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Empowering women: how Mexico's conditional cash transfer programme raised prenatal care quality and birth weight

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Data from a controlled randomised trial are used to estimate the effect of Mexico's conditional cash transfer programme, Oportunidades, on birth outcomes, and to examine the pathways by which it works. Birth weights average 127.3 grams higher, and low birth weight incidence is 44.5 per cent lower among beneficiary mothers. Better birth outcomes are explained entirely by better quality prenatal care. Oportunidades affected quality through empowering women with information about adequate healthcare content to expect better care, and with skills and social support to negotiate better care. Efforts to empower the less well-off are necessary for public services to fully benefit the poor.

Keywords: public policy; evaluation; poverty; Mexcio

1. Introduction

Low birth weight affects 20 million infants annually, and over 95 per cent of this burden occurs in less developed nations (World Health Organization 2004). Reducing low birth weight is a global health priority because of its consequences on neonatal and infant mortality, morbidity and mortality during childhood and adolescence, adult chronic conditions and economic productivity (Ashworth 1998, Moore *et al.* 1999, Prentice *et al.* 2005, Alderman and Berhman 2006). Recommended interventions to reduce low birth weight include increasing prenatal care utilisation, improving the quality of prenatal care, and addressing maternal nutritional deficiencies (Institute of Medicine 1985, Alexander and Korenbrot 1985, Merialdi *et al.* 2003, Bhutta *et al.* 2005).

One programme with potential to improve birth weight outcomes is conditional cash transfers (CCT). Many governments have turned to CCTs as a means of improving the health and schooling of children born into poor families (Lagarde *et al.* 2007). In general, CCT programmes use money as an incentive for parents to invest in their children's human capital, thereby enabling their children to have the capabilities to escape poverty when they reach adulthood. With respect to maternal and child health, CCTs typically condition the cash transfer on obtaining prenatal care, and on participating in classes that educate mothers about prenatal care and proper nutrition, as well as encourage them to demand quality prenatal care.

We use data from a controlled randomised trial to evaluate the impact of Mexico's CCT programme, Oportunidades, on the birth weight of children from poor rural families and

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examine the pathways by which the improvements occurred. We find that the programme increased birth weight by 127.3 grams and reduced the incidence of low birth weight by 4.6 percentage points, which represents a 44.5 per cent reduction in low birth weight. We then examine three possible pathways for the programme's impact: increased utilisation of prenatal care, improved quality of prenatal care, and maternal nutrition. We find that the improvements in birth weight are entirely attributable to the programme's impact on quality.

Our analysis supports the hypothesis that Oportunidades affected quality through empowering women to insist on better care by informing them of what content to expect, and by giving them skills and social support to negotiate better care from healthcare providers. These results are further supported by qualitative research that beneficiaries report increased self-confidence, and positive attitudinal changes with regard to healthcare, prevention and self-care, and patient participation (Adato *et al.* 2000b). In fact, medical doctors reported that 'beneficiaries are the ones who request the most from us' and that they are 'very demanding' (Adato *et al.* 2000a, 91, 188). We acknowledge that we cannot separate out the effect of information alone from the social support to act on that knowledge. Oportunidades provided beneficiaries with both information and the will to take actions that positively affected their welfare.

Our results are consistent with the theory of economics and identity (Akerlof and Kranton 2000, 2002). This theory argues that one's sense of self can affect payoffs and economic outcomes. In the case of poverty and social exclusion, if poor and minority families view themselves as undeserving – and healthcare providers hold similar views –then the less well-off will not fully benefit from public services such as health and education. Qualitative research in Mexico supports this theory, reporting that low-income women are resigned to receiving poor quality healthcare (Tezoquipa *et al.* 2005). The explicit intervention to educate mothers to insist on their rights is, in effect, to change their identity in their own eyes and in the eyes of the medical care providers.

The policy implication of our results is that efforts to empower the less well-off and change their 'identity' are necessary for public services to fully benefit the poor. Indeed, a major problem in access to healthcare and other public services is that poor, uneducated and minority beneficiaries may not know their healthcare rights or believe that they are entitled to those rights from healthcare providers.[1] These results support the goal of the specific recommendations put forward in the *World Development Report* to make public services, such as healthcare, more accountable to clients – especially the less well-off (World Bank 2004).

Our results also contribute to the growing body of evidence that CCTs have greatly improved child health and nutritional outcomes. Across diverse settings, CCTs have been successful in reducing child mortality, anaemia, diarrhoea, acute respiratory infections, and stunting (Morris *et al.* 2004, Maluccio and Flores 2004, Lagarde *et al.* 2007). The CCT in rural Mexico has resulted in reductions in child morbidity, mortality, and anaemia, and in improvements in child height for age and physical functioning (Gertler 2004, Rivera *et al.* 2004, Barham 2006, Fernald *et al.* 2008). However, none of these studies evaluates the programme's impact on birth weight or tries to sort out the specific pathways by which CCT programmes are effective. Our paper is the first to document the impact on birth weight, and to examine empowerment and quality of care as mechanisms.

Finally, this paper contributes to the surprisingly small literature on the effect of the quality of prenatal care on birth weight (Carroli *et al.* 2001). Several observational cross-sectional studies report positive associations between the clinical content of prenatal care and birth outcomes. US women that did not receive all components of nationally recommended health advice were more likely to have a low birth weight infant compared with

women who received the optimal level of advice (Kogan *et al.* 1994). Having access to a more complete prenatal examination was associated with higher birth weight in Jamaica (Peabody *et al.* 1998); failure to comply with clinical standards was a strong predictor of perinatal mortality in Mexico (Cruz-Anguiano *et al.* 2004). Using panel data from Indonesia, Barber and Gertler (2009) try to sort out causality, and find that improvements in adherence to prenatal and childcare clinical guidelines were associated with improvements in child height. Even though improving quality of prenatal care is frequently promoted, the evidence base remains weak.

This paper is organised into several sections. We first describe the Oportunidades programme, the benefit structure, and health and nutrition requirements. We then discuss the epidemiology of birth weight in low-income settings and how Oportunidades could improve birth weight. Third, we examine the magnitude of the reduced-form programme impact on birth weight, and the pathways by which the programme could have worked. The paper concludes with a discussion of policy implications.

2. Oportunidades

In 1997, Mexico established Oportunidades (originally called PROGRESA), a programme designed to address short-term and long-term poverty.[2] Oportunidades provides cash transfers conditional on family members, especially pregnant women and young children, obtaining preventive medical care from public clinics, on attending *pláticas* (educational talks) about health-related topics, and on school-aged children attending school. The income transfer is meant to address immediate needs such housing, food security and medical care needs, whereas conditioning the transfer on health and education is intended for investments in children's human capital. As a result, when children reach adulthood, they will have the capabilities to take advantage of labour market opportunities and to pull themselves out of poverty. In this sense, Oportunidades was designed to break the intergenerational transmission of poverty. Oportunidades is one of the largest programmes of its kind. In 2004, it distributed approximately US$3 billion to more than five million households – including approximately one-third of all rural families in Mexico.

