



Chronic undernutrition, short-term hunger, and student functioning in rural northwest China



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ARTICLE INFO

Article history:

Received 29 March 2016

Received in revised form 9 December 2016

Accepted 13 December 2016

Keywords:

Hunger
Height-for-age
Dropout
Internalizing problems
Externalizing problems
Non-cognitive behavior

ABSTRACT

Chronic undernutrition and hunger remain significant problems for children, in global perspective, and may have important implications for children's ability to function effectively at school. In this paper, we capitalize on a longitudinal data set of children in 100 villages in Gansu Province to estimate differences in achievement, behavior, and long-term persistence associated with chronic undernourishment and short term hunger. We show that chronic undernourishment and short-term hunger relate to children's school functioning in distinct ways: chronically undernourished children have poorer literacy acquisition and subsequent school persistence, while children who report subjective hunger have more behavioral problems.

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1. Introduction

Chronic undernutrition and hunger remain significant problems for children, in global perspective. In 2011, at least 165 million children were affected by stunting, or low height-for-age, a common indicator of chronic undernutrition (Black et al., 2013). In China, despite very rapid improvements in nutrition in recent decades, UNICEF figures indicate that there are about 12.7 million stunted children (Liang, 2013). In poor rural communities in China's central and western provinces, UNICEF figures indicate that one out of 10 children under 5 is stunted (Liang, 2013). In addition to chronic undernutrition, short-term hunger is widespread. The *World Food Program (2015)* estimates that 66 million primary school-age children attend classes hungry across the developing world. A recent study of boarding school students in a province in Western China revealed that over half of children surveyed reported sometimes or often feeling hungry in class and feeling hungry at night to the point that it keeps them awake (Luo et al., 2009, p. 14).

While childhood undernutrition and hunger are important concerns in their own right, they may also have important implications for children's ability to function effectively at school. "Material hardships related to food," including food insufficiency and hunger, are reliable correlates of cognitive, behavioral, and emotional problems among low-income children, though these hardships are

often closely intertwined with other dimensions of household disadvantage (Belsky et al., 2010). Hungry children may perform more poorly in school due to previous damage to their basic cognitive capacity or to current hunger, which can affect attention spans (Howe and World Food Programme, 2006, p. 43). Yet, these concerns have been only partially incorporated into studies of children's educational outcomes in low-income, developing country contexts. Studies have considered chronic hunger, typically measured by height-for-age for age, in relation to test performance and educational outcomes (Hannum et al., 2014; for reviews, see Hoddinott et al., 2013a, 2013b; for studies related to China, see Jamison, 1986; Kingdon and Monk, 2010). Another line of work has considered short-term hunger, usually by investigating whether meal provision or missing meals is related to children's adjustment, behavior, and achievement (Adolphus et al., 2015; for reviews, see 2013; Hoyland et al., 2009; Jomaa et al., 2011).

However, few studies in highly deprived settings, where undernutrition and hunger might be prevalent, have been able to make use of longitudinal data that might reveal persisting as well as short-term effects. Moreover, little research has incorporated these two dimensions of food-related deprivation simultaneously, or investigated their relationships with a range of short- and long-term school functioning indicators. In this paper, we capitalize on a unique longitudinal study of children from 100 villages in one of China's poorest provinces to investigate the associations of both chronic undernutrition and short-term hunger with multiple dimensions of school functioning, and with school persistence over time. We consider potential relationships to learning outcomes—namely

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literacy—and to behavioral outcomes—namely, internalizing and externalizing behavior problems and teacher-reported behavior problems. Specifically, we ask, are children exposed to chronic undernourishment and who report short-term hunger at heightened risk for poor learning and behavioral outcomes, or for subsequent school dropout five years later?

One problem that has plagued existing literature has been the likely coincidence of hunger and undernutrition with other unmeasured confounders. While the current study cannot completely address this concern, we are able to adjust for a rich set of potential confounders, including household wealth and, in some specifications, children's prior academic performance, internalizing and externalizing behavior problems, and behavioral problems in the classroom. Further, for analyses of short-term hunger effects on behavioral outcomes, we are able to estimate individual fixed-effects specifications that adjust for any unmeasured, stable attributes of individuals. As we will show, chronic undernourishment and short-term hunger relate in distinct ways to children's school functioning in rural Northwest China: chronically undernourished children have poorer literacy acquisition and subsequent school persistence, while children who report subjective hunger have more behavioral problems.

