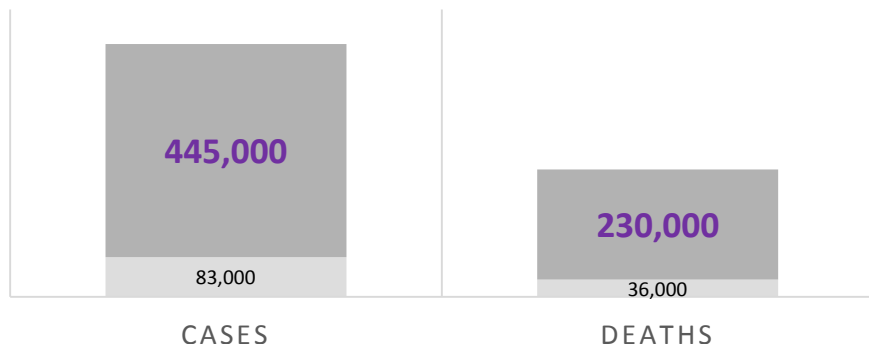# SelfCerve

Empowering and enabling the women of the world to identify risks early and alleviate the fear of cervical cancer in the privacy and comfort of their own homes
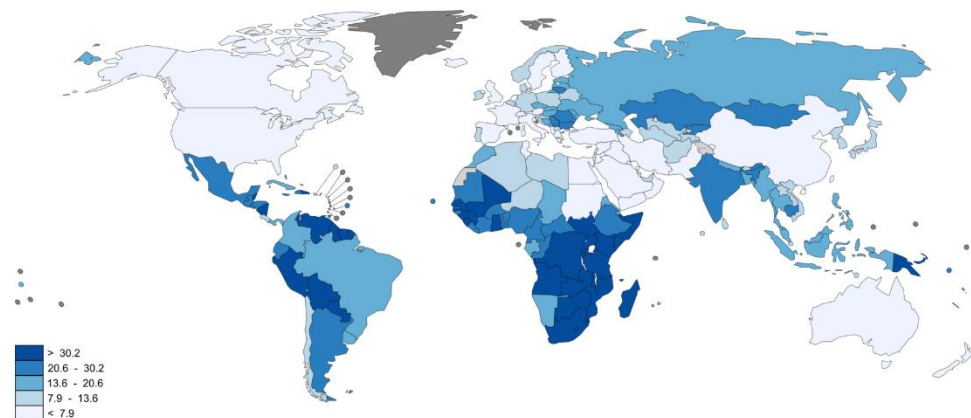
Global Snapshot: Cervical Cancer & Screening

ESTIMATED INCIDENCE, MORTALITY

■ More developed regions **■ Less developed regions**

445,000

83,000

CASES

230,000

36,000

DEATHS

ESTIMATED CERVICAL CANCER INCIDENCE

> 30.2
20.6 - 30.2
13.6 - 20.6
7.9 - 13.6
< 7.9

Estimated Incidence, Mortality and Prevalence Worldwide in 2012, World Health Organization

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If diagnosed and treated early, cervical cancer is highly curable

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High Income Countries:

Pap Smears

Pathologist   Microscopy

- *Costly equipment necessary*
- *Highly skilled training (>4 years)*
- *Not point of care*
- *No self-screening*

Low Income Countries:

Visual Inspection with Acetic acid (VIA)

