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# Healthcare appliances



Funded by:



IKEA Foundation



# Agenda

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- Overview of the healthcare off-grid sector
- Healthcare appliances in Uganda: Case Study of a signs monitor
- Webinar feedback survey



# Our speakers



## ▶ **Luc Severi**

- Senior Energy Access Specialist at Sustainable Energy for All
- Experience working in Mozambique, Senegal, and Liberia, including SolarNow and Save the Children International, as well as for the UN Foundation.
- Active participant in the green and circular economy, working primarily with renewable energy solutions for off-grid and rural households, schools, and health centers.
- Master's in Commercial Engineering from KULeuven and an MSc Development Management from the London School of Economics.



## ▶ **Assumpta Nantume-Greene**

- As Research Coordinator at Neopenda, she leads the company's multi-country clinical trials on a novel wireless vital signs technology, neoGuard
- Over 5 years of experience in designing and implementing clinical trials and epidemiological studies on health innovations.
- Master's of Science in Global Health degree from Duke University, a Bachelor of Pharmacy degree for Mbarara University of Science and Technology and is also a Global Health Corps alumn.



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# Overview of the healthcare sector

Luc Severi, SeforAll



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# Powering Healthcare

## Setting the Scene

October 2020

**Luc SEVERI**

Sr. Energy Access Specialist

[@lucseveri](#)

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# Data on health facility electrification is sparse, but what data does exist points to serious gaps in access and reliability



**59%**

health facilities in low and middle-income countries lack reliable

power  
Source: International Journal of Hygiene and Environmental Health (2018)



**1 in 4**

health facilities in LDCs has no electricity

Source: Global Health Science Practice (2013)



**50%**

primary health centers in India lack power or reliable power

Source: Council on Energy, Environment and Water (2017)

