Deprivation and Under-five Health and Nutrition in the Greater Kampala Metropolitan area

- Kananura RM, Waiswa P, Wasswa R, Blumenberg C, Boerma T, Maiga A
Introduction

- At least **50% of population** in SSA projected to live urban areas
- Social services such as water and sanitation facilities **not matching urbanization**
- Yet high **population density** is associated with **poor sanitation** that could lead to the **spread of diseases and reinfection**.
- “urban penalty” concept
  - cities **concentrate poor people**, and expose residents to unhealthy environments, leading to a disproportionate burden of poor health
- An estimate of **60% of the sub-Saharan** live in slums – **could be underestimated**
  - **unreliable data**
  - **differences in the definitions.**
    - Slum areas
    - Informal settlement

Level of urbanization in Africa
Study area and aim

- We use Uganda Demographic Health Surveys (DHS) data collected between 2006-2016
  - to analyze urban deprivation and its association with under-five child health in Greater Kampala metropolitan.

- Greater Kampala Metropolitan:
  - Kampala city
  - Kampala urban outskirt of Mpigi, Mukono, and Wakiso.
    - Demarcation seem to only consider urban outskirts within 20 Km
    - 30 Km not considered but this were daily commuters also reside
  - Nonetheless, we selected urban areas as reported in UDHS data
  - We defined deprivation as a standard of living or quality of life below that of the majority in a particular society
Methods

• 2006-2016 UDHS data
• 2006 and 2011 UDHS data did not have district name – **reconstructed** using DHS GIS points and national GIS administrative boundary data.

<table>
<thead>
<tr>
<th>District</th>
<th>Before merging</th>
<th>After merging</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kampala</td>
<td>NA</td>
<td>485</td>
</tr>
<tr>
<td>Mpigi</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Mukono</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Wakiso</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Total</td>
<td>NA</td>
<td>485</td>
</tr>
</tbody>
</table>

Note: NA – Not available

• Data liked to other datasets for further analysis
Methods

• **Household data** for – household characteristics that are used to measure the living standards of the slum residents
  • Water accessibility
  • Type of toilet
  • Substandard household structure
  • Overcrowding – household residents per number rooms
  • Number of rooms

• **Child dataset** for child morbidity and slum-like relationship
  • Common morbidities – fever, diarrhea
    • if the mother reported that the child experienced either of these conditions within the two weeks preceding the interview.
  • Nutrition indicators
    • Stunting: height-for-age z-scores that were below 2 standard deviations.
    • Anemia: moderate and severe cases
  • Access to medical treatment

• **Women and Men data** for assessing the demographic and socio-economics characteristics of people living in slum-like household conditions
  • Education level
  • Employment type
  • Age
  • Marital status

• **All datasets pooled together** using household identifier
Data analysis

• **Step 1:** Factor analysis

• **Step 2:** The deprivation composite score is calculated

\[
c_j = \sum_{k=1}^{n} w_{dk}^* I_{kd}
\]

\(c_j\) is individual’s \(j\) deprivation score,

\(w_{di}^*\) Weight for indicator \(i\) in domain \(d\). \(I_k = 1\)

\(I_{kd}\) is the arithmetic mean of \(k\) indicators/items within domain \(d\)

**Step 3:** Slum index \(z\)-scores

\[
Z_{ct} = \frac{c_{tj} - \mu_{ct}}{\sigma_{ct}}
\]

• \(Z < 0\) less slum-like; \(= 0\) moderate (average living conditions) slum-like living conditions; and \(> 0\) severely slum-like living conditions

**Step 4:** investigated the association between the Slum-like Severity Index and child health outcomes and nutritional indicators

• Logistic or modified Poisson regression

• child indicators as dependent variables

• Slum like index and place of residence as covariates

• Considered the interaction between slum-like index and the place of residence
Results
In line with the UN-habitat of slum conditions, **at least 97% live in household characterized by at least one of the slum-like condition**.

The UN-habitat definition may categorize most of the residents as slum areas.

