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Impact of Food Assistance Programs on Obesity in Mothers and Children: A Prospective Cohort Study in Peru

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Objectives. To assess obesity risk among mothers participating in Community Kitchens and children participating in Glass of Milk (Peru food assistance programs).

Methods. We analyzed prospective data from the Young Lives study. The exposure consisted in varying degrees of benefit from any of the programs (no participation in any of the programs, program participation for some months, or program participation nearly every month) at baseline (2006–2007). The outcome was overweight and obesity in mothers and children at follow-up (2009–2010).

Results. Prevalence of childhood overweight and obesity was 15.5% and 5.1%, respectively; the corresponding figures for mothers were 40.5% and 14.6%. Children exposed nearly every month to the Glass of Milk program had a 65% lower risk of becoming obese compared with children not participating in the program (relative risk [RR] = 0.35; 95% confidence interval [CI] = 0.18, 0.66). Mothers participating frequently in the Community Kitchens program had almost twice the risk of becoming obese compared with those who did not participate (RR = 1.93; 95% CI = 1.18, 3.15).

Conclusions. Participating in food assistance programs in Peru was associated with a lower risk of obesity in children and greater risk of obesity in mothers. (*Am J Public Health*. 2016;106:1301–1307. doi:10.2105/AJPH.2016.303191)

Obesity is a global health issue from which Latin America is not exempt.¹ For women aged 20 years and older in Andean Latin America, obesity prevalence is 23.4%,² which is higher than in some countries in Asia, Africa, and Europe. Childhood obesity is also a concern in Latin America, where between 22 million and 25 million school-aged children are overweight or obese.³ In Peru, obesity rates for adults and children (aged 5–9 years) are 28.5% and 8.9%, respectively.⁴ These estimates vary according to rural, urban, coastal, or highland setting.^{4,5} Peru shows a greater prevalence rate of childhood and adolescent obesity than other countries in the region, and in Asia, Africa, and Europe.^{2,3}

Although Peru has experienced significant economic growth over the past few decades, there are still inequalities across the country: the 24% national poverty rate conceals a great deal of variation because poverty rates reach 48% in rural areas. Poor families would benefit from food assistance programs (FAPs).

Unfortunately, studies in the United States have linked FAPs with obesity, particularly for women.⁶ However, the evidence regarding children is less conclusive. Infants whose mothers participate in FAPs have higher odds of being overweight,⁷ but for older children, the association is not as clear as that observed in the United States and Mexico.^{8–10} Studies in Chile have reported increasing rates of obesity as well as excess energy intake among beneficiary children.^{11–14} A study in Peru found a 29% higher obesity prevalence among women participating in these programs.¹⁵ However, this study combined

FAPs as the exposure, precluding an assessment of the impact of specific FAPs. Two programs with great impact in Peru are *Vaso de Leche* (Spanish for Glass of Milk) and *Comedores Populares* (Spanish for Community Kitchens; File A, available as a supplement to the online version of this article at <http://www.ajph.org>).

Most of the existing evidence of the association between FAPs and obesity comes from cross-sectional studies in developed countries.^{6–8,10,16} Previous studies have been unable to discriminate in detail the exposure of interest because of the broad use of participation in FAPs or the focus on only 1 program. The present study includes the frequency of participation in 2 specific programs, and the outcomes were measured separately for mothers and children. This study improves upon previous studies that have put together FAPs instead of singling them out. We aimed to assess the obesity risk of mothers and children who are beneficiaries of 2 FAPs: Community Kitchens for mothers and Glass of Milk for children.

METHODS

This is a secondary analysis of prospective data from the Young Lives study,¹⁷ which is a prospective cohort following children in 4 developing countries: Ethiopia, India, Peru, and Vietnam. The study began in 2002 and included 2 cohorts at baseline: a younger cohort with children aged 6 to 18 months and

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an older cohort with children aged 7 to 8 years. The follow-up rounds were conducted in 2006–2007 and 2009–2010.¹⁷

This study only includes the data from the younger Peruvian cohort, specifically the first (hereafter known as baseline) and second follow-up (hereafter known as follow-up) rounds, conducted in the years 2006–2007 and 2009–2010, respectively. We did not include the 2002 assessment because there was not complete information about the FAPs. Furthermore, at such time children were aged 6 to 18 months, preventing us from using the same obesity definition as for older children. Moreover, when aged 6 to 18 months, children are still breastfeeding making it difficult to talk about obesity as a misbalance between energy intake and expenditure like with older children. Local and contextual knowledge regarding FAPs is required to appropriately interpret the results; thus, we focused on information from our country: Peru.