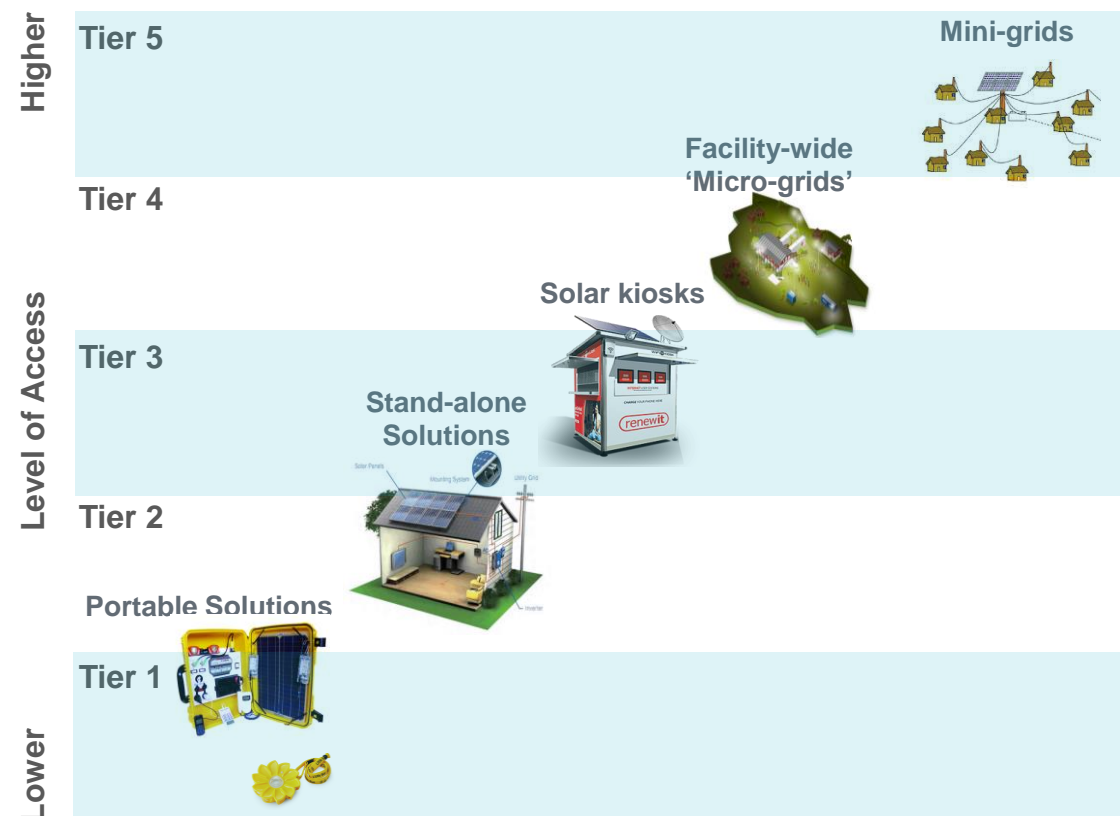


**70%**

equipment breaks down, with voltage surges a main cause

Source: Annual Review of Biomedical Engineering (2007)

# A range of distributed renewable energy solutions exist to power health facilities



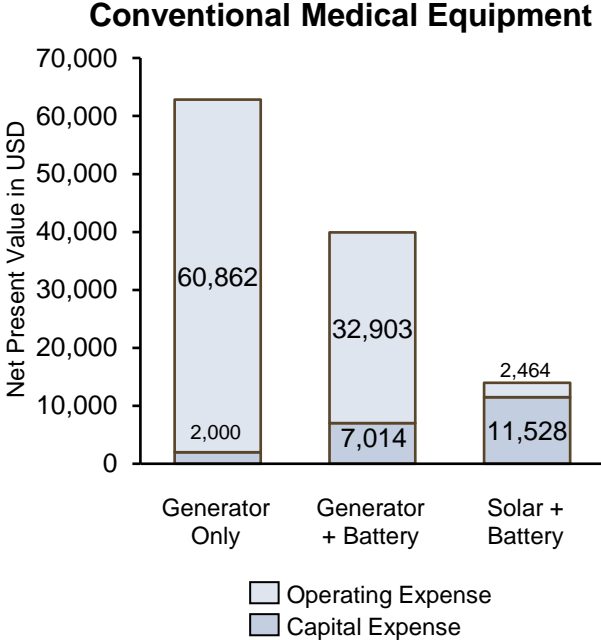
**Innovative delivery models are being developed and piloted to improve long-term sustainability**

**Rapidly deployable solutions exist on supply and demand side**

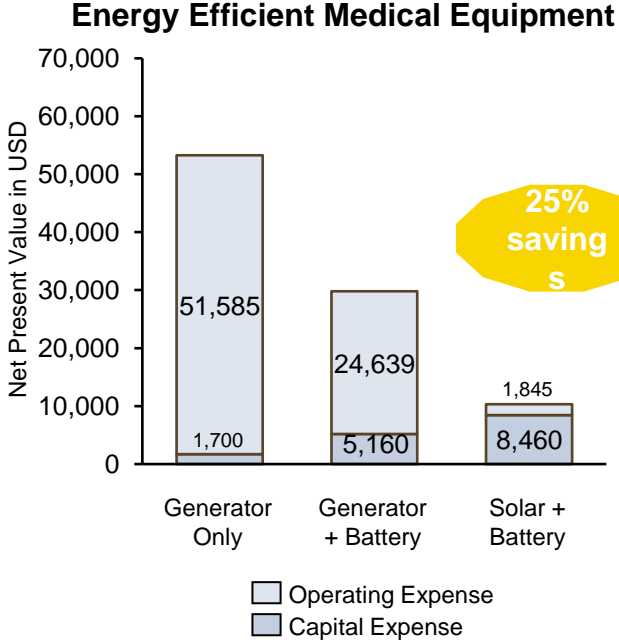
# The power of efficiency (example)

- Simulation of rural Kenyan Facility @ 8.6kWh/day**
- Lighting
  - Refrigeration
  - Radio
  - Computer
  - Lab centrifuge
  - Microscope
  - Blood chemical analyzer
  - Hematology analyzer
  - CD4 machine

**Comparative Costs of Stand-alone Power Equipped with...**



**Comparative Costs of Stand-alone Power Equipped with...**





# Key barriers to rapid deployment of energy solutions to health facilities



## DATA



- Where are the health facilities located?
- Which facilities are priority COVID-19 facilities?