2.1. Cash transfer structure

Participating households receive cash transfers conditional on preventive health activities and children attending school (SEDESOL 2009a, 2009b). The monthly health stipend is conditional on each family member obtaining regular preventive medical care consultations and *pláticas,* or health education sessions. The principal beneficiary, usually the mother in the household, is also required to attend monthly programme meetings. The health transfer is fixed at approximately US$15 per household per month regardless of the number of household members or their health requirements. The education transfer is paid per child, and the amount varies by school grade and gender of the child. The transfer starts in the third grade and is conditional on 85 per cent attendance and on not repeating a grade. The stipend rises substantially after completion of primary school and is higher for girls during junior high and high school. The maximum total monthly transfer was capped at approximately US$90 and US$160 for families with primary and high school children, respectively. Total transfers for health and education averaged 17 to 20 per cent of pre-programme rural per-capita household consumption (Gertler *et al.* 2006).

Oportunidades requires that households prove compliance via certification at public clinics and schools (Adato *et al.* 2000a). Within the health facility, a beneficiary is provided

an appointment book detailing the health requirements for all family members. One part of the form is kept at the clinic to record attendance and another part is returned to the beneficiary as proof of registration and attendance. An estimated one per cent of households were denied the cash transfer due to non-compliance.

A unique feature of the programme is the deliberate decision to give the cash transfers directly to the female head of household. This decision was based on the expectation that resources given to women would more likely be spent on improvements in health and nutrition within the family.

2.2. *Healthcare requirements and nutritional supplements*

The Oportunidades health requirements are extensive (SEDESOL 2003). They identify not only the number of visits, but also the content of care by age group. Specifically for pregnant women, five prenatal visits are required, with an emphasis on monitoring the pregnancy's progression and on the prevention, detection, and control of obstetric and perinatal risk factors. Two additional postpartum visits correspond with the newborn check-ups at seven and 28 days, and include family planning and maternal nutritional advice.

In addition to obtaining healthcare, nutritional supplements are given to pregnant and lactating women, all children aged between four months and two years, and malnourished children between the ages of two and five years. The programme developed two types of supplements to meet the separate nutritional needs of pregnant women and children. The main ingredients include whole dry milk, sugar, maltodextrin, vitamins, minerals, and artificial flavours and colours.[3] Beneficiaries collect a one-month's supply of supplements at the health clinics for each targeted family member.

2.3. *Empowerment*

Oportunidades explicitly tries to empower women to take control of their lives and improve health outcomes through a series of activities. The first activity is *pláticas,* or educational meetings about health improvements, public services available to beneficiaries, and their right to access those services. The second is help in making and keeping appointments with healthcare providers as well as providing necessary skills to get the most out of those appointments through a network of *promotoras*. Third, social support is available through *faenas*, *or* community activities.

The programme mandates attendance at monthly *pláticas,* or health education meetings (Adato *et al.* 2000a). Up to 25 themes are discussed, and many *pláticas* emphasise prevention and reduction of health risks, including immunisations, sanitation, and appropriate homecare during illnesses. *Pláticas* are mainly directed at mothers as primary caregivers but are open to other family members and non-beneficiaries. Relevant to this study, pregnant women are required to attend *pláticas* in which information is provided about what to expect from prenatal care consultations, the clinical content of this care, maternal nutrition, and other reproductive health information.

Monthly meetings also occur between beneficiary women and *promotoras*. *Promotoras* are beneficiary women elected to act as a liaison between Oportunidades and the beneficiary communities. *Promotoras* receive training about how the programme operates, and convey new programme information, answer questions, and complete monitoring forms. In health, they also carry out patient appointment reminders and establish a communication link between the health centres and beneficiaries. The monthly meetings aim to ensure that the programme's objectives and requirements are explicitly announced and understood, and to

encourage women to ask for their right to health and educational services. These meetings are designed to provide beneficiaries with information and skills to obtain the full benefits of public services.

Faenas are monthly voluntary work activities that involve community improvements, such as cleaning up schools, streets, or health clinics. While *faenas* were in place before the programme, *promotoras* also encourage Oportunidades beneficiaries to participate. *Promotoras* together with health workers make a link to programme benefits, and *faenas* are an incentive for beneficiaries to participate in activities that improve community sanitation and promote social cohesion (Adato *et al.* 2000b).

The *pláticas* provide health information and information about the right to public services, and the regular meetings with the *promotoras* make explicit the programme benefits and entitlements. Both the meetings and the *faenas* provide an opportunity for women to discuss personal or community issues and to strengthen social support mechanisms. It is intended that these activities increase women's capabilities to take action that positively affects their health, welfare, and living standards. Qualitative research suggests that the programme did indeed succeed in empowering beneficiaries. Both the *promotoras* and beneficiaries reported increased self-confidence as well as freedom of movement and association (Adato *et al.* 2000b).

2.4. Beneficiary enrolment and duration of benefits

The rural Oportunidades programme established eligibility in two stages (Skoufias *et al.* 1999). First, the programme identified underserved or marginalised communities, and then it identified low-income households within those communities. Poor communities were selected using a marginalisation index constructed from 1990 and 1995 census data measuring adult literacy; basic household infrastructure such as running water, drainage, electricity, and dirt floors; number of housing occupants; and the agricultural labour force.

Within poor communities, a socio-economic survey was conducted to identify eligible households using a proxy means test from data about household demographics and physical structure; individual socio-economic characteristics, occupation, income, and disability; and access to health services. Households classified as poor were eligible for participation. The original classification scheme designated approximately 52 per cent of households as eligible.

Some 97 per cent of eligible households living in treatment localities enrolled in the programme (Rivera *et al.* 2004). Once enrolled, households received benefits for three years conditional on meeting programme requirements. To prevent migration into treatment communities, new households were unable to enrol until the next certification period. Households in rural areas were recertified by proxy means tests after three years to determine future eligibility and continued receipt of programme benefits. Ineligible households were still guaranteed three more years of support followed by three years of transitional support. Thus, households could expect a minimum of nine years of programme benefits upon enrolment.

3. Pathways to improved birth weight

In this section, we provide an overview of the pathways by which Oportunidades is hypothesised to affect birth weight. The main contributors to low birth weight are preterm birth (<37 weeks gestation) and intra-uterine growth restriction (IUGR) (defined as less than 2500 grams at full gestational age). While preterm birth accounts for the vast majority of

low-birth-weight infants in high-income countries (Blondel *et al.* 2002), IUGR accounts for most low birth weights in low-income settings such as the Oportunidades' beneficiary populations (de Onis *et al.* 1998, Kramer 2000). IUGR is attributable to low maternal nutritional intake, low pre-pregnancy body mass index, hypertensive disorders, and other untreated illnesses and infections (Kramer 1987, 2003, Bergström 2003). The main interventions to improve birth weight in this setting, therefore, are improved maternal nutrition and the prevention and treatment of conditions during pregnancy.

