Prevalence of Severe Acute Malnutrition (SAM) among under-five children: A community-based cross-sectional study from Puducherry, India

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What is the prevalence of Severe Acute Malnutrition (SAM) in slums of Muthialpet, Puducherry
Prevalence of Severe Acute Malnutrition (SAM) among under-five children: A community-based cross-sectional study from Puducherry, India

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ABSTRACT

Research Question: What is the prevalence of Severe Acute Malnutrition (SAM) in slums of Muthialpet, Puducherry

Study setting: Slums of Muthialpet, Puducherry (population = 20,000)

Study Design: Community-based cross-sectional descriptive study

Methodology: Random sampling was used to sample 300 children (6 mo – 5 yrs) from slums of Muthialpet, Puducherry. Slums of Muthialpet were divided into 5 areas and sample size of each area was determined based on the percentage population of the area. Sampled children from the community were sent to a pre-decided anganwadi of the area for anthropometry.

Results: Prevalence of SAM among under-five children in slums of Muthialpet, Puducherry, was 3.6% (0.95 CI: 1.9, 6.1). This is less than national and Tamil Nadu figures.

Key Words: Severe Acute Malnutrition (SAM), prevalence, cross-sectional study, under-five children
INTRODUCTION
According to National Family Health Survey (NFHS) III there are nearly 57 million undernourished children in India which is 1/3 of the world’s share [1]. In India, 5 million children die every year due to direct or indirect influence of malnutrition (1 child death for every 10 seconds) [2].

Severe acute malnutrition (SAM) remains a major killer of under-five children and is a neglected health condition [3]. SAM is diagnosed when the child has any one of the following criteria: weight for height (W/H) Z score < -3SD, Mid Upper Arm Circumference (MUAC) < 115 mm, malnutrition with bipedal edema or visible severe wasting (any one) [4]. According NFHS III, 6.4% of under-five children in India suffer from SAM [1]. Nine million children in India have SAM - 1/2 of world’s share.

No local data is available for prevalence of SAM in Puducherry. Weight for age data from Integrated Child Development Scheme cannot give information on SAM. Hence, we planned a cross sectional descriptive study with the primary objective to determine the prevalence of SAM in slums of Muthialpet region of Puducherry. Secondary objective was to determine prevalence of other malnutrition indicators like moderate wasting, severe stunting, moderate stunting, severe underweight and moderate underweight.

MATERIAL AND METHODS
Muthialpet is an urban area of Puducherry along the coastline. Its population is approximately 45000. The study was conducted in Muthialpet because the PHC was attached to department of Community Medicine, Indira Gandhi Medical College and Research Institute for MBBS training. Considering feasibility of conducting a community-based cross-sectional study during clinical posting of MBBS IIIrd semesters students, the study population was restricted to the slums of Muthialpet.

Slums of Muthialpet, Puducherry consist of the following areas namely: Vaithikuppam, Solainagar, Angalamman nagar, Ramalinganagar, Ganesh nagar, TV Nagar, Pudupalayam and Soukupet. Total population of slums of Muthialpet is approximately 20,000 with an expected under-five population of 2000.

The study was a community-based cross-sectional descriptive study. Under five children (6 mo to 5 yrs) residing in the slums of Muthialpet was the study population. Operational definition of primary outcome variable – Severe Acute Malnutrition, was defined as presence of W/H Z score less than -3 and/or MUAC less than 11.5 cm among 6 mo – 5 yrs children. An exception to this was for infants where the MUAC criterion was not used. Operational Definition used for various secondary outcome variables was as follows: moderate wasting – W/H Z score between -2 & -3; moderate stunting – height for age Z score between -2 & -3; severe wasting – height for age Z score less than -3; moderate underweight – weight for age Z score between -2 & -3; and severe underweight – weight for age Z score less than -3. Age was confirmed through immunization cards. Salter electronic baby and toddler scale, model 914 was used to weigh the children. Seca 214 portable stadiometer and Infantometer (Mfd. by ISO 9001:2000 Co.) were used to measure height and length respectively. Weight was measured to the nearest 10g and height / length to the nearest millimeter. Mean of two heights / lengths was taken. Two data collection forms were used: one for field and one for centre. WHO growth charts based on WHO Child Growth standards, 2006, were used for determining the status of malnutrition.

