Feasibility Trial of an Electronic Adaptive Learning Curriculum for Pediatric Healthcare Workers in Tanzania

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Presenting Author Disclosure Information

I have no relevant financial relationships with the manufacturer(s) of any commercial product(s) and/or provider(s) of commercial services discussed in this CME activity.

I do not intend to discuss an unapproved/investigative use of a commercial product/device in my presentation.
Preventable Under-5 Mortality Remains High

- 5.2 M children U5 die each year
  - Majority in Low- and Middle-Income Countries
  - Large percentage due to preventable, treatable illness

Deaths among children aged 1–59 months (54%)

- Pneumonia, 13%
- Intrapartum-related events, 1%
- Preterm birth complications, 2%
- Meningitis, 2%
- AIDS, 1%
- Malaria, 5%
- Diarrhoea, 8%
- Injury, 6%
- Measles, 1%
- Tetanus, 1%
- Congenital, 5%
- Other, 12%

Neonatal deaths (46%)

- Pneumonia, 3%
- Preterm birth complications, 16%
- Intrapartum-related events, 11%
- Sepsis or meningitis, 7%
- Other, 3%
- Injury, 1%
- Tetanus, 1%
- Congenital, 5%
- Diarrhoea, 0.3%
Evidence-Based Practice (EBP) Training: Strengths & Limitations

• Adherence improves outcomes
  • In-person training (WHO & AHA)
    • Increase knowledge and initial adherence

• Limitations
  • Labor intensity
  • Cost ($80-$300 USD)
  • Loss to Follow-Up
  • "One Size Fits All"

Possible Solution: Mobile Health and Adaptive Learning

- **Mobile Health**
  - Broad, rapid dissemination
  - Leverages increasing mobile technology
  - Real-time updates
  - Funding priority for WHO

- **Adaptive Learning**
  - Digital algorithms for customized learning
  - Increased and *more* rapid acquisition of mastery
  - Outperforms in-person teaching in high-resource settings
Development: Content

Source Material: TMOH > BMC > WHO > AHA

Topic Selection: Local Stakeholders

Content Approval: Iterative expert review

Learning Engineer Review

Beta Testing

Peer Review

Administrative Approval
# Development: Structure

## Pediatric Acute Care Education (PACE): Introduction

<table>
<thead>
<tr>
<th>Systematic Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triage: Emergency and Priority Signs</td>
</tr>
</tbody>
</table>

## Problem

<table>
<thead>
<tr>
<th>Respiratory: Lung Tissue Disease</th>
<th>Circulatory: Hypovolemic Shock</th>
</tr>
</thead>
</table>

## Assessment

<table>
<thead>
<tr>
<th>Airway and Breathing</th>
<th>Circulation, Disability &amp; Exposure</th>
</tr>
</thead>
</table>

## intervention

<table>
<thead>
<tr>
<th>Oxygen Therapy, Antibiotics</th>
<th>Fluid Therapy, Blood Transfusion</th>
</tr>
</thead>
</table>

## Total

| 11 Modules |
Development: The Platform

WHO DIAGNOSTIC CRITERIA FOR SEVERE ACUTE MALNUTRITION (SAM)

- Weight-for-length/height
  - Less than -3SD
- Mid-upper arm circumference
  - <115 mm (only in patients over 6 months of age)
- Edema
  - Both feet

Because of the importance of severe acute malnutrition, also known as SAM in the management of shock, let's take a moment to review the diagnostic criteria for SAM.

According to the WHO, children may be diagnosed with SAM if they have a weight for length/height $<-3$ SD, a mid-upper arm circumference $<115$ mm, or edema of both feet.

As soon as any of these three criteria are identified, a diagnosis of SAM is made.
Study Site: Mwanza, Tanzania

Mwanza Region
Population: 2.7 million
U5 Mortality Rate: 57/1000
Est U5 Deaths: 28,500/YR

Bugando Medical Center
900 Bed Tertiary Center
Regional Teaching Hospital

https://hmisportal.moh.go.tz/hmisportal/#/data-statistics/hwJNMC3LrPd/hwJNMC3LrPd, extracted 21Sept2019
Study Design: Prospective Mixed-Methods Single-Arm Feasibility Trial

