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Can Subsidized Early Child Care Promote Women's Employment?: Evidence from a Slum Settlement in Africa

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Abstract

Studies from North America, Europe, and Latin America show that women's disproportionate child care responsibilities significantly impede their labor force participation. Yet, some have questioned whether similar barriers exist in sub-Saharan Africa, where women primarily work in the informal sector and may receive extensive kin support. To test whether child care obligations limit African women from engaging in paid work, we conducted a randomized study which provided subsidized early child care (ECC) to selected mothers living in a slum area of Nairobi, Kenya. We found that not only are mothers eager to send their children to ECC centers, but also that women who were given subsidized ECC were, on average, 8.5 percentage points (or over 17%) more likely than those who were not to be employed. This effect rose to over 20 percentage points among women who actually used the ECC services. Furthermore, working mothers who were given subsidized ECC were able to work fewer hours than those not given ECC without any loss to their earnings. These findings provide strong evidence that subsidizing child care for women in poor urban settings could be a powerful mechanism to improve female labor outcomes and reduce gender inequalities in Africa.

Introduction

Increasing female employment, and women's economic empowerment more broadly, is a key strategy to reducing global gender inequalities (World Bank 2011). Previous efforts to promote women's economic opportunities have focused on two main approaches: 1) building women's human capital and skills through expanded primary and secondary schooling and 2) increasing women's entrepreneurship opportunities though micro-credit loans and financial literacy programs. Both of these approaches have had considerable success (Lloyd and Young 2009). In sub-Saharan Africa, for example, primary school enrollment for girls rose from 48 percent to 77 percent between 1990 and 2015 nearly eliminating the primary school gender gap (MDG SSA 2015). By 2011, over 200 million people had received micro-credit loans of which three-quarters were women (Maes and Reed 2012). Nonetheless, although there has been a sizeable shift of women out of agriculture and into the service and industry sectors, female employment rates overall have barely risen over the last two decades (ILO 2016). Moreover, women's jobs continue to generally entail long hours for little pay, and the gender gap in paid work has remained virtually unchanged. Globally, men are more than 25 percentage points more likely to be employed than women (ILO 2016).

This limited success may be partially attributed to the failure of these previous efforts to adequately take into account women's unpaid care responsibilities, and specifically, care for young children. Although globally half of women engage in paid work, they continue to bear disproportionate responsibility for the care of young children (Budlender 2008; World Bank 2011). On average, women in low- and middle-income countries (LMIC) spend nearly three hours more *per day* on unpaid work than men (ILO 2016). Given these high expectations of time devoted to child care, continuing with secondary schooling is generally not an option for young mothers (Lloyd and Young 2009). Young women are also less likely than young men to take advantage of vocational training programs because of their greater family obligations, including care of their own children as well as younger siblings (Cho et al. 2016). Child care responsibilities may also prevent women from using microfinancing opportunities to start or expand their own business. Evidence suggests that women take out smaller microfinance loans and typically use them for small-scale businesses that are more readily compatible with childcare (Agier and Szafarz 2013). Such studies have drawn greater international attention to the potential for these child care obligations to impede not only women's economic equality, but also overall economic development (ILO 2016). After decades of efforts to include unpaid child care work on the development agenda, target 5.4 of the Sustainable Development Goals (SDG) specifically seeks to "recognize and value unpaid care and domestic work" (Eyben 2013).

Several reports have argued that greater provision of affordable center-based early child care (ECC), including creches, day cares, and preschools, may be a highly effective strategy in reducing gender inequalities in labor force participation (Cassirer and Addati 2007; Todd 2013; Diaz and

Rodriquez-Chamussy 2016; Samman et al. 2016).[1] Working families in high-income countries (HICs) rely heavily on center-based child care services to allow parents to participate in the labor force (Samman et al. 2016). Such services, however, are usually costly. In the U.S., one out of four families with young children pay more than 10% of their income on child care and poor families spend nearly 20% (Mattingly et al. 2016). A substantial body of research in wealthier countries demonstrates a strong negative association between child care costs and maternal employment (Baker et al. 2008; Lefebvre and Merrigan 2008; Gong et al. 2010; Fortin et al. 2012; Haeck et al. 2015; Brilli et al. 2016), although a few studies contend that these effects are small (Lundin et al. 2008; Havnes and Mogstad 2011). These findings have motivated several countries in North America and Europe to provide subsidized child care. Many of these programs have proven to be highly successful and cost-effective. A study by Baker et al. (2008) showed that compared to the rest of Canada, women's employment rose by 7.7 percentage points after the introduction of the heavily subsidized Universal Day Care Plan in 1997 in Quebec. Other countries in Europe have found similar positive effects (Geyer et al. 2014; Brilli et al. 2016). Moreover, the short- and long-term economic benefits of these programs reaped through increased female labor supply are estimated to greatly surpass their costs (Lefebvre et al. 2009; Fortin et al. 2012). A recent study of two early child care programs the U.S. by Garcia et al. (2016) estimated that the full life-cycle benefits, including increased maternal employment, exceed the costs by a ratio of 7.3 to 1.

In LMICs, ECC centers have expanded dramatically in the past two decades (Samman et al. 2016). Most of these services are privately provided, but there is mounting interest in government subsidized ECC programs, particularly in Latin America and Asia. Mexico, Brazil, and India, have already established government subsidized ECC programs, which often target low-income families (Angeles et al. 2012; Barros, et al. 2011; Calderon 2012; Attanasio et al. 2016; Jain 2016). However, few African governments have followed suit. Even among regional leaders in ECC, such as Kenya, the focus of government spending has been on improving quality by developing training programs for caregivers and establishing guidelines for registered center-based facilities rather than reducing costs (Adams 2000; Adams and Swadener 2000; Belfield 2006; Adams 2009; Githinji and Kanga 2011). Thus, although one study found that more than 70% of children aged three to six years attended preschool in four African cities, nearly all ECC in Africa, including in urban slums, is private (Bidwell and Watine 2014; IPA 2013). A handful of studies indicate that the high costs of ECC prohibit many mothers from using these services (Lokshin et al. 2000; Murungi 2013). In addition, concerns about the quality of center-based care may also discourage mothers from using these services. Mothers are likely to be reluctant to send their children to centers if they hear anecdotal reports of unsanitary conditions, minimal food provision, limited learning and educational materials, and, in extreme cases, neglect and abuse (Githinji and Kanga 2011). Whether the lack of affordable child care options or concerns about low-quality services restricts maternal employment and earnings is largely unknown (Leroy 2011; Brown et al. 2014).

[1] In this paper we use the terms ECC centers, day cares, and child care centers interchangeably. We rarely refer to preschools given that most of the children in our study are under the age of four.

In this study, we tested whether access to affordable and improved-quality day care influenced women's labor market engagement in a slum area of Nairobi, Kenya, through the evaluation of a randomized control trial (RCT) with three study arms. After gathering extensive data on these women's economic opportunities and child care arrangements, mothers in two of the study arms were given vouchers for subsidized center-based ECC for one year. To examine whether the quality of daycare services affected women's use of ECC services, about half of the day cares participating in the voucher program were randomly selected to receive additional provider training and materials. We then assessed whether mothers used these ECC facilities and, if so, how it impacted 1) maternal employment, 2) number of hours worked, and 3) maternal income.

ECC and Women's Labor Market Engagement in LMICs

Maternal Employment

There is a large and growing body of research on ECC in Latin America and Asia. Some of these studies assess the impact of *greater access* to ECC facilities (regardless of use), while others evaluate the effect of ECC programs on maternal employment, contingent on mothers using these services. Many of these studies use experimental or quasi-experimental designs to evaluate whether the roll-out of government programs or the rapid expansion of ECC facilities leads to higher female employment. Two evaluation studies of Mexico's *Programa de Estancias Infantiles para Apoyar a Madres Trabajadoras* (PEI), a child care support program targeting low-income families, found that its implementation significantly increased maternal employment (Angeles et al. 2012; Calderon 2012). In Rio de Janeiro, Brazil, assessments of a lottery-based voucher program that granted free child care for low-income households found that mothers who enrolled their child in day care were 27 percentage points more likely to work for pay (Barros et al. 2011), although the effects of this program did not persist after the child transitioned out of the ECC program (Attanasio et al. 2016). The rapid expansion of pre-schools in Argentina also corresponded to a rise in maternal employment of between 7% and 14% (Berlinski and Galiani 2007). In Asia, rural mothers who benefited from India's government-sponsored Integrated Child Development Scheme (ICDS) were 15% more likely to work than mothers not using these services (Jain 2016). Other studies, which rely on methods such as discontinuity analysis or proximity and cost of local day care centers as instruments, generally also found positive associations between access to child care and maternal employment in Argentina (Berlinski et al. 2011), China (Du and Dong 2013), Colombia (Attanasio and Vera-Hernández 2004), and Ecuador (Rosero and Oosterbeek 2011). However, the cost and number of local day care centers were not associated with mothers' work status in Guatamala City (Hallman et al. 2005). To our knowledge, no previous studies have examined the relationship between quality of ECC and maternal employment.