3.1. Nutrition

First, Oportunidades could have improved birth weight through better maternal nutrition. Improving dietary intake is promoted to address weight gain before and during pregnancy. Balanced protein-energy supplements have been demonstrated in randomised controlled trials to reduce the risk of low birth weight by 30 per cent (Merialdi *et al.* 2003). Specific micronutrients including magnesium, calcium, and Vitamin A also promote higher birth weight (Merialdi *et al.* 2003, Bhutta *et al.* 2005).

Nutritional improvements are a key Oportunidades programme component. In addition to the healthcare requirements, pregnant and lactating women are given nutritional supplements as part of programme participation. However, operational problems may have reduced the impact of the supplements. A study of the acceptability of the nutritional supplements for the Oportunidades programme reported that participants experienced nausea, diarrhoea, and vomiting, which may have affected compliance (Zarco *et al.* 2006). Efforts to minimise such side effects by diluting the supplement may also have reduced its nutrient density. Other reports suggest substantial leakage due to a culture of sharing food. In addition, problems existed at the operational level in the distribution of the supplements, and shortages were reported at health centres (Adato *et al.* 2000a).

Another pathway by which the programme could have affected maternal nutrition is through the cash transfers. There is evidence that families spent a good portion of the Oportunidades cash transfer in purchasing food (Hoddinott and Skoufias 2003, 2004). They not only purchased more calories, but those calories were of higher quality in terms of fruits, vegetables, and proteins.

3.2. Prenatal care utilisation

The second possible pathway to improving birth weight is through use of prenatal care. The Oportunidades' requirements include five prenatal visits, which emphasise monitoring the pregnancy's progression, health education, and the prevention, detection, and control of obstetric and perinatal risk factors. While an increased number of prenatal care visits has been promoted as a means to improve birth outcomes (Alexander and Korenbrot 1995), the evidence supporting this recommendation is weak. In their review of randomised controlled trials, Carroli *et al.* (2001) identify two published studies conducted in developing countries. The largest is a multisite evaluation of urban clinics in Argentina, Cuba, Saudi Arabia, and Thailand, which compared standard prenatal care averaging eight visits with four to six goal-oriented visits (Villar *et al.* 2001). They report no significant differences in low birth weight or urinary tract infection, and slightly higher rates of pre-eclampsia in the shorter, goal-oriented model. The second trial was conducted over a two-year period in Harare (Munjanja *et al.* 1996). It randomised women into a shorter goal-oriented programme (four compared with six visits), and found no significant differences in birth weight, or perinatal and maternal morbidity and mortality.

3.3. Healthcare quality

In contrast with the number of prenatal care visits, the clinical content or quality is likely to be important in improving birth weight. Evidence-based practice guidelines for prenatal care procedures are well established (Institute of Medicine 1985). Their importance can be illustrated with the example of anaemia. Anaemia results from different factors including nutritional deficiencies and infectious diseases. However, iron supplements during pregnancy have been demonstrated to be effective in reducing maternal anaemia, in increasing mean birth weight, and in reducing the incidence of low birth weight (Villar *et al.* 2003). Measuring haemoglobin levels can detect moderate to severe anaemia that requires additional attention beyond routine supplementation. Iron-deficiency anaemia at full gestational age has been reported at 40 per cent and higher in Mexico (Shamah-Levy *et al.* 2003). However, less than one-half (49%) of women in our sample reported having a blood sample taken during prenatal visits – ranging from 26 to 62 per cent by clinical setting. This suggests that encouraging healthcare providers to conduct evidence-based procedures could have a positive health impact.

These findings are consistent with previous studies demonstrating substantial practice variation in Mexico and elsewhere (Das and Hammer 2005). In urban Mexico, private practitioners adhered to 33.2 per cent of recommended clinical practice guidelines compared with 88.2 per cent among practitioners at social security clinics (Barber 2006). In rural Mexico, the percentage of healthcare providers asking about bleeding during pregnancy (a serious danger sign) ranged from 57 to 82 per cent (Barber *et al.* 2007a). In Mexico City hospitals, 27 per cent of providers conducted three or less procedures out of six essential activities to be offered to all women during prenatal visits (Coria-Soto *et al.* 1996).

Oportunidades could have resulted in higher quality of care because of increased awareness and expectations encouraged by the *pláticas* and meetings with *promotoras*. During pregnancy, women attended monthly *pláticas* to improve knowledge of the importance of prenatal and postnatal healthcare. In addition, monthly meetings with *promotoras* aim to explicitly describe the health requirements and ensure that participants demand their benefits. Therefore, the programme could have increased the quality of healthcare received by promoting more informed and active healthcare consumers. In qualitative interviews, medical doctors reported positive changes in beneficiary attitudes about healthcare, prevention and self-care, and patient participation, as well as pressure on medical doctors to respond to beneficiary healthcare demands (Adato *et al.* 2000a).

4. Experimental design and data sources

An important advantage of the rural Oportunidades programme is that a controlled randomised evaluation was carried out early in its implementation to determine programme impact. The evaluation was based on a sample of 506 communities in seven states, which were among the first to receive programme benefits (Berhman and Todd 1999). The 506 treatment communities ranging from 500 to 2500 residents were randomly selected using probabilities proportionate to the size of communities from a total of 6390 from seven states that were scheduled to be incorporated into the programme in two phases. Of these 506 communities, 320 were randomly assigned to the first phase and 180 to the second. Information about the timeline for implementation of benefits was not made public. Eligible households in treatment communities were scheduled to receive benefits in May

1998, and control communities started to receive benefits in December 1999. Attanasio *et al.* (2009) find no evidence of an anticipation effect.

Our primary source of data was collected in 2003 in the Encuesta de Evaluación (ENCEL), a survey commissioned by the Mexican Government to evaluate the medium-term impact of rural Oportunidades. The analyses here employ data from modules collecting socio-economic and fertility data from households. Complete fertility histories as well as the details of the most recent pregnancy were collected. We supplement the 2003 information with socio-economic data collected from a 1997 baseline survey of the same households collected prior to the intervention, and with data about programme incorporation and benefits distributed from Oportunidades administrative records.

While the socio-economic survey interviewed all households in the 506 communities, the fertility module was applied to a subsample. The subsample size was based on sufficient power to detect small differences in reproductive outcomes between beneficiaries in communities incorporated into the programme in May 1998 and those incorporated into the programme in December 2000 (CONAPO 2003). This survey used a two-stage stratified sampling design. Within each state, the target sample was based on the proportion of women of reproductive age across the three groups. In order to achieve the target sample size, 286 of 506 communities were randomly selected based on a probability sample proportionate to the number of women of reproductive age. Within each community, all households that had reproductive age women were surveyed, and a randomly selected woman was surveyed from each household if the household had more than one eligible woman. The fertility survey achieved 84 per cent completed interviews for the target sample; the most common reason cited for incompletion was not being at home, and 1.8 per cent refused to be interviewed. In these analyses, we focus on reports of prenatal services received by women that delivered a singleton live birth between 1997 and 2003. The sample includes 840 women who participated in the original randomised evaluation,[4] experienced a live birth between 1997 and 2003, and reported valid birth weights.

