**Supplementary material**

**Supplemental Table 1: Items used for creating the wealth index**

|  |  |
| --- | --- |
| Communication | Radio+, ++, +++  Television+, ++, +++  Telephone +, +++  Mobile telephone++, +++  Watch+++ |
| Transport | Bicycle +, ++, +++  Motorcycle +, ++, +++  Car/truck+, ++, +++  Boat/ Canoe+, ++, +++  Boat with a motor++, +++  Donkey+  Animal drawn cart++, +++ |
| Health and Hygiene | Piped drinking water in residence+, ++, +++  Piped drinking water into yard++, +++  Piped drinking water from public tap +, ++, +++  Piped drinking water outside of residence+  Open well drinking water in yard/plot+, ++  Open well drinking water outside yard+, +++  Protected well drinking water in yard+, ++, +++  Unprotected well drinking water++, +++  Protected well drinking water outside yard+, +++  Borehole well drinking water in yard+, +++  Borehole well drinking water outside yard+, ++, +++  Drinking water from spring+, +++  Uses river, canal, or surface water for drinking+, +++  Uses rain for drinking water+, ++, +++  Uses tanker truck for drinking water+, ++, +++  Uses bottled water for drinking+, ++, +++  Drinking water from gravity flow scheme+  Own flushing toilet+, ++, +++  Shared flushing toilet+, ++, +++  Has traditional pit latrine+,  Covered pit latrine with no slab++, +++  Covered pit latrine with slab++, +++  Has private pit latrine++  Shares pit latrine++  Uncovered pit latrine with slab+++  Composting toilet/ecosan+++  Ecosan toilet+++  Has VIP latrine+, ++, +++  Uses shared VIP latrine++, +++  Uses bush or field as latrine+, ++, +++  Other type of latrine+, +++ |
| Household essentials | Has electricity+, ++, +++  Lantern+  Cupboard+, ++, +++  Table++, +++  Chairs++, +++  Sofa set++, +++  Bed++, +++  Clock++, +++  Has refrigerator+, ++, +++  Has video recorder  Has cassette player++, +++  Has dirt, earth, dung principal floor surface+, ++, +++  Has parquet principal floors+, ++, +++  Has vinyl or asphalt tile principal floors+  Has ceramic tile principal floors+, +++  Has cement principal floor+, ++, +++  Has brick floor+++  Has stone floor+++  Has other type of flooring+, +++  Uses electricity as cooking fuel+, ++, +++  Uses gas as cooking fuel+, ++, +++  Uses biogas as cooking fuel+, +++  Uses kerosene as cooking fuel+, ++, +++  Uses coal as cooking fuel+  Uses charcoal as cooking fuel+, ++, +++  Uses wood/straw as cooking fuel+, ++, +++  Does not cook+++  Uses other type of cooking+, ++, +++  Has thatch for walls+, ++, +++  Walls of mud and poles+, ++, +++  Walls of unburnt brick+, ++, +++  Walls of unburnt brick and plaster+++  Walls of burnt bricks and mud+, ++, +++  Walls of burnt bricks and cement+, ++, +++  Wood timber for walls+, ++, +++  Has bricks, cement blocks, concrete walls+, +++  Has stone walls+, +++  Has thatched roofing+, +++  Has wood/planks roofing+++  Has corrugated iron roofing+, ++, +++  Has asbestos roofing+++  Has tile roof +++  Has tin roof +++  Has cement roof++  Has nat roof ++  Has finished roof ++  Uses electricity for lighting+  Uses biogas for lighting+  Uses kerosene for lighting+  Uses charcoal for lighting+  Uses dung for lighting+ |
| Household members | Number of household members per sleeping room++, +++ |
| Household farming assets | If household works own family agriculture land++  Cattle own++  Cows, bulls own++  Horses, donkeys, mules own++  Goats own++  Sheep own++  Chickens own++ |

+ Included in 2001 survey

++ Included in 2006 survey

+++ Included in 2011 survey

**Supplemental Table 2: Analysis of sub-regions in the overall multivariable model for moderate-severe stunting (primary analysis) for the 2006 and 2011 surveys**

|  |  |
| --- | --- |
| Variable: regions | Moderate-severe stunting, N=4,433, OR (95% CI) |
| Eastern (ref.)  Central 1  Central 2  Kampala  East Central  North  West Nile  Western  Southwest | 1.00  1.15 (0.79, 1.66)  1.24 (0.88, 1.76)  1.69 (1.14, 2.50)\*\*\*  1.42 (1.06, 1.90)\*\*  1.25 (0.94, 1.66)  1.26 (0.93, 1.73)  1.65 (1.22 2.23)\*\*\*  2.23 (1.63, 3.06)\*\*\* |

ref., reference category.