Research on ECC and maternal employment in sub-Saharan Africa is sparse and draws mixed conclusions (Leroy 201; Brown et al. 2014). In Kenya, the cost of local day cares is negatively associated with maternal employment (Lokshin et al. 2014), but another study found no significant

association between the price or proximity of local child care and women's employment in Accra, Ghana (Quisumbing et al. 2007). A study in Togo used variation in the number of children under five to demonstrate that women with higher child care burdens were less likely to engage in paid work (Tabbert 2009). To our knowledge, there was only one other randomized control trial on ECC in Africa, but this study (like most research on ECC) focussed on child outcomes. Nonetheless, it found that the creation of preschools in rural Mozambique increased the probability that the child's primary caregiver was employed by 6.2 percentage points (Martinez et al. 2012). When the analyses were limited to the child's mother this result became insignificant, possibly reflecting the high level of care provided by grandmothers in this rural setting.

By reducing a mother's reservation wage, public (free or subsidized) provision of ECC should theoretically lead to an increase in labor force participation. If child care is a binding constraint on women's employment, as suggested by the existing literatures, we conjecture that *improving access to affordable, better quality child care will increase maternal employment* in poor, urban African settings. However, we note that there are reasons that this effect may be comparatively small in this context. First, educational attainment and vocational training is low, unemployment is high, and the local job market is characterized largely as casual, informal and low-skill. Hence, even women who have access to child care may find it difficult to find consistent paid work. Second, if they do find work, it is likely to consist of low-skilled and low-quality jobs in the informal sector, precisely because it allows them the flexibility to simultaneously look after their children (e.g. Hallman et al. (2005)). Lastly, although kin availability may be more limited in urban settings than in rural ones, mothers may be able to depend on other family members, particularly the child's older sisters or grandmothers, to act as the primary caregiver while they work (Lokshin et al. 2000). If increased availability of center-based child care simply crowds out these informal care arrangements, then it may have little impact on maternal employment. In fact, the widespread perception women primarily engage in "child-compatible" informal work and have access to a large kin network for support may partially account for the relative dearth of research and programs on formal ECC in sub-Saharan Africa.

Number of Hours Worked

When evaluating the relationship between ECC and the number of hours women work, it is important to consider whether these analyses include *all mothers* or *working mothers* only. The majority of studies from LMICs focus on all mothers and, implicitly or explicitly, calculated the number of hours worked for non-working mothers at zero (Attanasio and Vera-Hernandez 2004; Hallman et al. 2005; Berlinski et al. 2011; Rosero and Oosterbeek 2011; Angeles et al. 2012; Du and Dong 2013). Since many of these studies showed that mothers using ECC were more likely to be working, it is not surprising that they also found an increase in the average number of hours worked. Angeles et al. (2012), for example, found that mothers who took advantage of Mexico's ECC program worked on average 24 hours more per month than mothers who did not participate. Similar effects were found among mothers using a day care facilities in Ecuador and China (Rosero and Oosterbeek 2011; Du and Dong 2013). Estimates among mothers using day care in rural

Columbia were even larger, up to 75 additional hours per month (Attanasio and Vera-Hernandez 2004). In contrast, one of the few studies that focused exclusively on working mothers found no significant impact of free child care on the number of hours worked by low-income mothers in Rio de Janeiro (Barros et al. 2011).

Economic theory may help explain why access to child care can increase the likelihood of working (external margin), but conditional on working, have no effect, or even decrease, the total number of hours (internal margin). Among working mothers, the impact of subsidized ECC on the number of hours worked is theoretically ambiguous (Todd 2013). Assuming leisure is a normal good and the mothers' wages stay constant, then mothers who receive subsidized child care could work fewer hours than those who must pay for child care to enjoy the same level of consumption. In addition, because center-based care is usually fixed at around 40 hours per week, subsidized care may shape mothers' time constraints differently above and below this threshold. Specifically, it may encourage mothers to work up to 40 hours but no longer. Alternatively, mothers may shift to jobs with shorter hours that are less compatible with simultaneous child care from jobs that require longer hours of work, but can be performed while tending to young children.

Mothers in poor urban environments may be especially reluctant to work long hours as many of the jobs available to them are not only physically demanding (e.g., laundry, sewerage cleaning), but also dangerous (e.g., scavenging at a dumpsite, sex work). Moreover, in these settings access to higher wage jobs are limited for low-skilled workers providing little incentive to work longer hours. Thus, overall, we would expect that few mothers given subsidized child care will work more than 40 hours. In sum, we would expect that *if access to affordable child care increases maternal employment, then the average number of hours worked among all women will be higher for those using ECC. Among working mothers, however, the effect of subsidized child care on hours worked is ambiguous.*

Maternal Income

Ultimately, the most important benefit of subsidized child care is that it could increase the income available and serve as a key mechanism towards poverty alleviation for women and their families. Unfortunately, only a handful of studies have assessed this outcome. As with hours, the theoretical implications of ECC on income is ambiguous and depends on the initial employment status of the mother and any change in hours. Even in studies focused on earnings among all women there are mixed empirical findings. Some studies found a significant positive effect of ECC on mother's income (Barros et al. 2011; Calderon 2012), although others found no differences between mothers using ECC and those who do not (Quisumbing et al. 2007; Rosero and Oosterbeek 2011; Angeles et al. 2012). One study speculated that because these mothers were particularly economically disadvantaged they may have under-reported their income for fear of losing access to the child care (Angeles et al. 2012).

In informal economies, income is reported with considerable measurement error (Deaton 1997; Feige 1990; Glewwe 2007), especially when generated from self-employment activities (Hamilton 2000). For many women who sell goods and foods, estimating their true earnings, which deducts from revenues the costs of production inputs, can be especially difficult. For other women who perform services such as laundry on an ad hoc basis, payment may be late or the customer may refuse to pay for unsatisfactory work (Clark et al. 2017). These types of occupations do not pay an "hourly wage" and at best provide an imprecise measure of "average" wage. Despite these potential measurement issues, our conceptual framework suggests that *on average women with access to affordable day care will earn more income, if overall maternal employment rises.* For working mothers, the effect on earned income will depend on both hours worked (ambiguous effect) and on the wage received. With few opportunities for higher wage jobs, the effect on earned income is ambiguous. In fact, as discussed previously some mothers with subsidized ECC may reduce their number of working hours because they are more productive, leading to little effect on earnings. Similarly, some mothers who had to work more to afford ECC can scale back on hours worked thanks to the subsidy while maintaining all other household expenditures constant. In these circumstances, *the effect on total earned income among working mother is ambiguous.* Taking into consideration the total number of hours worked, however, it is possible that *mothers given subsidized ECC will earn more income (per hour)*, if they shift to working fewer hours in better-paid, but less child-compatible, jobs or if ECC allows hourly productivity to rise.

Study Site

High levels of both internal migration and fertility are fueling rapid urbanization across sub-Saharan Africa. By 2030, more than half of Africans will live in urban areas (Montgomery 2008). Many will reside in poor urban slum areas, which are characterized by a lack of sanitation, limited health care facilities, low-quality housing, high levels of violence and crime, and pervasive poverty (APHRC 2014). In Nairobi, approximately 60% of its inhabitants live in these informal settlement areas such as Korogocho.

Although working mothers around the globe must manage child care while securing sufficient economic resources to cover expenses related to food, clothing, shelter, and other necessities, this may be especially daunting for mothers living in slum settlements. Since most slum-dwelling men and women work in the informal sector, estimates of employment status are difficult to obtain, but an estimated 62% of women and 72% of men participated in the labor force in 2016 in Kenya (Word Bank 2017). Employment is not necessarily higher in slum communities and the labor market can be quite volatile. A study of four slum settlements in Nairobi found that female unemployment actually rose from 40.6% in 2000 to 50.7% in 2012 (APHRC 2014). Although many women move to urban areas looking for better-paying work in the manufacturing or service industries, most jobs available to poor urban women are low-skilled, unstable, and poorly paid. In 2015 when we began our study, a large fraction of working women (about 30%) in Korogocho

were engaged as small-scale vendors selling food or goods in local markets or along the side of the road. Others were washing laundry (about 15%) or providing other types of cleaning services (30%), which included participation in the National Youth Services (NYS) (Clark et al. 2016). Until early 2016, the NYS, a government-sponsored program to enhance young people's employment skills and increase youth employment, had employed young women and men in Korogocho to remove trash, clean drainages and sewage trenches, and make small infrastructural repairs. The remaining quarter of working women performed a variety of jobs including services such as hair dressing, tailoring, and domestic work, or scavenging for reusable materials at Dandora, Nairobi's largest solid waste disposal site, which borders Korogocho.

Demographic factors tend to compound these economic ones. In Kenya, like other countries in sub-Saharan Africa, despite an initial drop in fertility, there is evidence that the fertility transition has stalled in recent decades (Bongaarts 2008). In Korogocho, the total fertility rate (TFR) in 2009 was 3.7 children, which was lower than the national estimate (TFR 4.6), but higher than for Nairobi as a whole (TFR 2.8) (Emina et al. 2011). Furthermore, because women in Kenya tend to space their births, they are likely to spend a significant proportion of their adult lives with at least one child under the age of five. According to the most recent Demographic and Health Survey in Kenya (KNBS et al. 2015), about 45 percent of Kenyan women aged 15 to 49 years currently have at least one child under the age of five years (author's calculation).