Assuming prevalence of SAM as 6% (NFHS 3 – India) in Puducherry with α of 0.05 and absolute precision of 2.7%, sample size of 300 under-five children was calculated according
to the formula $\frac{4pq}{z^2}$ (where L is the absolute precision = 2.7%, P is the expected prevalence = 6% and Q = 100 - P).

The study was conducted over a time period of 11 days from 1\textsuperscript{st} December 2012 to 11\textsuperscript{th} December 2012. The study population was divided into five areas based on the geographical proximity. Sample size of each area was determined based on the percentage population of that area. Data collection was done over five days; each day being allotted to one of the five areas (Table 1). 46 students were divided into 9 groups. On a given day, 7 groups stayed in field and 2 at the anganwadi centre. The anganwadi chosen was the most prominent and easily identifiable among all the anganwadi centres of the area to be covered in a day. Groups in the field were expected to sample children and groups in the pre-decided anganwadi were expected to do the anthropometry of the sampled children. Each area was divided into 7 sub-areas; one sub-area was given to one field group. Target sample size per day per sub-area was given to each field group by dividing the expected sample size (Table 1) of the area by 7.

Random sampling technique was used by each field group in the sub-area allotted to them. First, the road map along with the houses of the sub-area to be sampled was first drawn by the group. Then, direction in which the houses would be sampled was decided. A random house was chosen as the first house by spinning a bottle. From the first house, the rest of the houses to be sampled were covered by moving in the pre-decided direction, till the required target for the sub-area for each group was attained. Children, 6 mo – 5 yrs, who stayed at the house overnight were sampled irrespective of their anganwadi registration status. The parents of the children sampled were informed about the survey and their verbal informed consent was obtained. A unique ID was issued for each child on a referral slip in the following format – Day/Group number/Serial number (D1/A6/1). The parents were asked to take the sampled children along with the referral slip to the pre-decided Anganwadi for the required measurements. Two data sheets were used: one for the field group and the other for the centre group. The following variables were entered in the field data sheet: child id, name, age, sex and address. The following variables were entered in the centre data sheet: child id, weight, height/length and MUAC.

Malnutrition status was assigned by plotting various anthropometric parameters in height for age, weight for age and height for weight growth charts. Data was entered in SPSS v 17 and frequencies generated. Open epi online software used for determining 0.95 confidence intervals of prevalence.

**OBSERVATION**

A total of 305 children were sampled from slums of Muthialpet. When area-wise sample obtained was compared against the expected, it was found that it was not significantly different except for Angalamman nagar (Table 1). Age and sex distribution of the sampled children is given in figure 1. It was found that the ratio of < 2 yrs and > 2 yrs was approx. 1:1, as against 1:2 (expected). There was over representation of 6 mo – 2 yrs children. The difference in sex distribution wasn’t statistically significant.

Prevalence of SAM was 3.6% (0.95 CI: 1.9, 6.1). All the cases of SAM were based on W/H Z score criteria (Table 2). Prevalence of other malnutrition indicators is given in Table 3.
Table 1: Data collection plan to attain the expected sample size

<table>
<thead>
<tr>
<th>Day</th>
<th>Date</th>
<th>Area</th>
<th>Percentage</th>
<th>Population</th>
<th>Expected Sample</th>
<th>Observed Sample</th>
<th>Corrected Chi Sq</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>01.12.2012</td>
<td>Vaithikuppam</td>
<td>27%</td>
<td>81</td>
<td>68</td>
<td>1.55</td>
<td>0.21</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>03.12.2012</td>
<td>Solainagar</td>
<td>13%</td>
<td>105</td>
<td>87</td>
<td>2.63</td>
<td>0.10</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>04.12.2012</td>
<td>Angalamman Nagar</td>
<td>35%</td>
<td>39</td>
<td>59</td>
<td>4.02</td>
<td>0.04</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>05.12.2012</td>
<td>Ramalinganagar and Ganesh Nagar</td>
<td>12%</td>
<td>36</td>
<td>42</td>
<td>0.27</td>
<td>0.59</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>06.12.2012</td>
<td>T V Nagar, Pudupalayam and Soukupet</td>
<td>13%</td>
<td>39</td>
<td>49</td>
<td>0.91</td>
<td>0.34</td>
<td></td>
</tr>
</tbody>
</table>

