Closing the Nutrition Impact Gap Using Program Impact Pathway Analyses to Inform the Need for Program Modifications in Mexico’s Conditional Cash Transfer Program

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ABSTRACT

Background: Mexico’s Prospera-Oportunidades-Progresa Conditional Cash Transfer Program (CCT-POP) included the distribution of fortified food supplements (FFS) for pregnant and lactating women and young children. Rigorous evaluations showed significant impacts on nutrition outcomes but also substantial gaps in addressing nutrition problems.

Objectives: To highlight the program design-related and implementation-related gaps and challenges that motivated further research and the eventual design and roll-out of a modified nutrition component for CCT-POP.

Methods: We used a program impact pathway approach to highlight the extent and quality of implementation of CCT-POP, and its impact on nutrition outcomes. We drew on previously published and new primary data, organized into 3 sources: impact evaluations, studies to inform reformulation of the FFS, and a longitudinal follow-up study using qualitative and quantitative methods to document FFS use and the dietary intake of women and children.

Results: Despite positive impacts, a high prevalence of malnutrition persisted in the population. Coverage and use of health services improved, but quality of care was lacking. Consumption of FFS among lactating women was irregular. Micronutrient intake improved among children who consumed FFS, but the pattern of use limited frequency and quantity consumed. Substantial diversity in the prevalence of undernutrition was documented, as was an increased risk of overweight and obesity among women.

Conclusions: Three key design and implementation challenges were identified. FFS, although well accepted for children, had limited potential to substantially modify the quality of children’s diets because of the pattern of use in the home. The communications strategy was ineffective and ill-suited to its objective of motivating FFS use. Finally, the program with its common design across all regions of Mexico was not well adapted to the special needs of some subgroups, particularly indigenous populations. The studies reviewed in this paper motivated additional research and the eventual redesign of the nutrition component. J Nutr 2019;149:2281S–2289S.

Keywords: fortified food supplements, dietary intake, pregnant and lactating women, infant and young child, program impact pathway, program impact

Introduction

Mexico’s conditional cash transfer (CCT) program, initially named Progresa, later Oportunidades, then Prospera (referred to here as CCT-POP), began at pilot scale in 1997 in rural areas and was extended to urban areas in 2002. The program was 1 of the first CCTs (1) and has undergone rigorous impact evaluations for 20 y. The common features of all CCTs include targeting to low income subgroups and provision of cash on the condition of compliance with some type of conditionalality. Most programs include conditionalities related to participation in preventive healthcare services, and incentives to send and keep children in school, but substantial variability in the specifics of those conditionalities exists among programs (1).

Several reviews of the impact of CCT programs on nutrition, health, and child development outcomes have been published (2–6). Authors have concluded that CCTs have a consistent positive impact on child anthropometry (height indicators), but mixed impact on other nutrition outcomes (6). The pathways by which these impacts have been achieved have been compared across several programs, with consistent positive results on the underlying determinants of malnutrition (e.g., poverty reduction, health service use, among others). However, information to assess the full pathway from underlying...
Methods

The impact pathway used for this analysis focuses on those aspects of the CCT-POP with potential to improve dietary intake among pregnant and lactating women and infants and young children, drawing on the determinants to direct determinants (i.e., dietary intake and infectious disease) and ultimately improved child nutrition outcomes has been limited by a lack of data in several programs (6). Diversity among programs including the actual package of interventions implemented, and the extent to which conditionalities are enforced limits the utility of such reviews to inform CCT design. Such differences may substantially modify the potential for nutritional impacts, an aspect that has as yet been inadequately illustrated. For example, CCT-POP is 1 of the few programs that include distribution of fortified food supplements (FFS), Nutrivia for pregnant and lactating women (PLW), and Nutrisano for infants and young children (IYC).

As evaluators, we were continually asked by CCT-POP implementers whether the nutritional impacts were “sufficient” given program design and investment, and large enough to contribute to the achievement of the program’s long-term goal, i.e., improved human capital. Nutritional supplements similar to Nutrivia and Nutrisano have resulted in improved growth of close to 3 cm in the short term under controlled field conditions (7), but this reference provides little basis for target setting in a complex program such as CCT-POP. This dialogue led to a series of analyses of the evaluation data and several complementary studies to explore in depth the quality of CCT-POP implementation and the adequacy of design for the context in various subgroups of the population, and to measure results for intermediate steps across the pathway to nutritional impacts. These studies sought to understand how impacts were achieved, identify the design and implementation factors that may limit greater impact, and to inform options to strengthen design and implementation. In this paper we provide an overview of the findings of these many studies, organized around the program’s original intended impact pathway for nutrition. As part of this supplement, our specific objective is to highlight the program design-related and implementation-related gaps and challenges that motivated further research (8, 9) and the eventual design and roll-out of a modified nutrition component for CCT-POP (10, 11).

