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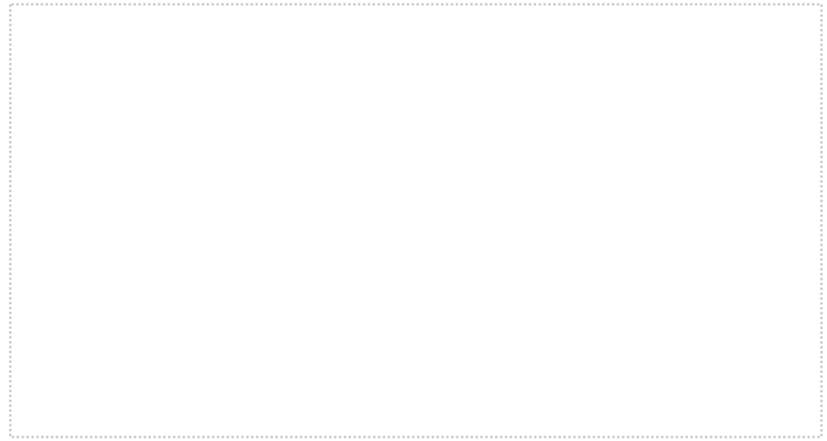

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Fig. 1.

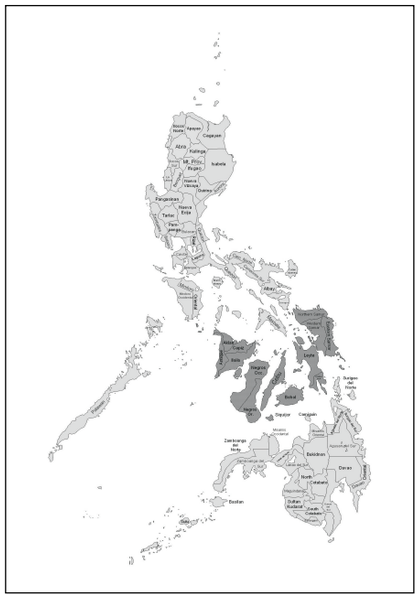
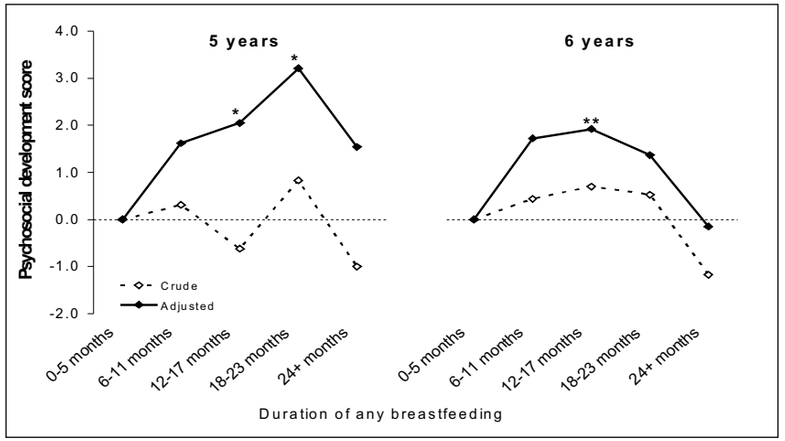


Fig. 2.



No. 11

Breastfeeding and Later Psychosocial Development in the Philippines

Paulita L. Duazo, Josephine L. Avila
and
Christopher W. Kuzawa

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TABLE 3. Regression models relating duration of breastfeeding to psychosocial test score measured at 5 and 6 years of age[1]

Breastfeeding Duration (months)	5 years (n=1, 405)		6 years (n=1,347)	
	crude	**adjusted**[2]	**crude**	**adjusted**[2]
0-5	0.0	0.0	0.0	0.0
6-11	0.31 (-2.11, 2.73)	1.62 (-0.75, 3.99)	0.44 (-2.07, 2.95)	1.72 (-0.72, 4.16)
12-17	-0.62 (-2.55, 1.30)	2.05 (0.08, 4.02)**	0.70 (-1.26, 2.67)	1.92 (-0.01, 3.86)*
18-23	0.83 (-1.61, 3.28)	3.21 (0.78, 5.65)**	0.53 (-1.73, 2.80)	1.37 (-0.85, 3.60)
24+	-1.0 (-3.0, 1.0)	1.54 (-0.49, 3.57)	-1.17 (-3.32, 0.98)	-0.15 (-2.27, 1.96)
R^2	0.00	0.08	0.00	0.09

[1](95% CI), *p<0.1, **p<0.05
[2]Adjusted for gender of child, daycare attendance, maternal education, father's presence at home, hygiene, non-income producing assets

Figure Legends

Fig. 1. Map of the Philippines. Project areas are presented in dark grey. Communities included in the study have been identified as either “at risk” or “in need” of additional services, as indicated by high rates of infant mortality, childhood wasting, and a high elementary school drop out rate.