Although the study is not nationally representative, it is informative of mothers and children living in constrained settings in a middle-income country. Furthermore, the sampling procedure focused on poor areas where most of the FAPs are set. Thus, our results could be of particular interest for individuals in resource-constrained settings. For this study, we included participants with complete data at baseline on child age, sex, body mass index (BMI), and information regarding participation in FAPs (Figure A, available as a supplement to the online version of this article at <http://www.ajph.org>).

Variables

Outcomes. Outcomes were overweight and obesity defined according to BMI cut-off points. For children, we used the International Obesity Task Force sex- and age-specific cut-off points,¹⁸ whereas for mothers, we used the traditional cut-offs (weight in kilograms divided by the square of height in meters [kg/m^2]): overweight was defined as BMI greater than or equal to $25 \text{ kg}/\text{m}^2$ but less than $30 \text{ kg}/\text{m}^2$, obesity as BMI $30 \text{ kg}/\text{m}^2$ or greater, and underweight as BMI $< 18.5 \text{ kg}/\text{m}^2$.¹⁹

Exposure. There were 2 exposure variables assessed at baseline: being a beneficiary of the Glass of Milk or the Community Kitchens program (File A). Information was retrieved

from mothers with the following questions: “In the last 12 months, have your children benefited from the Glass of Milk program?” and “In the last 12 months, did you go to the Community Kitchens program in your area?” Possible answers were “Yes, almost every month”; “Yes, some months”; “Yes, only 1 or 2 months”; and “No.” We collapsed these answers into 3 categories: No (reference); Yes, some months (“Yes, some months” and “Yes, only 1 or 2 months”); and Yes, almost every month.

Although some mothers in the study could have been beneficiaries of the Glass of Milk program, we did not include this program as an exposure variable for mothers because the question was assessing children in particular.

Other variables. For children, we included sex and age (4 and 5–6 years). For mothers we included age (< 30 years and ≥ 30 years) and education level (none or primary and high school or higher). With regard to the household, we included location (urban and rural), wealth index in tertiles (bottom, middle, and top), and household food security (food security and food insecurity) assessed with a locally adapted version of the US Department of Agriculture’s Food Insecurity and Hunger Module. We assessed all of these variables at baseline.

We chose these variables on the basis of previous studies and because they have been shown to be associated with the exposure and outcomes of interest. For example, a previous study with the same population showed that higher wealth index was associated with higher risk of obesity in children.²⁰ Likewise, a study with Peruvian women proved that wealthier women were more likely to be obese, although the opposite was found for women with higher education.²¹

Statistical Analysis

We conducted analyses with Stata version 13.0 (StataCorp LP, College Station, TX). We used means and standard deviations to describe numerical variables. We described categorical variables by using proportions and 95% confidence intervals (CIs). To compare categorical variables, we used the χ^2 test.

We calculated incidence rate per 100 person-years and relative risk (RR), each with its associated 95% CI, per 100 person-years. We calculated the RR by using generalized

linear models with Poisson family and log link, including robust standard errors to account for the cluster effect. When the outcome was children overweight, we excluded children with either overweight or obesity at baseline; when the outcome was obesity, we excluded children with obesity at baseline. We made similar exclusions with the mothers.

The adjusted models for children included child sex, age, household location, wealth index, food security, and maternal education. The models for mothers were adjusted by household location, wealth index, food security, and maternal education and age. We conducted further analyses with mothers to understand if the risk effect differed according to socioeconomic status: we stratified the adjusted model for mothers by wealth index.

RESULTS

At baseline, there were 2052 children, and we excluded 103 because of missing values. There were no differences between included and excluded participants regarding child age and sex, participation in either FAP, children nutritional status, and mother nutritional status.