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Abbreviations used: CCT-POP, Progresas-Oportunidades-Prospers Conditional Cash Transfer Program; FFS, fortified food supplement(s); INSP, National Institute of Public Health of Mexico; IYC, infants and young children; PLW, pregnant and lactating women.

Impact evaluation studies

Impact evaluations were carried out in rural [randomized effectiveness trial with cross-sectional panels (13, 14)] and urban areas [quasi-experimental study with cross-sectional panels (15)]. Data collection was comprehensive and covered many topics. For this review we focused on impact for nutrition outcomes including intermediate outcomes, any information available related to Nutrivia/Nutrisano, and updates of the magnitude and distribution of nutrition issues in the population. We accessed results published in peer-reviewed journals and detailed reports publicly available on the CCT-POP site.

Studies with specific objective to inform reformulation of Nutrivia/Nutrisano

Nutrivia and Nutrisano are powdered milk-based products distributed monthly (or every second month, depending on the health center) by health staff. Women received Nutrivia from the first antenatal visit until 1 y postpartum and were instructed to consume it once daily as a beverage. Nutrisano is a porridge (papilla in Spanish) targeted at all children aged 4 mo to 23 mo and children aged 2–4 y identified during routine health visits as having low weight-for-age (this was modified in 2006 to target children aged 6 mo to 59 mo). Both products were developed in Mexico and fortified with age-appropriate and physiological status-appropriate amounts to contribute close to 100% of recommended daily intakes (22) of iron, zinc, folic acid, vitamin C, vitamin E, vitamin B-12, vitamin A (children only), and iodine (women only), as well as ≥20% of mean estimated energy requirements.

The small impact on anemia prevalence among IVC observed in the original rural impact evaluation (23) motivated a series of studies to determine whether the iron type and content should be modified. Three studies were carried out, 2 of which have been previously published (16, 17). The third study was a randomized efficacy trial to evaluate the impact of consumption of Nutrisano on children’s iron status using micronutrient syrup as a reference (18). The trial was conducted in a small urban community in Puebla, Mexico in 2000. At that time, the program provided Nutrisano as of age 4 mo. Children aged 4–12 mo at baseline (the beneficiaries of the program) were recruited through the primary health centers. Parents of children were invited to participate, and written consent was sought. The study was not registered in a trial registry as this was not required by INSP at that time.

Individual children were randomly assigned using random number tables to receive Nutrisano or a micronutrient syrup containing iron in the form of ferrous sulfate. The syrup was available as an essential tables to receive Nutrisano or a micronutrient syrup containing iron in the form of ferrous sulfate. The syrup was available as an essential medical product in the health centers. Nutrisano was provided daily (6 d/wk) by project staff for 4 mo. Hemoglobin concentration was assessed in a venous blood sample using Hemocue. Serum ferritin and C-reactive protein were measured by nephelometry (Behring Nephelometer B-N 100 Analyzer) in samples collected at baseline and endline in the INSP laboratory in Cuernavaca, Mexico.
The results of this study and the analysis of the evaluation data raised several questions as to the acceptance and pattern of utilization of Nutrivida and Nutrisano, which motivated several additional studies.

Studies assessing Nutrivida/Nutrisano acceptance, consumption, and dietary intake

From July 2003 to May 2004 we recruited a cohort of lactating women and their infants and young children to assess dietary intake, and knowledge, acceptance, and use of Nutrivida and Nutrisano (19). Children aged 6–23 mo at baseline and their breastfeeding mothers (the beneficiaries of CCT-POP) were identified with support from health centers. Although Nutrivida was also provided to pregnant women and consumption patterns may differ during pregnancy, we chose to follow lactating women only for logistic reasons (i.e., mother/child pairs). A subset of 22 communities that had previously participated in the urban impact evaluation (13 intervention and 9 control) were randomly selected to be part of the follow-up. Data were collected approximately every 3 mo and included a single 24-h recall for each woman and child, and a detailed questionnaire of supplement use, preparation, and consumption pattern (i.e., 4 data points per child/women over a 12-mo period). Note that the population does not rely on subsistence farming and we did not anticipate major seasonal variation in the pattern of dietary intake with the exception of highly seasonal fruits such as mango. Height, weight, and hemoglobin concentration were measured at baseline and at 12-mo follow-up.