These high child care demands may coincide with limited kin support as many residents of urban slums are migrants who are geographically separated from their extended kin networks. Korogocho is a relatively established informal settlement with about a quarter of its residents born within the community. However, another quarter of its population is estimated to leave every year with a roughly similar number of new residents entering the community (Beguy et al. 2010). The geographic proximity of these migrants to their extended kin networks is likely to vary by ethnicity. The traditional homelands for Kikuyus, who comprise the largest ethnic group in Korogocho (about 30%), are concentrated in Nairobi's neighboring districts. In contrast, the traditional homelands for the Luo (29%) and Luhya (18%) are located in Western Kenya, near Lake Victoria. Because child care generally requires the physical presence of the caregiver, this geographic variability may have little impact on the availability of kin as few kin living outside the immediate area are likely to provide regular child care (Madhavan et al. 2017). Hence, all migrants regardless of ethnicity may have limited assistance available. A recent study in Korogocho found that even among single mothers, who are presumably most dependent on kin support, over 30% did not receive child care from any kin member (Clark et al. 2017). Little is known about the availability, use, or costs of center-based child care in Korogocho, but NGO reports from nearby slums in Nairobi, highlight their extensive use by children above the age of three (IPA 2013).

Data and Methods

Analytic Sample

Since 2002, the Nairobi Urban Health and Demographic Surveillance System (NUHDSS) has collected basic demographic information on all residents of Korogocho every four months. Our sampling frame relied on the most recent NUHDSS enumeration conducted between April and May 2015 to identify a total of 1,928 mothers with at least one child aged one to three years (inclusive) at the time of enumeration. We excluded children below the age of one year because many of these children would be breastfeeding and were ineligible for a majority of day care centers in the area. Similarly, we excluded children aged four years and above because these children would be five years old by the time of the second interview and may have moved on to primary school.

Of the mothers identified, 27% were excluded from the survey because they could not be located or had moved out of the Demographic Surveillance Area (n=524). Thirty-nine children and one mother had died before the time of our baseline survey. Only 2% of mothers (n=27) refused to participate. Among those contacted, an additional 11 mothers were deemed ineligible because either they or their child did not live in the household, and 95 mothers had children who were outside the eligible age range.[2] One child died shortly after the interview and the mother asked not to be included in the study. Thus, the baseline survey, which was conducted between August and October 2015, interviewed a total of 1,222 women about their current childcare arrangements, economic activity, child health and well-being, and other socio-demographic characteristics. We exclude 30.5% of mothers (n=373), who were using an eligible day care facility for at least one of their eligible children.[3] About 10% of mothers, who were using ineligible child care services, including those paying for child care at informal centers or receiving free child care, are included, yielding an analytic sample of 849 mothers.

One year later between August and October 2016, we conducted an endline interview with 738 (87%) of these mothers. The majority of mothers who were not interviewed had moved away (n=87), a few were not located (n=18), one mother died, and five refused to be re-interviewed.[4] Further analyses (presented in Appendix A) indicate that there are important differences between women who were lost-to-follow-up (LFU) and those who were re-interviewed at endline. Most notably, attrition rates were higher among mothers in the control group (16.6%) than those in the intervention arms (9.8%). In addition, mothers who were LFU tended to be slightly younger, more educated, and belong to an ethnic group other than Kikuyu. There is no evidence of selective attrition with respect to our three main outcome variables (employment, hours, or income) or other characteristics.

2 Children who were age four at the time of the baseline survey were included as long as they were under age four at the time of enumeration.

3 Eligible day cares are those identified during our ECC center inventory, which provided care for a fee to 10 or more children. Mothers already using an eligible day care were given vouchers for that center, but since they are not randomized at the individual-level, they are excluded from our analyses. See Study Design and Intervention for more details about day care selection and assignment.

4 Five eligible children died between baseline and endline. Because several of these children lived most of the year, their mothers are retained in our analyses. Excluding these cases does not alter our results.

Study Design and Intervention

After conducting an exhaustive inventory of existing ECC facilities in Korogocho, we identified 48 well-established and registered day care centers. An additional 11 child care facilities were identified but were deemed ineligible because they were either too small (caring for fewer than 10 children) or were sponsored by faith-based or community-based organizations that offered free services. Although the remaining 48 centers met our criteria for "formal" ECC centers, there was considerable variability in the quality of services they offered. Nearly all ECC centers were open five days per week for about 7.5 hours each day. About 70% of the centers provided food during the day, although it was often of low nutritional quality. Notably, only 30% of centers had toys and educational materials at baseline

Randomization for our project occurred at both the day care-level and the individual-level. First, the 48 eligible established day care centers in Korogocho were stratified by village and then randomly assigned into one of three study arms: control (C), voucher-only (V), or voucher-plus-quality (VQ). This randomization process resulted in 16 V centers, 17 VQ centers, and 15 control day cares. Both the V and VQ centers agreed to accept monthly vouchers from women assigned to their centers, for which they would be compensated directly by the project. They also received some unrestricted funds (equivalent to USD $50) to help them accommodate potentially higher numbers of children owing to the intervention. Day cares assigned to the VQ arm were given additional training for their caregivers on early childhood development by the Aga Khan Foundation, and provided with materials such as mattresses, potties, toys, and hand-washing stations.

Second, we randomly assigned mothers who were not using one of these 48 eligible day care centers at baseline into one of the three arms of the study.[5] Mothers in the control arm (C) (n=280) served as our comparison group. Mothers assigned to the voucher-only group (V) (n=284) were given a list of the 16 V centers and asked to select their top three preferred centers. Mothers in the voucher-plus-quality arm (VQ) (n=285) selected among the 17 VQ centers. In most instances, we were able to accommodate mothers' preferences. Matching was facilitated by our field supervisors to reduce over-crowding at particular facilities. The full day care assignment and training of the VQ day care providers took approximately two months. Mothers were given 12 monthly vouchers, covering the months of January to December 2016, for all their children aged one to three years. A majority of mothers began using their vouchers in February 2016. For further details about the sample selection and randomization process see Clark et al. (2016). Ethical clearance to conduct the study was obtained from the McGill University Institutional Review Board and the AMREF Health Africa Ethical and Scientific Review Committee. Informed consent was obtained from all mothers.

[5] Mothers who were using one of the ineligible ECC providers were also randomly assigned to one of the study arms and are included in our analyses. Many of the mothers who were already receiving care for free at the community-based centers, however, declined to accept the vouchers.

Measures

Dependent Variables

This paper focuses on three main outcomes, which were measured at both baseline and endline: 1) maternal employment, 2) hours worked, and 3) maternal income. For our first outcome, women were classified as "employed" if they answered "yes" to the question "Did you engage in any activity (including self-employment) that generated income in cash or in-kind in the last month?" Mothers were then asked a series of detailed questions about up to three of these paid activities. Most mothers (93.3%) reported only one paid activity and less than 1% reported three activities. For our measure of number hours worked, we summed all reported hours across the three activities. In our analyses that include both employed and unemployed women, we considered unemployed mothers to have worked zero hours. Mother's monthly income represents the sum of both cash and in-kind contributions (which were minimal) across all three activities. As is standard practice in labor economics, we took the log of mother's total monthly earnings to minimize the effects of high outliers for those reporting positive earnings. For unemployed women this variable takes the value of 0.

Intervention Variables

To assess the impact of the intervention we relied on two main variables: 1) the original study arm assignment and 2) the actual use of day care services. To assess the impact by the original study arms, we first created a dichotomous variable indicating whether a mother was assigned to either of the two intervention arms (AnyV) or the control group (C). To test for differences between the two intervention arms, we then created a categorical variable separating mothers who received vouchers to regular day cares (V) and mothers who received vouchers for improved-quality day cares (VQ) (with the control group remaining as the reference category).

In our analyses of the effects of day care use, we first created an indicator variable for whether or not mothers were using any day care services for any of their children aged one to three years (AnyDC). In addition, we created a categorical variable to further distinguish whether mothers used a regular day care (RDC) or one of the quality-improved day cares (QDC). For both the dichotomous and categorical variables the reference category is comprised of mothers not using any day care services. During the study period, many mothers in the control arm of the study began paying for child care services including those provided by V and VQ day care centers. In addition, about 10% of mothers in our sample sent at least one child to a day care that did not meet the eligibility criteria or was located outside Korogocho. We focused on any day care use, rather than day care use only at eligible centers, to better represent the full spectrum of types of ECC services available to mothers in this area. When we restricted our analyses to use of eligible day cares only, the results were quite similar (analyses available upon request). Lastly, because these analyses

were conducted at the mother-level, our variables reflect whether mothers paid for day care for *any* of her children.[6]

Control Variables

In our adjusted models we controlled for important mother and household characteristics at baseline including mothers' age (continuous variable), education (coded as a categorical variable where 1 = "none", 2 = "some primary school", 3 = "completed primary school", and 4 = "secondary school or higher") and ethnicity (includes the five most common ethnic groups in Kenya). We also created indicator variables for whether the mother was currently married/cohabiting or was a recent migrant, the latter defined as having moved to the area within the last five years. Following the procedure recommended by Filmer and Pritchett (2001), we used principal component analysis to create a household wealth index based on household amenities (type of toilet, source of water, and whether they owned or rented their housing) and ownership of 21 common household assets, such as bicycles, sofas, tables, beds, stoves, lamps, televisions, and cell phones. For the 6% of households (n=73) that were missing information on at least one of these items, we imputed the mean wealth asset score. To capture aspects of household composition pertinent to child care, we constructed measures for the total number of children under the age of five and the presence of any other females (other than the respondent) above the age of 10. Lastly, we included dummies for each of the seven villages (communities) in Korogocho to control for any fixed village-level characteristics.