Fig 2. Association between duration of breastfeeding and psychosocial development score of 5 and 6 year-old children (from multiple regression, value is β adjusted for gender of child, daycare attendance, maternal education, father's presence at home, hygiene, non-income producing assets). *p<0.1, **p<0.05

TABLE 1. Sample characteristics

	Value[1]
Child	
Male (%)	53.6
Breastfeeding duration (months)	13.7 ± 8
Had prenatal care (%)	92.4
Birth complications (%)	3.2
Received multivitamin (%)	23.8
Attendance in daycare (%)	58.7
Family	
Maternal age (years)	31.9 ± 8.2
Father present (%)	90.2
Paternal education (years)	7.4 ± 3.4
Maternal education (years)	8.2 ± 3.7
Legally married (%)	94.4
Electricity in home (%)	71.2
Owns television (%)	29.5
Lives in ECD program barangay (%)	60.6

[1]means ± SD unless marked otherwise

TABLE 2. Means and standard deviations of parental and household characteristics

	Duration of breastfeeding (months)					
	0 to 5	**6 to 11**	**12 to 17**	**18 to 23**	**24+**	**p[1]**
Mother's education (years)	9.6 ± 3.9	8.4 ± 3.8	7.7 ± 3.5	8.0 ± 3.4	7.8 ± 3.5	0.001
Father's education (years)	8.8 ± 4.3	8.1 ± 4.0	6.9 ± 3.6	6.9 ± 3.7	6.9 ± 3.6	0.001
Mother's age (years)	34.2 ± 10.4	31.0 ± 8.7	30.7 ± 7.4	31.2 ± 7.4	32.5 ± 6.9	0.001
Father's age (years)	36.6 ± 10.2	33.6 ± 8.7	33.9 ± 8.2	34.4 ± 8.7	36.2 ± 8.3	0.001
Asset scale (0-20)	2.7 ± 3.0	1.8 ± 2.5	1.2 ± 1.9	1.1 ± 2.0	1.0 ± 1.9	0.001
Hygiene scale (0-12)	6.8 ± 2.1	6.2 ± 2.2	6.1 ± 2.2	6.1 ± 2.2	5.9 ± 2.3	0.001
Electricity in home (%)	82.2	74.6	68.6	68.4	65.0	0.001
n	551	334	832	395	640	

[1]p-values based on one-way ANOVA or Pearson's 2 X^2

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Abstract

Recent work has emphasized the lasting impact of early life nutrition on health, human capital and economic performance. This study evaluates whether breastfeeding duration predicts later psychosocial development in a large low socioeconomic status (SES) sample in the Philippines. The sample consists of 2,752 children aged 5-6 years who were measured in 2004 as part of the Philippine government's Early Childhood Development Project (ECD). Duration of any breastfeeding was the primary exposure, which was the primary independent variable in models predicting a cumulative index of psychosocial development that has been shown previously to predict school readiness. In this sample, children of mothers with low education and SES tended to breastfeed longer. Despite this, breastfeeding duration was a positive predictor of future psychosocial development (PD) measured in late childhood, but only after adjustment for SES and related confounders. These findings add to growing evidence that breastfeeding could provide lasting economic and social benefits that transcend immediate impacts on infant nutrition and growth.

Introduction

The health benefits of breastfeeding for child nutritional status and growth are a primary rationale for promoting breastfeeding in developing nations (Popkin et al., 1990). Breastfeeding has also received attention for its demographic consequences as a suppressor of ovulation and protection against short interbirth intervals (Thapa et al., 1988). More recent attention has focused on the potential for improved early life nutrition, including breastfeeding, to lead to improvements in offspring health and economic performance that persist into adulthood (Barker 1994; Gluckman and Hanson 2006; Palloni 2006). Breastfeeding has been linked to lower rates of adult chronic diseases, including obesity and diabetes (Schack-Nielsen and Michaelsen 2006). Studies also find that children exclusively breastfed or who were breastfed for longer score better in mid-childhood on tests of motor or cognitive development (Daniels and Adair 2005; Quinn 2001; Sacker 2006).