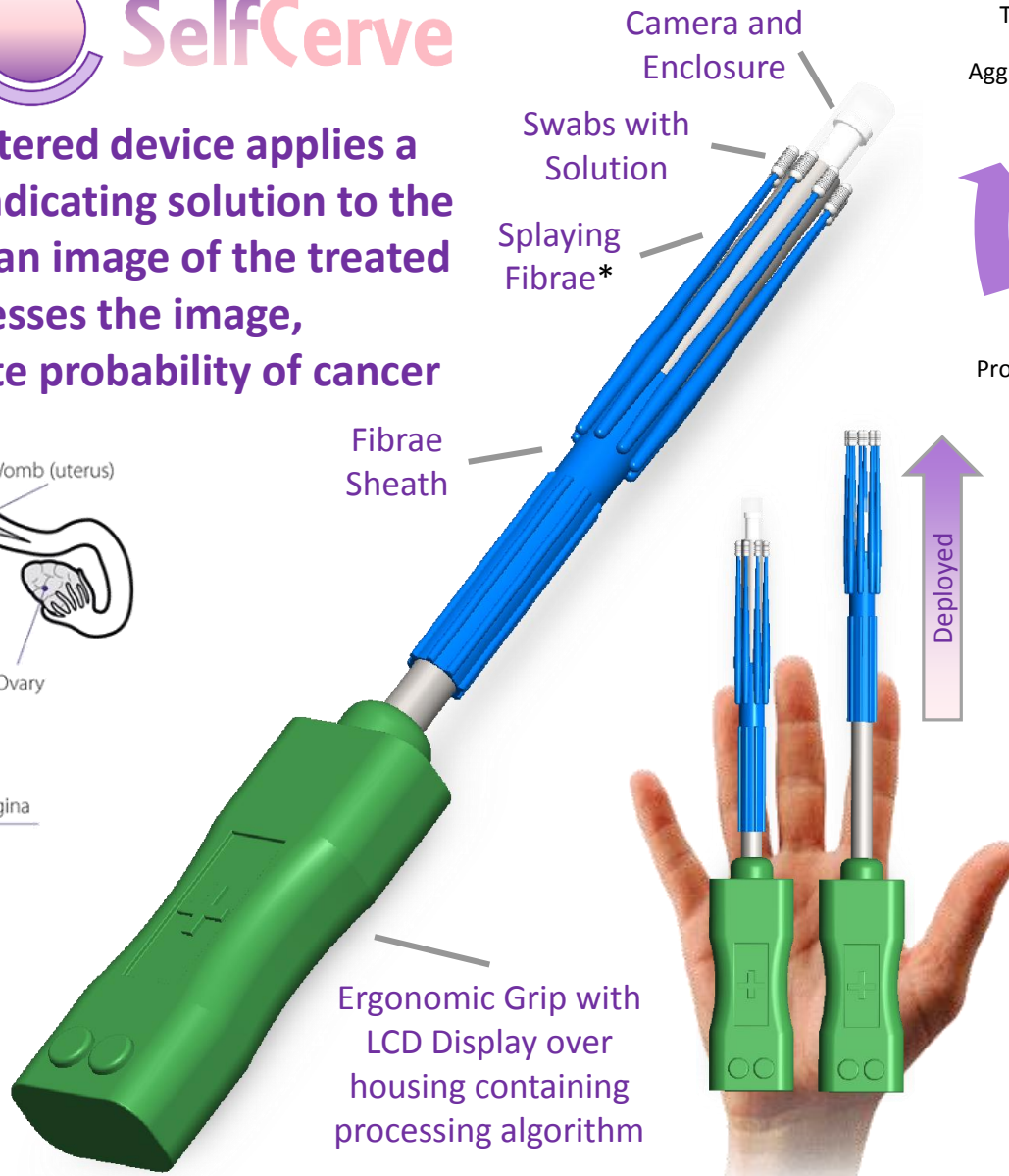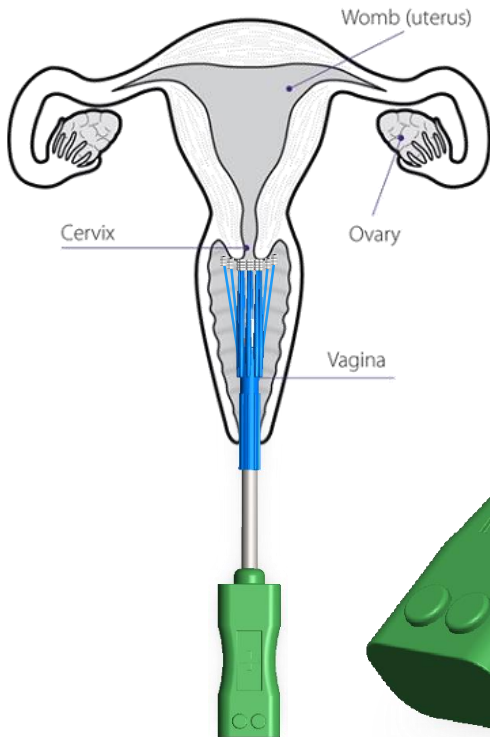Community Health Workers   Gross Inspection

- *Training of CHWs takes >6 months*
- *Poor Sensitivity, Specificity by less trained examiners*
- *Point of care*
- *No self-screening*
- *VIA Programs difficult to implement (<10 programs globally)*

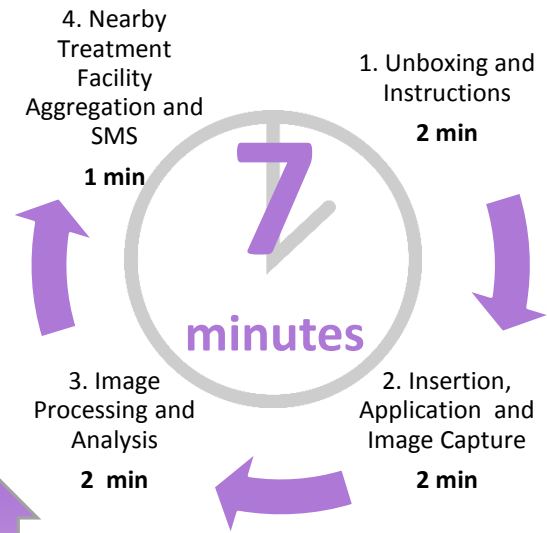**>80%** of cervical cancer cases and deaths occur in less developed countries

