PEDIATRIC POST-DISCHARGE MORTALITY

DEVELOPING PREDICTION MODELS FOR RISK ASSESSMENT IN UGANDA

Matthew Wiens
University of British Columbia & Centre for International Child Health
Funding
Background

• Acute infectious diseases most common cause of pediatric death in Africa

• MDG 4 will not be met by most countries in sub-Saharan Africa

• Post-discharge mortality not recognized as a major contributor to child mortality

Background

Wiens et al. PLOS One. 2013;6(8):e66698
Background

What’s needed?

1. A strategy to identify vulnerable children
2. A strategy to improve care following discharge
Study

Design:
• Prospective cohort study

Eligibility:
• Admission
• proven/suspected infection
• 6m – 5yr

Outcome:
• 6 month post-discharge mortality

Analysis:
• Logistic regression using admission variables
### Candidate predictor variables

<table>
<thead>
<tr>
<th>Clinical</th>
<th>Laboratory</th>
<th>Social/demographic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height/Weight/MUAC</td>
<td>Hemoglobin</td>
<td>Bed net use</td>
</tr>
<tr>
<td>Heart rate</td>
<td>HIV status</td>
<td>Maternal age</td>
</tr>
<tr>
<td>Respiratory rate</td>
<td>Malaria blood smear</td>
<td>Maternal Education</td>
</tr>
<tr>
<td>Blood pressure</td>
<td></td>
<td>Maternal HIV status</td>
</tr>
<tr>
<td>Temperature</td>
<td></td>
<td>Maternal death</td>
</tr>
<tr>
<td>Oxygen Saturation</td>
<td></td>
<td>Number of siblings</td>
</tr>
<tr>
<td>Blantyre coma score</td>
<td></td>
<td>Sibling deaths</td>
</tr>
<tr>
<td>Immunization status</td>
<td></td>
<td>Distance (time)</td>
</tr>
<tr>
<td>Prior antibiotic use</td>
<td></td>
<td>Distance (cost)</td>
</tr>
<tr>
<td>Prior antimalarial use</td>
<td></td>
<td>Availability of latrine</td>
</tr>
<tr>
<td>Time since last hospitalization</td>
<td></td>
<td>Water source</td>
</tr>
<tr>
<td>Duration of illness</td>
<td></td>
<td>Boiling of drinking water</td>
</tr>
</tbody>
</table>
Enrollment

Subjects Screened
n=1824

Subjects excluded
(no infection)
n=517 (28.3%)

Subjects enrolled
n=1307
In-hospital outcomes

Subjects enrolled
n=1307

Died in hospital
n=65 (5.0%)

Discharged alive
n=1242 (95.0%)
Follow-up rate: 98.5%
## Baseline information

<table>
<thead>
<tr>
<th>Admission Characteristics</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in months (median, IQR)</td>
<td>18 (12 – 33)</td>
</tr>
<tr>
<td>Male sex</td>
<td>682 (55%)</td>
</tr>
<tr>
<td>WAZ &lt; -2</td>
<td>347 (30%)</td>
</tr>
<tr>
<td>HIV positive</td>
<td>58 (4.7%)</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>390 (31%)</td>
</tr>
<tr>
<td>Malaria</td>
<td>621 (50%)</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>96 (8%)</td>
</tr>
<tr>
<td>Length of stay (median, IQR)</td>
<td>2 (1 – 5)</td>
</tr>
</tbody>
</table>
# Primary prediction model

<table>
<thead>
<tr>
<th>Variable</th>
<th>OR (95% CI)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MUAC</td>
<td>0.95 (0.94 – 0.97)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>SpO2</td>
<td>0.96 (0.94 – 0.99)</td>
<td>0.0031</td>
</tr>
<tr>
<td>Time since last hospitalization</td>
<td>0.76 (0.61 – 0.93)</td>
<td>0.0080</td>
</tr>
<tr>
<td>HIV positive</td>
<td>2.67 (1.19 – 6.00)</td>
<td>0.0171</td>
</tr>
<tr>
<td>Abnormal BCS</td>
<td>2.41 (1.19 – 4.87)</td>
<td>0.0147</td>
</tr>
</tbody>
</table>
ROC curve of primary model

AUC: 0.815

Sens: 80.0
Spec: 64.8
PV-: 98.4%
PV+: 10.7%
Application of risk model

Prediction models are mathematically complex!

- $\text{logit}(p) = 7.85 + (-0.047; \text{MUAC}) + (-0.041; \text{SpO2}) + (-0.28; \text{time last hosp.}) + (0.98; \text{HIV}) + (0.88; \text{BCS})$

Mobile phones can do math and are common in Africa
Application of risk model

- Mobile App
- CHW Referral
- Discharge Kit
Mobile Application

1. Accurate identification of vulnerable children
2. Improved resource efficiencies
3. Improved discharge or referral planning
Community Referral

Sick Child

CHW Visit (iCCM)

Referral to CHW

Referral to HC/Hospital

Discharge
Discharge Kit

- Education for mother
  - Vulnerability following discharge
  - Health behavior (prevention)
  - Early recognition
  - Early health seeking

- Incentives
  - New bed net
  - ORS
  - Soap
Discharge Kit

Oteebwa ebi: Ahabw’okugira ngu bakutsibura tikirikumanyisa ngu oburwaire bw’omwaana bwakire gye. Guma n’ofayo! Rebeeka ngu waguma ory’omuyonjo! Rebeba obumanyiso bubi aha mwaana wawe! Randa kare obujanjabi aha irwariro erikuri haihi!


Guma obyame omukatimba k’ensiri buri eizooba!

Rebeba obumanyiso bubi aha mwaana wawe! Omwaana wawe yaba atakurya, atakuzaana nainga atakubysama eizooba ryoonsa nabasa kuba arwire munonga. Ekindi reeba okwitsya kubi, okuhemba omuririo, nari okuhaba.

Tunga kare obujanjabi aha irwariro erikuri haihi! Otakasibayo ku tunga obujanjabi. Ogayende aha irwariro erikuri haihi nainga tayayira omushaaho waha kyaaro.
Conclusions

1. Post-discharge mortality is important
2. Post-discharge mortality can be predicted
3. Interventions can be developed
4. Pragmatic RCT’s and economic studies required prior to major scaling projects
Questions?

Thanks to:

Team Canada
• Charles Larson
  • Joel Singer
• Mark Ansermino
• Niranjan Kissoon
• Hubert Wong
• Guohai Zhou
• Nasim Lowlavaar

Team Uganda
• Elias Kumbakumba
  • Andrew Ndamira
• Jerome Kabakyenga
  • Julius Kiwanuka
• Celestine Barigye