Local spatial clustering of stunting and wasting among children under the age of five years

Summary of research*

Location: Ethiopia

What we know: The prevalence of stunting and wasting in Ethiopia has fallen but remains a considerable burden. Effective nutrition strategies must target where there is greatest burden.

What this article adds: A recent study in the Meskane Mareko District of Ethiopia used a spatial point process to investigate whether undernutrition indicators (stunting and wasting) have a tendency to cluster in order to determine the physical location and scale of clustering and discover risk factors for the observed clustering. A total 2,371 children under five years of age were anthropometrically assessed in 1,744 households. Overall stunting prevalence was 40.2% (19.1% severe); wasting prevalence was 9.8% (5.3% severe). Older children, poorest children and male children were more likely to be stunted; male children were more likely to be wasted. Only wasting and severe wasting clusters were observed in two of the six kebeles surveyed (4x and 10x more likely to be wasted/severely wasted within clusters). Across all six kebeles, likely significant clusters for stunting (1.5x risk) and severe stunting (1.7x) were identified. For stunting, household locations (elevation of the house and place of residence) were risk factors. For severe stunting, household dietary diversity, food-security status and latrine availability were risk factors. Spatial locations of high-risk areas for stunting could be an input for geographically targeting and optimising nutritional interventions.

Ethiopia has documented a significant decline in the prevalence of both stunting and underweight between 2000 and 2014; 31% decrease in stunting (58% to 40%) and 39% decrease in underweight (41% to 25%) (CSAE & ICF, 2012; CSAE & ORC, 2006; CSAE & ORC, 2001; CSAE, 2014). However, prevalence remains considerable (WHO classification: medium to high grade). Effective nutrition strategies in Ethiopia, as elsewhere, require targeting on the basis of nutritional vulnerability and burden to maximise benefit. This requires the identification of specific locations of at-risk populations in a given geographical area, a process that is aided by the use of spatial analytical approaches.

This paper attempts to use such an approach, spatial point process, to investigate the local spatial structure of stunting and wasting among children under the age of five years (U5s) in a particular area of Ethiopia. The study aimed to evaluate whether undernutrition indicators (stunting and wasting) have a tendency to cluster in order to determine the physical location and scale of clustering and discover risk factors for the observed clustering.

A community-based, cross-sectional study was conducted between December 2013 and April 2014 in the Meskane Mareko District of Ethiopia (around 513.65km² in size) in the Gurage Zone South of Addis Ababa. The study district houses the Butajira Rural Health Programme (BRHP) run by Addis Ababa University, a health and demographic surveillance system that collects data on vital events and demographic patterns in the district. The BRHP includes one urban and nine rural communities (kebeles) and is divided into three agro-ecological zones, each containing three kebeles. The study randomly selected two out of three kebeles from each agro-ecology zone. Data were then collected from the six kebeles, totalling 4,077 households. Out of these, 737 households were excluded (vacant or inhabitants very old and unable to respond), leaving 3,340 eligible households. From these households, weight and length/height were measured in all U5s. A team of 20 local research assistants was used to take anthropometric measurements, all of whom had initial training and evaluation of performance.
The survey collected a range of socio-demographic and health data of children and respondents; e.g. child’s age, sex, morbidity, mother’s education, religion, marital status and occupation, and household data; e.g. ownership and size of land, type of house and construction materials and possession of certain items. Household food security was measured using the Household Food Insecurity Access Scale (HFIAS) tool. Household food intake was qualitatively captured through 24-hour recall on food group consumption. Interviews were conducted by the 20 research assistants, overseen by two supervisors. Household geographic locations and elevations were determined using a hand-held GPS (Garmin GPSMAP®). EpiData version 3.1 was used for data entry. The statistical software package Stata version 11.0 was used for data cleaning and analysis. Anthropometric indices (Z-scores) were calculated using the WHO Anthro software version 3.2.2; analysis of spatial clustering was carried out using Kulldford’s spatial scan statistics and SaTScanTM version 9.1.

**Results**

A total of 3,340 households was visited, of which 53.4% (1,784) households had one or more U5s. Response rate was 97.8% (1,744 households), resulting in anthropometric assessment of 2,371 U5s. Sixty-nine houses were not surveyed after repeated visits because of unavailability or refusal.

The overall prevalence of stunting among U5s was 40.2%; 19.1% were severely stunted. The highest prevalence of stunting was in children aged 24-35 months (49.9%). The lowest was in children below the age of six months (14.6%); prevalence increased with the age of child. Male children (42.9%) were more stunted than female children (37.9%) and children in the poorest wealth stratum (45.1%) were more stunted than those in the richest (35.2%). The prevalence of stunting varied considerably among the six kebeles. The highest prevalence (52%) was documented in Dobena kebele (1,853m above sea level). The prevalence of wasting and severe wasting was 9.8% and 5.3% respectively. A smaller difference in wasting prevalence was found between male children (10.7%) and female children (8.9%). The highest prevalence of wasting was documented in Shershera Bido (13.5%) and Dirama (11.7%) kebeles (≥1977m above sea level). Concurrence of wasting and stunting in children was not reported.

Spatial scan statistics were applied separately for the six kebeles to find out whether there was a distinct spatial cluster in the distribution of stunting and wasting at a smaller scale. Results showed most likely significant clusters only for wasting and severe wasting in two of the six kebeles. In Dirama, a single cluster of 31 cases (18.2 expected) in 129 households was identified. Children in this cluster were four times more at risk of wasting than children outside the cluster. In Bati Lejano, a smaller cluster of seven cases (0.88 expected) in 15 households was identified; cluster children were ten times more at risk. The presence of significant clusters of undernutrition on a higher scale across the six kebeles was also examined; this indicated a most likely significant cluster for stunting and severe stunting. For stunting, a single large cluster size of 390 cases (304.19 expected) in 756 households was identified; cluster children were 1.5 times more at risk of stunting than children outside the cluster. For severe stunting, a single cluster size of 106 cases (69.39 expected) in 364 households was identified; cluster children were 1.7 times more at risk.

The authors found no difference between cases of stunting within and outside the cluster with regard to child and household dietary-related factors such as child morbidity, household dietary diversity and food-security status, nor household socio-economic conditions and latrine availability. The only factors that continued to be different were household locations (elevation of the house and place of residence). Stunted children within an identified spatial cluster were positioned at lower elevations than those outside a cluster (P<0.05). For severe stunting, significant differences were found between cases within and outside the cluster with regard to household dietary diversity, food-security status and latrine availability. In these cases, no differences were found with regard to the elevation of the house and place of residence.

The authors conclude that the distribution of wasting and stunting was partly spatially structured in the communities analysed. Distinct areas were identified within and between villages that have a higher risk than the underlying at-risk population. This indicates that the spatial distribution of wasting and stunting may not be a
completely random process, but could be determined beyond the individual or household level. Spatial locations of high-risk areas for stunting could therefore be an input for geographically targeting and optimising nutritional interventions.

References


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