## ENERGY DEMAND



- Which electricity-dependent (medical) appliances are needed and recommended?
- Which appliances are currently available?



## SYSTEM DESIGN



- How much power is needed, at what point of the day?
- Which energy technologies are appropriate?



## FINANCING



- How much CapEx and OpEx is required to address the power gap in the health sector?
- How quickly can funds be disbursed?



## SECTOR CAPACITY



- How do health and energy stakeholders collaborate?
- What is the current capacity of the energy access sector to respond?



## SUSTAINABILITY



- What is the most appropriate delivery/business model to deploy energy solutions rapidly, at scale, and in a sustainable way?

# Powering Healthcare

**Luc SEVERI**

Sr. Energy Access Specialist

[@lucseveri](#)





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**Any questions?**



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# Quick poll questions for the audience



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# neoGuard: health monitor

Assumpta Nantume, Neopenda



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neopenda

Innovating needs-based medical technologies for  
emerging markets



A wireless vital sign monitor for patients in low-resource settings  
Presented by Assumpta Nantume, MSc  
Healthcare Appliances - Efficiency for Access Design Challenge 2020

The product development and research efforts discussed in this presentation are funded by Neopenda, PBC and have been conducted in collaboration with the innovators of the neoGuard™ technology: Sona Shah (CEO, Neopenda) and Teresa Cauvel (CTO, Neopenda).



Traditional medical equipment is  
not designed for

**85%**

of the world's population





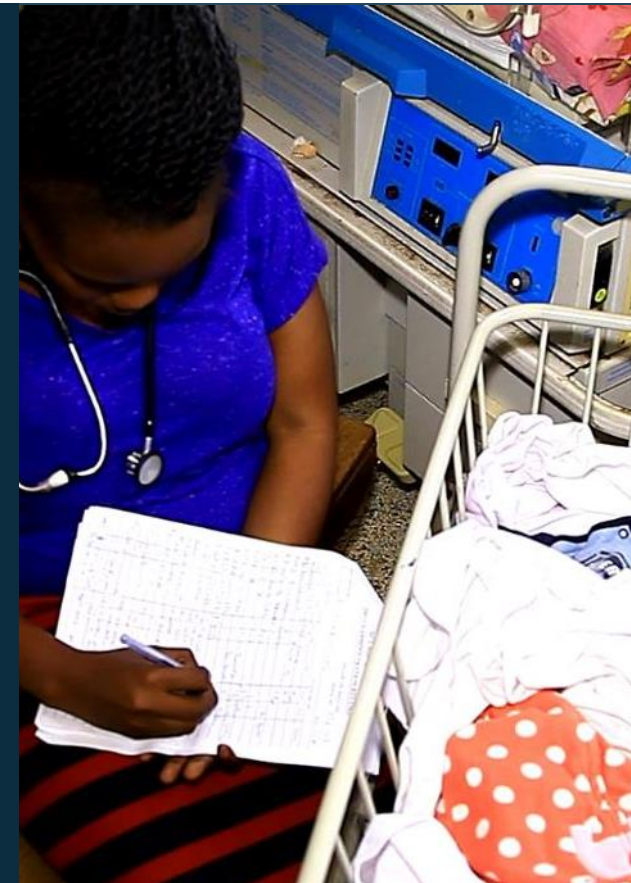
## Equipment in the U.S.

Too expensive & fail to meet environmental constraints (power, WiFi, spare parts etc.)



## Global health interventions

Focus on **responding to** specific disease burdens rather than advancing comprehensive care



## Reality

On the ground, staff have to make do with manual methods

**36,000**

newborn deaths in  
2017

**13.1**

nurses & midwives  
per 10,000  
populations

**4%**

of neonates in NICUs  
have a vital signs  
monitor

**90%**

of neonatal deaths  
in NICUs can be  
averted

“Babies in need of my immediate attention go unnoticed, and they die from preventable causes.”