5. Did Oportunidades have an impact on birth weight?

The first set of analyses estimates the overall programme impact on birth weight in grams and low birth weight (<2500 grams). Birth weight data are obtained from maternal reports, and corroborated with birth certificates, maternal health cards, or other medical records. Valid birth weight data are available for 82 per cent of the sample. Maternal recall of birth weight is considered accurate for extended periods (O'Sullivan *et al.* 2000).

5.1. Empirical methods

We regress birth weight and the probability of low birth weight on a dummy variable identifying whether the women was a beneficiary at any time before delivering her most recent live birth. Because of the randomisation, this should provide a consistent estimate of programme impact. However, we also include controls for individual, household, and community covariates that have been identified as predictors of birth weight in other studies in order to reduce idiosyncratic variation and improve the power of the estimates. Since the level of randomisation was at the community level, we estimate the model by random effects clustered at the community level. In addition, to test the robustness of the results, we also estimate the models using community fixed effects.

The dummy variable indicating whether the women was a beneficiary before the birth was obtained using data detailing the timing of cash transfers received by beneficiaries based on household rosters and government administrative records. We compare eligible women that

delivered before receiving their first cash transfer (non-beneficiary births) with eligible women that delivered a live birth at any time after the household received their first cash transfer (beneficiary births). Some 20.5 per cent of eligible women delivered before receiving any cash transfers. On average, women in the sample participated in the programme for 2.8 years before delivery.

The control variables in the analyses include maternal and child characteristics from the fertility module, 1997 census, and administrative reports. Maternal and infant characteristics include maternal age, marital status at the time of the birth, the number of pregnancies prior to the birth, miscarriage or abortion prior to the birth, infant gender, whether the mother smoked during pregnancy, days weighed after birth, and whether the child was still alive at the time of the interview. The 1997 census provides data about socio-economic characteristics prior to intervention including educational level and age of the household head, indigenous-speaking households, household size, proportion of child and adolescent household members by sex and age group, household socio-economic index (whether the household owned land, their house, a refrigerator, a gas water heater, and a television, and had internal water and electricity), distance to an urban area, male and female community wages, and altitude.

5.2. *Results*

The randomisation succeeded based on the comparison of maternal, household, and community characteristics; our analyses use a balanced sample of beneficiaries and non-beneficiaries (Table 1). Of the 22 variables considered, there is only one significant difference at the five per cent level between the groups. Not surprisingly, the socio-economic frequencies demonstrate that the sample is restricted to a very poor population. On average, women were 29 years old at the time of delivery, had about six prior births but few miscarriages or reported smoking during pregnancy. The sample is also about one-third indigenous, and household heads had less than four years of education on average.

Table 2 reports the regression results predicting overall programme impact, and the first three models report the results for birth weight in grams. The first model regresses birth weight against the treatment dummy variable 'beneficiary' without any controls. The coefficient is the difference in the means of the two groups. Beneficiary births are 82 grams heavier than non-beneficiary births, but the difference is not statistically significant. In Model 2, we include the control variables described above. In this case, the estimates show a 127.3 grams programme impact on birth weight, which is different from zero at the 0.05 level. Since mean birth weight in the control group is 3166.9 grams, the estimated impact represents about a 4.1 per cent increase in the mean. Finally, the community fixed effects results reported in Model 3 are very similar to the random effects results. Based on Hausman test statistics reported in the last row, we cannot reject the random effects specification in favour of fixed effects.

Models 4–7 (Table 2) report the results for regressions predicting low birth weight. Models 4 and 5 report the estimated log odds from random effects probits, and Models 6 and 7 report the results from linear probability models estimated with random and fixed effects. The probit regression with no controls (Model 4) suggests a 19 per cent reduction in low birth weight, but the result is not significant. Adding the controls (Model 5), the beneficiary group had a 32 per cent reduction in the odds of low birth weight, and the difference is significantly different from zero at the 0.05 level. We re-estimate the model using a linear probability specification (Model 6) and find that beneficiaries had 4.6 percentage points lower low birth weight than the non-beneficiary group and the estimate is significant at the 0.05 level. Since mean low-birth weight in the non-beneficiary group was 10.3 per cent, this specification suggests that the programme reduced low-birth weight by 44.5 per cent. Model

Table 1. Comparison of non-beneficiary and beneficiary characteristics (n = 840).

Variables	Non-beneficiaries	Beneficiaries	Difference	p-value
Maternal and infant characteristics				
Maternal age (years)	29.48	29.22	–0.25	0.66
	[6.38]	[6.75]		
Total prior pregnancies	5.05	4.62	–0.43	0.04
	[2.42]	[2.59]		
Prior miscarriage or abortion (%)	8.05	6.61	–1.44	0.49
Mother smoked during pregnancy (%)	4.60	4.80	0.20	0.89
Days weighed after birth	3.37	2.48	–0.89	0.12
	[7.81]	[6.08]		
Alive at time of interview (%)	99.43	98.20	–1.23	0.26
Female (%)	43.68	46.85	3.17	0.49
Baseline household socioeconomics and demographics				
Household socioeconomic index (0–1)‡	0.42	0.41	–0.02	0.36
	[0.18]	[0.18]		
Indigenous-speaking household (%)	27.01	34.53	7.52	0.07
Household head years of schooling	3.70	3.60	–0.10	0.73
	[2.71]	[2.57]		
Age of household head (years)	41.32	40.17	0.15	0.15
	[8.91]	[9.92]		
Maternal schooling (years)	4.18	4.19	0.01	0.95
	[2.54]	[2.73]		
Household size	6.51	6.53	0.03	0.91
	[2.23]	[2.43]		
Males, age 0–5 years (proportion)	0.15	0.14	–0.01	0.40
Females, age 0–5 years (proportion)	0.16	0.14	–0.02	0.15
Males, age 6–17 years (proportion)	0.14	0.16	0.02	0.22
Females, age 6–17 years (proportion)	0.16	0.14	–0.01	0.25
Baseline community characteristics				
Altitude (meters)	1255.43	1333.69	78.26	0.34
	[855.58]	[805.35]		
Distance to urban centre (km)	106.42	107.91	1.49	0.75
	[43.94]	[43.16]		
Health centre in community (%)	78.13	81.23	3.10	0.32
Female wage (pesos per mo.)	163.38	178.25	14.87	0.72
	[507.28]	[576.46]		
Male wage (pesos per mo.)	221.10	267.29	46.19	0.42
	[1218.51]	[1140.06]		
Sample size	174	666		

Note: Standard deviations in parentheses. ‡Household socio-economic index is measuring ownership of land, their house, a refrigerator, a gas heater, a television, and internal water and electricity.