The broader social and economic impacts of breastfeeding could be highly relevant to the Philippines, where the government currently has a policy of strong promotion of breastfeeding (Department of Health 2007). Despite this, few studies have investigated the potential impacts of breastfeeding on offspring health and development in the country. One recent study in the Philippines reported a beneficial effect of longer duration of breastfeeding on IQ score measured in mid- and late-childhood (Daniels and Adair 2005). These apparent benefits of having been breastfed were detected only after adjusting for the lower educational attainment and lower socioeconomic standing that characterized women in the sample who breastfed longer. These findings reveal how the

impact of breastfeeding may extend beyond infant nutritional benefits to positively impact human capital. While these recent findings are important, this study used data collected more than 2 decades ago in urban and outlying areas of Metro Cebu, the Philippine's second largest metropolitan area. Whether these findings are relevant today, and in the predominantly rural areas where breastfeeding is more common, remains to be evaluated.

In this paper, we assess the potential impact of breastfeeding on child development as measured by a composite scale of psychosocial development obtained when children were 5 or 6 years old. This scale reflects a child's performance across 7 different developmental domains that collectively index a child's readiness to enter and succeed in primary school. Data come from a large, population-based longitudinal survey of child nutrition and growth that was recently conducted in central regions of the Philippines. Follow-up data on psychosocial development, used together with data on duration of breastfeeding and on a range of potential socioeconomic, educational and other confounding factors, provide a unique opportunity to evaluate the broader effects of breastfeeding on psychosocial development in a lower income, rural subset of Philippine society.

Materials and Methods

Study population

This study uses data from a longitudinal evaluation of the Early Childhood Development (ECD) intervention, part of the larger Baseline Indicators Study of the Early Childhood Development Project initiated by the Philippine government. The goal of the ECD Project was to improve the survival and developmental potential of at-risk children in predominantly rural regions of the country (Office of Population Studies 2002). Rather than changing existing programs, it provided technical and financial support to local government units (LGUs) with the intent of enabling them to deliver improved services for pregnant mothers and children.

The evaluation study collected information on program implementation, and on the quantity and quality of service delivery in health- and non-health services. It also collected household information, child-rearing behaviors, and maternal health and health care-seeking practices. Outcome measures included indices of child growth, health and development. At baseline, the study enrolled 7,925 children representative of 0-4 year old infants and children in project areas **(Fig. 1)**. Follow-ups were conducted at yearly intervals with a total of 4 surveys completed by the end of the study in 2005. During the Year 4 survey, members of the baseline cohort ranged in age from 4 to 9 years, with a sample size of 6,871. Attrition was due mainly to migration (9.3%), deaths (0.4%), refusals and others (2.2%) (Armecin et al., 2006; Office of Population Studies 2005).

For the present analyses, we limit our sample to children who were followed since baseline and who were 5-6 years of age during the psychosocial assessment conducted in Study Year 4. This corresponds with an age when psychosocial development has been found to stabilize (Patterson 2008) and is also the age of entry into schooling (World Bank 2004). In addition, children with physical and neurological abnormalities that could influence test

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samples is uncertain, but could reflect several factors. Although in theory this could indicate that breastfeeding for longer durations has declining benefits, we feel that residual confounding is a more likely explanation. In this sample, infants who were breastfed longest come from the lowest income households and were born to mothers of lower educational attainment. Thus, it seems likely that our ability to adjust adequately for the negative impacts on development that poverty and its related exposures have in the long breastfeeding duration subgroup was constrained by our imperfect measures of these confounding influences. An intervention study would be necessary to establish whether the apparent declining benefit associated with the longest breastfeeding durations is real or an artifact of residual confounding. While these details remain to be clarified, our findings suggest that, compared to children who were not breastfed or for a shorter duration, breastfeeding for longer durations has important benefits for developmental outcomes of relevance to education and human capital.

The relationships documented here are consistent with and complement prior findings in the Philippines by Daniels and Adair (2005) who used 1983-1986 infant feeding data to predict IQ in a population-based sample living in Metro Cebu. In their sample, longer periods of breastfeeding predicted higher childhood IQ, with benefits of breastfeeding peaking during the second year of breastfeeding. Similar to our findings, the relationships that they documented were only detectable after adjusting for strong negative confounders that tend to be correlated with breastfeeding duration and that have negative impacts on offspring psychosocial development. Our analysis reveals a similar pattern of benefits to psychosocial characteristics that predict school readiness in a contemporary sample representing rural regions of the country where breastfeeding is common.