“Sometimes it is 150 [babies] for you alone... it makes us ineffective. It commonly encroaches on the monitoring, because by the time you start on the first baby, when you reach the last baby you may not find the last baby surviving.”

- Damalie Mwogererwa (Senior Neonatal Nurse)





Patent-pending reusable wearable vital signs monitor measuring:



Pulse rate



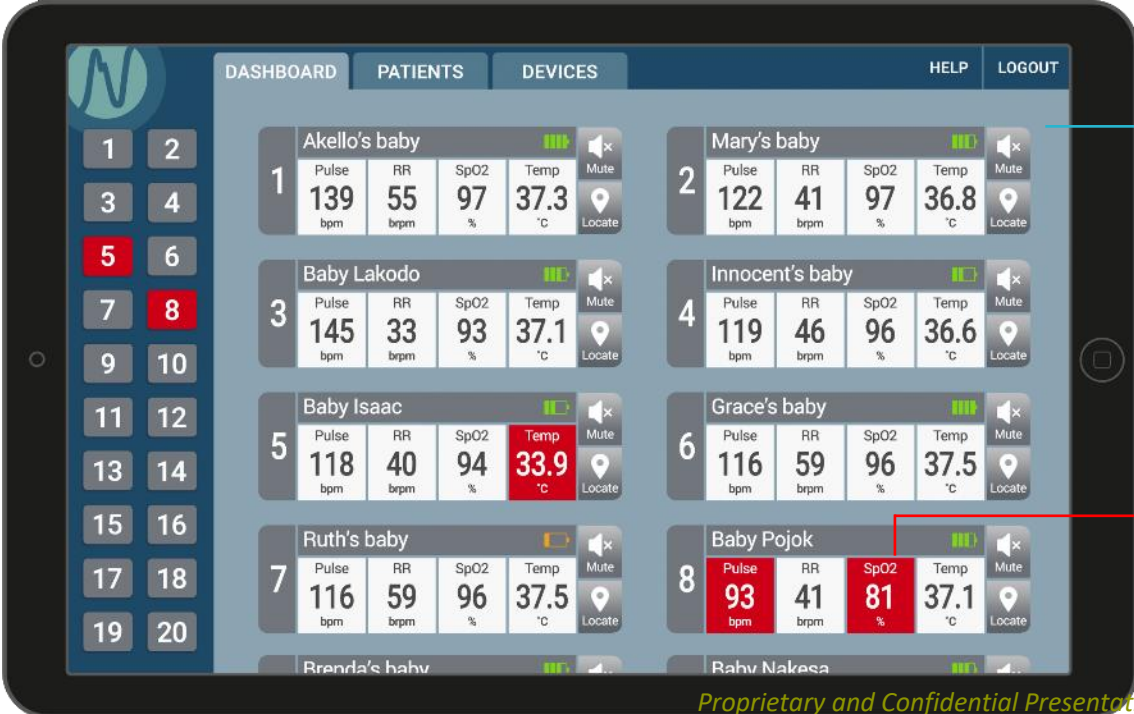
Oxygen saturation



Respiratory rate



Temperature



Wireless central monitoring dashboard



Real-time alerts to newborns in distress



**Vital signs:** Measurements of the body's most basic functions, and markers of disease severity.

## Vital signs measured by neoGuard:



### Heart / pulse rate

*Important for neonates because...* HR can indicate congenital heart diseases and defects, and is a symptom of infections.



### Peripheral oxygen saturation (SpO<sub>2</sub>)

*Important for neonates because...* Hypoxia, or reduced oxygen levels, is associated with mortality and poor neurodevelopmental outcomes.