Recognizing that living standards vary greatly both within and between urban suburbs

UN-habitat definition may lead to challenges of capturing modest improvements in living conditions

We consider the concept of deprivation as standard of living **below** that of the majority in a specific context
Identification of slum-like measures

Scree plot for selection of factors - 5 factors selected

<table>
<thead>
<tr>
<th>Variable</th>
<th>Substandard housing conditions and hygiene</th>
<th>Limited water access</th>
<th>Overcrowding</th>
<th>Cooking with wood-excluding charcoal</th>
<th>Limited access to toilet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unimproved toilet</td>
<td>0.574</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At least 5 households share a toilet</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.912</td>
</tr>
<tr>
<td>Time to get water takes at least 30 minutes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water not within the premises</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Substandard roof</td>
<td>0.867</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Substandard wall</td>
<td>0.699</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Substandard floor</td>
<td>0.832</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unclean fuels for cooking</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.946</td>
</tr>
<tr>
<td>At least 5 people per sleeping room</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.933</td>
</tr>
<tr>
<td>Single room</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.559</td>
</tr>
</tbody>
</table>

Kaiser-Meyer-Olkin Measure of Sampling Adequacy 0.688
• Overall, households in GKM areas had an average slum-like score of **30%**

• No significant changes observed over the years

• No significant differences between Kampala city and neighboring outskirts
• Close to 30% of the household experienced severe slum-like conditions
• As of 2016, 67% household in GKM were living in slum-like conditions, with no significant changes observed over a decade (66% in 2006 and 70% in 2011).
Limited access to toilet:
Limited access to water:
Overcrowding:
Substandard living conditions:

Contribution of each domain
Contribution of each domain

- Limited access to toilet:
  - 2006: 22.4%
  - 2011: 26.4%
  - 2016: 31.6%

- Limited access to water:
  - 2006: 19.7%
  - 2011: 22.9%
  - 2016: 25.1%

- Overcrowding:
  - 2006: 31.8%
  - 2011: 29.2%
  - 2016: 28.7%

- Substandard living conditions:
  - 2006: 24.1%
  - 2011: 19.9%
  - 2016: 13.6%

Legend:
- Substandard housing conditions
- Limited water access
- Overcrowding
- Unclean fuels for Cooking (charcoal excluded)
- Limited access to toilet
## Contribution of each domain

<table>
<thead>
<tr>
<th>Year of survey</th>
<th>Limited access to toilet</th>
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<th>Substandard living conditions</th>
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<tr>
<td>2006</td>
<td>24.1</td>
<td>31.8</td>
<td>19.7</td>
<td>13.6</td>
</tr>
<tr>
<td>2011</td>
<td>22.4</td>
<td>29.2</td>
<td>22.9</td>
<td>28.7</td>
</tr>
<tr>
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<td>26.4</td>
<td>25.1</td>
<td>22.9</td>
<td>31.6</td>
</tr>
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### Contribution of different items to slum-like living conditions

- **Limited access to toilet:**
  - Sharing of toilet with at least 4 households
  - Having no water within the premise
  - Household with one room
  - Unimproved toilet, household floor, and wall structures

- **Limited access to water:**

- **Overcrowding:**

- **Substandard living conditions:**
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**Contribution of each domain**

- **Limited access to toilet:**
  - 2006: 22.4%
  - 2011: 26.4%
  - 2016: 31.6%

- **Limited access to water:**
  - 2006: 19.7%
  - 2011: 22.9%
  - 2016: 28.7%

- **Overcrowding:**
  - 2006: 31.8%
  - 2011: 29.2%
  - 2016: 13.6%

- **Substandard living conditions:**
  - Limited water access
  - Overcrowding
  - Unclean fuels for Cooking (charcoal excluded)
  - Limited access to toilet

**Contribution of different items to slum-like living conditions**

- **Unimproved toilet:**
  - 2016: 4.6%
  - 2011: 8.9%
  - 2006: 8.6%

- **At least 5 people per sleeping room:**
  - 2016: 6.3%
  - 2011: 5.8%
  - 2006: 7.1%