7 includes fixed effects and the estimates are similar. Again, we cannot reject the random effects specification in favour of fixed effects based on a Hausman test.

The coefficients on the control variables (not reported here) are consistent with results from other studies (Kramer 1987, 2000, 2003). Factors that predict higher birth weight or a decrease in the odds of low birth weight include maternal age and education for the mother and head of household. The proportion of females aged six to 17 years in the household is also a predictor of a decline in odds of low birth weight, independent of the number of prior births. Given traditional work and gender roles in rural Mexico, this could indicate assistance by adolescent children for household management that could reduce the mother's work

Table 2. Regression models estimating the Oportunidades programme impact on birth outcomes.

	Birth weight in grams			Low birth weight (<2500-g =1)			
	RE	RE	FE	RE probit (log odds)	RE probit (log odds)	RE linear probability	FE linear probability
	1	2	3	4	5	6	7
Beneficiary (=1)	81.9 [54.2]	127.3** [54.0]	101.8* [58.3]	–0.186 [0.154]	–0.323* [0.169]	–0.046** [0.024]	–0.044* [0.025]
Control variables							
Maternal/infant characteristics	No	Yes	Yes	No	Yes	Yes	Yes
Baseline household socioeconomic & demographic	No	Yes	Yes	No	Yes	Yes	Yes
Baseline community characteristics	No	Yes	Yes	No	Yes	Yes	Yes
Hausman test			0.26				0.75

Note: RE = random effects, FE = fixed effects. Coefficients and standard errors. Regressions include control variables listed in Table 1.
*Significant at the 0.10 level, **significant at the 0.05 level. Mean (standard deviation) birth weight of non-beneficiary group is 3166.9 grams (632.4). Non-beneficiary birth low birth weight is 0.103.

burden. Consistent predictors of either low mean birth weight or an increased probability of low birth weight include older maternal age, smoking during pregnancy, female infant, residing in an indigenous-speaking, distance to urban population centres, and wages of females in the community. Higher wages of females in the community could be related to negative birth outcomes because of an increase in physical or emotional stress during pregnancy or possibly exposure to occupational health hazards.

The magnitude of these results compares well with other estimates of the impact of the Oportunidades programme on child health. Evaluations of households participating in the randomised effectiveness evaluation report a 25.3 per cent reduction in illness episodes, a similar decline in the probability of anaemia among children, and an increase in age-adjusted height by 1.1 cm (Gertler 2004, Rivera *et al.* 2004). Given that birth weight remains an important predictor of neonatal and infant mortality, this finding may also help explain an 11 per cent decline in infant mortality among beneficiary households in rural areas (Barham 2006).

5.3. Falsification test

One possible alternative explanation for our results is that there was some other change, such as an improvement in the quality of care or an economic boom that occurred in treatment areas but not in control areas. We test this hypothesis by examining whether pregnant women living in treatment areas who were not eligible for Oportunidades had better birth outcomes than ineligibles living in control areas. To do so, we generate a set of hypothetical beneficiaries defined as non-eligible women in the treatment areas that gave birth after the start of the programme in April 1998, and non-eligible women in control areas that gave birth after November 2000. Similarly, we define hypothetical non-beneficiaries as non-eligible women in the treatment areas that gave birth before the start of the programme in April 1998, and non-eligible women in control areas that gave birth before November 2000.

We regress birth weight and the probability of low birth weight on a dummy variable identifying whether the women was a hypothetical beneficiary at any time before delivering her most recent live birth. Again, because of the randomisation, this should provide us with a consistent estimate of programme impact. However, we also include the same controls for individual, household, and community covariates identified above in order to reduce idiosyncratic variation and improve the power of the estimates. Since the level of randomisation was at the community level, we estimate the model by random effects clustered at the community. In order to test the robustness of the results, we also estimate the model using community fixed effects.

The sample with valid birth weights includes 306 women, of which 85 were hypothetical non-beneficiaries. Comparing the control characteristics for the hypothetical beneficiaries and non-beneficiaries, we found all but two characteristics statistically the same between the two groups (Appendix 1). Hypothetical beneficiaries were slightly younger and they were living in households with somewhat fewer children under five years of age. These results suggest that the randomisation was successful in balancing the characteristics of the ineligible populations across control and treatment areas.

The results of the falsification test are reported in Appendix 2. We estimated both random and fixed effects versions of the birth weight and probability of low-birth-weight models with full sets of controls. The estimated programme impact was small and not statistically different from zero in all cases. These results support the hypothesis that the differences in birth outcomes are a result of the programme and not some other difference between the treatment and control communities.

6. Did Oportunidades have an impact on utilisation?

We now turn to the pathways by which Oportunidades improved birth weight. We first investigate whether the programme had an impact on healthcare utilisation as measured by the decision to seek prenatal care, the minimum number of consultations (five) required to receive Oportunidades benefits, and the total number of consultations. However, the descriptive statistics in the first row of Table 3 suggest that most women were already complying with the prenatal care requirements before they became beneficiaries. Specifically, 94.3 per cent of the non-beneficiaries in this sample had obtained prenatal care, the average number of consultations was 6.4 compared with the required number of five visits, and nearly three-quarters had five visits or more. Therefore, the programme was unlikely to have much of an impact on utilisation in this sample.

We examined programme impact on utilisation using the same methods as the analysis of birth weight. Specifically, we regressed the various measures of utilisation on a dummy variable identifying whether the woman was the beneficiary controlling for the individual, household, and community covariates included in the birth weight regressions. Because of the randomisation, this should provide us with a consistent estimate of programme impact on utilisation. Again, since the level of randomisation was at the community, we estimate the model by random effects.

The measures of utilisation are whether the mother sought prenatal care, whether she obtained five or more visits, and the number of visits as a continuous variable. The estimation results are reported in Table 3. We find no impact of programme participation in any of the models estimated. This suggests that the programme impact on birth weight is not attributable to changes in utilisation among beneficiaries, or compliance with the programme's health utilisation requirements.

Table 3. Regression models estimating the Oportunidades programme impact on prenatal care-seeking and utilisation.

	Sought prenatal care (=1)	Obtained five consultations or more (=1)	Number of consultations
Mean of dependent variable for non-beneficiaries	0.943	0.742	6.40
	RE probit dy/dx	RE probit dy/dx	RE poisson dy/dx
Beneficiary (=1)	0.034 [0.236]	0.015 [0.130]	–0.0348 [0.037]
Control variables			
Maternal and infant characteristics	Yes	Yes	Yes
Household socioeconomics & demographics	Yes	Yes	Yes
Community socioeconomics	Yes	Yes	Yes
No. of observations	840	804	804

Note: RE = random effects. Coefficients and standard errors reported for programme participation variable. Specific control variables are listed in Table 1.