Identification Strategy

Our analyses largely follow those specified in the registered pre-analysis plan (Clark and Kabiru 2015).[7] The identification strategy relies on the random assignment of mothers to either the control group (C) or one of the two treatment groups (V or VQ). We estimated two sets of models: 1) intent-to-treat (ITT), which determined the mean differences in outcomes across mothers in the three study arms and 2) treatment-on-treated (TOT), which examined the impact on mothers who used any day care services. In our basic (and preferred) model, we regressed our outcome (Y) at endline on assignment to either of the two intervention arms (AnyV), where Y represents 1) maternal employment, 2) hours worked, or 3) maternal income (Eq. 1). We then examined whether the effects differed for mothers who received vouchers for regular day cares (V) and mothers who received vouchers for improved-quality day cares (VQ) (Eq. 2).

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[6] Mothers with more than one child rarely decide to send only one to day care. Hence, analyses conducted at the child-level yield nearly identical results as those at the mother-level.

[7] The analyses presented deviate from the pre-analysis plan in two important respects. Specifically, we do not show our results for *household income* as these are nearly identical to those for maternal income or for *disadvantaged mothers*. There are no significant differences of the effects of subsidized child care by mothers' migration status. Moreover, contrary to our expectations, the intervention has a stronger effect for married mothers than for unmarried mothers, but this is largely because nearly all unmarried mothers are already working at baseline. All additional analyses are available upon request.

1. $$Y_i = \beta_0 + \beta_1 AnyV_i + \varepsilon_i$$
2. $$Y_i = \beta_0 + \beta_1 V_i + \beta_2 VQ_i + \varepsilon_i$$

For the next set of analyses, we included a vector (X) of the baseline mother and household characteristics described above (Eq. 3). The inclusion of these variables can help minimize differences across study arms which may exist despite random selection or may be introduced through the process of selective attrition. To further reduce variability we also included lagged (baseline) dependent variable. For the sake of brevity, we do not present our findings which disaggregate our intervention arms into V and VQ as these arms were never significantly different from one another.

3. $$Y_i = \beta_0 + \beta_1 AnyV_i + X_i\beta_2 + \varepsilon_i$$

In our final set of ITT analyses, we examined the change between baseline and endline for maternal employment, hours worked, and income (Eq. 4).

4. $$\Delta Y_i = \beta_0 + \beta_1 AnyV_i + \varepsilon_i$$

For our dichotomous outcome, maternal employment, we relied on probit models to assess difference at endline and ordered probit models to evaluate change in employment status between surveys. Either OLS or logit analyses yield similar results. We relied on the Brant test following our ologit analyses to confirm that the parallel regression assumption was not violated. Analyses of our continuous outcomes, number of hours worked and maternal income, employed tobit models to account for left censoring of mothers who were not working in our full sample. OLS was used in all subsequent analyses that limit the sample to working mothers. For ease of interpretation, all probit and tobit models present the average marginal effects (dy/dx). All models report robust standard errors.

In our TOT analyses, we cannot simply assess differences in maternal labor market engagement by whether mothers use day care because it is an endogenous process. Indeed, mothers may send their children to a day care center as a consequence of finding work, rather than its cause. We, therefore, followed the standard practice in evaluating TOT effects in RCT studies and used the random study arm assignment as an instrument for day care use. Study arm assignment is likely to be a valid instrument because it is positively associated with higher day care use by mothers given vouchers (a condition we verified) and it should be uncorrelated with mother and household characteristics given that mothers were randomly assigned to different study arms.

Our TOT models were identical to our ITT ones except that we focused on the endogenous indicator of whether mothers used day care services and instrument this variable with our randomly assigned study arm variable using a two-stage-least-squared procedure. For example, in the first stage of our basic model, we regressed an indicator for whether mothers used any day care services

(AnyDC) on whether they received a voucher (AnyV). In stage two, we used the predicted values from stage one ($\widehat{AnyDC}$) to estimate parameter β_1 which represents the average impact of subsidized day care for the subset of mothers who used day care (Eq. 5) In our adjusted models, the other control variables (X) were included in both stages. In addition, we used random assignment into the three study arms (C, V or VQ) as an instrument for whether mothers used no day care, used an RDC center or a QDC center (Eq. 6).

5. $$Y_i = \beta_0 + \beta_1 \widehat{AnyDC}_i + (X_i\beta_x) + \varepsilon_i$$

6. $$Y_i = \beta_0 + \beta_1 \widehat{RDC}_i + \beta_1 \widehat{QDC}_i + (X_i\beta_x) + \varepsilon_i$$

The instrumental variable approach is straightforward for continuous outcomes and for these we used the *ivregress* command in STATA 14. Although it remains common practice to also use this approach for dichotomous outcomes, such as maternal employment, it is not recommended (Lewbel 2009). Another alternative is to use ivprobit, but this approach is also problematic when the endogenous variable (such as day care use) is dichotomous. We, therefore, adopted a bivariate probit approach since we had both a dichotomous outcome and endogenous regressor. This approach assumes that the error terms in both the first and second stage equations are jointly normal. According to Murphy's score test, this assumption was not violated (Murphy 2007). Bivariate probit models also depend on the correct specification of the stage one model, which cannot be verified. Thus, although our estimates are quite similar regardless of the model specified (see Appendix B), even the bivariate probit results should be interpreted with caution.[8] Lastly, in our analyses testing for differential effects for regular (RDC) and quality-improved (QDC) on maternal employment we adopted a conditional mixed process using the *cmp* command in STATA to account for the categorical nature of our endogenous variable (Roodman 2011).

Results

Baseline Characteristics

Table 1 provides a description of mother and household characteristics at baseline as well as tests for differences in these characteristics among the three study arms. On average, mothers in our sample were nearly 29 years old and had eight years of education. More than 60% had completed primary school. Almost a quarter of the mothers in our sample were not currently married or cohabiting and among these women 43.1% were never-married while 56.9% were formerly married. Migration is common in this population; roughly one in five mothers in our sample moved into this area within the last five years. The ethnic composition found in our sample reflects the

[8] Perhaps the best alternative is a procedure recommended by Lewbel (2009) called the special regressor (SR) method. Unfortunately, this approach requires a special exogenous variable with a kurtosis value of more than 3. Most studies use respondents' age, but in our sample this variable has a low kurtosis value and, hence, produces unreliable results. We were unable to identify any other suitable special exogenous variables.

national diversity. The largest group was comprised of Kikuyus (27.8%), followed by Luo (23.6%), Luhya (18.6%), and Kamba (7.2%). There was also a large Somali population (18.9%). In terms of household composition, a large fraction of mothers (40.1%) co-resided with at least one other female above the age of 10 who could potentially assist with child care. A similar proportion of households (43.5%) had more than one child under the age of five.

Table 1 also shows that our randomization process ensured balance across most baseline characteristics. The only exception is that mothers who received a voucher (11.1%) were less likely than those in the control group (16.4%) to have no education. This difference was most pronounced in comparisons of mothers in the voucher-only arm. An F-test assessing the joint significance of mothers' education found no statistical differences by study arm (p=0.17). Furthermore, there were no statistically significant differences in the average number of years of education across study arms. No statistically significant differences were found with respect to other control variables, including mothers' age, ethnicity, household wealth, household composition, and village. Nor were there any statistically significant differences at baseline for use of any day care or the three main outcomes across the study arms.

TABLE 1— BASELINE MOTHER AND HOUSEHOLD CHARACTERISTICS BY STUDY ARM

	Total	**Control (C)**	**Inter-vention (I)**	**Sig. (C vs. I)**	**Voucher Only (V)**	**Sig. (C vs.V)**	**Voucher plus Quality (VQ)**	**Sig. (C vs.VQ)**
n	***849***	***280***	***569***		***284***		***285***	
Intervention Variable								
Use Any Day Care	11.31	10.36	11.78		13.03		10.53	
Dependent Variables								
Paid Work (%)	57.13	58.21	56.59		55.99		57.19	
Hours per Week (if working) (mean)	40.16	41.64	39.42		38.49		40.33	
Mothers Income per Month (if working) (mean)	4778.08	4823.23	4755.23		4839.78		4672.76	
Independent Variables								
Age (mean)	28.8	28.7	28.9		28.9		28.9	
Years of education (mean)	8.0	7.8	8.1		8.2		8.1	
Education (%)								
None	12.8	16.4	11.1	*	10.2	*	11.9	
Some Primary	25.2	23.2	26.2		27.8		24.6	
Completed Primary	40.1	38.9	40.6		39.8		41.4	
Secondary or higher	21.9	21.4	22.1		22.2		22.1	
Wealth Index-Quintiles (%)								
First (poorest)	21.8	19.3	23.0		22.2		23.9	
Second	21.4	18.2	23.0		22.5		23.5	

Third	18.4	20.0	17.6	17.6		17.5
Fourth	19.3	21.4	18.3	18.7		17.9
Fifth (least poor)	19.1	21.1	18.1	19.0		17.2
Currently Married (%)	76.5	79.6	75.0	73.1	†	76.8
Recent Migrant (%)	19.4	18.9	19.7	19.7		19.7
Ethnicity (%)						
Kikuyu	27.8	24.6	29.4	30.3		28.4
Luo	23.6	23.9	23.4	23.9		22.8
Luhya	18.6	20.0	17.9	15.9		20.0
Kamba	7.2	5.4	5.4	7.0		9.1
Somali	18.9	21.4	17.6	19.0		16.1
Other	4.0	4.6	3.7	3.9		3.5
Any Older Females (%)	40.1	37.5	41.3	39.8		42.8
Number of Children < 5 years old						
One	56.5	58.6	55.5	57.0		54.0
Two	33.3	31.1	34.5	33.1		35.8
Three or more	10.1	10.4	10.0	9.9		10.2
Villiage (%)						
Gitathuru C	13.7	13.9	13.5	13.7		13.3
Grogan A	8.0	7.9	8.1	8.1		8.1
Grogan B	5.4	5.4	5.5	5.3		5.6
Highridge	27.8	27.9	27.8	27.8		27.7
Korogocho A	15.1	15.0	15.1	15.1		15.1
Korogocho B	5.8	5.7	5.8	5.6		6.0
Nyayo/Kisumu	24.3	24.3	24.3	24.3		24.2

Significance tested with Chi-squared for categorical variables and t-tests for continuous variables.