There is currently much interest in the lasting influence of early environments on later health and well-being (Gluckman and Hanson 2006). While much of this research has focused on the influence of nutrition on later chronic disease (e.g. Barker 1994), including in the Philippines (Adair et al 2001; Kuzawa and Adair 2003), the impact of similar developmental processes on economically-relevant outcomes, such as cognitive or school performance, is gaining increasing attention (e.g. Palloni 2006). Our findings add to this body of knowledge by suggesting that breastfeeding could have beneficial effects on psychosocial development, which is a significant predictor of school readiness in this sample. Despite the lower educational attainment and household incomes of breastfeeding mothers and offspring, we found evidence for benefits of breastfeeding on the psychosocial development of children once we adjusted for these factors in multiple regression models. Our findings suggest that programs that aim to promote breastfeeding could have benefits for child psychosocial development and school readiness, beyond the better-appreciated short-term benefits to infant nutrition and growth status.

ACKNOWLEDGEMENTS

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performance, such as esotropia, autism or cerebral palsy (57 or 2.1%), and those with incomplete data (32 or 1.2%), were also excluded from the analysis. The final analysis sample was 2,752. We evaluated whether the sub-sample differed significantly from the total sample with respect to key socioeconomic and other characteristics. Children in the analysis sample had mothers who were 10 months younger ($p<0.05$) and were more likely to have their fathers present ($p<0.05$). However, there were no significant differences in mother's or father's educational attainment, breastfeeding duration, birth weight and child's health at two years.

Variables

Psychosocial development. Psychosocial development was assessed using the Philippines Revised Early Childhood Development Checklist (REC) in which the skills listed were developmentally sequenced by age. The REC was designed primarily to emphasize specific strengths and weaknesses in the child's developmental stage and to aid caregivers and health providers in their assessment of the different stages of development among children aged 0 to 84 months (Bautista and Reyes 2001; OPS 2005). For older children the tool was aimed at measuring the personal and social adjustment, literacy, and school readiness skills of children. It includes items which are important pre-requisites for school readiness and into early years of primary grades including emergent literacy skills and psychosocial attributes essential to adjust to school life. It covers seven developmental domains including gross motor, fine motor, receptive language, expressive language, social-emotional, self help and cognitive function. Overall psychosocial development was defined as a composite of the seven underlying domains (Cronbach's alpha =0.86). Prior work has shown that it is a strong predictor of school readiness in this cohort of children ($r=0.48$). Before analysis, each domain score and the composite psychosocial development scores were converted into age-specific norms based upon a reference population composed of 10,915 children from six regions in the Philippines (OPS 2002). The scaled scores for each domain and the composite scores were derived and used to classify developmental indices for each child in the study. The scaled score ranged from 1-19 with a standard deviation of 3; the composite score was reported as a standard score ranging from 35-150 with a standard deviation of 15 (OPS 2005).

The psychosocial development checklist was administered during the 4 surveys. At the end of the Year 4 survey, children were 4 to 9 years of age. The composite score at age 5 years had a relatively large correlation (Pallant 2000) with fine motor, self-help, expressive language, cognitive, and social-emotional domains (r's=0.55,0.58,0.53,0.64 & 0.64, $p<0.05$, respectively), with a comparable pattern observed at age 6. As expected, mean scores increased with age (108.6 at 6 years vs. 99.4 at 5 years, $p<0.05$).

Duration of any breastfeeding. Our main exposure was duration of any breastfeeding (BF), which was evaluated through maternal recall at each of the yearly follow up surveys. Maternal recall of BF duration has been shown to be accurate and reliable in validation studies, many of which have included a longer period between breastfeeding and recall than our yearly surveys (Gillespie et al., 2006; Promislow et al., 2005; Kark et al., 1984). Individuals were assigned to one of five categories representing duration of breast feeding, corresponding to the recent study of Daniels and Adair (2005): 0

- 5 months (comparison group), 6-11, 12-17, 18-23 and 24+ months of breastfeeding. All analyses incorporated the "never breastfed" individuals into the 0-5 month group, since similar results were obtained when "never breastfed" individuals (~5% of the sample) were grouped together with the 0-5 month group and when "never breastfed" was modeled using a separate dichotomous variable.

Potential confounding variables. A range of potential confounders between breastfeeding and later psychosocial development were identified a priori based upon similar published studies (Daniels and Adair 2005; Clark et al., 2006; Sacker et al., 2006) and from associations within the data set. These included gender, age, daycare attendance, existence of offspring health problem at birth, prenatal care, mother's education, presence of father within the household, access to electricity, hygiene, household assets and ECD program exposure. Exposure to program services has been shown to significantly improve child psychosocial status (Ghuman et al., 2006). Household wealth or non-income producing assets were evaluated by tallying ownership of common household appliances. Hygiene status, with scores ranging from 0-12 (0 being poorly kept), was included reflecting cleanliness inside the house, food storage, presence of excreta outside the house, and garbage and waste disposal.