7. Did Oportunidades beneficiaries get higher quality?

While the number of prenatal care visits may not be a pathway, an improvement in the quality or clinical content of care may explain the effect of the programme on birth weight. We posit that Oportunidades could have improved quality through three possible mechanisms. The first is that Oportunidades required beneficiaries to use public clinics; this would lead to an increase in quality if public providers supplied higher quality than private providers. Second, there may have been pressure on the Department of Health to improve the supply of prenatal services. Third, Oportunidades could have empowered women to demand better care through information, resources, and a sense of entitlement.

7.1. Measurement of quality

Quality is measured in terms of the clinical content of care or, in other words, the procedures patients received correspond with the Mexican clinical guidelines for best practice (Secretaría de Salud 1993). The prenatal procedures are those routinely conducted during history-taking and diagnostics (obtaining blood and urine samples, asking about bleeding and discharge during pregnancy); the physical examination (measuring blood pressure, weight, and uterine height; and pelvic examination); and other preventive procedures (giving tetanus toxoid immunisations and iron supplements; advising about family planning and lactation; and recording health information). We construct a composite index, which is the sum of positive responses as proportion of the total. We standardise the index to a mean of zero and standard deviation of one.

Table 4, panel A reports the prenatal procedures received by beneficiary status. We find that beneficiary women received on average more of the recommended procedures overall and for each domain (history-taking, physical, and prevention). Specifically, more beneficiary women had a urine sample and blood pressure taken, their uterine height measured, and their health information recorded.

Table 4. Measuring quality: prenatal care procedures received by beneficiary status.

	Non-beneficiaries	Beneficiaries	Difference	p-values
Panel A. Prenatal procedures and quality scores				
History-taking and diagnostics summary score	0.5472 [0.3298]	0.6282 [0.3210]	0.081	<0.01
Asked about bleeding	0.711	0.758	0.047	0.21
Asked about discharge	0.717	0.771	0.054	0.16
Blood sample taken	0.411	0.490	0.079	0.10
Urine sample taken	0.350	0.493	0.143	<0.01
Physical examination summary score	0.763 [0.280]	0.821 [0.217]	0.059	<0.01
Blood pressure taken	0.850	0.941	0.091	<0.01
Weighed	0.922	0.951	0.029	0.15
Uterine height measured	0.828	0.883	0.056	0.06
Pelvic exam	0.450	0.510	0.060	0.16
Prevention and case management summary score	0.836 [0.265]	0.879 [0.215]	0.043	0.05
Tetanus toxoid immunisation	0.894	0.931	0.037	0.11
Iron supplements	0.806	0.858	0.053	0.11
Advised about lactation	0.900	0.910	0.010	0.67
Advised about family planning methods	0.856	0.883	0.028	0.31
Recorded appointments	0.722	0.810	0.088	0.01
Total quality summary scores				
Raw (0–1)	0.724 [0.252]	0.784 [0.201]	0.060	<0.01
Standardised	–0.222 [1.178]	0.056 [0.943]	0.279	<0.01
Panel B. Public and private quality scores				
Public clinical quality scores (standardised)	–0.003 [0.897]	0.190 [0.715]	0.193	0.04
Private clinical quality scores (standardised)	–1.719 [1.703]	–0.917 [1.609]	0.802	0.03
Panel C. Care seeking				
Sought care in public sector (=1)	0.872	0.879	0.007	0.77
Panel D: Comparison of Quality Scores for (Ineligible) Hypothetical Beneficiaries and Non-Beneficiaries				
	Hypothetical non-beneficiaries	Hypothetical beneficiaries	Difference	p-values
Quality scores (standardised)	–0.054 [1.0432]	0.0184 [0.9872]	0.072	0.65

7.2. Empirical methods and results

We examine programme impact on quality using methods similar to the analysis of birth weight. Specifically, we regress the aggregate quality index on a dummy variable identifying beneficiary women controlling for the individual, household, and community covariates included in the birth weight regressions, with the exception of those related only to birth

Table 5. Regression models estimating the Oportunidades programme impact on standardised quality of prenatal care received for eligible populations and ineligible hypothetical populations.

	Eligible population		Ineligible (hypothetical) population	
	1	2	3	4
Beneficiary (=1)	0.3632*** [0.0784]	0.4050*** [0.0810]	0.1015 [0.1572]	0.1827 [0.1894]
Control variables				
Maternal & infant characteristics	Yes	Yes	Yes	Yes
Household socioeconomics & demographics	Yes	Yes	Yes	Yes
Community socioeconomics	Yes	Yes	Yes	Yes
Community Fixed Effects	No	Yes	No	Yes

weight (that is, infant gender, altitude). Because of the randomisation, this should provide us with a consistent estimate of programme impact on quality. Again, since the level of randomisation was at the community, we estimate the model by random effects.

The results are reported in first two columns of Table 5. The first column reports the random effects estimates and the second reports the fixed effects estimates. We estimate that beneficiaries received 0.36 standard deviation units higher quality, and the magnitude of the results increases slightly with community fixed effects. Both of the estimates are significantly different from zero at the 0.01 level.

7.3. Why did quality increase?

We consider three hypotheses regarding why beneficiaries received higher quality of care: programme requirements to obtain care from the public sector; the government strengthened the supply of health services; and women could have been empowered by the programme to demand more and better care. We discuss briefly each of these possibilities in turn.

First, our previous research in Mexico documented that the quality in the public sector is significantly higher compared with private alternatives for the rural poor (Barber *et al.* 2007a). We report similar results for this sample in Table 4, panel B. Given that beneficiary families were required to obtain care in public facilities, higher quality of care could have resulted from the substitution of private service providers with public service providers. However, we found no significant differences in the use of public sector for beneficiaries and non-beneficiaries in this sample (Table 4, panel C).

Second, there was some intention on the part of the government to increase supplies and human resources for health services in anticipation of higher utilisation among beneficiaries. However, no evidence suggests that quality improvements were actually implemented in programme areas (Adato *et al.* 2000a). Improved technical quality could have resulted from better-trained healthcare providers with improved facilities and equipment, practising stricter adherence to clinical protocols. In this case, these supply-side interventions would have improved the quality of care for both Oportunidades beneficiaries and non-beneficiaries.

We test this hypothesis by examining whether pregnant women who were not eligible for Oportunidades in treatment areas received higher quality than those in control areas. Similar to the falsification test described above in Section 5.3, we utilise the set of hypothetical beneficiaries – defined as ineligible women in the treatment areas that gave birth after the start of the programme in April 1998, and ineligible women in control areas that gave birth after November 2000. These women would have also benefited from supply-side

improvements in health quality. Hypothetical non-beneficiaries are non-eligible women in the treatment areas that gave birth before the start of the programme in April 1998, and non-eligible women in control areas that gave birth before November 2000.