The mean age of the children was 5.3 (SD = 0.4) years, and 50.5% were boys. The mean age of the mothers was 31.1 (SD = 6.7) years. Regarding the nutritional status of the children, 4.7% (95% CI = 3.7%, 5.6%) were underweight, 15.5% (95% CI = 13.9%, 17.1%) were overweight, and 5.1% (95% CI = 4.2%, 6.1%) were obese. At baseline, most of the children with obesity received the Glass of Milk program almost every month (37%; $P < .001$). For the mothers, 1.0% (95% CI = 0.3%, 1.0%) were underweight, 40.5% (95% CI = 38.3%, 42.7%) were overweight, and 14.6% (95% CI = 13.0%, 16.2%) were obese. At baseline, most mothers with obesity had high-school or higher education (66.1%; $P < .001$). For both children and mothers with obesity, most lived in urban areas and were in the top tertile of wealth index ($P < .001$). We excluded underweight children or mothers from further analyses.

In general, 62% of the children who participated almost every month in the Glass of Milk program were in the bottom wealth index tertile, whereas 61% of the children in the top tertile reported not participating in

this program ($P < .001$). However, such a discrepancy across socioeconomic strata was not observed in mothers in the Community Kitchens program. Nearly 85% of women across wealth index categories reported not participating in this program, and 10% of all women reported using it once or twice a month; 4% of all mothers reported participating almost every month ($P = .334$). Sociodemographic variables of children and mothers according to their nutritional status are shown in Tables 1 and 2.

Incidence and Risk of Overweight or Obesity Among Children

When the outcome was childhood overweight and obesity, we included 4010 and 4772 children-years, respectively. The overall incidence rate of overweight and obesity was 4.3 (95% CI = 3.7, 5.0) and 1.1 (95% CI = 0.9, 1.5) per 100 children-years, respectively; Table 3 shows the incidence rate by each category of the exposure variable. Children exposed nearly every month to the Glass of Milk program had a 65% lower risk of becoming obese compared with children not

participating in the program (Table 4). When we further adjusted these regression models for maternal age, the risk estimates did not change.

Incidence and Risk of Overweight or Obesity Among Mothers

When the outcome was mother overweight and obesity, we included 2419 and 4341 mother-years, respectively. The incidence rate of overweight and obesity was 9.8 (95% CI = 8.6, 11.1) and 3.3 (95% CI = 2.8, 3.9) per 100 mother-years, respectively. Mothers in households participating in the Community Kitchens program had a higher incidence of overweight and obesity (Table 3). Mothers participating frequently in the Community Kitchens program had almost twice the risk of becoming obese versus those who did not participate in this program (Table 4). When we stratified the adjusted model by each tertile of wealth index, there was a higher obesity risk for mothers across strata: in the bottom tertile, those who reported using the Community Kitchens

program for some months had a 250% higher risk of obesity. In the middle tertile, mothers who used the program some or almost every month had a 200% and 250% higher obesity risk, respectively. In the top tertile, only mothers who used the program almost every month had a 279% higher obesity risk.

DISCUSSION

In households participating in FAPs in resource-limited settings in a middle-income country, children and mothers have different obesity risk profiles: children who frequently participate in the Glass of Milk program had a 64% lower risk of developing obesity, but mothers frequently participating in the Community Kitchens program had a 93% higher risk of becoming obese. These results were independent of food security and wealth index, suggesting that the effect of the assessed FAPs cannot be explained by socioeconomic status, nor by lack of access to nutritional food. Thus, other variables could explain the association between FAPs and weight outcomes, warranting further studies to disentangle the implied mechanism linking FAPs and weight profiles.

Comparison With Other Studies

The risk of obesity in middle-income countries seems to be higher among those who are better off relative to those who are worse off, particularly for children and women.²² This could explain why our children were not at higher obesity risk. However, in developed countries, people in the lowest socioeconomic level are at higher risk of obesity, and this could explain the different results obtained in the United States.^{7–9} We report that children and mothers who have the same socioeconomic status have different obesity risk profiles. We hypothesize that mothers are moving faster toward rates of obesity similar to those observed in developed countries, but children are still somehow protected.

