

# A NEW DEVICE -POLITEULTRALUMEN- SETS A NEW TREATMENT RECORD FOR NEONATAL SEVERE HYPERBILIRUBINEMIA IN HARDEST-TO-REACH PLACES

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**Background:** The treatment of severe hyper bilirubinaemia in remote locations—without electricity and specialist doctors—is hampered by a lack of technologies that are operable by basic-trained healthcare workers. This study objectives were to research, design and develop a simplified low-cost medical device that could be deployable to hardest-to-reach places for severe jaundice treatment.

**Methods:** Low-cost elements, components, and workpieces were applied in design to develop an applicable bi-directional phototherapy machine. Materials were sourced from in-country local markets to prototype the resultant device for capacity tests, and safety assessments. The device was crafted to operate sustainably by solar energy, mitigating climate-change. This was trialled in a controlled setting to determine its efficiency in the breakdown of ‘severe’ serum bilirubin to a ‘mild’ benchmark levels at <11.5mg/dL in the first 12 cases treated.

**Results:** The new device passed 100% technical and clinical safety assessments, delivering total body irradiation treatment capacity of 45—158  $\mu\text{W}/\text{cm}^2/\text{nm}$  with 460 nm light-wavelengths across targeted respective aspects of the body of a neonate. The device utilises real-time solar-power whilst self-banking its private reserve energy, which lasts 27-hours after sunshine. All initial 12 patients were successfully treated within  $17.8 \pm 8.7$  irradiation-hours without any injuries or vital signs issues.

**Conclusion:** The new device is non-invasive like standard EBT+overhead-phototherapy. Yet in comparison, it reduced average: hospitalisation (7days-to- $\frac{3}{4}$ day), cost (US\$262-to-US\$28), senior labour (3-to-zero), power (grid/generator-to-none), carbon emission (high-to-none), and risks (high-to-none). This device is a potential LMIC-solution for severe jaundice, hence a progress towards actualising neonatal care in hinterlands.

Keywords: LMIC, severe jaundice, hyperbilirubinemia, exchange blood transfusion, neonate, climate change