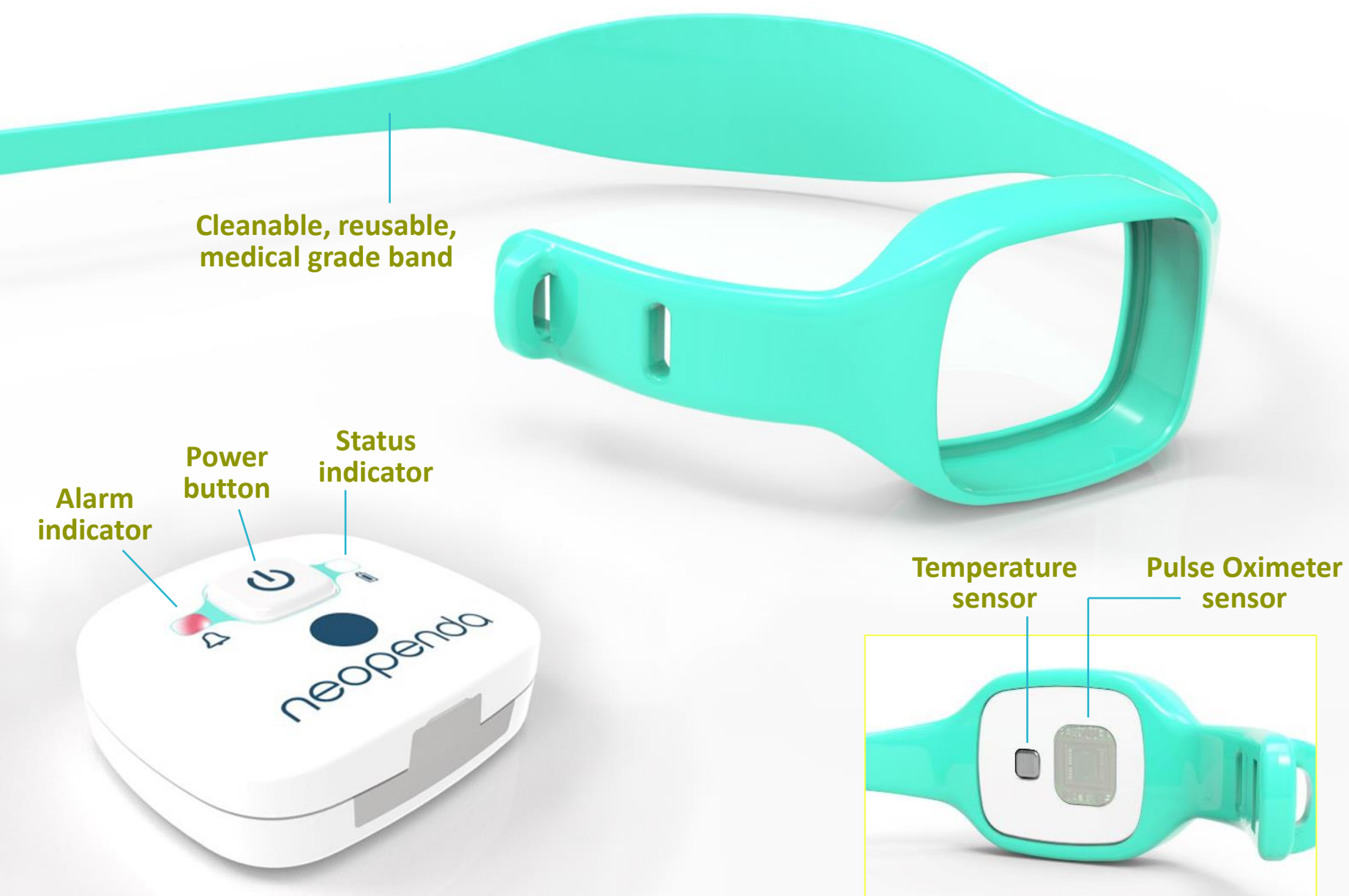
### Respiratory rate

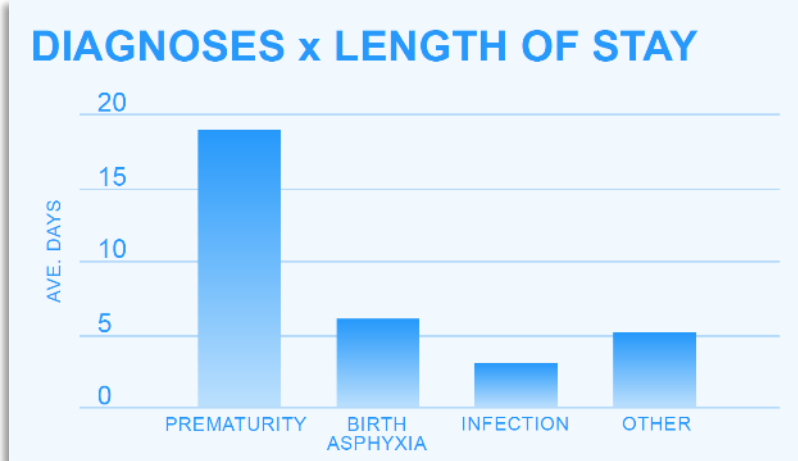
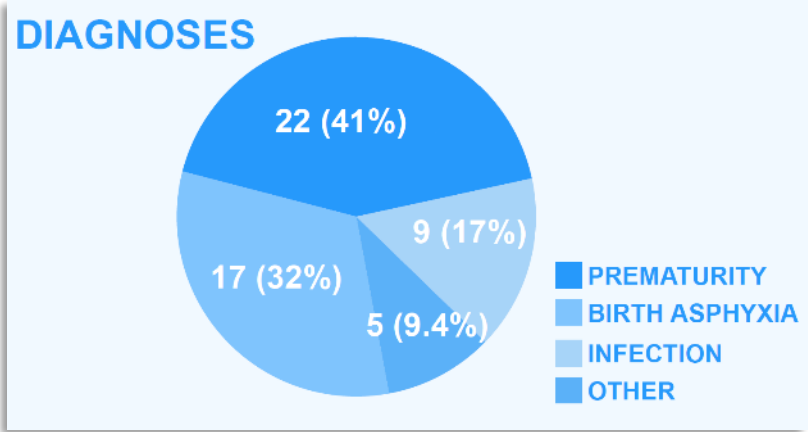
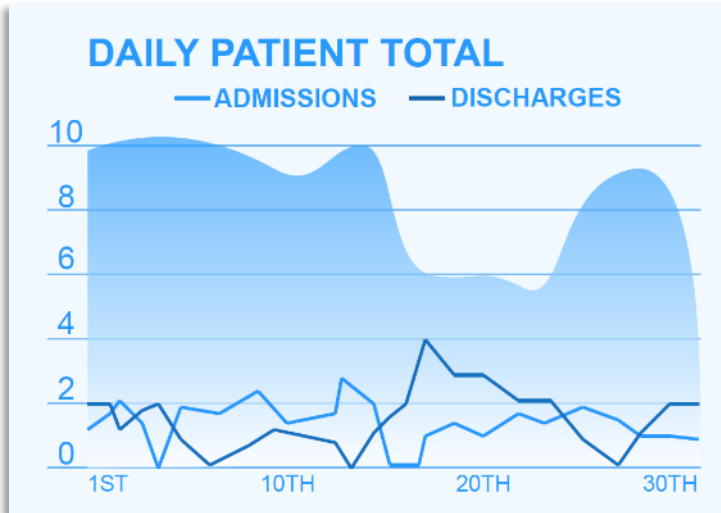
*Important for neonates because...* Neonates are susceptible to apnea.



### Temperature

*Important for neonates because...* Hypothermia is very common in prematures, and rapid intervention is key.