Sig. †p<0.10, *p<0.05, **p<0.01, ***p<0.001

Although we limited our analyses to mothers who were not sending any of their eligible children to one of the 48 eligible day cares in Korogocho at baseline, we note that about 10% of mothers in our sample were using child care at an ineligible center for at least one of their children. Although few of these mothers were using center-based child care, many (57%) were working for pay. These mothers worked, on average, about 40 hours a week and earned slightly less than 5,000 Kenyan Shillings (KES) (about $46 USD) per month. Given that the average household income in our sample was slightly under 10,000 KES per month, it suggests that when mothers are working they contribute about half of household earnings. In addition, mothers who were using day care at baseline report paying about 540 KES (about $5 USD) per month per child for day care. Since

mothers have on average about 1.5 children under the age of five, we estimate that child care costs would consume about 17% of working mothers' income.

Day Care Use

TABLE 2— MOTHERS' USE OF ANY DAY CARE

	Unadjusted Models						Adjusted Models[a]			Change Models		
	Model 1[b]			Model 2[b]			Model 3[b]			Model 4[c]		
	ME	Robust S.E.	Sig.	ME	Robust S.E.	Sig.	ME	Robust S.E.	Sig.	ME	Robust S.E.	Sig.
AnyV	0.247	0.0367	***				0.237	0.0331	***			
V				0.260	0.0401	***						
VQ				0.234	0.0407	***						
Any V												
End Day Care										-0.017	0.00546	**
No Change										-0.176	0.03077	***
Begin Day Care										0.193	0.0331	***
Controls included	No			No			Yes			No		
Model used	Probit			Probit			Probit			Oprobit		
Obs.	738			738			736			738		
Wald	48.24			48.75			138.4			29.99		
Control mean	0.575			0.575			0.580					
% Change AnyV	0.429						0.409					
% Change V				0.453								
% Change VQ				0.406								

a: Adjusts for mothers' age, education, ethnicity, marital status, migrant status, household wealth, household composition, village, and lagged dependent variable.

Sig. †p<0.10, *p<0.05, **p<0.01, ***p<0.001

Before turning to our main study results, we first determine whether our intervention impacted our key mechanism, use of day care. Although only about 10% of mothers in our analytical sample were using child care at an ineligible center at baseline, one year later over 80% of mothers who were given vouchers were sending their children to day care (at either eligible or ineligible centers). This uptake rate was very similar across the two intervention arms (83.6% in V and 80.9% in VQ study arms). Not all of this increase, however, can be attributed to the subsidy as more than half of mothers (57.6%) in the control arm also started to send their children to an ECC center. Much of this increase in day care use probably reflects children getting older. In this setting, it is common for mothers to feel that day care is more appropriate and beneficial for children after the age of three. This preference is reflected in our finding that the average age of a child not using day care

was 2.2 years old compared to 3.1 years old among children sent to day care at baseline. Nonetheless, there remains a nearly 25 percentage point difference (or 42.9% increase) in day care use between mothers given vouchers compared to those who were not given vouchers. This difference is highly statistically significant ($p<0.000$). After controlling for baseline characteristics of the mother and household, these differences in ECC use remain virtually unchanged. Nor are there any appreciable differences when examining the change in day care use between baseline and endline. Mothers who were given vouchers were significantly more likely to start using day care. They were also significantly less likely to discontinue day care use during the intervening year, although this effect is much smaller given that few mothers were using day care at baseline.

FIGURE 1. ATTENDANCE REPORTED BY DAY CARES

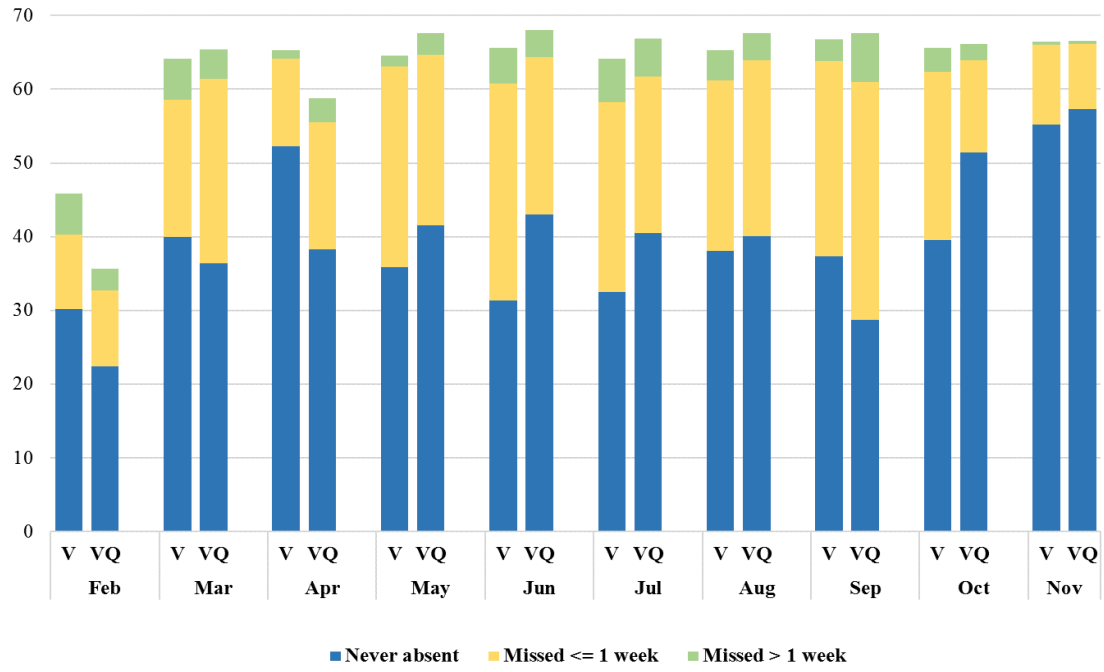


Figure 1 displays monthly attendance by children at their assigned V or VQ day care centers as reported by the child care providers. After an initial start-up phase which lasted until March, Figure 1 shows that slightly over 70% of mothers used their vouchers in any given month. Of mothers who ever used their vouchers, over half used them every month and over 90% used them for at least eight months. Moreover, children attended day care regularly with very few children missing more than a week of care per month. We also find very little systematic difference in attendance among children assigned to the V or VQ study arms.

To verify mothers' reports of day care use, we matched mothers' reported day care use at endline with the center's attendance records for September. The matched data showed high levels of agreement with 82.8% of mothers' reports and day care records agreeing about whether or not the

child attended day care. About 15% of children were reported by their mothers as using day care, but there are no records of their attendance in their assigned V and VQ centers. Further inspection revealed that nearly all of these children were attending day care centers for which they were not given a voucher. For example, some mothers offered vouchers for a V day care preferred instead to send their child to a VQ day care despite having to cover these expenses by themselves. Other mothers enrolled their children in centers outside of Korogocho or in faith- or community-based centers. Hence, mothers' reports appear to be reliable indicators of children's regular use of day care services.

Maternal Employment

Turning to our labor market outcomes, Table 3 examines the relationship between subsidized child care and maternal employment. In the top panel, which shows the ITT results, we find that mothers who received a voucher for either V or VQ day care centers were, on average, 8.5 percentage points more likely to be employed compared to mothers who did not receive a voucher (57.4% vs. 48.9%, respectively). This represents a 17.3% increase in employment between mothers in the control versus those in the intervention arms of our study. When we analyzed the study arms separately (Model 2), we find that mothers with vouchers for VQ centers were slightly, but not significantly, more likely to engage in paid work relative to mothers with vouchers for V child care facilities. Adjusting for baseline characteristics (Model 3) reduces the magnitude of the coefficient, indicating that mothers who received vouchers were only 6.4 percentage points more likely to work, and it became insignificant at the 5% level (p=0.060). In our final set of ITT analyses in Model 4, we assessed the change in employment status between baseline and endline. Mothers who received vouchers were four percentage points more likely to become employed if they were unemployed. They were also five percentage points less likely to become unemployed if they were already employed compared to mothers in the control group. These results indicate that subsidizing day care may be as helpful to mothers in maintaining work as in finding it.

