Field Testing a Neonatal Phototherapy Device: a novel approach for data collection using Facebook

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Introduction
Nearly all cases of kernicterus resulting from neonatal jaundice can be prevented with timely deployment of high-intensity, blue light phototherapy. Poor outcomes from kernicterus are much more prevalent in developing countries, in large part due to lack of context appropriate phototherapy devices that are deliverable to remote regions and function robustly in areas with power outages. The Bili-Hut™ is a novel, portable high-intensity phototherapy device capable of prolonged operation with a 12V battery. We describe the successful introduction of this innovation into a resource constrained hospital in rural Burundi, enabling local treatment of jaundiced newborns for the first time. A novel approach for field testing was to leverage the familiarity and use of social media (Facebook) amongst staff. This enabled communication with the field site in near real-time and as well as means for comprehensive data collection.

Methods
Data Collection via Facebook
In August 2015 a Bili-Hut™ 4th generation prototype was transported to Kibuye Hope Hospital, Gitega Province, Burundi in the suitcase of a medical volunteer. After training staff and establishing a protocol for screening and treatment, jaundiced infants meeting locally determined criteria for phototherapy were treated with the Bili-Hut™. To ensure continuous therapy, the Bili-Hut™ was connected to a power supply that would divert to a standard car battery during power outages. When line power was restored, the device would operate from line power and the battery would recharge (Below, left.). Local medical staff collected patient treatment information on data collection cards prepared for this project. Once completed, the cards were uploaded to a private Facebook page for analysis. (Below, right.)

Response to Phototherapy: Serum bilirubin levels were obtained on 53 of 85 infants treated with the Bili-Hut™, with 28 infants having both pre- and post-treatment levels (plot). Mean and median pre-treatment levels (mg/dL) were 13.5 and 12.9, respectively, and 6.0 and 6.1, post-treatment. The average treatment time in Bili-Hut™ was 44 hours.

Results
Eighty-five (85) newborn NICU patients were treated with the Bili-Hut™ from September 2015 - February 2017. Pre-treatment serum bilirubin testing was performed on 50 infants (59%) and both pre- and post-treatment bilirubin testing was performed on 28 infants (33%). Infants receiving phototherapy without serum bilirubin testing were treated empirically on the basis of clinical suspicion of significant jaundice by the care provider. The most common reasons reported for not obtaining serum bilirubin testing were lack of laboratory reagent and difficulty with phlebotomy.

Patient Demographics:
- Mean gestational age: 37.2 weeks
- Median gestational age: 33 weeks (28-36)
- Mean birth weight: 1.9 kg
- Median birth weight: 1.6 kg (1.0-2.6)

Post-treatment levels for each infant group are compared to expert recommendations for gestational age, with treatment thresholds for bilirubin level and pretreatment bilirubin levels for each individual infant are compared to expert thresholds for gestational age

<table>
<thead>
<tr>
<th>Gestation (Weeks)</th>
<th># of Infants</th>
<th>Mean Serum Bilirubin Level (mg/dL)</th>
<th>At Below Px Range</th>
<th>&gt;PTx and &lt;ETx Range</th>
<th>≤ETx Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>28</td>
<td>1</td>
<td>15.5</td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>30</td>
<td>1</td>
<td>8.6</td>
<td>1</td>
<td></td>
<td>1</td>
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<td>34</td>
<td>5</td>
<td>10.1</td>
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<td>40</td>
<td>5</td>
<td>15.4</td>
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<td>3</td>
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<td>2</td>
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</tbody>
</table>

Conclusion
This field test demonstrates successful implementation of continuous phototherapy using a novel portable, battery operable, high-intensity neonatal phototherapy device in a remote, developing area with unreliable line power. Use of a social media platform (Facebook) as a communication tool enabled near real-time data collection, troubleshooting, and guidance in an area with limited travel access due to regional political conflict and unfavorable seasonal climate conditions. Comprehensive data collection via this method has enabled a deeper understanding of local limitations and challenges in jaundice management and has guided further interventions to improve care.

Discussion
Social media platforms such as Facebook are widely used in the developing world. Ease of use, near real-time communication, ability to upload photographs and weblinks, and private page security are features that enable data sharing and collaboration in regions that may not be accessible for on-site field study. Although our results demonstrate the effective use of a social media platform for data collection in a rural Burundian Hospital, strong, local buy-in and an on-site champion were critical to the success of this initiative. In addition, data obtained from this field test confirm the urgent need for reliable serum bilirubin testing in low-resource settings. Scarcity of resources for routine screening had the demonstrated effect of delaying diagnosis. Nearly 80% of infants <35 weeks of gestation were treated with the Bili-Hut™. To ensure continuous therapy, the device would operate from line power and the battery would recharge after line power was restored, the device would operate from line power and the battery would recharge (Below, left.). Local medical staff collected patient treatment information on data collection cards prepared for this project. Once completed, the cards were uploaded to a private Facebook page for analysis. (Below, right.)

Preterm infants <35 weeks: Limitations of Visual Screening

- Bilirubin levels exceeding the recommended threshold at the time of starting treatment. This insight has since resulted in the implementation of an on-site champion role.

Citations

We wish to acknowledge the staff, volunteers and medical trainees at Hope Africa University and Kibuye Hope Hospital for their outstanding contributions in enabling this study and to recognize their exceptional care of sick and preterm infants.

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