KidPrint

IDENTITY FOR EVERYONE

Eliah Aronoff—Spencer MD PhD
earonoffspencer@ucsd.edu

Asst. Professor of Medicine
UC San Diego, La Jolla, CA, USA

Our Story

One day BMGF called with an unexpected question...Can we fingerprint babies?

Problem

We started with a mission to identify newborns & infants for vaccine delivery

Solutions

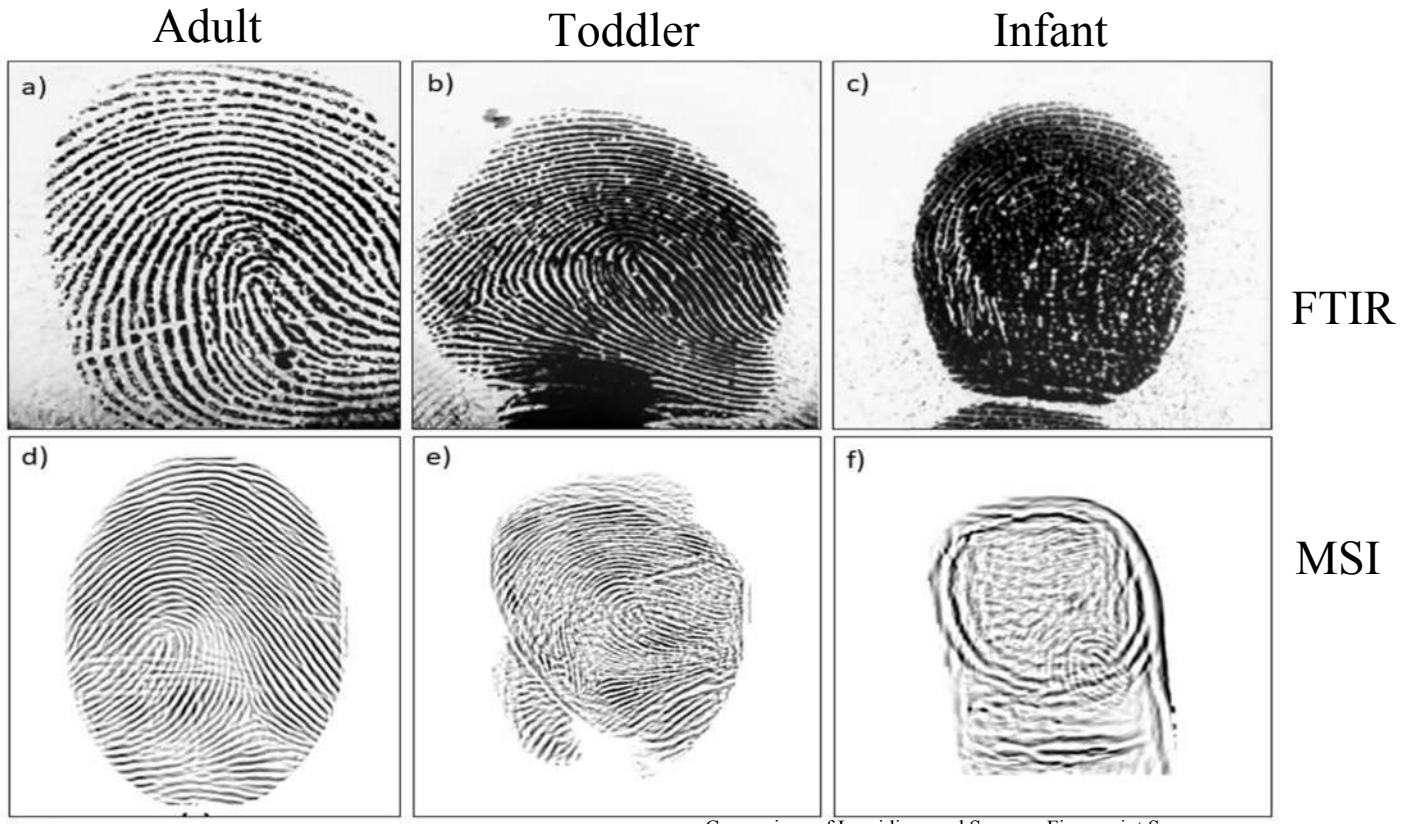
We used human centered design and developed people centered technology

Opportunities

Biometric birth certificate, proof of relationship, linkage to records

Current Approaches

could the technology be the problem?