Total nutrient intake from home diet and Nutrivida/Nutrisano was assessed from 24-h recall data at each time point and averaged over the 4 measurements. Potential displacement of home diet with Nutrivida/Nutrisano consumption was assessed by comparing intake in intervention and control communities. We used the supplement consumption data to describe preparation and use pattern and intra-household sharing.

Additional studies during the same period used qualitative research methodologies to explore use and acceptance of the nutritional supplements (20, 21) and ethnographic research to gain insights into the social-cultural and other factors that might facilitate or impede use of the program generally, and the supplements specifically.

Results

Results of the review are organized into 3 sections. First, we present a brief overview of what is known about the impact of CCT-POP on nutrition-related outcomes in women and infants and young children. We then present results across the intended impact pathway of the program as it was originally designed in 1997. The program sought to improve nutrition outcomes through actions directed to pregnant and lactating women (dotted lines in Figure 1), and to infants and young children.
(solid lines) (19, 21, 23–37). The arrows in Figure 1 show the intended pathway to impact and the content of each box provides a summary of what was learned through the impact evaluations and the studies described in Table 1.

Brief overview of the nutrition-related impact of CCT-POP

In the long term, the CCT-POP seeks to increase human capital among low-income families through improving health, nutrition, and education outcomes. Forthcoming evaluations will provide evidence of impacts of CCT-POP on adult height, and several education and cognition indicators after 20 y of implementation (study forthcoming: World Bank).

Several short-term impacts were assessed as part of evaluations in rural and urban areas. In rural areas, recall of birth weight was assessed among a single cross-sectional sample of women aged 15–49 y with a singleton live birth between 1997 and 2003. Program participation was associated with a 127.3 g higher birth weight (P = 0.02) and a 4.6% lower prevalence of low birth weight (P = 0.05) (24). Positive impacts in the short and medium term on nutritional status of children, particularly child growth and to a lesser extent anemia have been well documented (14, 25), as has impact on health status (23, 38), and for some indicators of child development (26).

The evaluation results illustrated that while the program used similar economic targeting criteria to identify beneficiary families in all regions of the country, the prevalence of undernutrition was substantially higher in rural than in urban areas (27) and among indigenous populations (28). For example, in rural areas only, the prevalence of stunting in the first trimester, and 4.1% increase in the number of common childhood illnesses (23) and improved micronutrient intake (19), P<0.05 (24). Positive impacts in the short and medium term on nutritional status of children, particularly child growth and to a lesser extent anemia have been well documented (14, 25), as has impact on health status (23, 38), and for some indicators of child development (26).

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The program sought to achieve improved pregnancy and lactation outcomes (dotted lines in Figure 1) by improving women’s health and nutrition during pregnancy and lactation. Timely and continual antenatal care was included as a conditionality required for continued receipt of program benefits. Cash provided to the female head of household was intended to empower women and lead to increased food purchase (6). Nutrivida was developed to fill dietary gaps of key micronutrients required during pregnancy. Messages related to both health and dietary intake, including the use of Nutrivida were delivered through education sessions, participation in which was part of the program requirements.

During the first years of implementation there were significant increases in the coverage of antenatal care among beneficiary pregnant women (e.g., 6% increase in 2000) (29, 31). The program successfully improved the timeliness and frequency of antenatal care, with a 16.7% increase in antenatal care during the first trimester, and 4.1% increase in the number of common childhood illnesses (23) and improved micronutrient intake (19), P<0.05 (24). Positive impacts in the short and medium term on nutritional status of children, particularly child growth and to a lesser extent anemia have been well documented (14, 25), as has impact on health status (23, 38), and for some indicators of child development (26).
of visits attended per woman (30). The quality of antenatal care, however, remains a challenge in the primary healthcare system (31), as does access for some women, particularly indigenous women (39). While participation in antenatal care is close to universal, in 2006 only 37.1% of pregnant or lactating women reported having received Nutrivida, slightly higher in rural (41.4%) than urban (28.6%) areas (40). Given the periodic and cross-sectional design of the impact evaluation surveys, there are insufficient data to assess the extent to which any improvement of pregnancy outcome was mediated through improved dietary intake during pregnancy and/or antenatal care. Some data are available, however, on food purchase and consumption. As intended by the program, the cash transfers increased household consumption (i.e., purchase) of total calories, and of several nutritious foods including fruits, vegetables, and animal-source foods (32). Evidence suggests that this did translate into increased consumption of these foods by PLW after 1 and 2 y of CCT-POP participation (33, 41), but full details of dietary patterns of women were not available.

