and providing school uniforms, providing HIV prevention education (Baird, McIntosh, & al, 2011; Duflo, Dupas, Kremer, & Sinei, 2006; Dupas, 2011), and vocational training combined with reproductive health education (Bandiera et al., 2014) have shown promise in reducing adolescent pregnancy and pregnancy-related school dropout. Such evidence underscores the practical reality that multipronged approaches are almost undoubtedly needed to affect large changes in this outcome (Kâgesten, Parekh, Tunçalp, Turke, & Blum, 2014; UNFPA, 2013).

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Of particular relevance to the present study is research that has shown that empowerment programs can significantly reduce adolescent pregnancy through mechanisms such as increasing young women's control over their own bodies and decreasing teenage marriage (Baird et al., 2011; Bandiera et al., 2014; Taylor et al., 2014). Furthermore, a review article on interventions to improve sexual and reproductive health in adolescents identified building community as a key feature of effective interventions (Kågesten et al., 2014). In particular, the use of local women from the targeted communities to deliver the interventions was identified as being essential. In our own research, we have similarly shown that a girls' empowerment and self-defense intervention using people from the local communities reduced sexual assault (Sarnquist et al., 2014; Sinclair et al., 2013), but to our knowledge, the effect of reduced sexual assault on adolescent pregnancy has not been demonstrated. We hypothesized that the empowerment and self-defense intervention might also decrease pregnancy rates, as girls who have a sense of control over their own bodies as well as belief in their rights might be more likely to access contraception to protect themselves, negotiate contraception use with their partner(s), and/or refuse sex entirely.

In 2011-2012 our team implemented a girls' empowerment intervention, and in 2013 we implemented a combined girls' empowerment and boys' transformation intervention in secondary schools in several communities around Nairobi. The interventions were successful in decreasing sexual assault in those communities; specifically there was a drop in annual rape incidence from 24.5% to 9.2% ($p < .001$) in the first study of 522 girls in one community and 17.9% to 11.1% ($p < .001$) in the second study of 1,978 girls in four communities (Sarnquist et al., 2014; Sinclair et al., 2013). These interventions addressed girls' assertiveness and self-esteem and taught self-defense (2011, 2012, and 2013) as well as later incorporating sessions on boys' attitudes toward women and bystander intervention (2013 only). Both the self-defense components and the teaching of girls and boys in parallel but separate curriculums were innovative features of this intervention.

Based on discussions with administrators in the intervention schools, who anecdotally reported that school dropout due to pregnancy decreased following the intervention, we retrospectively collected data on pregnancy-related school dropout. The analysis presented here explored whether there were measurable differences in such dropout between intervention and control schools.

Method

Participants

There were in all 68 schools from four communities used in this analysis, split into two cohorts across a 2-year period from 2011 to 2013. Of these 68 schools, 56 received the

intervention and 12 did not. There were 36 schools in the first cohort ($n = 1,964$ girls), which participated in 2011-2012. Of these 36 schools, 29 received the intervention ($n = 1,594$) and 7 schools received the standard of care (SOC) life skills course ($n = 370$). There were 32 schools in the second cohort ($n = 1,690$ girls), which participated in 2012-2013. Of these 32 schools, 27 received the intervention ($n = 1,163$) and 5 schools received the SOC ($n = 527$).

The girls in the schools ranged in age from 13 to 20, with approximately 80% between 15 and 18 years. The intervention schools came from the Dandora, Huruma, Kibera, and Korogocho neighborhoods in Nairobi, Kenya. These informal settlements are characterized by absolute poverty, very high crime, and minimal infrastructure resulting in open sewers, limited access to potable water, living structures made of found materials with dirt floors and no locks, and limited access to electricity. Girls are at high risk of early pregnancy due to myriad risk factors, including transactional sex for food or shelter, sexual assault facilitated by lack of lighting and locks, and cultural norms regarding the expectations of girls such as obeying men and not complaining or bringing attention to themselves. Ujamaa, the nongovernmental organization (NGO) that implemented the intervention, first performed a census of these neighborhoods and found that there were 63 secondary schools. Of these, 7 refused participation, leaving 56 schools in the intervention group. The 12 SOC schools in our study came from Makadara, Kawangware, and Mukuru neighborhoods; these were all the secondary schools in these communities. These neighborhoods were selected as suitable SOC neighborhoods because of approximate comparability with the intervention neighborhoods on size, monthly income, and cost to rent (see Table 1). A census of all secondary schools in the control neighborhoods was not performed; schools were selected by convenience and willingness to participate.

