International Journal of Educational Research 75 (2016) 102–114

Contents lists available at ScienceDirect

International Journal of Educational Research

journal homepage: www.elsevier.com/locate/ijedures

Does pre-school improve cognitive abilities among children with early-life stunting? A longitudinal study for Peru

Santiago Cueto[a,*], Juan León[a], Alejandra Miranda[a], Kirk Dearden[b], Benjamin T. Crookston[c], Jere R. Behrman[d]

[a] Group for the Analysis of Development, Av. Grau 915, Barranco, Lima 4, Peru
[b] Micronutrient Initiative, 801, Second Floor, B-28, Qutab Institutional Area, Tara Crescent, New Delhi 110016, India
[c] The College of Life Sciences, Brigham Young University, 2137 LSB Provo, UT 802, United States
[d] University of Pennsylvania, 3718 Locust Walk, Philadelphia, PA 19104, United States

ARTICLE INFO

Article history:
Received 7 May 2015
Received in revised form 11 September 2015
Accepted 29 September 2015
Available online 29 December 2015

Keywords:
Child development
Pre-school
Height-for-age
Peru

ABSTRACT

Several studies in developing countries have found that children who experience growth faltering in the first years of life show lower cognitive abilities than their peers. In this study, we use the Young Lives longitudinal dataset in Peru to analyze if attending pre-school affects cognitive abilities at age five years, and if there is an interaction with HAZ at age one year. Using instrumental variables we found, for receptive vocabulary, a positive effect of attending *Jardines* (formal) pre-schools; the effect of attending *PRONOEI* (community-based) pre-schools was not significant. More years attending *Jardines* was more beneficial for children who were better nourished. We suggest working to improve the quality of *PRONOEI*s, and with teachers on targeting children of lower nutritional status.

1. Introduction

Many empirical studies have shown negative associations between early growth faltering in children, subsequent low height-for-age *z*-scores (HAZ) over time relative to the medians for the WHO (2006) reference for well-nourished populations, and school achievement and learning. For example, Grantham-McGregor et al. (2007) reviewed the literature in developing countries and found that early stunting (HAZ < -2 SD from median) and poverty in the first five years of life were associated with lower subsequent cognitive abilities, school achievement, and productivity in adult life. Their estimates suggest that worldwide 200 million children under five years of age in developing countries are not fulfilling their developmental potential. Theoretical models and empirical findings suggest that schooling (or other formal educational programs) and nutrition may have independent but also possibly interactive effects in promoting children's development. For example, Pollitt (1990, 2002) reviewed empirical studies that showed that different health and nutrition deficiencies have impacts on school achievement. Brown and Pollitt (1996) provided a theoretical model on how undernutrition could affect intellectual development, including schooling attainment as a mediating mechanism.

Starting interventions early would seem an important consideration, in order to avoid what could be irreversible damage due to early-life growth faltering and other developmental deficiencies. This would seem to point to the possible value of pre-school interventions. Indeed, among educators and many policymakers, early childhood care and education have

* Corresponding autor: Fax: +51 1 247 1854.
E-mail addresses: scueto@grade.org.pe (S. Cueto), jleon@grade.org.pe (J. León), amiranda@grade.org.pe (A. Miranda), kdearden@micronutrient.org (K. Dearden), benjamin.crookston@gmail.com (B.T. Crookston), jbehrman@econ.upenn.edu (J.R. Behrman).

http://dx.doi.org/10.1016/j.ijer.2015.09.011
0883-0355/

become a priority, and were included as the first goal of Education for All [EFA] (UNESCO, 2006). EFA reports show that pre-school enrolment rates are increasing in most countries. Internationally, there is evidence of the positive effects of early childhood care and education on later achievement (Ruhm & Waldfogel, 2011); however, the impacts of programs vary, suggesting that there are issues of quality in how programs are conceived and implemented (see Barnett, 2008, for the USA; Goodman & Sianesi, 2005 for the UK; and Díaz, 2006, for Peru). Montie, Xiang, and Schweinhart (2006) examined the impact of pre-school attendance on cognitive and verbal abilities by age seven years in a 10-country study. Even though their study included only children enrolled in pre-school, they found that abilities by four years of age predicted abilities three years later, thus emphasizing the importance of early interventions. Schady et al. (2015) also report that differences in cognitive skills by household wealth quartiles begin prior to 30–36 months of age and persist into the early schooling years in five Latin American countries, including Peru. Engle et al. (2011) estimate high benefit-cost ratios (6.4–17.6, depending on baseline enrollment and discount rates) for reducing pre-school enrollment gaps by wealth quintiles in 73 developing countries. In spite of the potential benefits pre-school may have on the development of cognitive abilities of children in developing countries, to our knowledge there are only a handful of studies that examine the benefits of pre-school on children who experience early-life growth faltering. The present study explores if the type of pre-school and the number of years attended is related to children's skills by age five years, and also if there is an interaction between HAZ at age one year and attending either type of pre-school on children's cognitive skills.