- **Unimproved floor:**
  - 2016: 4.0%
  - 2011: 4.8%
  - 2006: 8.2%

- **Unclean fuel for cooking:**
  - 2016: 20.3%
  - 2011: 21.2%
  - 2006: 8.3%

- **Unimproved roof:**
  - 2016: 4.5%
  - 2011: 3.7%
  - 2006: 20.5%

- **At least 5 households share a toilet:**
  - 2016: 2.0%
  - 2011: 2.6%
  - 2006: 2.0%

- **Time to get water takes at least 30 minutes:**
  - 2016: 2.0%
  - 2011: 2.0%
  - 2006: 3.0%

- **Water not within the premises:**
  - 2016: 23.1%
  - 2011: 20.3%
  - 2006: 17.7%

- **Unprotected water source:**
  - 2016: 31.6%
  - 2011: 26.4%
  - 2006: 22.4%
Compared to children residing in less slum-like (better) condition:
Compared to children residing in less slum-like (better) condition:

- Residing in Slum-like conditions increased the likelihood of fever (moderate: OR=2.67 and severe: OR=3.09)
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- Residing in **Slum-like conditions** increased the likelihood of fever (**moderate: OR=2.67** and **severe: OR=3.09**)
- Residing in **Slum-like conditions** increased the likelihood of Diarrhea (**moderate: OR = 1.21** and **severe: OR=1.47**)

<table>
<thead>
<tr>
<th>Association of slum-like conditions with fever</th>
<th>Association of slum-like conditions with Diarrhoea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less slum-like condition within Kampala (Reference)</td>
<td>Severe slum-like conditions within city outskirts</td>
</tr>
<tr>
<td>Average slum-like conditions within city outskirts</td>
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</tr>
<tr>
<td>City outskirts</td>
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- Residing in Slum-like conditions increased the likelihood of fever (moderate: OR=2.67 and severe: OR=3.09)
- Residing in Slum-like conditions increased the likelihood of Diarrhea (moderate: OR = 1.21 and severe: OR=1.47)
Compared to children residing in less slum-like (better) condition, within Kampala City:
Compared to children residing in less slum-like (better) condition, within Kampala City:

- The risk of diarrhoea was high among those residing in severe and moderate slum-like conditions within the city outskirts.
Compared to children residing in less slum-like (better) condition:
Compared to children residing in less slum-like (better) condition:

- Residing in **Slum-like conditions** increased the likelihood of stunting (moderate: OR=1.23, severe: OR=1.40)
Compared to children residing in less slum-like (better) condition:

- Residing in Slum-like conditions increased the likelihood of stunting (moderate: OR=1.23, severe: OR=1.40)
Compared to children residing in less slum-like (better) condition:

- Residing in Slum-like conditions increased the likelihood of stunting (moderate: OR=1.23, severe: OR=1.40)
- Residing in Slum-like conditions increased the likelihood of anemia (moderate: OR=1.18, severe: OR=1.44)
Compared to children residing in less slum-like (better) condition:

- Residing in Slum-like conditions increased the likelihood of stunting (moderate: OR=1.23, severe: OR=1.40)
- Residing in Slum-like conditions increased the likelihood of anemia (moderate: OR=1.18, severe: OR=1.44)
Compared to children residing in less slum-like (better) condition:
Compared to children residing in less slum-like (better) condition:

- Seeking treatment for fever was less likely in slum-like households
Compared to children residing in less slum-like (better) condition:

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<table>
<thead>
<tr>
<th>Association of slum-like with access to medical treatment for fever</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severe slum-like conditions within city outskirts</td>
</tr>
<tr>
<td>Average slum-like conditions within city outskirts</td>
</tr>
<tr>
<td>Less slum-like condition within Kampala (Reference)</td>
</tr>
<tr>
<td>City outskirts</td>
</tr>
<tr>
<td>Less slum-like condition (Reference)</td>
</tr>
<tr>
<td>Severe slumi-like conditions</td>
</tr>
<tr>
<td>Average slumi-like conditions</td>
</tr>
</tbody>
</table>
Compared to children residing in less slum-like (better) condition:

