SHORT COMMUNICATION

Rainfall shocks are not necessarily a sensitive early indicator of changes in wasting prevalence

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Evidence on the impact of weather shocks on child nutrition focuses on linear growth retardation (stunting) and thus, associates the effect of a short-term measure (weather events) on a cumulative measure (attained height). Relatively little is known on how weather shocks predict increases in wasting in a population. This study explores whether deviation in rainfall in Ethiopia, a drought prone country, is a sensitive indicator of future increases in wasting. Around 12% of children 0–23 months were wasted, but we found no consistent association between the rainfall shock variables and child weight-for-height Z-scores. The results indicate that monitoring rainfall does not provide a practical early warning to use for scaling up financing and management of preventative measures without additional information to increase precision.

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INTRODUCTION

An estimated 52 million children worldwide suffer from acute malnutrition which dramatically increases their risk of death: compared to well-nourished children, children with a weight-for-height Z-score (WHZ) 2–3 s.d. below the median die at a rate three times higher than those with a WHZ of −1 or higher. Equally telling, roughly half of all the projected lives saved from scaling up effective treatment for (severe) acute malnutrition, relatively little is known on how weather shocks predict increases in wasting in a population. This study explores whether deviation in rainfall in Ethiopia, a drought prone country, is a sensitive indicator of future increases in wasting. Around 12% of children 0–23 months were wasted, but we found no consistent association between the rainfall shock variables and child weight-for-height Z-scores. The results indicate that monitoring rainfall does not provide a practical early warning to use for scaling up financing and management of preventative measures without additional information to increase precision.

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METHODS

Our data came from the 2011 to 2012 and 2013 to 2014 rounds of the Ethiopia Socioeconomic Survey which were collected as a part of the Living Standards Measurement Study-Integrated Surveys on Agriculture (LSMS-ISA) project of the World Bank. The sample was drawn from a population frame that included all rural and small town areas of Ethiopia except for three zones of Afar and six zones of Somali region. In each household, the survey collected socioeconomic, demographic and nutrition-related information at both the household and individual levels. We focus on a subset of 2659 households with a child 6–59 months old. The household data were supplemented with monthly rainfall data for years 2011 and 2013 covering Ethiopia five arc-min spatial resolution, that is, squares of ~9.27×9.27 km at sea level. While Ethiopia has two rainy seasons, more than 90% of total grain production comes from the harvest following the long rains. Thus, we focus on that season. The effects of rainfall shocks on child WHZ were estimated using ordinary least squares regression (using Stata 14). Child WHZ was calculated using the WHO growth standard. Although there exist protocols for screening and effective treatment for (severe) acute malnutrition, relatively little is known on how weather shocks predict increases in wasting within a population. To encourage timely and informed action, this study explores whether deviation in rainfall in a drought prone country, Ethiopia, is a sensitive indicator of future increases in wasting.

RESULTS AND DISCUSSION

Around 11% of the children were wasted which is defined as a serious public health problem by the WHO. Rainfall-related shocks were common, affecting ~18% of the observations (Table 1). Despite the ample variation in rainfall both spatially and temporally, we found no association between the rainfall shock variables and

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suggests that the issue is not driven by insufficient power. Although a recent systematic review indicated that 12 of 15 studies found an association of weather events and stunting, this current study provides nuance in regards to timing. While both surveys were conducted within 4 months of the harvest—perhaps a partial explanation for absence of a significant association—the point estimates of the month dummies (a proxy for time since harvest) decline as time increase, although these coefficients are not significant as determinants of child WHZ.

We make no claims on the external validity of this result and doubt that it challenges the general concern about climate change and weather shocks on child malnutrition. Adverse weather affects both farm incomes and consumer prices and thus would have longer term impact on nutrition among low income households through such price shocks. However, the results do indicate that monitoring rainfall does not provide a practical early warning to use for scaling up financing and management of preventative measures without additional information to increase precision.

### Table 1. Characteristics of the study sample

| Characteristic | Children 6–23 months | Children 24–59 months |
|----------------|-----------------------|-----------------------|
| Age (months)   | 14.69 ± 4.80          | 40.89 ± 10.00         |
| Child sex, male (%) | 51.15               | 51.79                 |
| Weight-for-height Z-score | −0.18 ± 1.70       | −0.40 ± 1.45          |
| Wasting (%)    | 11.82                 | 10.30                 |
| Mother, some education (%) | 30.05             | 25.24                 |
| Father, some education (%) | 52.38             | 46.60                 |
| Access to a toilet (%) | 54.76              | 56.83                 |

### Table 2. Association of individual, household and rainfall characteristics with child weight-for-height Z-scores (children 6–23 months)

| Rainfall shock                  | Z-score | Decrease > 10% |
|---------------------------------|---------|---------------|
| Mother’s education              | 0.03    | 0.03          |
| Father’s education              | 0.02    | 0.02          |
| Wealth index: Quartile 2        | 0.35**  | 0.35**        |
| Wealth index: Quartile 3        | 0.51*** | 0.50***       |
| Wealth index: Quartile 4        | 0.41*** | 0.41***       |
| Month dummy = February          | 0.21    | 0.20          |
| Month dummy = March              | −0.19   | −0.19         |
| Month dummy = April              | −0.65   | −0.63         |
| Rainfall shock                   | 0.01    | 0.04          |

*Values are regression coefficients and standard errors. Other covariates included in the model were child age and sex, household size and a year dummy (see Supplementary Table for full results). ***P < 0.001, **P < 0.01, *P < 0.1.

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AUTHOR CONTRIBUTIONS

NAL undertook the data analysis. All authors contributed to the study idea and to the writing of the manuscript.

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