We found that mothers participating in the Community Kitchens program have a higher risk of obesity. Previous studies also reported that FAPs increase the prevalence and risk of

TABLE 1—Sociodemographic Variables of Children and Mothers According to Nutritional Status at Baseline: The Young Lives Study, Younger Cohort, Peru, 2006–2007

Variable	Overall	Normal Weight	Overweight	Obesity	P^a
Children					
Sex, no.	1949	1456	302	100	.51
Boys, %	50.5	50.0	53.0	54.0	
Girls, %	49.5	50.0	47.0	46.0	
Age, no.	1949	1456	302	100	.08
4 y, %	20.9	21.1	23.5	13.0	
5–6 y, %	79.1	78.9	76.5	87.0	
Glass of Milk, no.	1949	1456	302	100	<.001
No, %	35.6	33.0	41.4	54.0	
Yes, some months, %	16.4	17.6	14.2	9.0	
Yes, almost every month, %	48.0	49.4	44.4	37.0	
Mothers					
Age, no.	1941	820	751	271	<.001
18–27 y, %	35.7	40.4	30.6	27.7	
28–37 y, %	45.4	44.3	49.5	44.7	
38–47 y, %	17.4	14.0	18.2	26.6	
48–53 y, %	1.3	1.3	1.6	1.1	
Education, no.	1943	817	747	271	<.001
None or primary school, %	44.7	50.2	42.0	34.0	
High school or higher, %	55.3	49.8	58.0	66.1	

^a χ^2 test when comparing nutritional status.

TABLE 2—Household Variables According to Nutritional Status of Children and Mothers at Baseline: The Young Lives Study, Younger Cohort, Peru, 2006–2007

Variable	Overall	Children			<i>P</i> ^a	Mothers			<i>P</i> ^a
		Normal Weight	Overweight	Obesity		Normal Weight	Overweight	Obesity	
Household location, no.	1949	1456	302	100	< .001	820	751	271	< .001
Urban, %	69.4	66.8	72.5	86.0		61.3	73.6	85.6	
Rural, %	30.6	33.2	27.5	14.0		38.7	26.4	14.4	
Household wealth index, no.	1949	1456	302	100	< .001	820	751	271	< .001
Bottom, %	33.2	35.0	31.8	19.0		42.6	28.8	14.3	
Middle, %	33.5	35.0	30.1	15.0		30.4	35.7	41.0	
Top, %	33.3	30.0	38.1	66.0		27.0	35.5	44.7	
Household food security, no.	1949	1456	302	100	.03	820	751	271	.25
Food security, %	27.7	26.4	31.1	37.0		26.3	29.8	26.2	
Food insecurity, %	72.3	73.6	68.9	63.0		73.7	70.2	73.8	
Community Kitchens	1949	1456	302	100	.37	820	751	271	.20
No, %	85.9	85.5	87.1	91.0		86.6	86.7	81.2	
Yes, some months, %	9.8	10.2	8.3	8.0		8.9	9.2	13.3	
Yes, almost every month, %	4.3	4.3	4.6	1.0		4.5	4.1	5.5	

^a χ^2 test.

obesity, mostly for women.^{6,15} Overall, there seems to be a paradox when one compares these results with those of the children. A possible explanation includes the nutritional composition of the offer of each FAP. The Community Kitchens program, for example, provides meals with an excess of carbohydrates and few servings of fruits and vegetables. If physical activity is insufficient, there will be a positive energy balance leading to obesity. This seems a possible scenario because women in

resource-limited settings in Peru appear to have high rates of physical inactivity.²³ On the other hand, children in the Glass of Milk program receive a more balanced diet. Moreover, presumably children have higher rates of physical activity, thus leading to a negative energy balance and fewer new obesity cases.

Studies in Latin America have reported mixed results. In Brazil, an evaluation of the program *Bolsa Familia* revealed that the beneficiaries have a higher intake

of calorie-rich food with less nutritional value, which would lead to obesity.²⁴ In Mexico, the assessment of 2 assistance programs aimed at school-aged children did not yield higher obesity rates.¹⁰ Studies from Chile report that there was an increasing trend in obesity rates with a FAP with a plateau in 2001.¹¹ Statistics from 2002 to 2004 showed that the obesity prevalence was between 11% and 20% in preschool children,¹³ and in 2006, an assessment of central obesity revealed a prevalence of 16%.¹⁴ It has also been reported that beneficiaries of the FAP in Chile have better diet profiles when they consume what is provided by the program, but there is positive energy balance mostly when they eat at home and on the weekends.^{11,12}