2. Context

2.1. Chronic undernutrition

Chronic undernutrition remains pervasive in developing countries. In 2011, at least 165 million children were affected by stunting, or low height-for-age,¹ a common indicator of chronic undernutrition (Black et al., 2013). In China, despite rapid progress in reducing stunting, almost one in ten children were stunted as of 2010, the most recent year for which data are available (“2015 Nutrition country profile: China, 2015”), and rural children are more vulnerable than are urban children (Chen et al., 2007). A large body of research has examined the association of chronic undernourishment in early childhood with educational outcomes, test scores, and behavioral problems (Berkman et al., 2002; for a review, see Fanjiang and Kleinman, 2007; Jamison, 1986; Walker et al., 2005). Chronic under-nourishment is associated with poorer cognitive development, grade retention and dropout from school in developing countries (Grantham-McGregor et al., 2007). For example, low height-for-age has been associated with school enrollment (Alderman et al., 2001), grade-for-age attainment (Jamison, 1986), test scores (Kingdon and Monk, 2010), and behavioral problems in adolescence (Liu et al., 2004; Raine et al., 2014). A study from Jamaica shows that early childhood stunting is associated with lower self-esteem, hyperactivity, and more anxiety and depressive symptoms at adolescence (Walker et al., 2007). Children's exposure to chronic under-nourishment in early childhood also places them at risk of shorter stature at adolescence, which could impede their social skills accumulation during adolescence (Persico et al., 2004).²

¹ Low height-for-age, a common measure of “nutritional stock,” picks up slow growth from birth, usually due to repeated episodes of poor nutrition and/or other illnesses (Wisniewski, 2010).

² Persico et al. (2004) examine the relationships between wages and height at multiple life stages jointly and show that height in early childhood and height in adolescence are both strong predictors of wages in labor markets. They show that youths with shorter stature are more likely to be excluded from participation in sport clubs than their taller counterparts. These youth are impeded in accumulating social skills, which are an important determinant of wages. Their research extends the prior literature by highlighting the relationship between height at adolescence and later life-outcomes, rather than solely focusing on height in early childhood.

Causal impacts of chronic undernourishment on subsequent educational outcomes and productivities in labor markets are challenging to estimate (Behrman, 2009). However, some studies have sought to address estimation problems in investigating the impact of height-for-age on educational outcomes. In the Philippines, using sibling difference models with various instrumental variables, Glewwe et al. (2001) found that better-nourished children performed significantly better in school in part because these children tended to enter school earlier, but also because they learned more per year of schooling. In India, Kingdon and Monk (2010) found a positive effect of height-for-age z-scores on test scores, after addressing the endogeneity of health caused by omitted variables bias with a household fixed-effects estimator on a sub-sample of siblings as well as extensions and robustness checks using instrumental variables and alternative estimators. In Sri Lanka, Wisniewski (2010) showed that positive effects of height-for-age on test scores persisted with the use of a variety of instrumental variables to adjust for endogeneity and after adjusting for current health and nutrition status. In a study that utilized instrumental variables approaches to deal with potential confounders, height-for-age was linked to numerous outcomes in young adulthood, including family formation, reproduction, men's wage rates, and the avoidance of poverty, which are likely mediated through schooling and cognitive achievement (Hoddinott et al., 2013a, 2013b). In Bangladesh, Khanam (2014) found significant effects of height-for-age on enrollment and grade attainment using parental height as an instrument for child height.

In China, Jamison (1986) analyzed data on the height, weight, age and grade level of over 3000 children in five different locations in as part of a World Bank project. After controlling for location, lower height-for-age was associated with being further behind in grade-for-age attainment. Yu and Hannum (2007) replicated these findings using multi-province China Health and Nutrition Survey data from 1993, with additional adjustments for socioeconomic status and location, and showed further with data from Gansu Province in the year 2000 that a home nutritional environment scale could be linked to school performance, especially for children in the early grades. Hannum et al. (2014) studied the associations of poverty, undernutrition and food insecurity, and investigated literacy gaps associated with these forms of deprivation in Gansu Province. Results showed that the poorest children were at heightened risk of both low height-for-age and food insecurity, and both low height-for-age and food insecurity were associated with literacy acquisition. Further analyses suggested that height-for-age results might be emerging via an early nutritional effect on school performance and grade attainment.³

2.2. Short-term hunger

A largely separate line of work has considered the ways that short-term hunger is related to children's ability to function in the classroom. For example, existing literature suggests that skipping breakfast is associated with emotional and behavioral problems and may possibly have an adverse impact on cognitive function and academic performance (Rampersaud et al., 2005); research has also suggested adverse impacts of breakfast-skipping on alertness, attention, memory, processing of complex visual display, problem solving, and mathematics (Basch, 2011). A recent systematic review identified 36 studies that examined the effects of breakfast—habitual or acute—on in-class and academic performance among children and adolescents (Adolphus et al., 2013). Adolphus and her colleagues reported that increased frequency of

³ Other recent studies in China have focused not on undernutrition, but on nutrient deprivation and supplementation (Luo et al., 2012; Sylvia et al., 2013).

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