\*P ≤ 0.05, \*\*P ≤ 0.01, \*\*\*P ≤ 0.001

Model is adjusted for survey year indicator, household, maternal, and child-related variables.

**Supplemental Table 3: Analysis of discrete years of education in the overall multivariable model for moderate-severe stunting**

|  |  |
| --- | --- |
| Variable: continuous years of education | moderate-severe stunting, N=**14,747**, OR (95% CI) |
| 0 (ref.)  1  2  3  4  5  6  7  8  9  10  11  12 | 1.00  1.01 (0.82, 1.26)  1.00 (0.85, 1.18)  0.96 (0.82, 1,12)  0.90 (0.77, 1.05)  0.91 (0.78, 1.06)  0.84 (0.72, 0.97)\*  0.63 (0.54, 0.74)\*\*\*  0.71 (0.54, 0.94)\*  0.88 (0.66, 1.16)  0.73 (0.53, 1.01)  0.63 (0.46, 0.86)\*\*  0.43 (0.30, 0.61)\*\*\* |

ref., reference category.

\*P ≤ 0.05, \*\*P ≤ 0.01, \*\*\*P ≤ 0.001

Model is adjusted for survey year indicator, household, maternal, child-related variables.

**Supplemental Table 4: Overall WHO standard-based multivariable models for moderate-severe stunting (primary analysis), severe stunting, weight z-score, and CDC standard- based moderate-severe stunting**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Variable** | **Moderate-Severe Stunting, N=14,747** | **Severe Stunting N=14,747** | **Continuous Z-Score N=14,747** | **Moderate-Severe Stunting Using CDC Standard, N=14,747** |
|  | OR (95% CI) | OR (95% CI) | β (Standard Error) | OR (95% CI) |
| Intercept | - | - | 0.1218 (0.07) |  |
| **Household characteristics** | | | |  |
| Region  Central  Northern  Western  Eastern (ref.) | 1.25 (1.11, 1.42)\*\*\*  1.02 (0.89, 1.16)  1.74 (1.55, 1.96)\*\*\*  1.00 | 1.26 (1.07, 1.48)\*\*  1.16 (0.98, 1.37)  1.80 (1.56, 2.08)\*\*\*  1.00 | -0.19 (0.04)\*\*\*  -0.07 (0.04)  -0.41 (0.04)\*\*\*  0.00 | 1.29 (1.13, 1.46)\*\*\*  1.06 (0.92, 1.21)\*  1.77 (1.57, 1.99)\*\*\*  1.00 |
| Residence  Rural  Urban (ref.) | 1.20 (1.03, 1.40)\*  1.00 | 1.26 (1.02, 1.56)\*  1.00 | -0.19 (0.05)\*\*\*  0.00 | 1.22 (1.04, 1.43)\*  1.00 |
| Wealth Index  Poorest  Poorer  Middle  Richer  Richest (ref.) | 1.73 (1.45, 2.06)\*\*\*  1.50 (1.26, 1.78)\*\*\*  1.61 (1.36, 1.90)\*\*\*  1.37 (1.16, 1.61)\*\*\*  1.00 | 1.84 (1.45, 2.34)\*\*\*  1.70 (1.35, 2.15)\*\*\*  1.71 (1.36, 2.14)\*\*\*  1.46 (1.16, 1.83)\*\*  1.00 | -0.37 (0.05)\*\*\*  -0.30 (0.05)\*\*\*  -0.34 (0.05)\*\*\*  -0.20 (0.05)\*\*\*  0.00 | 1.67 (1.40, 2.01)\*\*\*  1.54 (1.29, 1.84)\*\*\*  1.67 (1.41, 1.98)\*\*\*  1.39 (1.18, 1.65)\*\*\*  1.00 |
| Source of drinking water  Non-improved  Improved (ref.) | 1.09 (1.00, 1.18)  1.00 | 1.03 (0.92, 1.14)  1.00 | -0.01 (0.03)  0.00 | 1.06 (0.97, 1.16)  1.00 |
| **Maternal characteristics** | | | |  |
| Age  15-19  20-30  31-49 (ref.) | 1.57 (1.31, 1.87)\*\*\*  1.18 (1.08, 1.29)\*\*\*  1.00 | 1.44 (1.15, 1.81)\*\*  1.11 (0.99, 1.24)  1.00 | -0.27 (0.06)\*\*\*  -0.10 (0.03)\*\*\*  0.00 | 1.52 (1.27, 1.83)\*\*\*  1.19 (1.08, 1.31)\*\*\*  1.00 |
