SICKLE CELL DISEASE

Affordable Design and Entrepreneurship | Global Health Fall 2015

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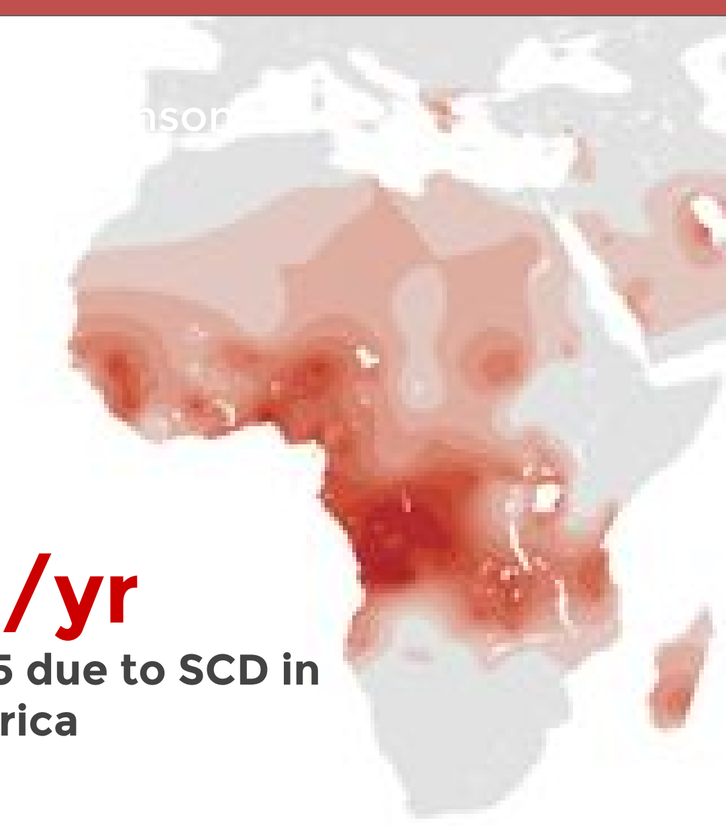
Sickle cell disease (SCD) is an inherited condition that causes production of abnormal hemoglobin. This leads to **painful, and often fatal, complications,** including swelling, anemia, and a weakened immune system.

SCD is **most common** among populations **in Sub-Saharan Africa.**

Normal red blood cell

Sickled cell

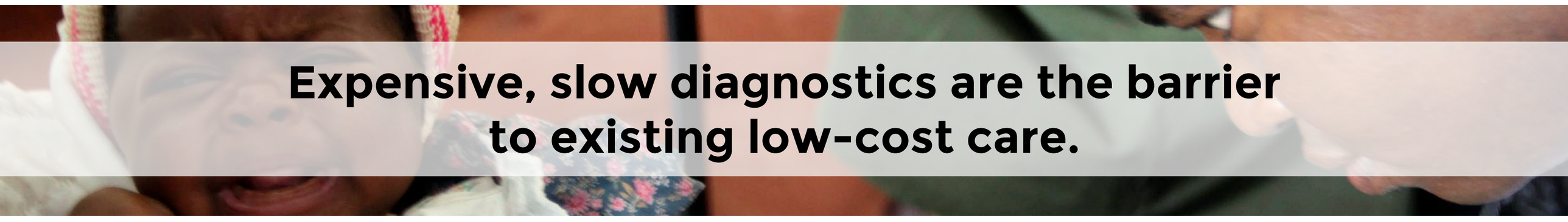


185,600/yr

die before age 5 due to SCD in sub-Saharan Africa

8.3 million

possible lives saved with universal screening in sub-Saharan Africa by 2050



Expensive, slow diagnostics are the barrier to existing low-cost care.

Current Diagnostics: 2.5 - 15 USD/test
Equipment cost: 250 - 1050 USD
Turnaround: 30 min - 1 month

Low-cost Care:
free workshops on preventing sickle crisis
routine screenings & vaccinations

Patients

Families affected by SCD are not aware of the disease and how to manage the condition on a day-to-day basis.

Clinics

Without a diagnosis, providing patients appropriate treatment takes longer.

Ministries of Health

Data regarding sickle cell disease prevalence has not been officially updated in 20 years.