We find no differences in the average quality scores between the hypothetical beneficiaries and non-beneficiaries (Table 4, panel D). Similar to the previous analyses, we also estimate random and fixed effects models using as the dependent variable quality received. The results are reported in columns 3 and 4 in Table 5. After controlling for maternal and socio-economic factors, there is no significant difference in quality received for hypothetical beneficiaries living in treatment areas. These regressions suggest that supply-side improvements do not explain the higher quality received by programme beneficiaries.

The remaining hypothesis is that the programme empowered beneficiary women to demand higher quality. This finding is supported by qualitative research with beneficiaries and healthcare providers (Adato *et al.* 2000b). *Promotoras* and beneficiaries report personal changes, including increased self-confidence, and freedom of movement and association. Medical doctors providing care to beneficiaries describe positive attitudinal changes with regard to healthcare, prevention and self-care, and patient participation. One doctor commented that 'beneficiaries are the ones who request the most from us'; and a large proportion of health providers reported that beneficiary patients are 'very demanding'. Together, this evidence suggests that Oportunidades empowered women to insist on better care by informing them of what content to expect and by giving them skills to negotiate better quality care from healthcare providers.

8. How did Oportunidades improve birth weight?

Lastly, we investigate the importance of different pathways that could explain the changes in birth weight. Because there appears to be no effect of the programme on utilisation, we focus on the contributions of nutrition and quality of care. To do so, we re-estimate the reduced-form birth weight and low birth weight regressions described in Section 5.2 by replacing the treatment dummy variable with length of time on the programme and quality of care.

Time on the programme is a proxy for the programme's nutritional content and any other changes resulting from the programme. Recall that improved nutrition could have resulted from either the supplements or more and better nutrition purchased by households. We measure the impact of nutritional supplements and purchased food through time on programme given that the effect of nutrition on women's health is cumulative. The longer someone has been on the programme, the more food they have been able to purchase and the longer they could have benefited from the supplements. Time on the programme would also pick up any other effects on health changes that the programme might have caused through the *pláticas* or the use of the cash transfers.

Time on programme is measured as the number of programme months from the start of cash payments to the date of delivery. Similar to the dummy variable identifying programme participation at time of delivery, the number of programme months is exogenous because the actual timing of incorporation into the programme was randomised, and a previous study found no relationships between the programme and fertility decisions (Steklov *et al.* 2006).

We measure quality using the standardised composite index described in Section 7.1. Quality, however, was not allocated randomly as part of the programme and may be endogenous. For instance, concerned mothers who are experiencing difficult pregnancies may be receiving more clinical services, and difficult pregnancies may be correlated with lower subsequent birth weight. In this case, least-squares estimates would underestimate the true impact of quality on birth weight.

We use an instrumental variables approach to identify the impact of quality on birth weight. Our instruments are the average community quality supplied in public clinics and in the private sector adjusted for the observed characteristics of the mothers receiving the care. We generated these instruments, by regressing the quality index on a set of maternal and household socio-economic characteristics, beneficiary status, and community fixed effects interacted with whether the care was at a public clinic or private provider. The estimation sample included all women who had a prenatal care visit including beneficiaries, non-beneficiaries and ineligibles. Our instruments are the community public provider fixed effects, community private provider fixed effects and the weighted average of the public and private fixed effects interacted with maternal education. The fixed effects reflect the average quality supplied by public and private providers in a given community, but are purged of differences in observed characteristics that represent individual or socio-economic risk. The first stage regressions are presented in Appendix 3.

The results are presented in Table 6. Models one to three describe the results for birth weight in grams, and four to six describe the results for low birth weight. All models are estimated using community random effects and include the same controls used in the reduced-form birth weight models reported in Table 3. Column one reports the results from a model that includes programme months and uninstrumented quality. Neither variable is significant at conventional levels. The second model replicates the first but the quality coefficient is by instrumental variables. Quality becomes significant and we estimate that a one standard deviation unit increase in quality is associated with an increase in birth weight of 387.8 grams. However, programme months is not significant. In Model 3, we remove programme months as a regressor and report the instrumental variable estimates of the coefficient on quality. We find that a one standard deviation increase in quality predicts an increase in birth weight of 409.7 grams, significant at the 0.01 level.

The same specifications for low birth weight (2500 grams = 1). Similar to the previous regressions, programme months as a separate regressor does not predict declines in low birth weight in Models 4 and 5. While quality is not significant in Model 5, the magnitude of the coefficient is large. When we remove months and use it as an independent variable in Model 6, quality becomes significant at the 0.05 level. A one standard deviation increase in quality corresponds with a 14-percentage point decrease in low birth weight.

Table 6. Regression models estimates of the impact of length time on the programme and quality of care on birth weight and the probability of low birth weight.

	Birth weight in grams			Low birth weight (< 2500 g = 1)		
	1	2	3	4	5	6
	RE	IV RE	IV RE	RE	IV RE	IV RE
Programme months	1.83	0.31	–	–0.001	–0.000	–
	[1.13]	[1.55]		[0.001]	[0.001]	
Standardised quality (SD)	18.84	387.76**	409.66***	0.009	–0.112	–0.140**
	[24.01]	[193.36]	[165.17]	[0.011]	[0.085]	[0.070]
Covariates						
Maternal & infant characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Household characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Community characteristics	Yes	Yes	Yes	Yes	Yes	Yes

Note: RE = random effects, IV = instrumental variables. Regressions include covariates listed in Table 1.

We then combine the information from the random effects models that beneficiaries received 0.3632 standard deviation units higher quality (Table 5) with the estimates of quality on birth weight (Table 6, Models 3 and 7). These results suggest that the programme impact operating via quality improvements amounted to a 148.8 gram increase in birth weight, and a 5.1 percentage point reduction in low birth weight. This estimate is very close to the 127.3 grams overall programme impact on birth weight and the 4.6 percentage point impact on low birth weight from the reduced-form models (Table 2). These results support the hypothesis that the programme impact on birth weight operated through improvements in quality.

9. Discussion

This study demonstrates that Oportunidades resulted in improved birth outcomes. Using the randomised design, we find that beneficiary births were 127.3 grams heavier and 44.5 per cent less likely to be low birth weight than non-beneficiary births. In examining the pathways for this result, we conclude that these improvements in birth weight were primarily attributable to improvements in the quality of prenatal care. Improved quality is probably a manifestation of the programme empowering women to demand their right to quality care. The programme empowered women by informing them about the importance of prenatal care, the content of this care, their right to this content; and by providing social support and encouraging them to be informed and active health consumers.

These results contribute to the growing body of evidence cited earlier that CCTs are having a large impact on child health improvements (Lagarde *et al.* 2007). Despite the fact that almost all of the previous analyses are limited to reduced-form impacts, this literature attributes the programme impact to a combination of price incentives for the use preventive medical care, the income effects of the cash transfer and the nutrition supplements. Our paper is one of the first to attribute the programme's impact to the quality of medical care and empowerment as mechanisms.