### TREATMENTS NEEDED IN PAST 30 DAYS

Supplemental oxygen	12 patients
Infant warmer	22 patients
CPAP	6 patients
Phototherapy	5 patients



**180**  
Co-founder days  
in Uganda



**>400**  
African healthcare workers  
engaged in the design &  
development process

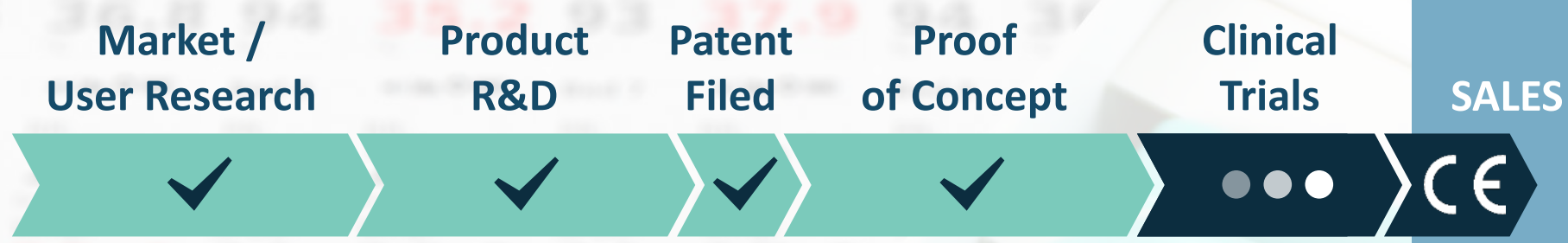


**60**  
Co-founder  
hospital visits









CISCO  
 MASSCHALLENGE  
 GE Healthcare  
 Floating Hospital for Children at Tufts Medical Center  
 Vodafone Americas Foundation  
 IEEE SIGHT Special Interest Group on Humanitarian Technology  
 UN WOMEN  
 americares  
 COLUMBIA UNIVERSITY IN THE CITY OF NEW YORK  
 GSBI Alumni  
 ADAP A DIFFERENT APPROACH TO POVERTY  
 MAKERERE UNIVERSITY  
 CENTER FOR PUBLIC HEALTH & DEVELOPMENT Saving Lives Through Innovations  
 techstars CHICAGO ACCELERATOR  
 AXEL JOHNSON INC.