Comparison of Lumidigm and Secugen Fingerprint Sensors

PART 1

What do you do when the technology is the problem?

RETHINK

Our Team - The other humans at the center

HEALTH ENGINEERING
Eliah Aronoff-Spencer
MD PhD

PROJECT MANAGEMENT
Alexandra Hubenko
MBA

OPTICAL DEVELOPMENT
Steve Saggese
PhD

ETHNOGRAPHY
Deborah Forster
PhD

STRATEGY & OPERATIONS
Michael Kleeman
MA

PEDIATRICS
Enrique Chacon-Cruz,
MD

PUBLIC HEALTH
Courtney Avery
MPH

ELECTRICAL ENGINEERING
Ting Zhao
MS

MECHANICAL ENGINEERING
Tom Kalisky
MS

MECHANICAL ENGINEERING
Michael T. Tolley
PhD

ELECTRICAL ENGINEERING
Drew Hall
PhD

INTERSECTION DESIGN
Jeremy Batter
MS

ANTHROPOLOGY
Maya Azarova
MA

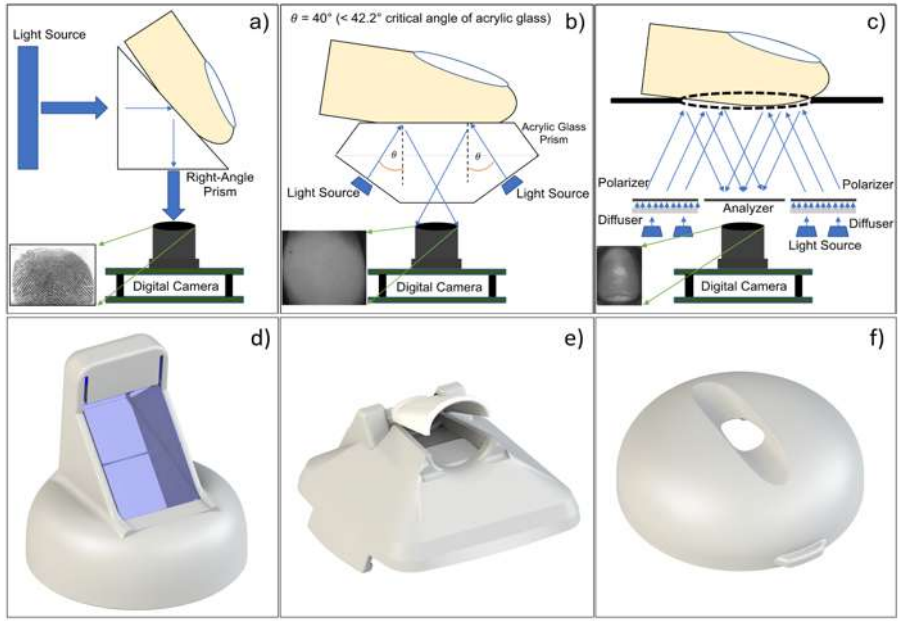
PROTOTYPING
Alex Grant
BS

OPTICS
Joe Ford
PhD

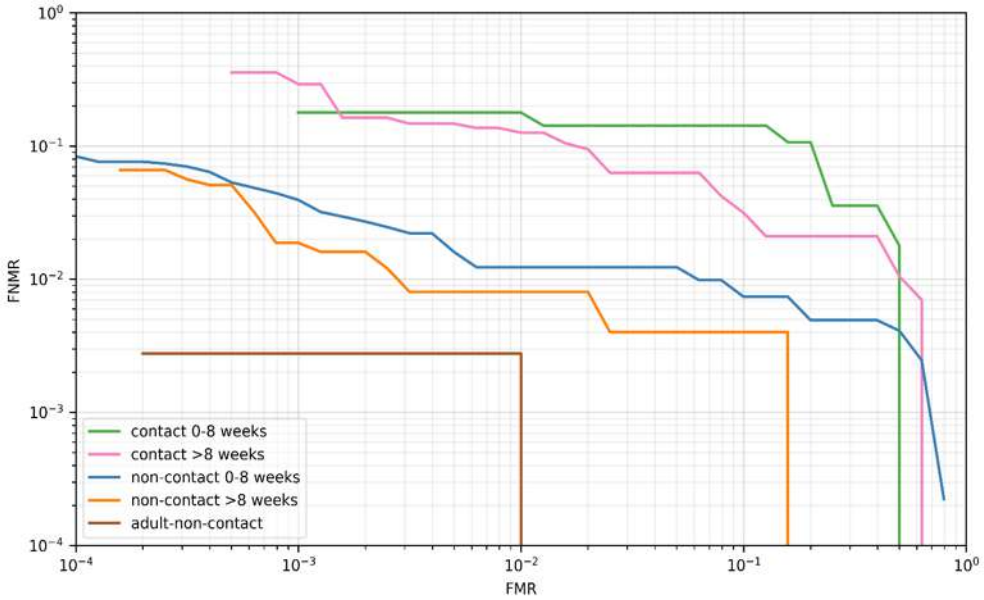
MACHINE LEARNING
Serge Belongie
PhD

HUMAN CENTERED DESIGN
Don Norman
PhD

High Resolution Contact vs. Non-Contact



		True Accept Rate @	
	Age at Enrollment	FAR =0.2%	FAR =0.1%
Contact	0-8 Weeks	0.821	0.821
	>8 weeks	0.837	0.708
Non-Contact	0-8 Weeks	0.973	0.961
	>8 weeks	0.984	0.981
	Adult	0.997	0.997



Kidprint U.S. Testing, Kalisky et, Submitted, Scientific Reports, June 2019

PART 2

Baby Centered Biometrics

Infant-centric biometrics

HIGH RESOLUTION SENSOR

Infant fingerprints are fully formed at birth, but they are 4x-5x smaller than adult's. Solution - a high-resolution imager to resolve the smaller details of infant prints and then scaled so that industry standard fingerprint analysis tools can be used.