There are approximately **1 billion women** (between ages 21 and 65) in **Low- & Middle-Income Countries** that do not have access to cervical cancer screening

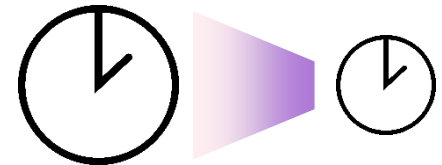SelfCerve

Product: SelfCerve

The self-administered device applies a proven cancer-indicating solution to the cervix, captures an image of the treated tissue, and processes the image, yielding a discrete probability of cancer
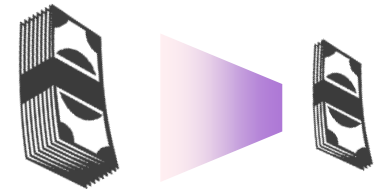
Womb (uterus)

Cervix

Ovary

Vagina

Camera and Enclosure

Swabs with Solution

Splaying Fibrae*

Fibrae Sheath

Ergonomic Grip with LCD Display over housing containing processing algorithm

Deployed

Provisional Patent Filed: US 62253648

4. Nearby Treatment Facility Aggregation and SMS
1 min

1. Unboxing and Instructions
2 min

7 minutes

3. Image Processing and Analysis
2 min

2. Insertion, Application and Image Capture
2 min

Fraction of Time

Minimal Cost

Improved Privacy
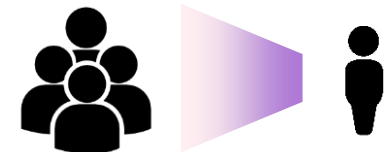
SelfCerve

System

Widespread distribution to high-risk regions through trusted entities

MINISTRY *of* HEALTH
REPUBLIC OF BOTSWANA

Ministry of Health and Family Welfare
Government of the People's Republic of Bangladesh

Government of India
Ministry of Health & Family Welfare
Department of Health & Family Welfare

Trusted entities distribute through existing medical aid distribution channels
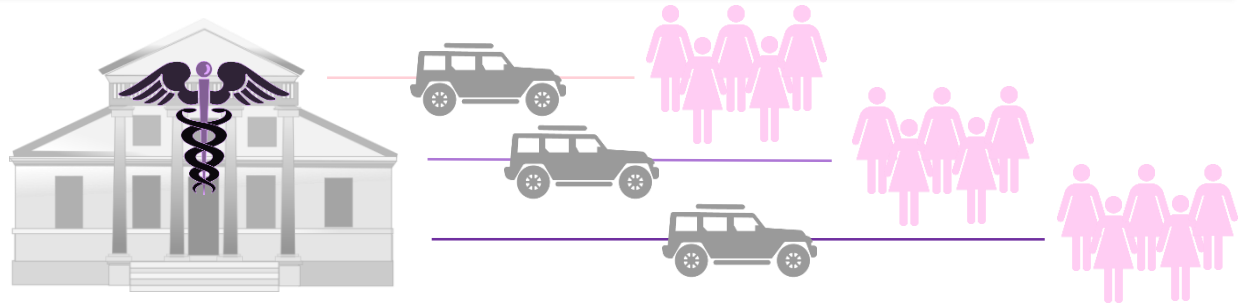
Private, at-home cervical cancer screening with clear and discrete delivery of results
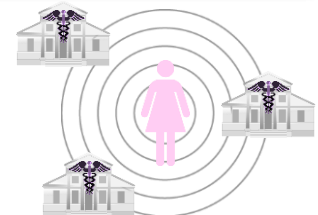
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Simple Universal Notification on LCD

$+$ $-$ O
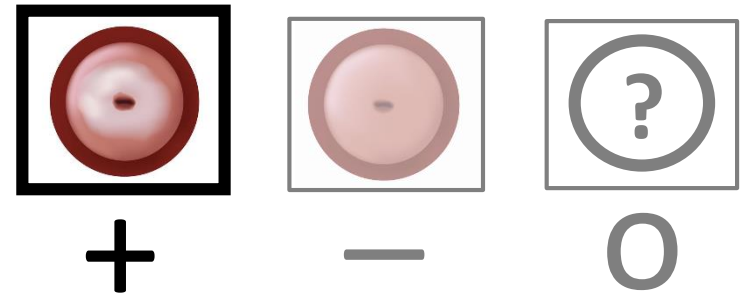
Quick linkage to follow-up and treatment