Intervention

The curriculum and trainer-of-trainers approach for the sexual violence prevention intervention were created by the NGO No Means No Worldwide and have been previously described in greater detail elsewhere (Sarnquist et al., 2014; Sinclair et al., 2013). In brief, the curriculum consisted of six 2-hour sessions held weekly over 6 weeks at the intervention schools. All sessions included role-plays, facilitated discussions, and verbal and physical skills practice. Session 1 involved building rapport and providing definitions of sexual assault and harassment as well as objectives for the program. Session 2 focused on personal awareness, self-efficacy, boundaries, and assertive communication skills. Session 3 introduced verbal and physical defense skills. Session 4 reviewed verbal and physical skills and included full-force skills practice. Session 5 focused on de-escalation and negotiation skills for risky situations and covered more advanced defense techniques, such as multiple or armed attackers.

Table 1. Characteristics of Study Neighborhoods.

Covariate	Intervention group				Control group		
	Korogocho	Huruma	Kibera	Dandora	Mukuru	Makadara	Kawangware
Population (2009 census)	52,286	106,913	170,070	135,000	100,000	31,000	86,824
Size (km ²)	1.5	1.4	2.4	1.5	1.5	1.8	3.0
Population density (people/km ²)	34,857	76,366	70,862	90,000	66,666	17,222	28,941
Monthly income ^a	3,000	7,000	5,000	6,500	4,400	5,000	6,500
Single room monthly rent ^a	1,000	2,000	800	2,000	1,400	2,500	400

^aIn Kenyan shillings.

Session 6 was a review of all previous sessions and a discussion of sexual assault and harassment experiences. The intervention was grounded in social learning theory and the health belief model, and drew from both U.S. and Israeli self-defense courses and approaches. Within this intervention, empowerment was defined as encompassing self-esteem and self-efficacy, as well as being verbally and physically empowered to defend oneself.

After the initial sessions, 2-hour refresher courses were offered to all students at 3, 6, and 10 months. All the trainers were local women from the targeted communities, most of who were in their 20s, and all underwent extensive training and hands-on skills practice before teaching sessions. The 2013 cohort also included training for adolescent boys in the same schools as the girls receiving the empowerment training. The boys' training focused on promoting gender equality, developing positive masculinity, and bystander intervention (teaching safe and effective techniques for boys to intervene in violent situations); the training has been previously described in more detail (Keller et al., 2015). The SOC group in both cohorts received a standard 1½-hour life skills class that is accredited by the Kenyan Ministry of Education and includes a wide range of topics, including not only sexual assault but also sanitation, food safety, and personal rights.

Data Collection

The main outcome was the annual incidence of girls dropping out of school due to pregnancy, comparing the school year prior to the delivery of the intervention to the school year in which the intervention was taught. Schools that are registered with the Ministry of Gender, Children, and Social Development in Kenya are required to keep written records documenting all school dropouts, whether from pregnancy, lack of fees, or other reasons. However, not all of the schools in this study were registered, and thus only 27 of the 68 schools (40%) had formal records. Where formal records existed, data were kept in de-identified form in books at the schools and were provided to study staff. At schools lacking formal records, headmasters, guidance counselors, and senior teachers who had been at the

school for at least 3 years were questioned as to the number of girls who dropped out each year as well as the reasons for the dropout. To ensure reliability in the data from these reports, each school was visited two or three times in April, May, and June 2014. In addition to relying on the adults in the school, the research team spot-checked the numbers supplied at five of the schools using the previously established roll call method, wherein peers who still attend school are asked to report the reasons their classmates dropped out (Dupas, 2011). Among the five schools included in that checking process, only one school had an estimate given by the students (one dropout) that was different from that given by the teachers (zero dropouts). In this case the data from the roll call method were used because of the previously established reliability of the method and because the students were able to report on the whereabouts of their peer who the adults indicated left due to "unknown" reasons.