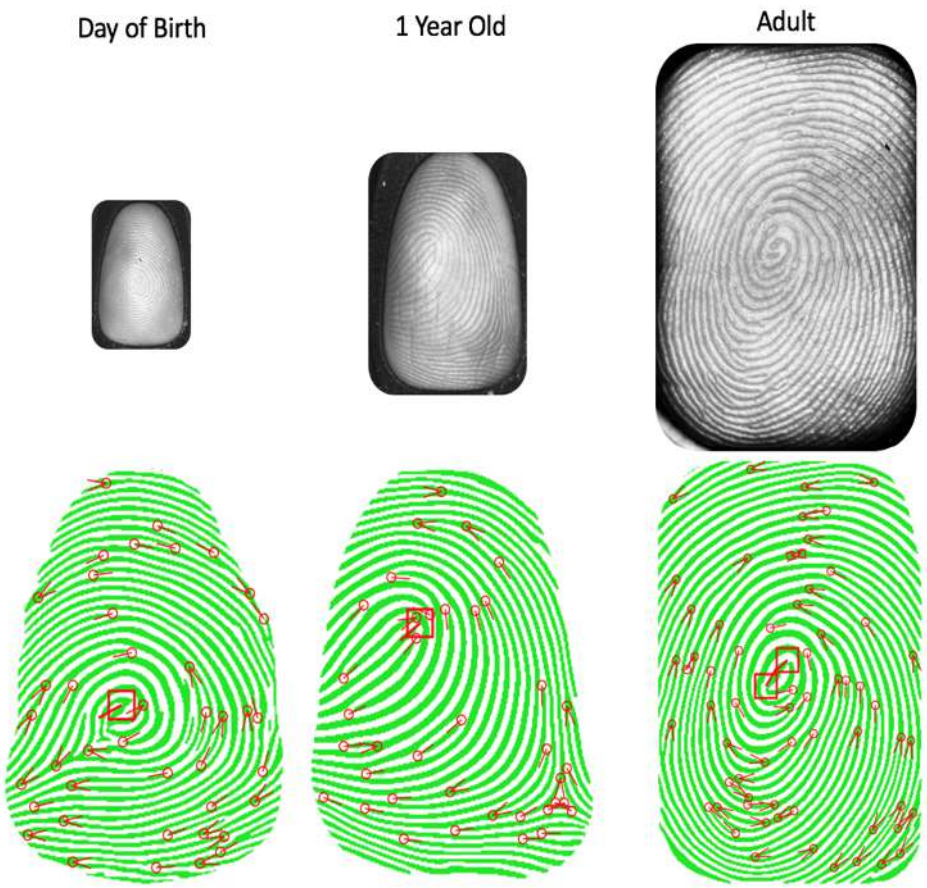
NON-CONTACT IMAGING

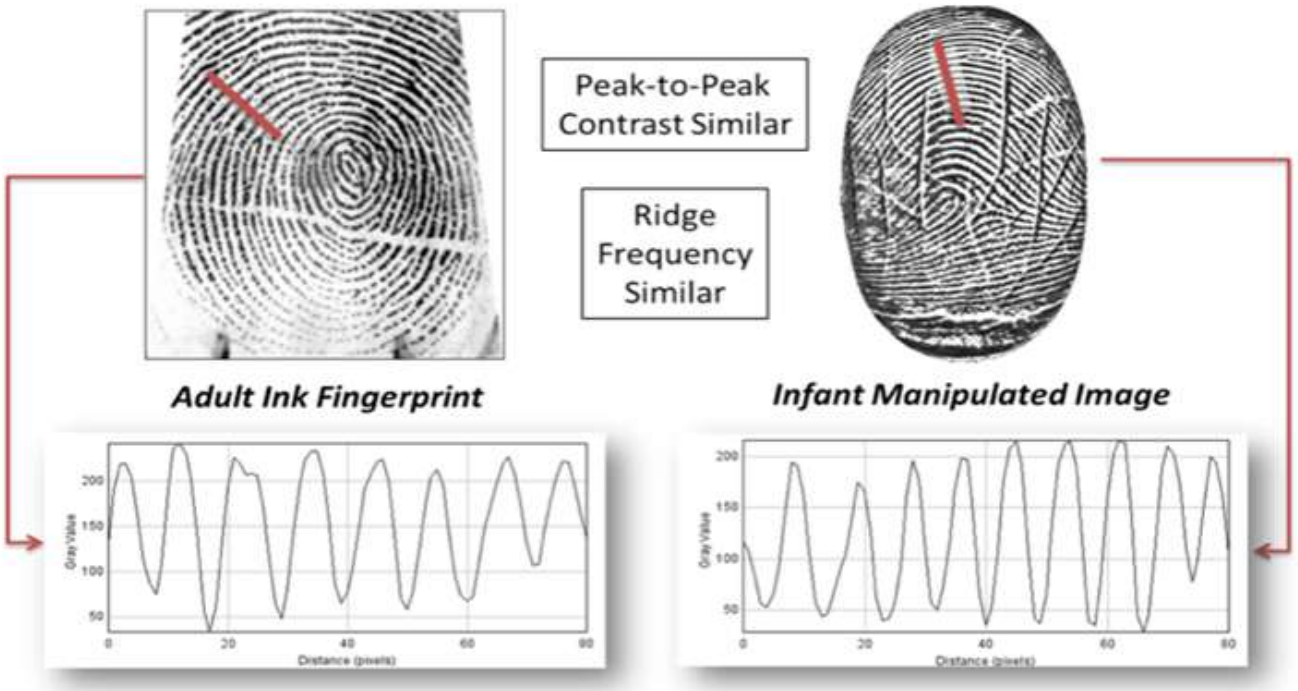
Infant skin is mushy, and kids exhibit a wide variability of skin conditions from peeling to very dry or wet. These issues render the standard contact-based imaging devices inoperable; our non-contact device reduces or eliminates these effects.

DEDICATED DEVICE

A dedicated biometric device controls the lighting, finger placement, and user interaction. Kids fingers grow, thus a dedicated device can accommodate this and adding health biometrics enables both low-cost liveness detection and vital measurements.

