Utilization of IoT Temperature Sensors in Warehousing & Distribution
Is it hot in here or is it just me?

Extent?
Frequency?
Location?
What do we know about ambient health commodities?

• Temperature/humidity limits
• Absence of monitoring systems
• Massive number of products
• Many storage locations
• Often transported with no climate control
• Focus on central warehousing
• Guidance exists: WHO, USP, and others
Lack of temperature/humidity data limits visibility, increases likelihood of product degradation, and prevents opportunities for corrective action.
Solution

Utilize “internet of things” technology to monitor temperature and humidity

- Sensors
- Network
- Platform
Ambient supply chain research objectives

- Sensor selection and considerations
- Determine commodity environment
- Determine external to internal correlation
- Develop recommendations
Mozambique

- 3 Regional Warehouses
- 3 Provincial Warehouses
- 1 Intermediate Warehouse
- 8 District warehouses
- 3 Hospitals, 2 Pharmacies
- 7 Health Centers
- 11 Community Health Workers
- 8 Trucks
Burkina Faso

1 Central Warehouse

2 Regional Warehouses

6 Health Districts

11 Health Centers

10 Community Health Workers

5 Trucks
Mauritania

3 Central Warehouses

1 Public Health Research Institute

11 Regional Stores

1 Blood Bank

4 Trucks
International Shipments

- Selection of shipments
  - We are currently working with our Delivery and Return team to identify shipments for this quarter

- Collection and placement of beacons
  - Beacons for the RDC collected and sent to South Africa

- Procurement of sensors for international shipments

- Sensors placed on international shipments
  - Sensors sent to 3PL/manufacturers for first shipments
  - Placed on first international shipments around 3/15-3/22

Shipments from Europe and Asia to Southern and Western Africa
Sensor Placement
CAMEC Central Warehouse
CAMEC Central – Radiography Room
CAMEC Central Trucks

Temperature

```
MR_CAMEC_Central_Truck_15811TRIM_ext
MR_CAMEC_Central_Truck_5856AV00_internal
MR_CAMEC_Central_Truck_5856AV00_external
MR_CAMEC_Central_Truck_5302AV00_external
MR_CAMEC_Central_Truck_15811TRIM_internal_back
MR_CAMEC_Central_Truck_5302AV00_internal
```

Chemonics Development works here.
Refrigerator Data (2-8 degrees Celsius)
Set and View Alarms Online, Get Notifications
Data Observations

Data below is from a warehouse over a 12-month period.
Data Observations

Data below is from a warehouse over a 12-month period.
Data Observations

Data below is from multiple locations across the in-country supply chain.
Data Observations

Data below is from several trucks across multiple countries
Data Analysis Vision

**Collect Data**
- Install sensors within in-country supply chains
- Install sensors within small sample of international shipments
- Expand data collection through the last mile

**Analyze Data**
- Descriptive Analysis ("Real-time" monitoring; Summary Stats)
- Diagnostic Analysis (Root cause analyses)
- Predictive Analysis (Regression; Climate data)
- Prescriptive Analysis (Optimization of routes or shipments?)

**Interventions**
- A/B testing of low-cost solutions
Questions?

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