The study was reviewed and approved by the Kenya Medical Research Institute National Ethics Review Committee. The Stanford University Institutional Review Board exempted the study from full review as Stanford researchers accessed only de-identified data sets.

Data Analysis

This analysis made use of a quasi-experimental design to address potential bias due to unobserved confounding. To enhance the precision of our estimates we also made use of a matched-pairs design to minimize bias arising from observed covariates. Matches were constructed using the size of the school and the number of prior-year dropouts due to pregnancy.

Geographic Variation as a Source of Randomization

The schools were not randomized; rather, in order to minimize costs, the intervention was focused in a geographic area around the NGO headquarters, which was determined by proximity to one of the informal settlements (Korogocho) and available office space. This reduced travel time and staffing requirements. Thus the intervention schools all came

Table 2. Mean Values of Covariates in Intervention Versus Control Schools for Pre- and Postmatching.

Covariate	Prematching		Postmatching	
	Intervention	Control	Intervention	Control
No. of girls	49.6	74.8	55.9	74.8
Baseline year dropouts, <i>n</i>	2.60	2.00	2.17	2
Outcome year dropouts, <i>n</i>	1.21	2.08	1.13	2.08
Dandora, %	27	0	33	0
Huruma, %	25	0	33	0
Kawangware, %	0	42	0	42
Kibera, %	25	0	25	0
Korogocho, %	10	0	8	0
Makadara, %	0	42	0	42
Mukuru, %	13	17	0	17

from Dandora, Huruma, Kibera, and Korogocho neighborhoods. Twelve comparison schools came from Makadara, Kawangware, and Mukuru districts, which were selected because of demographic comparability with the intervention sites (see Table 1). Using this approach, geographical variation in school location became the instrumental variable, the variable that acts as a randomizing assignment into the intervention or comparison groups. A randomizing variable is useful because it can reduce bias arising from unobserved confounding (Baiocchi, Cheng, & Small, 2014). In addition to using geographical variation as an instrumental variable, we used a matched-pairs design to control for school-level variation. That is, we limited our study to only schools in the intervention group that look as similar as possible at baseline to those in the comparison group.

Matched Pairs Difference-in-Differences Study Design

As described above, there were two cohorts in the intervention with a total of 12 schools in the SOC group. Each SOC school was matched to the single best intervention school using a bipartite matching algorithm (*optmatch* package in R), based on the size of the school and the number of prior-year dropouts due to pregnancy (Hansen & Klopfer, 2006). This produced 12 matched pairs, 7 from the 2012 cohort and 5 from the 2013 cohort (Table 2). No statistically significant difference in treatment effect existed between the two cohorts, allowing us confidence in combining them, but the small sample size limited the usefulness of a subanalysis of the two cohorts.

To enhance precision, we used a difference-in-differences design (Angrist & Pischke, 2008) to analyze between-school change within each dyad in reported number of pregnancy-related dropouts. For analysis purposes we then looked within each matched pair, focusing on the difference between the two schools within the given pair.

Results

School Dropout

Across all 12 matched pairs, school dropout due to pregnancy decreased by nearly half (46.1%) in the intervention schools (from 3.9% annual incidence to 2.1%). In the comparison schools, there was no significant change (an increase from 2.7% annual incidence to 2.8%). Table 3 contains a summary of the difference-in-differences of the matched sets. If one were to assume the matched-pair schools had been randomized, then the results of a uniformly randomized permutation test of the difference-in-differences return a *p* value <.029. This indicates the intervention and control groups are significantly different in terms of the change in the rates of dropouts pre- versus postintervention.

