Anthropometric criteria for best identifying children at high risk of mortality:

*work of the Wasting & Stunting Technical Interest Group (WaSt TIG)*

Tanya Khara: ENN
The status quo

Is this justified? Is it effective?
Wasting and Stunting Technical Interest Group (WaSt TIG)

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Review of existing evidence and prioritisation of research gaps

Technical Briefing Paper
The relationship between wasting and stunting, policy programming and research implications
by Tanya Khara & Carmel Dolan

July 2014

Abstract

Background

Wasting and stunting are global public health problems that frequently coexist. However, they are usually reported separately in terms of policy, guidance, programming and financing. Though both wasting and stunting are manifestations of undernutrition caused by disease and poor care, there are definitional gaps in our understanding of the physiopathological relationship between them and how interventions for one may affect the other. The aim of this exercise was to establish research priorities in the relationships between wasting and stunting to guide future research investments.

Methods and Findings

We used the CH-PNH (Child Health and Nutrition Research Initiative) methodology for setting research priorities in health. We utilised a group of experts in nutrition, growth and child health to prioritise 30 research questions against three criteria (answerability, usefulness and impact) using an online survey. Eighteen of 55 (77%) experts took part and prioritised research directly related to programming, particularly at the public health level. The highest-rated questions were: “Can interventions outside of the 1000 days, e.g., pre-school, school age and adolescence, lead to catch-up in height and in other developmental markers?” “What timely interventions work to mitigate seasonal peaks in both wasting and stunting?” and “What is the optimal formulation of ready-to-use foods to promote optimal growth? and also support linear growth during and after recovery from severe acute malnutrition?” There was a high level of agreement between experts, particularly for the highest ranking questions.

Conclusions

Increased commitment to rigorous evaluations of treatment and prevention interventions at the public health level, addressing questions of the timing of intervention, and the extent to
Being wasted & stunted is particularly risky

Children wasted, stunted and underweight are 12 times more likely to die than non-wasted or stunted children - similar risk of death to those severely wasted

(McDonald, Olofin et al. 2013)
What is the role of underweight?

All children who are wasted and stunted are underweight.

Multiple anthropometric deficit category is the same as WaSt.

WaSt cases are more stunted and more wasted than those with single deficits but severity doesn’t explain the level of mortality risk.

2,515 survey/SMART datasets (1992-2015), 51 countries, >1.7 million children

*Myatt et al; AoPH 2018*
How many are there?

- Ranging from 0% to 8%
- 9 countries >5%
- Pooled prevalence 3.0%
  (95% CI 2.97 to 3.06)
- Burden ~ 6 million children (6-59m) – update from GNR 16 million

Call for concurrence to be routinely reported in GNR/Joint estimates

Are these children being reached?

Khara et al; 2017, Maternal and Child Nutrition
How to best identify the most at risk children?

Niakhar (Senegal) 1980
- 5,751 children
- Every 6m for 2yrs
- WAZ<-2.8 together with MUAC<115mm identify all deaths associated with WHZ and WaSt

Myatt et al; 2018, Public Health Nutrition
Are we reaching the most at risk? Could we? And how?

Systematic Review and Meta-Analysis

Anthropometric criteria for best-identifying children at high risk of mortality: a pooled analysis of twelve cohorts

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Abstract

Objective To understand which anthropometric diagnostic criteria best discriminate higher from lower risk of death in children and explore programme implications. Design: A multiple cohort individual data meta-analysis of mortality risk (within 6 months of measurement) by anthropometric case definitions. Sensitivity, specificity, informedness and lack-of-informative predictive mortality, face validity and compatibility with current standards and practice were assessed and operational consequences were modelled. Setting: Community-based cohort studies in twelve low-income countries between 1977 and 2013 in settings where treatment of wasting was not widespread. Participants: Children aged 6 to 59 months. Results: Of the twelve anthropometric case definitions examined, four (weight-for-age Z-score WAZ < -2, (mid-upper arm circumference MUAC < 115 cm), MUAC < 115 mm or WAZ < -2 and MUAC < -2) had the highest informative predictive mortality. A combined case definition MUAC < 115 mm or WAZ < -2 was better at predicting deaths associated with weight-for-height (Z-score WHZ < 2.5) and concurrent wasting and stunting (WAZ < -2 the single WAZ < -2 case definition. After the assessment of all criteria, the combined case definition MUAC < 115 mm or WAZ < -2 was selected as the best overall criterion for identifying children at high risk of mortality.