TABLE 3— EFFECTS OF INTERVENTION AND DAY CARE USE ON MATERNAL EMPLOYMENT

	Unadjusted Models						**Adjusted Models[a]**			**Change Models**		
Intent-to-Treat	**Model 1**			**Model 2**			**Model 3**			**Model 4**		
	ME	**Robust S.E.**	**Sig.**	**ME**	**Robust S.E.**	**Sig.**	**ME**	**Robust S.E.**	**Sig.**	**ME**	**Robust S.E.**	**Sig.**
AnyV	0.085	0.0396	*				0.064	0.03	†			
V				0.074	0.0455							
VQ				0.094	0.0451	*						
Any V												
End Day Care										-0.048	0.02	*
No Change										0.005	0.00	
Begin Day Care										0.043	0.02	*

Controls included	No	No	Yes	No
Model used	Probit	Probit	Probit	Oprobit
Obs.	738	738	736	738
Wald	4.584	4.8	197.7	4.3
Control mean	0.489	0.489	0.50	
% Change AnyV	0.173		0.128	
% Change V		0.152		
% Change VQ		0.192		

Treatment-on-Treated	**Model 5**			**Model 6**			**Model 7**		
	ME	**Robust S.E.**	**Sig.**	**ME**	**Robust S.E.**	**Sig.**	**ME**	**Robust S.E.**	**Sig.**
AnyDC	0.223	0.10	*				0.153	0.08	*
RDC				0.151	0.0772	†			
QDC				0.238	0.1143	*			
Controls included	No			No			Yes		
Model used	Bivariate Probit			CMP			Bivariate Probit		
Obs.	738			738			736		
Wald	60.86			138.01			297.29		
Control mean	0.208			0.208			0.27		
% Change AnyDC	1.07						0.56		
% Change RDC				0.727					
% Change QDC				1.143					

a: Adjusts for mothers' age, education, ethnicity, marital status, migrant status, household wealth, household composition, village, and lagged dependent variable.

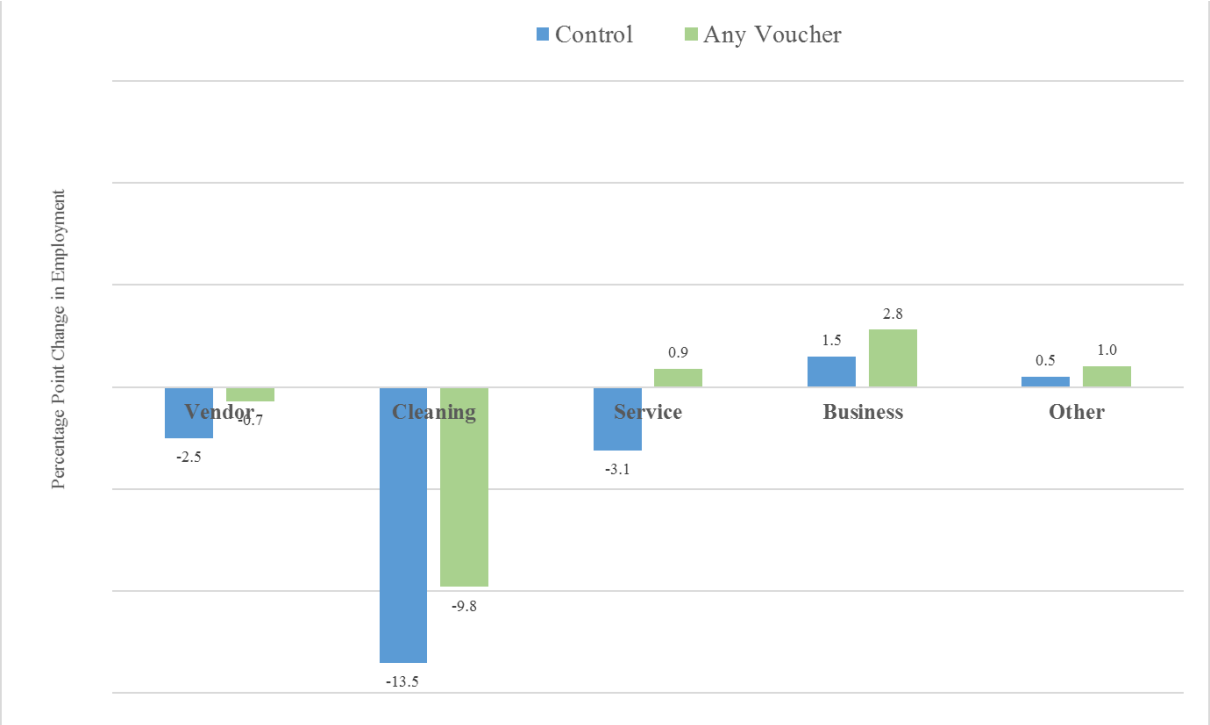
Sig. †p<0.10, *p<0.05, **p<0.01, ***p<0.001

The ability to protect jobs may be especially important in unstable job markets. Further analyses reveal that on average during this one year period, female employment rates fell in Korogocho particularly after the government-sponsored NYS activities ended. Figure 2 shows that the relatively higher loss of jobs among mothers in the control arm was felt across all types of work, but most acutely in the cleaning sector (which included NYS jobs). Service and vending employment also fell more sharply among mothers who were not given vouchers. In contrast, slightly more women who were given vouchers established their own businesses.

Not surprisingly the effects of actual day care use (TOT) are even stronger. Our unadjusted analyses suggest that women who used day care were 22.3 percentage points more likely to be employed than those who did not use day care (Model 5). This represents a two-fold increase in the likelihood of being employed among mothers using day care compared to those who did not.

In our adjusted model (Model 7), our estimate falls to 15.3 percentage points (or a 56% increase). As with our ITT analyses, although the effect size is smaller for mothers sending their children to RDCs, there are no statistically different effects for mothers using RDC or QDC centers. Sensitivity analyses, in which we use *ivregress* or *ivprobit* yield somewhat larger estimates (see Appendix B). However, these estimates may be less reliable because we have a dichotomous regressor and endogenous variable. Taken together these analyses suggest that subsidizing day care is an effective means of increasing its use and that among mothers who use day care it has a significant impact on maternal employment, particularly protecting mothers from losing employment during economic downturns.

FIGURE 2. CHANGE IN EMPLOYMENT BY TYPE OF WORK



Number of Hours Worked

We next examine the relationship between day care and number of hours mothers spend working. We used tobit models to assess differences in the number of hours worked by study arm among all mothers (top panel of Table 4). We found that mothers who received and used the vouchers worked approximately three more hours per week than mothers who did not receive vouchers, but these differences are not statistically significant in any model specification (Models 1 to 4).

TABLE 4— EFFECTS OF INTERVENTION AND DAY CARE USE ON NUMBER OF HOURS WORKED PER WEEK

	Unadjusted Models						Adjusted Models[a]			Change Models		
Intent-to-Treat-- All Mothers	**Model 1**			**Model 2**			**Model 3**			**Model 4**		
	ME	**Robust S.E.**	**Sig.**	**ME**	**Robust S.E.**	**Sig.**	**ME**	**Robust S.E.**	**Sig.**	**Coef.**	**Robust S.E.**	**Sig.**
AnyV	3.00	2.28					2.47	2.05		2.96	2.45	
V				3.14	2.62							
VQ				2.87	2.56							
Controls included	No			No			Yes			No		
Model used	Tobit			Tobit			Tobit			OLS		
Obs.	736			736			732			734		
F-stat	1.66			0.84			10.23			0.00		
Intent-to-Treat--Working Mothers	**Model 5**			**Model 6**			**Model 7**			**Model 8**		
	Coef.	**Robust S.E.**	**Sig.**	**Coef.**	**Robust S.E.**	**Sig.**	**Coef.**	**Robust S.E.**	**Sig.**	**Coef.**	**Robust S.E.**	**Sig.**
AnyV	-4.85	2.45	*				-6.12	2.79	*	-4.03	3.50	
V				-3.37	2.70							
VQ				-6.22	2.73	*						
Controls included	No			No			Yes			No		
Model used	OLS			OLS			OLS			OLS		
Obs.	402			402			293			295		
F-stat	3.92			2.64			3.06			1.33		
Treatment-on-Treated--Working Mothers	**Model 9**			**Model 10**			**Model 11**			**Model 12**		
	Coef.	**Robust S.E.**	**Sig.**	**Coef.**	**Robust S.E.**	**Sig.**	**Coef.**	**Robust S.E.**	**Sig.**	**Coef.**	**Robust S.E.**	**Sig.**
AnyDC	-19.54	10.34	†				-22.64	10.95	*	-14.64	13.07	
RDC				-14.97	11.02							
QDC				-19.50	10.09	†						
Controls included	No			No			Yes			No		
Model used	OLS			OLS			OLS			OLS		
Obs.	402			402			293			295		
Wald/F-stat	3.57			5.07			75.72			1.26		

a: Adjusts for mothers' age, education, ethnicity, marital status, migrant status, household wealth, household composition, village, and lagged dependent variable.