This lack of information was part of the motivation for the detailed dietary studies (data source 3 in Table 1). Over the year-long follow-up period, we found that only 25% of lactating women reported consuming Nutrivida, of whom ~60% prepared it according to recommendations (19). We did not go on to quantify nutrient intake from Nutrivida because of the very low reported quantities consumed. In a more in-depth study using qualitative research methods, women reported low acceptance of Nutrivida for their own consumption (34). Several reasons were reported including dislike of its texture, odor, and/or flavor, monotony of daily consumption, and concerns related to the time required for its preparation.

The prevalence of low weight among women was very low (<2%) and the prevalence of overweight and obesity high in all studies and all subgroups of the beneficiary population (19, 27, 28). For example, at the end of the year-long follow-up of beneficiary lactating women, the prevalence of overweight was 39.6% and obesity 24.3%, ~3 percentage points higher than baseline (35). We therefore concluded that the diets of PLW were low in micronutrients but adequate or high in energy.

Improving child outcomes through better care, dietary practices, and intake

For IYC, the program sought to reduce childhood illness through prevention of malnutrition and early detection and treatment of illness (solid lines in Figure 1). Health was promoted through routine health care including vaccinations and through the health talks (a program requirement). The free provision of Nutrisano during those health visits, accompanied by talks related to its use were intended to improve dietary intake among infants and young children. As expected by the CCT-POP requirements, beneficiary women brought their children to routine health care appointments more often than their counterparts without the CCT-POP, translating into 25% lower prevalence of common childhood illness during the first 6 mo of life (23).

Despite the increased household-level consumption of several nutritious foods (32), the results demonstrated no change in dietary intake from home diet among beneficiary children aged 6–24 mo, just less than half the recommended daily dose of 44 g (28).

As part of that study we found that Nutrisano was consistently shared with other household members, mostly other children. On average, 2.5 family members consumed the Nutrisano that had been targeted to a single child aged 6–23 mo. Nutrisano in both rural and urban areas was commonly prepared as a beverage rather than a porridge, facilitating sharing but limiting nutrient density. The education component had only 1 session related to Nutrisano (and Nutrivida together). The qualitative and ethnographic studies (20, 21) concluded that this was insufficient to educate and motivate women to use the products appropriately. The session format was not conducive to learning, with women often standing for extended times in the heat/sun. Education was done in Spanish even in the predominantly indigenous communities where women may have limited Spanish fluency. Finally, the qualitative research illustrated that knowledge was often not the barrier to consumption. For example, women in rural and urban areas across all studies reported understanding well that Nutrisano was intended for a specific child. They did not, however, agree with this principle and shared with all children (19).

The impact evaluations also illustrated some potential concerns for child feeding. Breastfeeding initiation was very high (almost 95%) both in urban and in rural areas (27, 35), and no change was detected in the urban evaluation (not assessed in rural evaluations) (27). In urban areas, however, beneficiary women had shorter total breastfeeding duration (mean 14.0 mo) than women in the comparison communities (mean 16.3 mo) (27). We also found that the recommendation to begin distribution of Nutrisano at 6 rather than 4 mo was not fully embraced and implemented by some medical staff (21). Similarly, many medical staff prioritized distribution of

Prospera program nutrition impact pathway analysis 22855
Generally, the program was CCT-POP had positive impacts on child health and nutrition. Discussion

Nutrisano to children with low weight regardless of age range (21).

CCT-POP had positive impacts on child health and nutrition outcomes, 1 of the many factors that contributed to its continuity over 20 y (46). Generally, the program was well designed to influence the primary causes of childhood undernutrition — health and dietary intake (8). Coverage of antenatal and young childcare increased significantly. Nutrivida and Nutrisano were designed to address nutritional deficiencies in the population, and the health education component sought to increase knowledge and improve practices related to their use in addition to several health topics. The cash transfer enabled families to purchase more nutritious foods. Some program quality issues were identified and addressed early on and have been reported previously. For example, the reformulation of Nutrisano and Nutrivida with a more bioavailable form of iron and increased vitamin C content to favor iron absorption was adopted and implemented in 2005 after the results of the studies presented here (47). The age to begin distribution of Nutrisano was modified from 4 to 6 mo to avoid interference with breastfeeding and to ensure clear and consistent messages related to the recommended duration of exclusive breastfeeding (37, 47).