TABLE 3—Incidence Rate per 100 Person-Years of Overweight and Obesity of Children and Mothers According to Food Assistance Programs at Baseline: The Young Lives Study, Younger Cohort, Peru, 2006–2007

Program	Incidence Rate (95% CI)	
	Overweight	Obesity
Children		
Glass of Milk		
No	6.1 (4.9, 7.6)	2.4 (1.7, 3.3)
Yes, some months	2.8 (1.8, 4.4)	0.6 (0.3, 1.5)
Yes, almost every month	3.6 (2.9, 4.5)	0.5 (0.3, 0.8)
Mothers		
Community Kitchens		
No	9.8 (8.5, 11.2)	3.1 (2.6, 3.7)
Yes, some months	11.2 (7.3, 16.8)	4.3 (2.6, 6.9)
Yes, almost every month	7.9 (4.0, 15.9)	6.2 (3.4, 11.2)

Note. CI = confidence interval.

Interpretation of the Results

The higher obesity risk observed among mothers could be attributable to unhealthy diets. Relative to Supplemental Nutrition Assistance Program (SNAP) nonbeneficiaries, beneficiaries have poorer quality diets^{8,25–27} and consume more sweetened beverages.^{8,16,28,29} Although the Community Kitchens program does not deliver sweetened beverages, they provide diets with lots of carbohydrates and few servings of fruits and vegetables. The FAPs such as the Community Kitchens program are located in poor

TABLE 4—Relative Risk of Overweight or Obesity Among Children and Mothers According to Food Assistance Programs at Baseline: The Young Lives Study, Younger Cohort, Peru, 2006–2007

Program	Overweight, RR (95% CI)		Obesity, RR (95% CI)	
	Crude	Adjusted	Crude	Adjusted
Glass of Milk, children, no.	417		1450	
No (Ref)	1	1	1	1
Yes, some months	0.52 (0.33, 0.82)	0.84 (0.58, 1.22)	0.25 (0.08, 0.73)	0.44 (0.15, 1.33)
Yes, almost every month	0.62 (0.43, 0.90)	0.96 (0.66, 1.38)	0.19 (0.10, 0.37)	0.35 (0.18, 0.66)
Community Kitchens, mothers, no.	767		746	
No (Ref)	1	1	1	1
Yes, some months	1.23 (0.97, 1.55)	1.25 (0.97, 1.60)	1.51 (0.93, 2.43)	1.47 (0.93, 2.36)
Yes, almost every month	0.85 (0.40, 1.77)	0.90 (0.43, 1.86)	1.70 (0.93, 3.12)	1.93 (1.18, 3.15)

Note. CI = confidence interval; RR = relative risk. Models for children adjusted by sex, age, household location, wealth index, food security, and maternal education; all assessed at baseline. Models for mothers adjusted by household location, wealth index, food security, maternal education, and maternal age; all assessed at baseline.

neighborhoods, where the built environment or much traffic may prevent people from engaging in physical activity and where healthy food choices may not be available.^{6,23,30,31} Although the United States represents a different epidemiological context, the following example sheds further light on the environmental effect. Children who grew up in well-off neighborhoods and participated in SNAP have higher BMI values at adulthood than their peers who did not participate in the program, and this difference decreases when one compares children raised in less-advantaged settings.³²

In terms of socioeconomic profiling, the “food stamp cycle” and the “income effect” have been proposed to explain the association between SNAP participation and obesity in the United States⁶; however, these effects may not explain our results. Participation in SNAP provides monthly benefits to purchase food,³³ whereas the programs assessed in this study directly provide food. As a consequence, alternative explanations could be proposed: (1) households receiving food assistance really do not need it¹⁵ or (2) the assistance distribution within households is not equitable. With regard to the first possible explanation, authorities should efficiently select beneficiaries by assessing socioeconomic and nutritional variables at the household and individual levels. Although our results showed that there may be a higher obesity risk for mothers across all wealth index tertiles, these estimates could have

a limitation because of lack of statistical power for subgroups analysis. This is different from what had previously been reported in Peru, where, in a cross-sectional study, the investigators only found a higher obesity prevalence in women with no poverty indicators.¹⁵ The second possible explanation could be supported by the fact that the distribution of energy and macronutrients within a family may vary for each member and according to their relationship with the household head.³⁴