Sig. †p<0.10, *p<0.05, **p<0.01, ***p<0.001

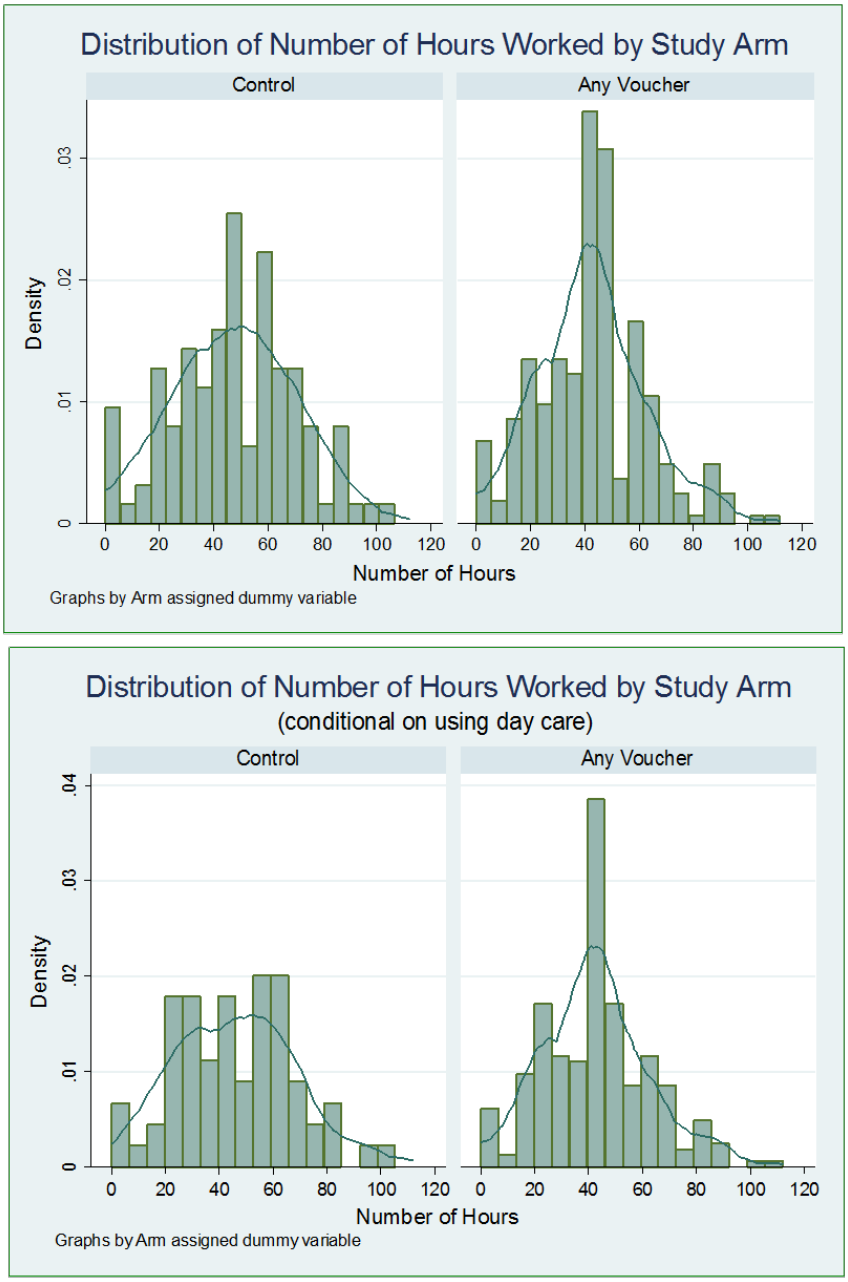
In contrast, when we limited the sample to mothers who were working at baseline (middle panel), we find, as expected, that mothers who received the vouchers worked significantly fewer hours than mothers in the control group. The effect size is nearly five hours per week in the unadjusted model (Model 5) and over six hours in the fully adjusted model (Model 7). The effect is concentrated among mothers in the VQ arm of the study (Model 6). However, even though the number of hours worked by mothers in the VQ arm is nearly double those in the V arm, the difference is not statistically significant. Model 8, which shows the change in number of hours worked between baseline and endline, restricts our sample to less than 300 mothers who worked at both baseline and endline. Although the differences are no longer statistically significant, the coefficient on being in the intervention group remains negative.

Our TOT models (bottom panel of Table 4) show even larger effects. Using day care was associated with working nearly 20 fewer hours per week (p=0.059) in the unadjusted model (Model 9). After adjusting for baseline characteristics, this difference rises to over 22 hours per week. However, as with our ITT models, the difference in the change in hours worked is not significant, possibly because of a reduced sample size.

Further analyses help explain the direction and magnitude of these effects. One possible explanation is that a larger fraction of mothers given vouchers were new labor participants, who relied more heavily on part-time work (i.e. <= 20 hours per week). However, a similar proportion of mothers receiving vouchers (15.1%) and those not receiving vouchers (13.3%) were working part-time. Moreover, the effects persist even when we limit the analyses to mothers who worked at both baseline and endline. In contrast, there is a striking difference in the portion of working mothers who worked for more than 60 hours a week (27.4% of women in the control arm compared to 15.5% in the intervention arms, p=0.006). These findings are consistent with a strong "income effect" that predicts that mothers receiving subsidized day care will work fewer hours (and consume more leisure). Mothers receiving the vouchers appear to be especially likely to cut back working extended hours.

In addition to a possible income effect, there is some evidence that the fixed nature of day care provision, which is usually set at 40 hours per week, may also impact the number of hours women work. Figure 3 shows the distribution of hours worked by mothers in the control arm and those who received a voucher. The top two histograms show remarkably different distributions of hours worked by study arm. Mothers who did not receive vouchers had a roughly normal distribution of hours centered around 50 hours. In contrast, mothers who received vouchers had a left-skewed distribution with a clear and rapid decline in mothers working more than 50 hours. When we limit these graphs to mothers who were using day care services (bottom graphs), the peak around 40 hours becomes even more pronounced for mothers who received a voucher.

FIGURE 3. NUMBER OF HOURS WORKED BY STUDY ARM



Effects on Maternal Income

Our final set of analyses examines the relationship between subsidized child care and mothers' earnings. Because mothers receiving vouchers were more likely to be employed, it is not surprising that our tobit models in the top panel show that receiving subsidized child care is associated with a significant increase in the log of maternal income in Models 1 to 4. As in our previous analyses, the effects for mothers in the VQ arm are larger, but not significantly different, than those for mothers in the V arm of our study.

TABLE 5— EFFECTS OF INTERVENTION AND DAY CARE USE ON MATERNAL INCOME PER MONTH (LOGGED)

	Unadjusted Models						Adjusted Models[a]			Change Models			Adjusted Models[b]		
Intent-to-Treat--All Mothers	**Model 1**			**Model 2**			**Model 3**			**Model 4**			**Model 5**		
	ME	**Robust S.E.**	**Sig.**	**ME**	**Robust S.E.**	**Sig.**	**ME**	**Robust S.E.**	**Sig.**	**Coef.**	**Robust S.E.**	**Sig.**	**ME**	**Robust S.E.**	**Sig.**
AnyV	0.83	0.37	*				0.68	0.33	*	0.78	0.39	*	0.69	0.19	***
V				0.74	0.43	†									
VQ				0.92	0.43	*									
Controls included	No			No			Yes			No			Yes		
Model used	Tobit			Tobit			Tobit			OLS			Tobit		
Obs.	738			738			736			738			734		
F-stat	4.722			2.462			10.30			0.006			46.24		
Intent-to-Treat--Working Mothers	**Model 6**			**Model 17**			**Model 8**			**Model 9**			**Model 10**		
	Coef.	**Robust S.E.**	**Sig.**	**Coef.**	**Robust S.E.**	**Sig.**	**Coef.**	**Robust S.E.**	**Sig.**	**Coef.**	**Robust S.E.**	**Sig.**	**Coef.**	**Robust S.E.**	**Sig.**
AnyV	0.11	0.21					0.35	0.25		0.28	0.46		0.56	0.24	*
V				0.12	0.23										
VQ				0.10	0.23										
Controls included	No			No			Yes			No			Yes		
Model used	OLS			OLS			OLS			OLS			OLS		
Obs.	404			404			297			299			295		
F-stat	0.29			0.14			1.23			0.38			1.63		
Treatment-on-Treated--Working Mothers	**Model 11**			**Model 12**			**Model 13**			**Model 14**			**Model 15**		
	Coef.	**Robust S.E.**	**Sig.**	**Coef.**	**Robust S.E.**	**Sig.**	**Coef.**	**Robust S.E.**	**Sig.**	**Coef.**	**Robust S.E.**	**Sig.**	**Coef.**	**Robust S.E.**	**Sig.**
AnyDC	0.45	0.84					1.31	0.89		1.02	1.67		2.04	0.89	*
RDC				0.48	0.93										
QDC				0.45	0.84										
Controls included	No			No			Yes			No			Yes		
Model used	OLS			OLS			OLS			OLS			OLS		
Obs.	404			404			297			299			295		
Wald	0.29			0.29			31.15			0.37			44.12		

a: Adjusts for mothers' age, education, ethnicity, marital status, migrant status, household wealth, household composition, village, and lagged dependent variable.

b: Adjusts for all variables specificed in a plus number of hours worked per week

Sig. †p<0.10, *p<0.05, **p<0.01, ***p<0.001

This relative increase in earnings among mothers receiving vouchers was primarily driven by higher levels of employment. When we limit our analyses to working mothers (middle panel), we find that positive but non-significant effects for receiving vouchers in all model specifications (Models 6 to 9). Similarly, there are no significant TOT effects (Models 11 to 14). These results are not surprising given that among working mothers, those who received vouchers worked around five fewer hours per week and those using day care worked roughly 20 hours less.

In our final set of analyses, we adjusted for this variation by including a control for the total number of hours worked in the last week along with other mother and household characteristics (Models 5, 10, and 15). In our analysis of all mothers (Model 5), we found that mothers who received vouchers earned significantly more than mothers who did not. In addition, among mothers who were working, mothers who received vouchers (Model 10) and those who used the vouchers for day care (Model 15) had higher incomes than mothers in the control group after adjusting for differences in the number of hours worked. Hence, providing subsidized day care for working mothers may not induce them to increase or maximize their total earnings, but it does appear to enable them to curtail working excessively long hours without significantly reducing their earnings.