Stakeholder Considerations

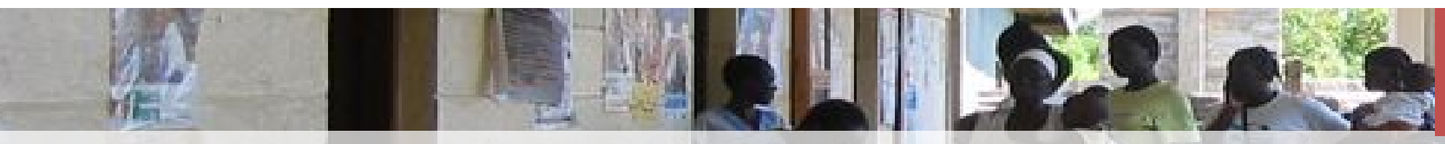
time = lost income (travel time, etc.)

limited time and training

large scale demands cost-effectiveness

varied insurance coverage

limited equipment, materials; grid failure



Our Mission

Together with our partner Daktari Diagnostics, we aim to **make low-cost, point-of-care sickle cell diagnostics available to everyone.**

DAKTARI SICKLE CELL TEST

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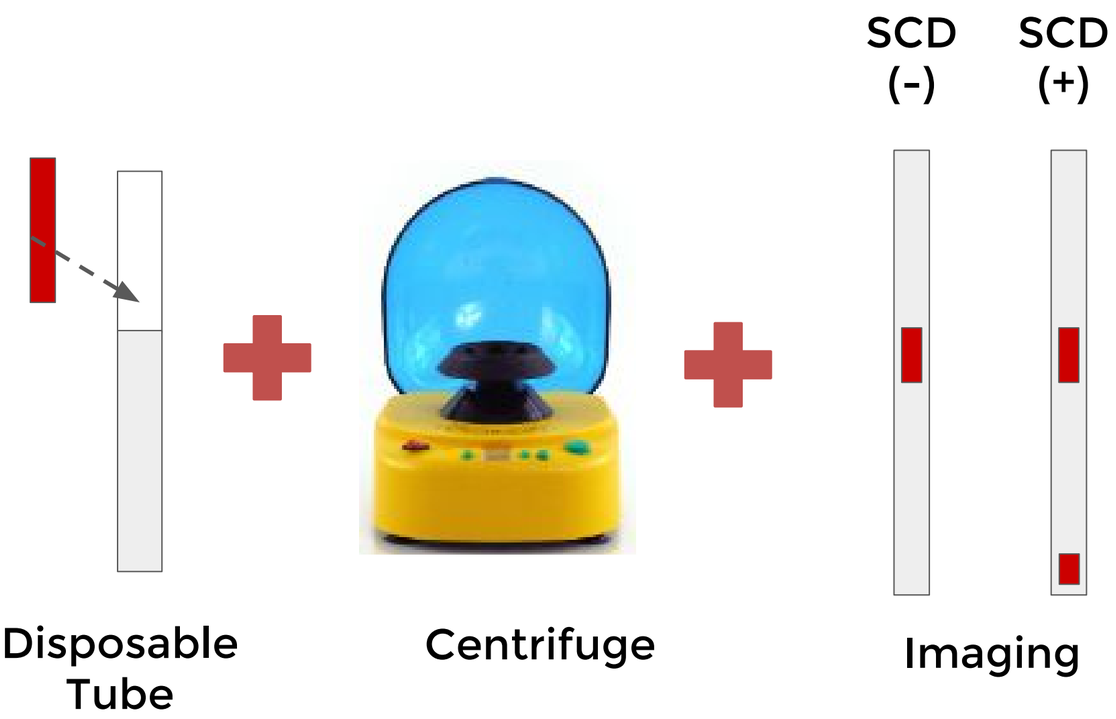
ADE Advisor: Anna Konstantinova
Daktari Liaison: Aaron Oppenheimer