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Pooled analysis of 12 cohorts, untreated children

<table>
<thead>
<tr>
<th>Country</th>
<th>Study</th>
<th>Recruitment years</th>
<th>Children aged 6-59 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indonesia</td>
<td>Katz (1989)</td>
<td>1977-78</td>
<td>3,806</td>
</tr>
<tr>
<td>Senegal</td>
<td>Garenne (1987)</td>
<td>1983</td>
<td>5,142</td>
</tr>
<tr>
<td>Sudan</td>
<td>Fawzi (1997)</td>
<td>1988</td>
<td>22,532</td>
</tr>
<tr>
<td>All</td>
<td>All</td>
<td>1977-2013</td>
<td>56,559</td>
</tr>
</tbody>
</table>
## Prediction of mortality: Pooled sensitivity, specificity and informedness

<table>
<thead>
<tr>
<th>Case-definition</th>
<th>Sensitivity (%)</th>
<th>95% CI</th>
<th>Specificity (%)</th>
<th>95% CI</th>
<th>Youden's Index (%)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>HAZ &lt;-3</td>
<td>32.63</td>
<td>[23.57;41.69]</td>
<td>79.30</td>
<td>[72.30;86.29]</td>
<td>13.49</td>
<td>[ 9.96;17.02]</td>
</tr>
<tr>
<td>HAZ &lt;-2</td>
<td>58.28</td>
<td>[48.96;67.60]</td>
<td>54.26</td>
<td>[43.75;64.78]</td>
<td>12.77</td>
<td>[ 7.93;17.60]</td>
</tr>
<tr>
<td><strong>WAZ &lt;-3</strong></td>
<td><strong>30.81</strong></td>
<td>[24.09;37.52]</td>
<td><strong>88.62</strong></td>
<td>[85.07;92.17]</td>
<td><strong>20.38</strong></td>
<td>[15.10;25.66]</td>
</tr>
<tr>
<td>WAZ &lt;-2</td>
<td>57.86</td>
<td>[49.71;66.00]</td>
<td><strong>66.28</strong></td>
<td>[56.91;75.65]</td>
<td><strong>24.94</strong></td>
<td>[19.87;30.02]</td>
</tr>
<tr>
<td>WHZ &lt;-2</td>
<td>28.45</td>
<td>[19.73;37.16]</td>
<td>90.06</td>
<td>[87.34;92.79]</td>
<td>18.47</td>
<td>[12.20;24.75]</td>
</tr>
<tr>
<td>MUAC &lt;115 mm</td>
<td>17.56</td>
<td>[ 7.60;27.53]</td>
<td>96.52</td>
<td>[94.14;98.90]</td>
<td>13.46</td>
<td>[ 6.49;20.44]</td>
</tr>
<tr>
<td>MUAC &lt;120 mm</td>
<td>25.11</td>
<td>[10.03;40.18]</td>
<td>92.64</td>
<td>[87.72;97.55]</td>
<td>17.23</td>
<td>[ 7.62;26.83]</td>
</tr>
<tr>
<td><strong>MUAC &lt;125 mm</strong></td>
<td><strong>37.22</strong></td>
<td>[20.30;54.13]</td>
<td><strong>85.89</strong></td>
<td>[77.02;94.76]</td>
<td><strong>23.00</strong></td>
<td>[13.77;32.23]</td>
</tr>
<tr>
<td>MUAC &lt;115 mm or WHZ &lt;-3</td>
<td>20.38</td>
<td>[13.58;27.18]</td>
<td>95.31</td>
<td>[93.24;97.38]</td>
<td>15.00</td>
<td>[10.12;19.89]</td>
</tr>
<tr>
<td><strong>MUAC &lt;115mm or WAZ &lt;-3</strong></td>
<td><strong>36.29</strong></td>
<td>[26.13;46.45]</td>
<td><strong>83.56</strong></td>
<td>[79.10;98.02]</td>
<td><strong>22.55</strong></td>
<td>[16.13;28.97]</td>
</tr>
</tbody>
</table>
Inclusivity: MUAC <125mm
## Summary of assessment of criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>Youden’s Index</th>
<th>Face Validity</th>
<th>Inclusivity</th>
<th>Compatibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>HAZ &lt;-3</td>
<td>●</td>
<td>○</td>
<td>○</td>
<td>●</td>
<td>?</td>
<td>○</td>
</tr>
<tr>
<td>HAZ &lt;-2</td>
<td>●</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>?</td>
<td>○</td>
</tr>
<tr>
<td>WAZ &lt;-3</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>WAZ &lt;-2</td>
<td>●</td>
<td>○</td>
<td>●</td>
<td>○</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>WHZ &lt;-3</td>
<td>○</td>
<td>●</td>
<td>○</td>
<td>●</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>WHZ &lt;-2</td>
<td>○</td>
<td>●</td>
<td>●</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>MUAC &lt;115 mm</td>
<td>○</td>
<td>●</td>
<td>○</td>
<td>●</td>
<td>○</td>
<td>●</td>
</tr>
<tr>
<td>MUAC &lt;120 mm</td>
<td>○</td>
<td>●</td>
<td>●</td>
<td>?</td>
<td>?</td>
<td>○</td>
</tr>
<tr>
<td>MUAC &lt;125 mm</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>○</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>WHZ &lt;-2 and HAZ &lt;-2 (WaSt)</td>
<td>○</td>
<td>●</td>
<td>○</td>
<td>●</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>MUAC &lt;115 mm or WHZ &lt; -3 (WHO)</td>
<td>○</td>
<td>●</td>
<td>○</td>
<td>●</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>MUAC &lt;115 mm or WAZ &lt; -3</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>
Risk and intensity of treatment