Discussion

In this study, we examined whether women's child care responsibilities act as a barrier to their ability to benefit from economic opportunities. Specifically, we investigated whether offering mothers living in urban slums in sub-Saharan Africa subsidized ECC could be an effective strategy to increase their employment and enhance their economic well-being. Our study reveals a very high demand for ECC services even for younger children (i.e. those younger than three years). More than half of the mothers in our control group (57.7%) started using day care. Yet, uptake among mothers who were given subsidized day care was 42.9% higher, resulting in over 80% of mothers in the intervention arms using day care services. These findings demonstrate that center-based child care is an important and acceptable means of child care for mothers living in these slum areas. Moreover, although these programs are relatively inexpensive (about $5 USD per month), the 25 percentage point difference in day care use, indicates that costs act as an important barrier to use.

Removing this barrier could significantly increase maternal employment. Consistent with our expectations, we found that mothers who were given vouchers for day care were 8.5 percentage points (or 17.3%) more likely to be employed than mothers who were not given vouchers. For mothers who actually used day care services, this effect rose to over 20 percentage points. These findings counter common perceptions that mothers' child care responsibilities in sub-Saharan Africa do not impede their labor force participation either because they can easily combine child care and work or because there is a "surplus" of female kin available for free child care. In fact, our results are remarkably consistent with previous studies in North America, Europe, and Latin

America, showing that subsidized day care increases maternal employment by roughly 10 percentage points overall and over 20 percentage points among mothers who use ECC services (; Berlinski and Galiani 2007; Baker et al. 2008; Barros et al. 2011; Angeles et al. 2012; Calderon 2012; Geyer et al. 2014; Brilli et al. 2016; Jain 2016).

In addition, because receiving vouchers induced more mothers to work (and in the context of this study to remain working), the average mother in the intervention arms earned more income than those in the comparison group. Furthermore, among working mothers, we find that mothers who had access to subsidized child care were able to work fewer hours than those in the control group without earning less. Given scarce opportunities for higher wages, it is not surprising that in this context the income effect dominates and mothers given subsidized child care reduce the number of hours they spend working compared to mothers who must pay for child care. Mothers given vouchers appear to be especially less likely to work more than 60 hours a week. This finding suggests that these mothers have more time to spend on their leisure, child care, or other domestic and social activities. However, it does not significantly increase their earnings relative to working mothers who did not receive the voucher. In short, subsidized child care can have a significant effect on the likelihood of finding (or keeping) a job (external margin) and thereby improves the economic well-being of these women. However, conditional on being employed, vouchers do not encourage women to work longer hours or to earn more income (internal margin).

Lastly, it is worth noting that the quality of child care had little influence on maternal labor market engagement. The effects were sometimes larger for mothers given vouchers for the quality-improved centers, but these differences were never significant. There are several possible explanations for these findings. First, the improvements made through our program may have been relatively small compared to the general pre-existing heterogeneity across facilities. Second, both regular and quality-improved centers received small monthly stipends, which could have been used to improve services. Perhaps more importantly, both types of centers could depend on a steady and reliable source of income via reimbursements for the vouchers from the project. Many child care providers commented that prior to our study payment from mothers was often late and erratic. As a result it was difficult for them to budget for improvements or buy food and supplies in bulk. Hence, it is possible that government-sponsored ECC, if reliably funded, could offer consistently higher quality day care than privately funded initiatives with irregular funding streams. Lastly, care child providers in our VQ centers may have shared lessons learned about child development and practical means of making toys and educational materials from locally available materials with their colleagues in control and V centers introducing “contamination” among the centers. Hence, from our findings, one should not hastily draw the conclusion that quality of care does not matter. In fact, both mothers and care providers repeatedly stressed the importance of both safety, health, and educational training. Rather in this context, cost appears to be the larger barrier to accessing care.

Given the rapid increase in non-agricultural job options coupled with the stalling decline in fertility rates, many women in sub-Saharan Africa will face a growing conflict between child care and paid

work responsibilities. Our findings are among the first to show that women's disproportionate child care responsibilities limit their economic engagement and to propose an effective means of reducing these gender inequalities. Given a gender gap in labor force participation of 10 percentage points in Kenya, our study suggests that providing subsidized child care could nearly equalize male and female employment rates, at least in poor urban environments (World Bank 2017). Whether subsidized day care would have a similar effect in more rural Africa is unknown. There is emerging evidence that its effects may be slightly smaller, but still significant (Martinez et al. 2012).

Failing to address inequalities in women's unpaid work, including child care, can have detrimental long-term effects. As Folbre (2014) points out "it may perpetuate the underutilization of women's capabilities and discourage the development of efficient forms of social insurance and public care provision" (pg. 129). Moreover, private provision of child care tends to exacerbate gender inequalities. Studies show that day care costs act as a "wage tax" for women, who calculate their potential income as earnings *minus child care costs*. Men rarely make similar deductions when considering their potential earnings. In addition, it has been argued that private child care provision disadvantages the poor for whom child care costs represent a disproportionate share of their income (Mattingly et al. 2016). Studies from high income countries suggest the public economic benefits reaped through increased maternal employment as well as through longer-term investments in the human capital development of children far outweigh the costs of ECC programs (Heckman, Leaf, and Prados 2016). In addition to raising household incomes and national GDPs, greater maternal employment may have other benefits as well. For example, another study in Nairobi showed that working mothers were more likely than non-working mothers to use health facilities when their child was ill (Taff et al. 2005). Although, to the best of our knowledge, careful cost-benefit analyses have not been conducted in sub-Saharan Africa, findings from this study suggest that subsidizing child care could be an effective means of promoting women's economic equality and fostering broader economic development goals.

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Appendices

APPENIX A. CHARACTERISTICS OF WOMEN LOST-TO-FOLLOW UP

	Total	Interviewed in Wave 2	Interviewed in Wave 1 Only	Sig.
n	***849***	***738***	***111***	
Intervention Variable				
Study Arm				
Control	33.0	31.3	44.1	**
V	33.5	33.9	30.6	
VQ	33.6	34.8	25.2	*
Dependent Variables				
Paid Work (%)	57.1	57.2	56.8	
Hours per Week (if working) (mean)	40.2	39.9	41.7	
Mothers Income per Month (if working) (mean)	4778.1	4688.6	5377.6	
Independent Variables				
Age (mean)	28.8	29.1	27.0	**
Education (%)				
Madrasa	12.8	14.4	2.7	**
Some Primary	25.2	24.3	31.5	
Completed Primary	40.1	39.7	42.3	
Secondary+	21.9	21.7	23.4	
Wealth Index-Quintiles (%)				
First (poorest)	21.8	21.7	22.5	
Second	21.4	20.2	29.7	*
Third	18.4	18.8	15.3	
Fourth	19.3	19.2	19.8	
Fifth (least poor)	19.1	20.1	12.6	†
Currently Married (%)	76.5	76.7	75.5	
Recent Migrant (%)	19.4	18.7	24.3	
Ethnicity (%)				
Kikuyu	27.8	28.6	22.5	
Luo	23.6	22.4	31.5	*
Luhya	18.6	17.1	28.8	**
Kamba	7.0	8.0	1.8	*
Somali	18.9	20.2	9.9	*
Other	4.0	3.8	5.4	
Any Older Females (%)	40.1	40.7	36.0	
Any Other Young Children (%)	41.5	42.6	34.2	†
Villiage (%)				
Gitathuru C	13.7	13.1	17.1	
Grogan A	8.0	8.1	7.2	
Grogan B	5.4	5.7	3.6	
Highridge	27.8	28.1	26.1	
Korogocho A	15.1	15.6	11.7	
Korogocho B	5.8	5.7	6.3	
Nyayo/Kisumu	24.3	23.7	27.9	

Significance tested with Chi-squared for categorical variables and t-tests for continuous variables.

Sig. †p<0.10, *p<0.05, **p<0.01, ***p<0.001

APPENDIX B. SENSITIVITY CHECKS FOR THE EFFECTS OF INTERVENTION AND DAY CARE USE ON MATERNAL EMPLOYMENT

	Unadjusted Models						Adjusted Models[a]		
Treatment-on-Treated	**Model 1**			**Model 2**			**Model 3**		
	Coef.	**Robust S.E.**	**Sig.**	**Coef.**	**Robust S.E.**	**Sig.**	**Coef.**	**Robust S.E.**	**Sig.**
AnyDC	0.34	0.16	*				0.29	0.15	*
RDC				0.31	0.17	†			
QDC				0.35	0.17	*			
Controls included	Yes			No			Yes		
Model used	IVregress			IVregress			IVregress		
Obs.	738			738			736		
Wald	4.37			4.62			503.70		
Treatment-on-Treated	**Model 4**			**Model 5**			**Model 6**		
	ME	**Robust S.E.**	**Sig.**	**ME**	**Robust S.E.**	**Sig.**	**ME**	**Robust S.E.**	**Sig.**
AnyDC	0.31	0.12	**				0.26	0.12	*
RDC				0.24	0.11	*			
QDC				0.27	0.10	*			
Controls included	Yes			No			Yes		
Model used	Ivprobit			Ivprobit			Ivprobit		
Obs.	738			738			736		
Wald	5.32			5.36			200.36		

a: Adjusts for mothers' age, education, ethnicity, marital status, migrant status, household wealth, household composition, village, and lagged dependent variable.

Sig. †p<0.10, *p<0.05, **p<0.01, ***p<0.001

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