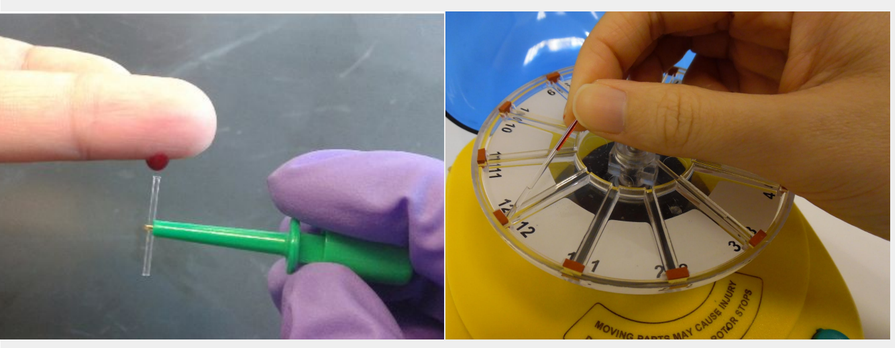
Product Introduction



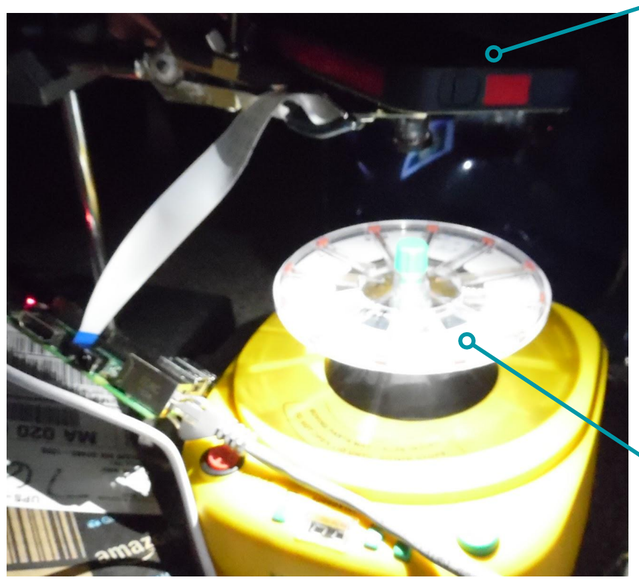
Two-phase solutions separate regular red blood cells from denser sickled cells in a blood sample when spun in a centrifuge. Our team is automating the imaging system for easier, more consistent diagnoses.

Deployment is planned for late 2017.
Time: 10 minutes
Sensitivity: >95%, **Specificity:** >97% (n=1500)
Cost: <$1.50 per test
Rechargeable battery

Prick Finger > **Load Centrifuge** > **Spin Samples** > **Take Picture** > **Image Analysis** > **Display Diagnosis**



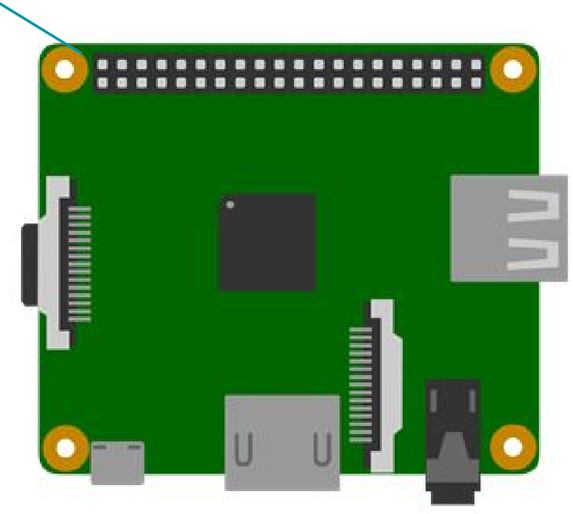
Imaging Prototype



CAMERA + LENS
Pi camera with wide angle lens on lid center

CENTRIFUGE + ROTOR
Custom rotor with LED display

SOFTWARE
Python redness thresholding

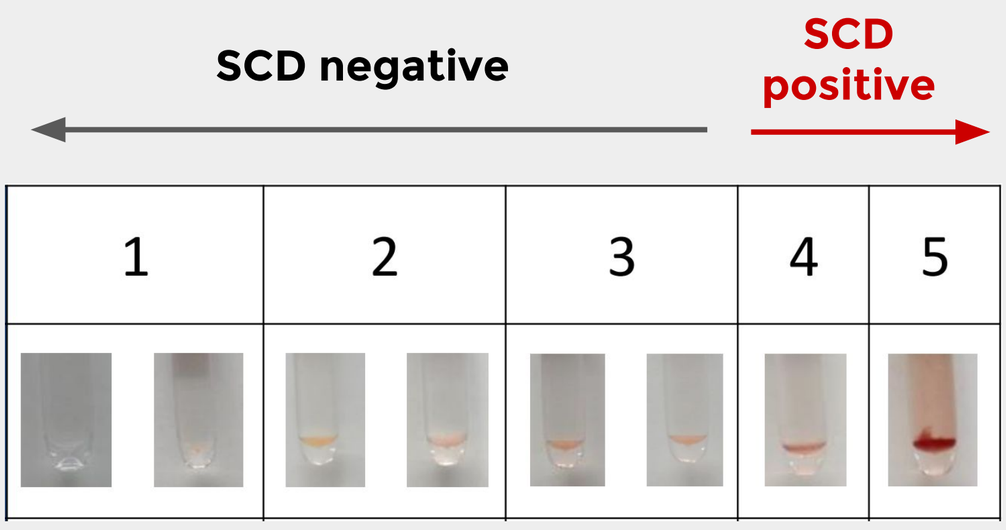


RASPBERRY PI BOARD

Future Work

PROTOTYPE
Differentiate samples based on the reading scale (right), in order to give a more accurate diagnosis.

USER EXPERIENCE
Design and test user experience in the field.



SOCIAL RETURN ON INVESTMENT
Refined numerical evaluation of sickle cell diagnostics' impacts.