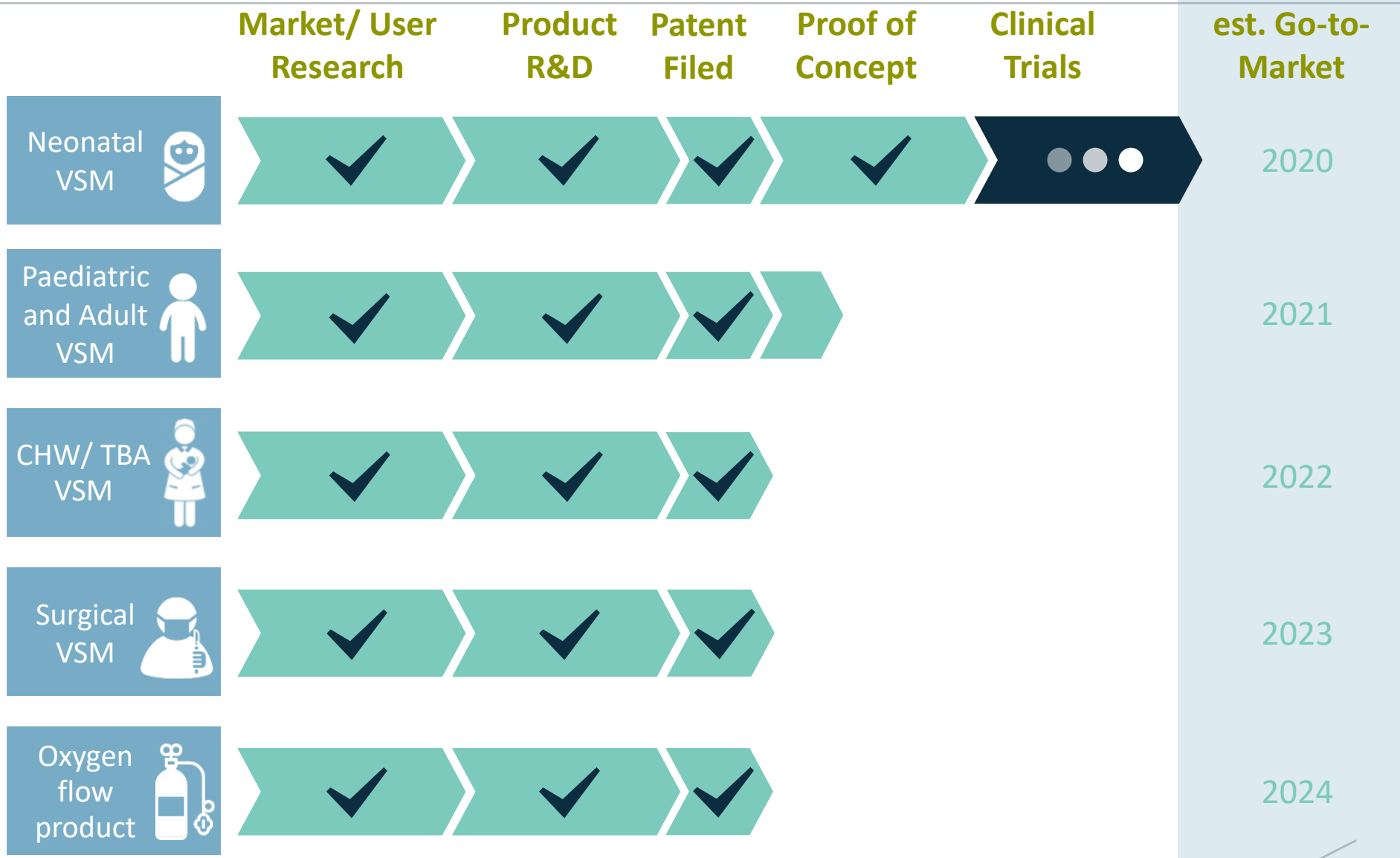
- In light of the COVID-19 pandemic, vital sign monitors are needed more than ever to deliver high quality medical care to vulnerable groups of patients worldwide.
- Vital sign measurement data is critical to:
  - Identifying suspected COVID-19 cases for further testing
  - Monitoring COVID-19+ patients for early signs of clinical deterioration
  - Mapping out potential COVID-19 hotspots
  - Effectively triaging high risk individuals to prioritize their care
  - Assessing effectiveness of treatment and disease severity
  - Managing allocation of scarce resources like ventilators and oxygen

- **Hardware change implemented:**  
Band extender that can fit adult head circumferences up to 62cm.
- **Software changes implemented:**
  - No adjustments to the system algorithms were required.
  - Adult-specific entry forms were adopted.
  - Default alarm limits were changed to clinically acceptable ranges for adult patients.



	Preterm Neonates	Term Neonates	Adults
PR (bpm)	100-200	80-200	60-100
SpO <sub>2</sub> (%)	90-95	95-100	95-100
RR (brpm)	30-60	30-60	10-20
Temp (°C)	35.5-37.5	35.5-37.5	35.5-37.5

- **Timeline:** November - December 2020
- **Study setting:** Jinja Regional Referral Hospital
- **Study population:** Adult patients (n=30) with respiratory illnesses
- **Study Objectives:**
  - (1) Accuracy
  - (2) Feasibility
  - (3) Safety
- **Methods:**
  - Simultaneous data collection with neoGuard device and a conventional patient monitor
  - Measurement comparison techniques to evaluate accuracy: Root Mean Square Deviation (RMSD) and Bland-Altman plots
  - Feasibility surveys and interviews with health staff and maintenance personnel





**Sona Shah**  
*CEO & Co-founder*



**Teresa Cauvel**  
*CTO & Co-founder*



**Dorothy Aanyu**  
*Program Coordinator, Uganda*



**Assumpta Nantume**  
*Research Coordinator, Uganda*



**Crystal Trivedi**  
*Supply Chain & Operations Lead*



**Matthew Tomback**  
*Embedded Engineer*



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## **Short feedback survey**



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