Non Contact Fingerprinting : A universal biometric





Kidprint U.S. Testing, Kalisky et, Submitted, Scientific Reports, June 2019

PART 3

PANDA GOES TO MEXICO

~~the~~ el PANDA

Clinical trial: 1/18-12/19
Phase I Results
TJ General, Baja CA

Kid Cohort

	PHASE I	PHASE II	TOTAL
# of subjects	295	205	500
% Females / % Males	45% / 55%	50% / 50%	47% / 53%
# of Total Visits	438	576	1014
Age at Enrollment			
0-3 days	171	154	325
4-30 days	43	24	67
> 30 days	81	27	108
# Number of Visits (Phase is based on enrollment date)			
1 visit	166	94	260
2 visits (Enrollment + 1 revisit)	48	59	107
3 visits (Enrollment + 2 revisit)	14	36	50
4 visits (Enrollment + 3 revisit)	7	36	43
5 visits (Enrollment + 4 revisit)	8	14	22
6 visits (Enrollment + 5 revisit)	11	5	16
7 visits (Enrollment + 6 revisit)	2	0	2
Total Revisits	143	373	516
Average days from last visit [min 0, max 181]	25.4	40.8	33.1
# of Paired Visits	419	598	1017

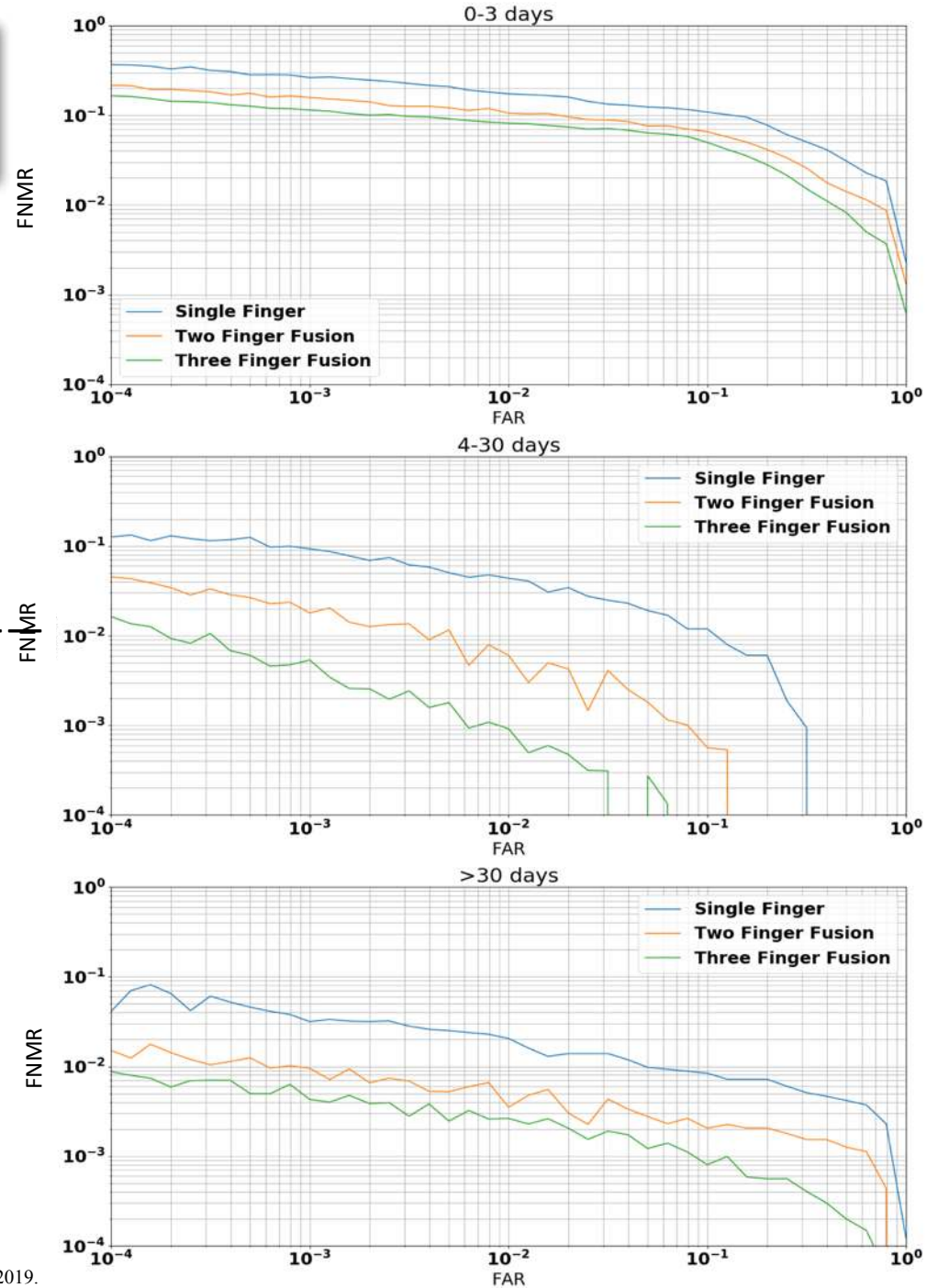
Kidprint Mexico. Clinical Trial, Unpublished data, Aronoff-Spencer et al, 2019.