Well-matched schools can be identified in the difference-in-differences column in Table 2. In the statistical analysis, the five pairs with zeros in that column do not favor the treated group nor the control group. Of the remaining seven pairs, six pairs showed larger decreases in the intervention group than in the control. These pairs are marked as favoring the treatment. Only one of the control schools experienced a greater decrease than its paired treatment school. If there were no treatment effect, and these data had come from a matched-pairs randomized trial, then within a matched pair the “treated” schools should show the larger decrease 50% of the time.

We used gamma sensitivity analysis, detailed below, to address the issue of the adequacy of the matching, in particular to address any differences between the paired schools at baseline such that they would have had different outcomes regardless of being in the intervention versus SOC group.

Sensitivity Analysis

Sensitivity analyses were run two ways: using the gamma sensitivity parameter and the Wilcoxon signed-rank test. Using the gamma sensitivity parameter (Rosenbaum, 2002),

Table 3. Difference-in-Differences Table Showing the Baseline Year's Number of Dropouts and the Outcome Year's Number of Dropouts.

Matched-pair ID	Intervention			Control			Difference-in-differences	Favors treated?
	Baseline	Follow-up	Difference	Baseline	Follow-up	Difference		
Pair 1	7	3	-4	5	4	-1	-3	✓
Pair 2	2	1	-1	2	1	-1	0	
Pair 3	2	0	-2	2	2	0	-2	✓
Pair 4	1	1	0	1	1	0	0	
Pair 5	2	1	-1	2	2	0	-1	✓
Pair 6	1	3	2	0	0	0	2	X
Pair 7	3	1	-2	3	5	2	-4	✓
Pair 8	0	0	0	0	0	0	0	
Pair 9	2	2	0	3	3	0	0	
Pair 10	0	0	0	0	0	0	0	
Pair 11	2	0	-2	2	3	1	-3	✓
Pair 12	4	2	-2	4	4	0	-2	✓
<i>M</i>	2.2	1.2	-1.0	2.0	2.1	0.1	-1.1	
<i>SD</i>	1.9	1.1	1.5	1.6	1.7	0.8	1.7	

Note. Five of the 12 pairs produced identical changes so these pairs favor neither the treated group nor the control group. Of the remaining seven pairs, six pairs showed larger decreases in the treated than the control. Only one of the control schools experienced a greater decrease than its paired treatment school.

we examined how much of a departure from true randomization would have been required before our significant results were explained not by treatment effect of the intervention but rather by potential selection bias. The parameter ($\Gamma = 1.24$) suggests that to attribute the higher rate of dropout in the SOC schools due to pregnancy to other covariates rather than to an effect of the intervention, the unobserved covariate would need to produce a 25% increase in the odds of a school having more dropouts and the covariates would need to be a perfect predictor of dropout due to pregnancy.

While less sensitive than the gamma sensitivity parameter, the Wilcoxon signed-rank test of the paired data is also an appropriate test to use, and produced a *p* value of .057.

Discussion

This study suggests that our interventions may have reduced dropout due to pregnancy at schools participating in the intervention by 46%, whereas there was no significant change in the control group. School dropout has lifelong negative consequences for girls, affecting their health, their children's health, and their future educational, career, and financial opportunities (Lloyd, Mensch, & Mensch, 2008; Lloyd & Young, 2009; Nove et al., 2014; WHO, 2014). Although preventing school dropout worldwide is widely recognized as important (Lloyd & Young, 2009; Nairobi, 2008), attempts to ameliorate adolescent pregnancy-related school dropout have had mixed results. Some promising recent interventions in sub-Saharan Africa include paying for school uniforms (which allows girls to attend school) or

providing information on HIV risk in Kenya (Duflo et al., 2006; Dupas, 2011), unconditional cash transfers in Malawi (Baird et al., 2011), and vocational training combined with reproductive health education in Uganda (Bandiera et al., 2014). The diversity of the above approaches underscores the reality that adolescent pregnancy is a multifaceted problem driven by a complex set of interlocking factors including poverty, gender bias, and inadequate access to education. Therefore, the best ways to reduce adolescent pregnancy may in fact be comprehensive sets of services (Kågesten et al., 2014; UNFPA, 2013). Thus, the most effective solutions will likely take a socioecological approach that considers microsystems, exosystems, macrosystems, chronosystems, and possibly also the additional mesosystems layer that has been suggested for addressing very complex social problems (Bronfenbrenner, 1999; Edleson & Toleman, 1992) to meet the needs of adolescents in these communities.