In middle-income countries, obesity, particularly for children and women, is more frequent among people who are better-off²²; however, such a trend may have changed in the past year, as well as by country and according the indicator used.^{21,35} Our results indicate how low-resource settings in Peru are moving toward the obesity profiles of developed countries. Thus, FAPs may offer an excellent venue for obesity prevention programs and for overall better nutritional status at the household level.¹¹

Strengths and Limitations

This study presents the results of a prospective cohort study, which rules out reverse causation. This study explored the association of interest according to the frequency of participating in FAPs. In addition, our study explored the participation in FAPs during the past year, whereas other studies did not define a time frame; however, it could also be a limitation as the development of obesity

may require a longer exposure to these programs.

It could be argued that not including the other countries of the Young Lives study is a limitation. We believe it is not a limitation but a conservative decision: FAPs between these countries may not be comparable because of differences between populations as well as in the objectives, methods, and procedures of each FAP.

Further limitations should be highlighted. First, we did not include some variables that had been explored in other studies. For example, we did not include the characteristics of the neighborhood, which seem to be important determinants of the association of interest (e.g., access to healthy food options).³² Future studies in developing settings should include this variable, as these settings are becoming filled with fast-food restaurants and other unhealthy food choices. In addition, we did not have data on food intake. Future studies should include food intake assessed with valid methods and clearly identifying food consumed as part of the program and otherwise.

Second, the questions regarding the exposures of interest referred to the previous year. If a participant's economic status improved, they could have become ineligible for food supply programs, whereas if a participant's economic status worsened, they could have faced further difficulties in meeting the nutritional requirements. Nevertheless, the wealth index used in this study did not vary much between baseline and follow-up.

Third, we could not assess whether a given family participated in both programs at the same time, or if they participated in any other. Thus, the influence of other programs could have influenced our results. However, the programs assessed in this study are strictly related to food assistance, whereas other initiatives such as cash transfer programs can be used for any purposes. Therefore, the effect of any other program on the nutritional status of the household member could have had a minor impact on our results.

Fourth, we excluded a significant number of mothers from the incidence analysis as they were already overweight or obese at baseline, possibly adding selection bias to our results. This would be particularly true if they were overweight or obese when they entered the FAP. We cannot determine the nutritional

status of the mothers when they first participated in the program. Future studies could address this limitation by following the mothers beginning the first time they received the FAP. Furthermore, another source of selection bias is the inclusion criteria for each FAP and where these are located: a FAP based in a low or low-middle income setting with participants who have low-salary jobs may be different from those based in a poor rural setting.

Fifth, the ascertainment of the exposure variables could have been affected by social desirability bias. If social desirability influenced the answers to the exposure questions, participants could have answered “no, they do not participate” as this would have made them appear to be in a better socioeconomic position; alternatively, they could have answered “yes, they participate very often” to sustain their eligibility status. However, in the overall distribution of, for example, the Glass of Milk program, 35.5% answered “no [participation]” and 47.9% answered “almost every month.” As a consequence, we believe social desirability did not skew the results, thus having little impact in the overall results.

A sixth limitation is the low prevalence of childhood obesity and the short follow-up time. Subsequent rounds of the Young Lives study, and other prospective cohorts including families, would help to assess whether our results sustain in time.

Conclusions

In resource-limited settings in a middle-income country, participation in 2 specific FAPs, measured by self-report, is associated with a lower risk of developing obesity for children (Glass of Milk program) but a higher risk of developing obesity for mothers (Community Kitchens program). Strategies to improve the nutritional status of either mothers or children could be conducted through specific FAPs. Interventions conducted in this population could have important implications in improving the overall nutritional status at the household level. **AJPH**

CONTRIBUTORS

R. M. Carrillo-Larco conceptualized the idea, conducted the analysis under the supervision of A. Bernabé-Ortiz, and drafted the article. All authors interpreted the results, participated in writing the article, provided important

intellectual content, and gave their final approval of the version submitted for publication.

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Note. The views expressed here are those of the author(s). They are not necessarily those of Young Lives, the University of Oxford, Department for International Development, or other funders.

HUMAN PARTICIPANT PROTECTION

This study is a secondary analysis of publicly available data from the Young Lives study. The Young Lives study received ethical approval as a whole as well as in each study site. Only de-identified data were used in this study. No personal information was available or is presented.

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