SelfCerve

Users can opt-in to receive
- Detailed screening results
- List of local physicians and treatment facilities

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Timeline

Month 1

ALGORITHM TESTING
Using images obtained through the Penn-Botswana cervical cancer screening program, our algorithm will: **(1)** Segment the cervix into sliced wedges to define regions of interest; **(2)** Classify the tiles within ascribed regions by mapping with pre-classified diagnosed images; **(3)** Evaluate cervical intraepithelial neoplasia

Month 2

PROTOTYPE REFINEMENT
Using human-centered design approaches, our team will create an ergonomically optimal device that easily inserts into the vaginal canal. We will work with pelvic models and test multiple prototypes of our device with variations in stick shape, opening shape, and camera positioning, to optimize the design

Month 3

DEVELOP AN INTEGRATED MODEL PROTOTYPE
Upon optimizing the design of our device, we will combine the mechanical and computational aspects of the device. With our partner gynecologists, we will then further refine the product for ease of insertion and image capture quality

Month 4

PILOT TESTING
We shall test the integrated prototype, in collaboration with Penn and MGH physicians, on 50 women while they are at their gynecologic exam, allowing us to compare our product's sensitivity and specificity to the gold standard PAP smear

Month 5

REVISITING PRODUCT EFFICACY AND MARKET PLAN
Iterate design based on physician and patient feedback. We will also plan a pilot experiment with the Ministry of Health in Botswana to launch 500 devices, and compare it's efficiency and efficacy against conventional methods

Months 6+

SET UP AN ECOSYSTEM IN LOW & MIDDLE INCOME COUNTRIES
Leverage partnership with the Ministries of Health and NGOs in Botswana, Bangladesh and India to discuss future strategies for production and distribution, and for widespread education on the value of early detection

Near Term Projected Costs: Labor – $15k   Equipment & Supplies – $10k   Travel/Consultation – $15k

SelfCerve

Team

DIVYANSH AGARWAL (Design & Data)
Perelman School of Medicine, PhD Candidate, 2021
Perelman School of Medicine, MD Candidate, 2022

Yale; BS & MS, Molecular, Cellular and Development Biology
Expertise: Statistics, Design
**Role:** Leadership, product viability, and supply chain. Past experience in statistical consulting and fundraising.

SONYA DAVEY (User Needs & Clinical Trials)
Perelman School of Medicine, MD Candidate, 2019

UPenn; BA Health & Societies, Biology, South Asian Studies
Expertise: Global Health, Education
Role: User needs, UX, and ergonomic design. Past experience implementing new technology *(Ultrasafe Ultrasound)* in low-resource settings.
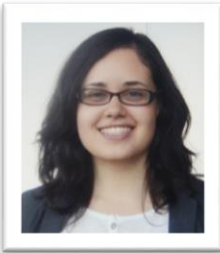
LINDSEY FERNANDEZ (Systems)
School of Eng & Applied Sci, PhD Candidate, 2021

Johns Hopkins; BS Biomedical and Computer Engineering
Expertise: Programming, Medical Imaging, Bioengineering
Role: System architecture and algorithm development. Has past experience in image analysis and algorithm development.
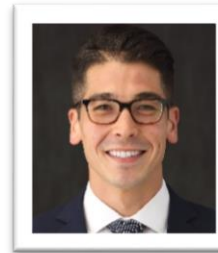
ALEX KUBO (Business & Mechanics)
The Wharton School; MBA Candidate, 2017

Lehigh University; BS Mechanical Engineering
Expertise: Mechanical Engineering, Business
Role: Leveraging technology and information to create a sustainable business model. Experience with device prototypes.

Advisors

Dr. Harvey M. Friedman
Professor of Medicine

Expertise: Director of the Botswana-UPenn Partnership. Has contacts with the Ministry of Health at various countries, including Botswana.

Dr. Jennifer K. Blakemore
Ob-Gyn Resident, NYU Langone Medical Center

Expertise: Obstetrics and Gynecology. MD, Perelman School of Medicine. Volunteer Ob-Gyn Physician in Maternity Hospital in Arusha, Tanzania.

Additional University of Pennsylvania Resources

Dr. Carrie Kovarik
Prof of Dermatology

Dr. Ronald Collman
Prof of Medicine

Dr. Thomas Randall
Fmr Director of Gynecologic Oncology

Dr. Mark Yim
Prof of IPD, Mech. Eng., and App. Mech.

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