Through this review of the program impact pathway, however, we highlight several gaps in the appropriateness of design for subsets of the beneficiary population, and in the quality of implementation. First, Nutrivida and Nutrisano are high-quality products, well accepted by the population, with minimal distribution challenges in the case of children at least. Their use, however, was not aligned with recommendations, likely because of several factors including inadequate promotion, which relates directly to the second challenge, poor quality design and implementation of the communications component. Group sessions convened monthly covered many topics (25 in total), leaving little opportunity to cover any in detail (only 1 addressed Nutrisano and Nutrivida). Didactic methodology and physical location did not favor knowledge transfer and methods did not foster skills development and motivation. Finally, the CCT-POP beneficiary population is diverse, with substantial variability in the magnitude and severity of nutritional issues by geographic region and ethnic group. The identification of these gaps triggered several studies to inform potential alternatives to Nutrivida and Nutrisano, opportunities and approach to strengthen the communications component, and to improve understanding of sociocultural factors that may influence program acceptance and use.

At the time these studies were conducted (early 2000s) there was a growing body of evidence that micronutrient powders could provide an equally efficacious alternative to iron or micronutrient syrups to reduce anemia in children (48, 49), but there was no evidence on whether they were likely to have effects on functional outcomes such as child growth and development. We recommended a randomized trial to compare the impact of 2 alternatives to Nutrivida (micronutrient tablets and micronutrient powders) and Nutrisano (micronutrient syrup and micronutrient powders) on several nutrition outcomes among women and children, respectively (9).

The program requirements motivated more and timely health service use, creating opportunities for regular contact between the providers and program beneficiaries. The importance of health workers’ knowledge and communications skills for effective nutrition behavior change is well recognized (50). The design of a single approach has many advantages for implementation of the communications component was underappreciated in the initial design. Minimal training was provided for health professionals to deliver the program, and issues with quality of care were well documented (31). Bonvecchio et al. (10) report on several additional studies to explore programmatically feasible approaches to education that could meet the information and skill development needs of the beneficiary population.

Finally, the studies highlighted substantial diversity in the prevalence of malnutrition and in child feeding and related practices between rural and urban areas, and among indigenous and nonindigenous populations. The importance of context for the design of effective nutrition programs is well recognized (51). The design of a single approach has many advantages for ease of implementation in a program the size and complexity of CCT-POP. Yet in doing so, specific contextual factors that may impede program acceptance and use may not be

### Table 2

Iron status, anemia, and iron deficiency in children aged 4–12 mo at baseline and 4 mo after supplementation, by study group

| Variables          | Fortified complementary food (Nutrisano) | Multiple micronutrient syrup |
|--------------------|-----------------------------------------|------------------------------|
|                    | (n = 98)                                 | (n = 100)                    |
| Hemoglobin, g/dL   | 11.7 ± 1.2                               | 11.8 ± 1.3                   |
| Serum ferritin, ng/mL | 17.1 (9.7, 45.2)                        | 26.0 (13.2, 32.3)            |
| Anemia, %          | 26.7                                     | 17.0                         |
| Iron deficiency, % | 28.1                                     | 25.0                         |
| 4 mo               |                                         |                              |
| Hemoglobin, g/dL   | 11.6 ± 1.3                               | 11.8 ± 1.3                   |
| Serum ferritin, ng/mL | 14.2 (8.5, 23.9)                       | 24.1 (18.9, 43.6)            |
| Anemia, %          | 29.2                                     | 17.8                         |
| Iron deficiency, % | 37.7                                     | 12.5                         |

1 Values are means ± SDs, medians (IQR), or prevalence (%).
2 Anemia defined as hemoglobin concentration < 11.0 g/dL.
3 Iron deficiency defined as serum ferritin < 12 ng/dL.
4 Significantly different (P < 0.01) than Nutrisano.

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2286S Supplement
adequately addressed. Theodore et al. will present results of several studies designed specifically to address this issue in CCT-POP (8).

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