There are several possible mechanisms for the reduction in adolescent pregnancy rates reported in this study. Empowerment programs for adolescent girls can significantly reduce adolescent pregnancy by increasing young women's control over their own bodies and decreasing teenage marriage (Baird et al., 2011; Bandiera et al., 2014). We did not directly measure sense of control or child marriage outcomes in the present study, but it is possible that we have affected them, especially in terms of increasing control over one's own body. Furthermore, building community, especially using women from the targeted community as peer educators, is an important feature of effective interventions, and one contained in the described intervention (Kågesten

et al., 2014). A third contributing mechanism of reduction in pregnancy-related dropout may have been the previously demonstrated reduction in sexual assault, which clearly can lead to pregnancy (Sarnquist et al., 2014; Sinclair et al., 2013). Further study of the empowerment intervention detailed here is warranted to understand the mechanisms for reducing pregnancy-related dropout.

Limitations

There are several limitations to this study. First, it is likely that many pregnancies go unreported as girls may transfer schools, drop out, or have abortions before school officials or peers know that they are pregnant; furthermore, the number of annual dropouts is relatively small (WHO, 2011). Second, the quality of the records varied by school, and even records that are apparently well kept could have errors, and where schools did not have records, reported numbers from school administrators and peers are subject to recall bias. Third, this is an observational study, thus attributing the difference in pregnancy-related dropout solely to the intervention requires strong assumptions. The difference-in-differences approach, which also used matched pairs created to take advantage of an instrumental variable (the geographic distribution of the schools as a randomizer), helps support the believability of the needed assumptions. In addition, our sensitivity analysis demonstrated some level of robustness to confounding. Fourth, even after matching we were unable to make the baseline characteristics of the school identical between the groups. In particular, note that the intervention schools tended to be smaller than the control schools. Fifth, this analysis makes use of two separate cohorts (i.e., a girls'-only cohort as well as a cohort that taught the girls' program as well as a boys' program), but this study's small sample size precluded a test of heterogeneity in treatment effect. Thus the estimated effect is a weighted average of the effect across the two cohorts, and we are unable to tease out the possibility of different effects in the two different cohorts. Given that more schools received the girls'-only intervention than the girls' plus boys' intervention, our estimated effect is likely to reflect the effect size in the girls'-only group slightly more. We, however, hypothesize that adding the boys' intervention probably increases the effect size; thus this imbalance may be an underestimate of the effect of the joint programs. We had too few schools to be able to adequately power a comparison of schools with the boys' program versus without; therefore we do not have sufficient evidence to make conclusions about the added benefit of the boys' program.

Conclusion

The results of the present study are promising, suggesting that these interventions, focused on empowerment, self-defense, and bystander intervention to prevent sexual assault,

have the secondary benefit of reducing pregnancy-related school dropout among the girls in the intervention. Thus, multipronged interventions with empowerment and self-defense components may be valuable additions to the body of knowledge about how to reduce pregnancy-related school dropout, especially in poorly studied informal settlement settings.

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Declaration of Conflicting Interests

The authors declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: Benjamin Omondi Mboya and Nickson Langat are employed by Ujamaa, the implementer of the intervention. Lee Paiva and Jake Sinclair are the founders of the NGOs Ujamaa (implementer) and No Means No Worldwide (NMNW; curriculum developer). Lee Paiva works as a volunteer and has never received any financial compensation for her work with NMNW. Stanford University investigators acted as pro bono external evaluators and were not paid for this work.

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