Statistical analysis

All statistical analyses were conducted using STATA Version 10 (College Station, TX). Analysis began with consistency testing of the composite index derived from the 7 domains of psychosocial development using the Cronbach Alpha. To examine selectivity due to sample attrition of the children between baseline and the Year 4 survey, a likelihood test of children participating in the Year 4 survey based on selected baseline characteristics was applied. Bivariate analysis was performed using simple descriptive statistics, with differences across levels of breastfeeding duration evaluated using chi-square and ANOVA. Unadjusted relationships between breastfeeding duration and of the composite development score in the final survey were evaluated using least squares regression. Finally, the relationship between duration of breastfeeding and psychosocial development was considered after adjusting for factors that might confound or mask the association between breastfeeding duration and later psychosocial maturity using multiple regression models. Backward elimination using the change-in-estimate approach was used to determine which a priori potential confounding factors significantly influenced the models, and thus, which were retained in the final model. If exclusion of the variable in the model substantially (>10%) changed the breastfeeding duration effect estimate, the variable was retained in the model. Because prior research in the Philippines has shown a diminishing effect of breastfeeding on IQ with increasing age/time elapsed since breastfeeding (Daniels and Adair 2005), we stratified all models by age during the final survey when psychosocial development was evaluated.

Results

Children were breastfed for an average of 14 months. The majority had mothers who sought prenatal care during pregnancy and for whom birth complications were not a problem. At baseline, less than one-fourth of the children were given multivitamin

supplementations. At the time of psychosocial evaluation, more than half of the children in the sample had attended daycare. More than half of the children lived in ECD program barangays which provided greater access to the ECD interventions. Maternal age was 32 years on average and about 94% were legally married **(Table 1)**.

In bivariate analysis, children of mothers with lower educational attainment tended to be breastfed longer ($p<0.01$). They had fathers with fewer years of education, and lived in households with lower levels of material assets and wealth (Table 2). In unadjusted models, there were no trends apparent between duration of breastfeeding and psychosocial development scores of children at any age. However, after adjusting for measures of maternal education, presence of father in home, day care attendance, and a range of wealth and status measures, a relatively consistent relationship between breastfeeding duration and psychosocial development emerged **(Table 3)**. When compared to children who were breastfed between 0-5 months (reference group), those who were breastfed longer tended to have higher psychosocial scores. This apparent benefit peaked sometime during the second year of life and then declined, with 24 months or more of breastfeeding predicting less of a benefit over the control group at all ages. This pattern was strongest in those individuals who were youngest at the age of psychosocial assessment (5 years of age). The regression coefficients declined by 6 years of age but retained the same general pattern **(Fig. 2)**.

Discussion

In a large, representative sample of rural Filipinos, we find evidence suggestive of a beneficial effect of breastfeeding on the psychosocial development of children. Our findings are consistent with the results of other studies documenting benefits of breastfeeding in both developed and developing nations, which have found that, compared to formula fed infants, breastfed infants have better growth status (Sacker et al., 2006), cognitive skills and school performance (Quinn et al., 2001; Horwood et al., 1998; 2001; Angelsen et al., 2001; Oddy, 2003) and emotional development (Woodward and Liberty 2005). The psychosocial scale used in our study is a predictor of abilities related to language acquisition, cognition and psychosocial maturity deemed essential for primary school entrance, and is also correlated with school readiness itself. Thus, our findings extend prior work to suggest that there may be benefits of breastfeeding to the domains of cognitive and psychosocial maturity that allow successful adjustment to school life in the primary grade levels.

In this sample, breastfeeding was more common among women living in rural, lower income households and communities, and who had lower educational attainment. Despite the negative effect of such factors on offspring developmental outcomes (Clark et al., 2006), we found evidence for a protective effect of breastfeeding on later psychosocial development when these effects were adjusted in multiple regression models. In the 5-year old age group, the psychosocial score among children breastfed 12 months or more was 2 to 3 points higher compared to those who were breastfed for less than 6 months. These associations were found to be significant. However, for those who were breastfed for more than 2 years, the apparent protective effect of breastfeeding was diminished. A similar trend was observed among the 6-year old group, and was also reported in the study by Daniels and Adair (2005). Why the apparent benefit of breastfeeding is reduced at older ages in these