Our results also provide empirical support to the theory of the economics of identity. The idea is that one's identity enters the utility functions of the beneficiary and the provider, and thereby affects equilibrium service provision. If poor and minority families view themselves as undeserving – and those that provide services hold similar views – then the less well-off will not fully benefit from public services such as health and education. We show that empowerment is a means by which governments can change identity and improve service provision to previously underserved groups. The policy implication is that efforts to empower the less well-off and change their 'identity' are necessary for public services to fully benefit the poor.

Our results are also among the first to empirically demonstrate the importance of efforts to improve the quality of prenatal care on birth weight in the developing world. Indeed, there is substantial potential for investment in quality as means to improve birth outcomes as demonstrated by wide variation in adherence to prenatal care guidelines in a large number of countries across the developing world (Piaggio *et al.* 1998, World Health Organization 2003, Pallikadavath *et al.* 2004, Das and Hammer 2005, Barber *et al.* 2007a, 2007b). In addition to empowerment, other efforts to improve quality such as pay for performance and those promoted in the *World Development Report* on making services work for the poor could be considered (World Bank 2004).

Finally, caution should be used in interpreting the results that nutritional supplements had little contribution to improvements in birth weight. As noted previously, the distribution and consumption of the supplements faced critical problems related to compliance, leakage, and availability. In addition, the effect of nutritional supplements during pregnancy may not be captured over a short study span. Significantly higher birth weights (150 grams) have been

reported among women who received high-energy, high-protein supplements as children over a 30-year study period (Ramakrishnan *et al.* 1999). Improved anthropometric measures have also been reported for adolescents whose mothers received nutritional supplements more than three decades earlier (Behrman *et al.* 2009). This suggests that the benefits of improved nutrition could be intergenerational rather than immediate.

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Notes

1. The Mexican Government set forth the goal of universal social protection based on the principle that healthcare is a social right.
2. See SEDESOL (2003, 2009a, 2009b) for the operational rules and performance of Oportunidades.
3. For women, the 52 grams daily ration was intended to be consumed as a beverage. It provides 250 kilocalories of energy, 12–15 grams of protein, and includes iron, zinc, vitamin B12, vitamin C, vitamin E, folic acid and iodine. The specific content per ration for the maternal and child supplements are detailed elsewhere (Rosado *et al.* 2000).
4. In the beginning of the evaluation, approximately 52 per cent of the households in the experimental communities were eligible for Oportunidades based on the original eligibility criteria. Over time, however, the government loosened the eligibility criteria to incorporate more households called *densificados*. We limit our analysis to the original group and exclude the *densificados* from the analysis.

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Appendix 1. Comparison of characteristics for hypothetical (ineligible) non-beneficiaries and beneficiaries

	Hypothetical non-beneficiaries	Hypothetical beneficiaries	Difference	p-value
Panel A. Control variables				
Maternal and infant characteristics				
Maternal age (years)	27.70	25.81	−1.89	0.04
	[6.77]	[6.32]		
Total prior pregnancies	3.73	3.17	−0.56	0.24
	[2.69]	[2.32]		
Prior miscarriage or abortion (%)	7.14	6.63	−0.51	0.91
Mother smoked during pregnancy (%)	0.00	5.42	5.42	0.10
Days after birth weighed	1.61	2.44	0.83	0.30
	[3.53]	[7.13]		
Alive at time of interview (%)	96.43	98.19	1.76	0.50
Female (%)	44.64	42.17	−2.47	0.74
Baseline household socioeconomics & demographics				
Household socioeconomic index (0–1)	0.61	0.61	0.00	0.61
	[0.21]	[0.22]		
Indigenous-speaking household (%)	24.40	14.95	−9.45	0.07
Educational level of household head (years)	5.09	4.36	−0.73	0.10
	[3.22]	[3.43]		
Age of household head (years)	42.45	43.15	0.15	0.69
	[10.70]	[12.93]		
Maternal educational level (years)	5.25	5.53	0.28	0.53
	[3.08]	[2.92]		
Household size	6.34	6.34	0.00	1.00
	[2.80]	[2.49]		
Males, 0–5 years in household	0.13	0.09	−0.05	0.03
Females, 0–5 years in household	0.11	0.08	−0.03	0.09
Males, 6–17 years in household	0.14	0.15	0.02	0.40
Females, 6–17 years in household	0.12	0.14	0.02	0.22
Baseline community characteristics				
Altitude (meters)	1688.93	1567.44	−121.49	0.46
	[781.89]	[803.92]		
Distance to urban centre (km)	94.15	90.83	−3.32	0.66
	[38.13]	[41.25]		
Health centre in community (%)	64.29	66.27	1.98	0.82
Female wages, formal employment (pesos per month)	196.43	228.06	31.63	0.72
	[439.74]	[605.27]		
Male wages, formal employment (pesos per month)	393.37	430.30	36.93	0.66
	[1884.96]	[1923.15]		

(*Continued*)

Appendix 1. (Continued)

	Hypothetical non-beneficiaries	Hypothetical beneficiaries	Difference	p-value
Panel B. Outcome variables				
Birthweight in grams	3152.77 [482.06]	3211.54 [497.93]	58.77	0.41
Low birthweight (<2500 grams =1) %	5.36	4.22	−1.14	0.69
Got prenatal care (%)	94.64	93.37	−1.27	0.74
Number of prenatal consultations†	5.98 [2.80]	6.31 [2.98]	0.33	0.55
Obtained five visits or more (=1)	69.81	73.55	3.74	0.68

Appendix 2. Falsification test: regression models estimating programme impact on birth outcomes for hypothetical ineligible beneficiaries

	Birthweight in grams		Low birth weight (<2500-g=1)	
	RE	FE	RE linear probability	FE linear probability
Explanatory variables	1	2	3	4
Hypothetical beneficiary (=1)	37.12 [79.01]	6.46 [114.66]	−0.0093 [0.0343]	−0.0042 [0.0476]
Maternal and infant characteristics	Yes	Yes	Yes	Yes
Baseline household socioeconomics and demographics	Yes	Yes	Yes	Yes
Baseline community characteristics	Yes	Yes	Yes	Yes
Hausman test		0.05		0.03

Notes: RE = random effects, FE =fixed effects. Coefficients and standard errors reported. Regressions include control variables listed in Appendix 1.

Appendix 3. First-stage regressions for quality

Instrumental variables	
Community Level Quality of Public Health Care	6.86*** [2.38]
Community Level Quality of Private Health Care	−0.42*** [0.15
Mean community quality*maternal years of schooling	−1.79** [0.79]
Beneficiary status (=1)	0.16** [0.08]
Additional control variables	
Maternal & infant characteristics	Yes
Household characteristics	Yes
Community characteristics	Yes
Year fixed effects	Yes
F-statistic for joint significance of the instrumental variables	33.3