- **MUAC < 115 mm and WAZ < -3**
  - Pooled Risk Ratio: 5.68 [4.40; 7.34]

- **MUAC ≥ 115 mm & WAZ < -3**
  - Pooled Risk Ratio: 2.25 [1.64; 3.09]

- **MUAC < 115 mm and WAZ ≥ -3**
  - Pooled Risk Ratio: 3.56 [1.42; 8.90]

- **115 mm ≤ MUAC < 125 mm**
  - Pooled Risk Ratio: 2.95 [1.88; 4.61]

- **All MUAC < 115 mm**
  - Pooled Risk Ratio: 5.28 [3.49; 7.97]
Potential caseload implications

Caseload = population x prevalence x coverage

Workload = caseload x treatment intensity

MUAC<115mm

MUAC<115mm & WAZ<-3

Coverage

Treatment Intensity

x4

x3

x2
Potential programme model

MUAC at each GM / GMP / MCH contact

Measure weight at GM / GMP / MCH and other clinic contacts

Plot weight against age

Therapeutic Feeding (CMAM) Program

GM / GMP / MCH ↔ TFP linkage

WAZ < −3?

Yes

Interpret growth trajectory

No

Counselling based on GM results

Health and general nutrition interventions

WAZ at CMAM / OTP sites

MUAC by Mothers / CBVs

MUAC & WAZ at health facilities

MUAC & WAZ at EPI delivery

MUAC & WAZ at IMNCl delivery

MUAC by mass screening
Further work.

- Protocol for [WaSt cohort study](#) developed and collaboration and funding being sought for implementation
- *Anthropometric deficits and the associated risk of death by age and sex in children aged 6–59 months: A meta-analysis* ([Thurstans et al 2022](#))
- *How do children with severe underweight and wasting respond to treatment? A pooled secondary data analysis to inform future intervention studies* ([Odei et al 2022](#))
- Related analysis of the implications of frequency of measurement (over to André)
Thank you.

https://www.ennonline.net/ourwork/reviews/wastingstunting


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