| BMI  Pregnant/postpartum  Thin  Over/Obese  Normal (ref.) | 1.04 (0.94, 1.16)  1.08 (0.92, 1.27)  0.70 (0.61, 0.79)\*\*\*  1.00 | 1.04 (0.91, 1.19)  1.15 (0.94, 1.41)  0.70 (0.58, 0.84)\*\*\*  1.00 | -0.01 (0.03)  -0.10 (0.06)  0.25 (0.04)\*\*\*  0.00 | 1.04 (0.93, 1.15)  1.11 (0.94, 1.31)  0.71 (0.62, 0.81)\*\*\*  1.00 |
| Highest educational level  None  Primary  Secondary+ (ref.) | 1.34 (1.14, 1.59)\*\*\*  1.20 (1.04, 1.38)\*  1.00 | 1.37 (1.08, 1.73)\*\*  1.25 (1.00, 1.55)\*  1.00 | -0.11 (0.05)\*  -0.10 (0.04)\*  0.00 | 1.52 (1.28, 1.81)\*\*\*  1.32 (1.13, 1.54)\*\*\*  1.00 |
| Work Status  Unemployed  Self-employed  Employed (ref.) | 1.06 (0.92, 1.23)  1.18 (1.04, 1.34)\*  1.00 | 1.21 (0.99, 1.47)  1.26 (1.06, 1.51)\*\*  1.00 | -0.08 (0.05)  -0.14 (0.04)\*\*\*  0.00 | 1.01 (0.88, 1.17)  1.07 (0.94, 1.23)  1.00 |
| **Child-related characteristics** | | | |  |
| Sex  Male  Female (ref.) | 1.42 (1.31, 1.54)\*\*\*  1.00 | 1.47 (1.32, 1.64)\*\*\*  1.00 | -0.22 (0.03)\*\*\*  0.00 | 1.26 (1.15, 1.37)\*\*\*  1.00 |
| Current age in months  13-23  24-35  36-59  0-12 (ref.) | 3.22 (2.85, 3.65)\*\*\*  4.61 (4.05, 5.25)\*\*\*  3.75 (3.32, 4.23)\*\*\*  1.00 | 3.64 (3.04, 4.37)\*\*\*  5.38 (4.47, 6.49)\*\*\*  4.05 (3.38, 4.86)\*\*\*  1.00 | -0.92 (0.04)\*\*\*  -1.20 (0.04)\*\*\*  -1.10 (0.04)\*\*\*  0.00 | 4.11 (3.61, 4/69)\*\*\*  3.76 (3.27, 4.32)\*\*\*  4.40 (3.86, 5.01)\*\*\*  1.00 |
| Low birth size  Yes  No (ref.) | 1.59 (1.44, 1.77)\*\*\*  1.00 | 1.56 (1.37, 1.77)\*\*\*  1.00 | -0.35 (0.03)\*\*\*  0.00 | 1.56 (1.40, 1.73)\*\*\*  1.00 |
| Preceding birth interval less than 24 months  Yes  No (ref.) | 1.19 (1.08, 1.32)\*\*\*  1.00 | 1.32 (1.16, 1.49)\*\*\*  1.00 | -0.12 (0.03)\*\*\*  0.00 | 1.23 (1.11, 1.37)\*\*\*  1.00 |
| Had fever in last two weeks  Yes  No (ref.) | 1.08 (0.99, 1.18)  1.00 | 1.01 (0.90, 1.13)  1.00 | -0.07 (0.03)\*  0.00 | 1.06 (0.97, 1.16)  1.00 |
| Had diarrhea in last two weeks  Yes  No (ref.) | 1.17 (1.11, 1.23)\*\*\*  1.00 | 1.16 (1.09, 1.24)\*\*\*  1.00 | -0.21 (0.03)\*\*\*  0.00 | 1.19, (1.12, 1.25)\*\*\*  1.00 |
| Survey Year  2001  2006  2011  1995 (ref.) | 0.89 (0.81, 0.99)\*  0.64 (0.57, 0.73)\*\*\*  0.58 (0.51, 0.67)\*\*\*  1.00 | 0.96 (0.84, 1.09)  0.64 (0.54, 0.76)\*\*\*  0.67 (0.56, 0.81)\*\*\*  1.00 | 0.05 (0.03)  0.34 (0.04)\*\*\*  0.39 (0.04)\*\*\* | 0.94 (0.85, 1.04)  0.66 (0.58, 0.75)\*\*\*  0.61 (0.53, 0.70)\*\*\*  1.00 |

ref., reference category.

\*P ≤ 0.05, \*\*P ≤ 0.01, \*\*\*P ≤ 0.001



**Supplemental Fig. 1: IRB termination letter, not human subject research**



**Supplemental Fig. 2: Sub-regions of Uganda**(41)

Sub-regions were combined into four regions as shown below:

Northern = West Nile, Mid Northern, and North East

Eastern = East Central and Mid Eastern

Central = Central 1, Central 2, and Kampala

Western = Mid Western and South Western