**Total Sample**: 100% 300 305

Table 2: Prevalence of SAM in slums of Muthialpet, Puducherry (Primary Outcome Variable) (n=305)

<table>
<thead>
<tr>
<th>SAM criteria</th>
<th>Number (%)</th>
<th>95% CI*</th>
<th>India: Overall (%)</th>
<th>India: Urban (%)</th>
<th>Tamil Nadu (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight for height</td>
<td>11(3.6%)</td>
<td>1.9-6.1</td>
<td>6.45</td>
<td>5.7</td>
<td>8.9</td>
</tr>
<tr>
<td>MUAC (&lt;115mm)</td>
<td>0</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>11(3.6%)</strong></td>
<td><strong>1.9-6.1</strong></td>
<td><strong>6.45</strong></td>
<td><strong>5.7</strong></td>
<td><strong>8.9</strong></td>
</tr>
</tbody>
</table>

*Open epi online software, www.cdc.gov.in **NFHS-3 (2005-2006) [1]*

Table 3: Prevalence of Other Malnutrition Indicators (Secondary Outcome Variables) (n=305)

<table>
<thead>
<tr>
<th>Malnutrition Indicator</th>
<th>Number (%)</th>
<th>0.95 CI*</th>
<th>India: overall (%)</th>
<th>India: Urban (%)</th>
<th>Tamil Nadu (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate wasting</td>
<td>26 (8.5%)</td>
<td>5.8-12.1</td>
<td>13.4</td>
<td>19.0</td>
<td>13.3</td>
</tr>
<tr>
<td>Moderate under weight</td>
<td>23 (7.5%)</td>
<td>4.9-10.9</td>
<td>26.7</td>
<td>30.1</td>
<td>23.4</td>
</tr>
<tr>
<td>Severe under weight</td>
<td>15 (4.9%)</td>
<td>2.9-7.8</td>
<td>15.8</td>
<td>10.6</td>
<td>6.4</td>
</tr>
<tr>
<td>Moderate stunting</td>
<td>24 (7.8%)</td>
<td>5.2-11.3</td>
<td>25</td>
<td>37.4</td>
<td>20.0</td>
</tr>
<tr>
<td>Severe stunting</td>
<td>17 (5.5%)</td>
<td>3.4-8.6</td>
<td>23</td>
<td>16.4</td>
<td>10.9</td>
</tr>
</tbody>
</table>

*Open epi online software, www.cdc.gov.in **NFHS-3 (2005-2006) [1]*
DISCUSSION
This is the first study from Puducherry documenting the prevalence of SAM. Prevalence of SAM in slums of Muthialpet was found to be lower than the national (overall and urban) and Tamil Nadu figures. Prevalence of other malnutrition indicators was also less than the national and Tamil Nadu figures. Though these areas in Muthialpet were notified as slums, the area was as good as other non-slum areas of Puducherry. Typical characteristics of slums was absent in these areas. Hence, we compared the urban national / Tamil Nadu data with our slum data.

The sample size we achieved was enough for us to analyze and interpret our secondary objective, i.e., the prevalence of other malnutrition indicators. Subgroup analysis wasn’t done as sample size wasn’t factored in for the same at the beginning of the study. It would have been ideal to use simple random sampling in the sub-areas of an area allotted to each field group. This would have required the students to perform line listing on the day of sampling. Hence, considering the time constraint of clinical posting (10 AM to 1 PM), we followed the sampling methodology as mentioned before. Non – response was less than 5%. There were large numbers of data collectors (46). They were briefed before data collection on how to do anthropometry. Also, during data collection, daily at least 10% of measurements were cross checked by the tutors of the department. 10% of the growth chart plotting and interpretation by students was cross checked by the tutors. Though sex distribution was equal, there was over representation of 6 mo – 2 yrs children. The reason for this could be the non-availability of children above 2 yrs of age at home.

Future studies are required to determine the effectiveness and cost-effectiveness of community-based management of SAM in Puducherry.
ACKNOWLEDGEMENT
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Students of MBBS batch of 2011, Roll No 47 – 96, 136 for participating in the study during their first clinical posting in Community Medicine.

Conflict of Interest: None

Financial support: None

References