- REDCap Consent
- Demographics
- Area9 Registration
- Intro
- Pre-PACE Assessment
- Adaptive Modules
- Refresh
- Post-PACE Assessment
- REDCap NoMAD Survey Provider Content Feedback

Baseline

12 weeks

100% Proficiency

Weekly WhatsApp reminders and data checks
Defining Feasibility: RE-AIM Framework

Defining Feasibility: RE-AIM Framework

RE-AIM

- Reach
- Efficacy
- Adoption
- Implementation
- Maintenance
- Knowledge acquisition
- Accessing the platform
- Completion
Defining Feasibility: RE-AIM Framework

- Reach
- Efficacy
- Adoption
- Implementation
- Maintenance
- Knowledge acquisition
- Accessing the platform

Completion: 60%
Knowledge acquisition: 15%
Accessing the platform: 75%
## Cohort Characteristics

<table>
<thead>
<tr>
<th>Demographics</th>
<th>Overall</th>
<th>Completed Maintenance</th>
<th>Did not complete Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>21</td>
<td>33.3% (7/21)</td>
<td>66.7% (14/21)</td>
</tr>
<tr>
<td>Median Age</td>
<td>26</td>
<td>26</td>
<td>26</td>
</tr>
<tr>
<td>Female Gender</td>
<td>28.6% (6/21)</td>
<td>14.3% (1/7)</td>
<td>35.7% (5/14)</td>
</tr>
<tr>
<td>Reported English fluency:</td>
<td>85.7% (18/21)</td>
<td>85.7% (6/7)</td>
<td>85.7% (12/14)</td>
</tr>
<tr>
<td>Previous acute care training*</td>
<td>63.2% (12/19)</td>
<td>85.7% (6/7)</td>
<td>50% (6/12)</td>
</tr>
<tr>
<td>Clinical Experience (Median Years)</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Electronic media as primary learning source</td>
<td>30% (6/20)</td>
<td>42.9% (3/7)</td>
<td>23.1% (3/13)</td>
</tr>
<tr>
<td>&lt; 25%</td>
<td>45% (9/20)</td>
<td>28.6% (2/7)</td>
<td>53.8% (7/13)</td>
</tr>
<tr>
<td>25-75%</td>
<td>25% (5/20)</td>
<td>28.6% (2/7)</td>
<td>23.1% (3/13)</td>
</tr>
<tr>
<td>&gt;75%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smart phone ownership (mobile phone capable of accessing internet with active data plan)</td>
<td>21/21 (100%)</td>
<td>7/7 (100%)</td>
<td>14/14 (100%)</td>
</tr>
<tr>
<td>Device for e-Learning</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mobile phone</td>
<td>90.5% (19/21)</td>
<td>85.7% (6/7)</td>
<td>92.3% (12/13)</td>
</tr>
<tr>
<td>Tablet</td>
<td>4.8% (1/21)</td>
<td>14.3% (1/7)</td>
<td>7.7% (1/13)</td>
</tr>
<tr>
<td>Computer</td>
<td>4.8% (1/21)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Determination of Feasibility

<table>
<thead>
<tr>
<th>Screened</th>
<th>Enrolled</th>
<th>Adoption</th>
<th>Maintenance</th>
<th>Efficacy</th>
<th>NoMAD</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>21 (87.5%)</td>
<td>17 (81%)</td>
<td>7 (33.3%)</td>
<td>24.4% (95% CI 3.1-45.7)</td>
<td>6 (28.6%)</td>
</tr>
</tbody>
</table>
Conclusions

• First feasibility trial of an adaptive electronic learning curriculum of evidence-based guidelines for acutely-ill children in an LMIC

• Current implementation strategy is feasible for Adoption and Effectiveness

• Not feasible for Maintenance

• Initial deployment notable for similar efficacy to conventional education interventions

• Results will inform future implementation
Limitations

• Small $n$ at a single facility with one cadre of healthcare providers
• NoMAD data only collected on those who completed PACE
• Definition of feasibility based on thresholds from prior educational studies rather than site-specific contextual data
Future Directions: Phase I Implementation Trial

- 8 healthcare facilities throughout Mwanza Region
- Multiple cadres of providers
- Additional qualitative data collection
  - Focus Group Discussions
  - Individual Interviews
- 181 participants enrolled thus far
Acknowledgements
Questions?
For more information on this subject, see the following publications:


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