- Seeking treatment for fever was less likely in slum-like households.
- Association of slum-like households’ conditions with diarrhea was insignificant.
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- Seeking treatment for fever was less likely in slum-like households.
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**Association of slum-like with access to medical treatment for fever**

<table>
<thead>
<tr>
<th>Less slum-like condition (Reference)</th>
<th>Average slum-like conditions within city outskirts</th>
<th>Severe slum-like conditions within city outskirts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kampala</td>
<td>1.00</td>
<td>1.10</td>
</tr>
<tr>
<td>City outskirts</td>
<td>0.93</td>
<td>0.93</td>
</tr>
<tr>
<td>Severe slum-like conditions</td>
<td>0.90</td>
<td>0.90</td>
</tr>
<tr>
<td>Average slum-like conditions</td>
<td>0.98</td>
<td>0.98</td>
</tr>
</tbody>
</table>

**Association of slum-like with access to medical treatment for Diarrhea**

<table>
<thead>
<tr>
<th>Less slum-like condition (Reference)</th>
<th>Average slum-like conditions within city outskirts</th>
<th>Severe slum-like conditions within city outskirts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kampala</td>
<td>0.46</td>
<td>4.30</td>
</tr>
<tr>
<td>City outskirts</td>
<td>0.46</td>
<td>0.46</td>
</tr>
<tr>
<td>Severe slum-like conditions</td>
<td>1.14</td>
<td>1.14</td>
</tr>
<tr>
<td>Average slum-like conditions</td>
<td>1.14</td>
<td>1.14</td>
</tr>
</tbody>
</table>
Who are the children parents/caretakers residing in slum-like conditions

Relative to the residents of less slum-like conditions:

• Individuals in the age group of 20–39 years, both men and women, were more likely to reside in slum-like household conditions
  - 20-24: RRR[95%CI] = 2.69[1.55-4.66]
  - 25-29: RRR[95%CI] = 2.55 [1.48-4.41]
  - 30-34: RRR[95%CI] = 1.81[1.03-3.16]
  - 35-39: RRR[95%CI] = 1.84[1.03-3.28]

• Married individuals were associated with a higher risk of living in households slum-like conditions (RRR[95%CI] = 1.33[1.1-1.6])

Relative to the residents of less slum-like conditions:

• Residing slum-like conditions decreased with higher levels of education
  - tertiary or university level: RRR[95%CI] = 0.16[0.12-0.21]
  - secondary level: RRR[95%CI] = 0.52[0.44-0.62]

• Individuals in professional occupations had a lower likelihood of living in severe slum-like conditions (RRR[95%CI] = 0.63[0.47-0.83]).

• Engaging in manual work and service occupations was linked to a higher risk of residing in households with severe slum-like conditions
  - manual work: RRR[95%CI] = 1.29[1.03-1.61]
  - service work: RRR[95%CI] = 1.39[1.12-1.72].
Conclusion

• A considerable number of households of the people living in GKM have slum-like household conditions, with no significant changes observed over a decade (2006-2016).

• The identified slum-like household conditions and the determinants of individual living in slum-like household conditions are key social determinants of health.
  • health services should be tailored to address the social determinants of health in urban settings.

• With the limited information for slum reliable estimates, our approach of categorizing the individual living in slum-like household conditions could be used in the identification and estimation of slum dwellers in developing countries.
Limitations

• The lack of other community context items such as population, uncollected garbage, contaminated water, open sewers, and poor drainage in the datasets that are clear measures of slum areas affect the estimates.

• DHS dataset is not powered to provide better estimates for slum and non-slum dwellers.

• Reporting of fever and diarrhoea in the DHS relies on self-reporting that involves recalling the events
Next step

• **Further granulized analysis**
  - **Delineation of urbanicity**: Considerations of urbanicity datasets based on global human settlement datasets
  - **Delineation of slums**: Linking DHS datasets to other geospatial/satellite datasets including population, built-up space, light intensity, fossil, foot-print
  - **Mapping various categories of slums within an urban setting**
Thank You!