1.1. Stunting, development of cognitive abilities and schooling

Early-life stunting is widely considered a non-specific indicator of chronic undernutrition. Though reductions in stunting prevalence are occurring globally, chronic undernutrition continues to be a major public health issue, especially for developing countries. De Onis, Blossner, and Borghi (2012) have estimated that worldwide, 171 million children are stunted (data for 2010). Most stunted children live in developing countries, with particularly high and stagnant rates in Africa and downward trends in Asia and Latin America, though still relatively high in much of Asia and a few countries in Latin America. Causes of early undernutrition are varied and depend upon manifestation. Infants and young children who fail to thrive (i.e., whose weight, height, head circumference, and psychosocial development are markedly below age-related norms) may fail because of organic and non-organic reasons including illnesses and genetic conditions on the one hand and inadequate parenting and environmental factors on the other (Iwaniec, 2004). McDougall, Drewett, Hungin, and Wright (2009) found eating difficulties to be associated with early weight faltering. However, Wright, Parkinson, and Drewett (2006) found that social and maternal characteristics had little influence. With respect to wasting, Martorell and Young (2012) found that high levels of undernutrition were associated with the poor status of women, the "thin-fat" infant phenotype, chronic dietary insufficiency, poor dietary quality, seasonality, and poor levels of sanitation. Martorell and Young (2012) and Schott, Crookston, Lundeen, Stein, and Behrman (2013) have identified a range of factors associated with stunting, including wealth, short stature of the mother, being a thin mother, mother's and father's level of schooling, and early age at first delivery. Victora, de Onis, Hallal, Blossner, and Shrimpton (2010) have found that growth faltering begins quickly after birth, thus suggesting that interventions should start during pregnancy or before children reach two years of age. In Peru, stunting prevalence has gone down (about 18% of children under 5 years of age are stunted; data for 2009; UNICEF, 2011). The prevalence of chronic undernutrition in Peru places the country above the mean for Latin America and the Caribbean, with reductions observed in most countries (UNICEF, 2006).

Several longitudinal studies provide ample evidence regarding the association between early growth faltering and later cognitive abilities and school achievement. For example, in Zimbabwe, Alderman, Hoddinott, and Kinsey (2006) found that undernutrition in early childhood had an effect on the number of school grades completed by young adulthood. For Guatemala, Behrman et al. (2014) found an impact of HAZ by age 72 months (plus or minus six months) on adult reading and cognitive abilities. The literature review mentioned above by Grantham-McGregor et al. (2007) also concludes that early stunting predicts later cognitive ability and school achievement.

Some limited literature has focused on the potential role pre-school and primary school attendance may have in helping children who experienced early-life growth faltering. For example, Grantham-McGregor, Powell, Walker, Chang, and Fletcher (1994) found that for severely undernourished, hospitalized, Jamaican children (initial ages 6–24 months), an intervention that started at the hospital but continued at home (i.e., two visits per week for three years) had an effect on cognitive development up to 14 years after treatment. This intervention included efforts to help mothers increase their verbal interactions and improve their play with children. Also, Walker, Chang, Powell, and Grantham-McGregor (2005) report on a study on nutrition and psychosocial stimulation of Jamaican children. The psychosocial intervention consisted of visiting children at home once a week for one hour for two years. The purpose of visits was to improve mother–child interactions. The intervention occurred when children were 9–24 months. While both the nutrition and psychosocial interventions had positive impacts in the short term, only the psychosocial intervention showed an impact on measures of cognitive development and achievement when children were 17–18 years of age. In a longitudinal study in the Philippines, Mendez and Adair (1999) found that stunting between zero and two years of age predicted cognitive abilities when children were 8–11 years old. More importantly, they found that stunted children were more likely than non-stunted children to enroll late in primary school, were absent more, and repeated more grades. In a longitudinal study in Guatemala, Hoddinott et al. (2013), using instrumental variable techniques, found that a one-SD increase in HAZ at age 24 months was associated with more