

# Electronically Controlled Gravity Feed Infusion Set

Safety and Efficacy of intravenous treatment regimens for Cryptococcal  
Meningitis

19<sup>th</sup> March 2019

Philippa Ngaju Makobore

Department Head, Instrumentation Division

UGANDA INDUSTRIAL RESEARCH INSTITUTE

# Presentation Outline

- ▶ Clinical challenge
- ▶ Features of the Electronically Controlled Gravity Feed Infusion Set (ECGF)
- ▶ First in Human Study in Adults
- ▶ Potential for scaling

# Clinical Challenge

- ▶ Intravenous fluids are mostly administered manually
- ▶ No feedback on status of therapy
- ▶ Ugandan hospitals - **inadequate health workers** (doctor to patient ratio **1:24,725**, nurse to patient ratio **1:11,000**)
- ▶ **Safety** and **accuracy compromised** especially for vulnerable populations



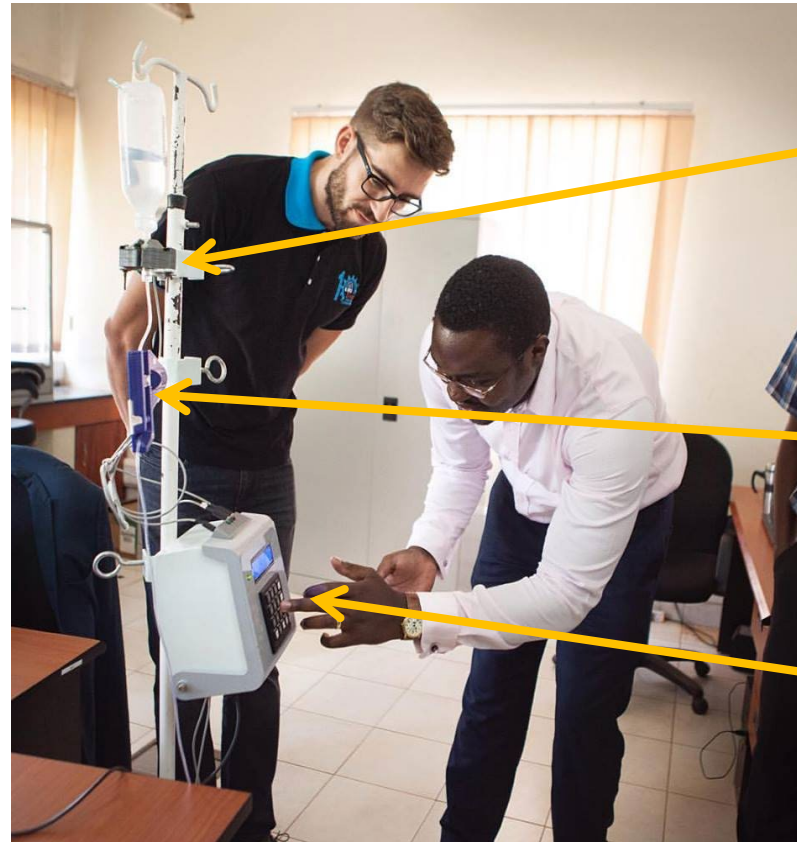
# The Solution

The Electronically Controlled Gravity Feed Infusion Set (ECGF) **significantly improves** the safe delivery of IV fluids and drugs while **saving clinician time associated with manual regulation of** an infusion therapy.



# Features of the ECGF medical device

- ▶ Dynamic flow rate control
- ▶ Slow/Rapid/Free flow alarm
- ▶ Over/under infusion alarm
- ▶ Faulty/unplugged sensor alarm
- ▶ Simplified user interface
- ▶ Battery operated - Hybrid solar and AC mains charging bed
- ▶ Estimated cost approx. US\$100-150 at production



Drop  
Sensor  
Module

Actuator  
Module

User  
Interface

Ssekitoleko S, e. a., 2015. *Design of a Low Cost Electronically Controlled Gravity Feed Infusion Set*. Addis Ababa, IEEE.



# In-house design and development



# First in human study in adults with infectious diseases

- ▶ 12 adult patients that met inclusion criteria enrolled on study
- ▶ Fluids or medication were administered within a  $\pm 7\%$  error margin (diff. btwn. actual and prescribed flow rate)
- ▶ No serious UADE however adverse events related to IV therapy were observed, phlebitis, difficulty accessing veins and expected adverse drug reactions
- ▶ Device sensitivity was acceptable as alarms were activated for rapid rate, over/under infusion and end of therapy
- ▶ Usability in terms of set up and parameter input improved as study progressed





# Training clinicians on the ECGF at Kiruddu





# Adult study findings



# Adult study findings





# Adult study findings



# Global market for infusion pumps

Valued at US\$ 5,874.3 million in 2014, expected to grow to US\$ 7,539.0 million by 2019



**African market is  
1.9%** of total  
available market



**Latin America, Middle  
East and Asia-Pacific is  
33.1%** of total available  
market



**Europe and North  
America is 65%** of  
total available  
market

**Long Term scaling of ECGF - AC to LMICs to HIC**

Global infusion pumps and accessories market assessment and forecast  
2015-2019, Spearhead Equity, Published 15 October 2015





# Take away messages

- ▶ **Improve patient safety and care and alleviate workload** through provision of an accurate and safe gravity-fed infusion controller
  - ▶ Reduce infant mortality and morbidity caused by under or over infusion
- ▶ **Accessibility to low cost, high quality context appropriate medical devices**
  - ▶ Ease of maintenance and calibration
- ▶ **Engagement of policy makers and relevant stakeholders**
  - ▶ Effectively scale

# Thank you for your attention, questions?



Project funded by:

Grand Challenges Canada™  
Grands Défis Canada<sup>MC</sup>

The trade-mark is owned by Grand Challenges Canada and used under license

## Technical and Clinical Advisors

Dr. Sabrina Bakeera- Kitaka- College of Health Sciences, Makerere University

Dr. David Meya, Infectious Diseases Institute, Makerere University

Prof. Noah Kiwanuka, School of Public Health, Makerere University

Prof. Charles Ibingira- Principal, College of Health Sciences, Makerere University

Prof. Peter Rolfe - Oxford BioHorizons Ltd. UK

Prof. Aaron Kyle - Biomedical Engineering, Columbia University, New York, USA