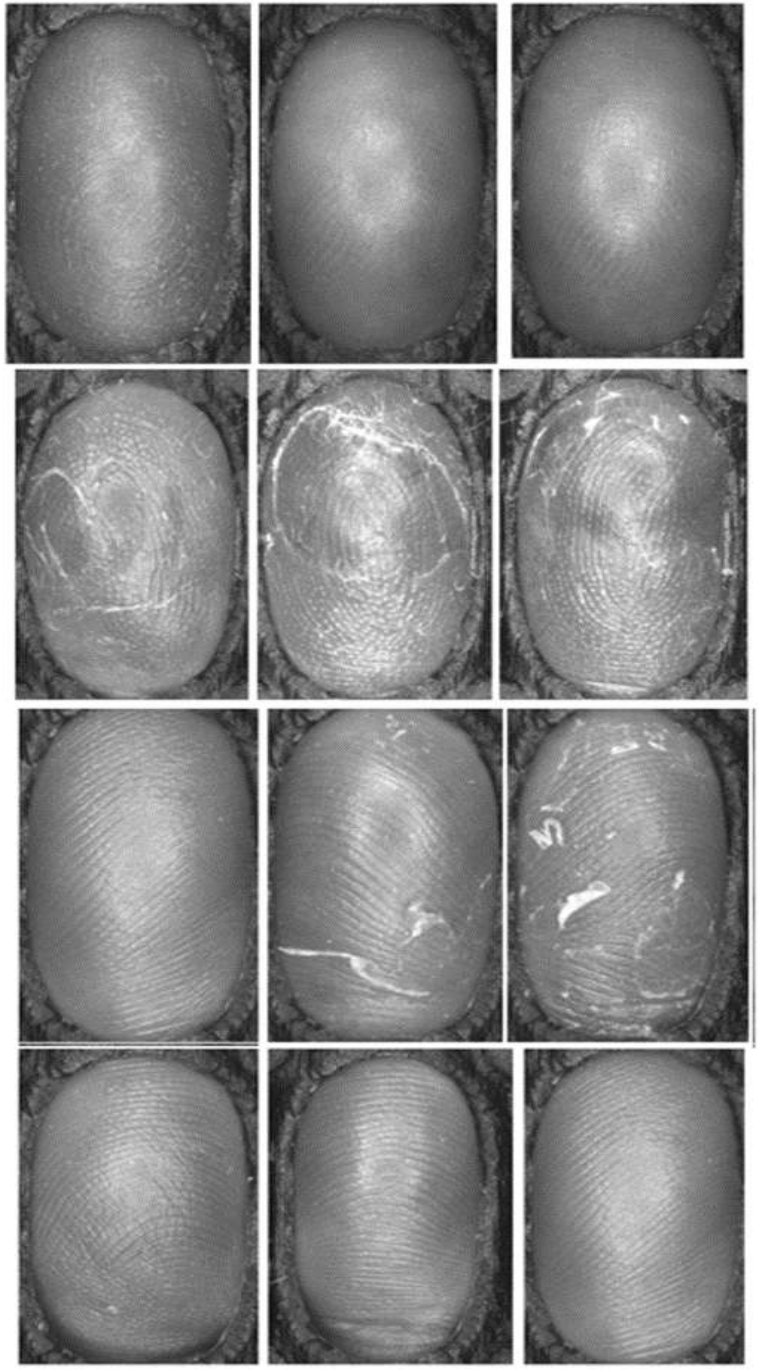
Phase I
Authentication vs Age

1 Finger - Age >3 days
TAR 96% at FAR =0.1%
1 Finger - Birth – 3 days
TAR 82% at FAR = 0.1%

———————————————————

3 Finger - Age >3 days
TAR >99% at FAR =0.1%
3 Finger - Birth – 3 days
TAR 93% at FAR = 0.1%



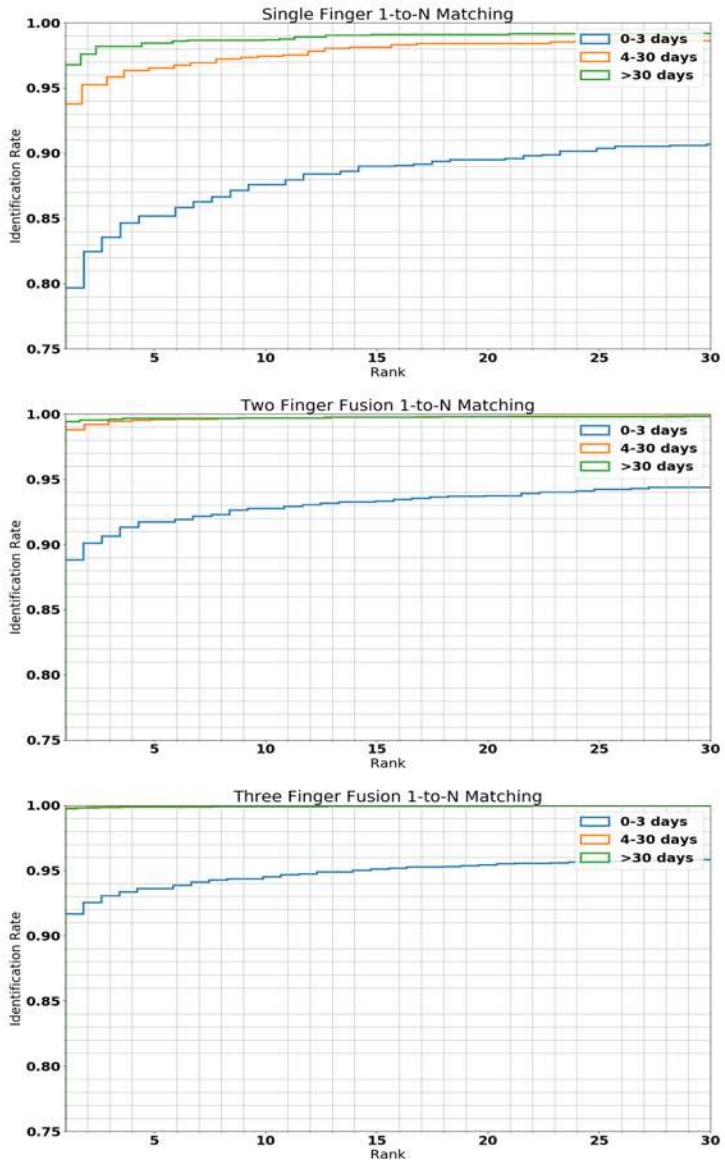


Kidprint Mexico. Clinical Trial, Unpublished data, Aronoff-Spencer et al, 2019.

Saggese et al, Gates Open Research, May 2019

Identification vs Age

	Identification Rate		
	Age Group: 0-3 days	**Age Group: 4-30 days**	**Age Group: >30 days**
One Finger:			
% N Rank 1	**0.7966**	**0.9376**	**0.9678**
% N Top 5	0.8517	0.9653	0.9844
% N Top 10	0.8759	0.9743	0.9869
% N Top 20	0.8950	0.9842	0.9909
Two Finger:			
% N Rank 1	**0.8881**	**0.9880**	**0.9942**
% N Top 5	0.9171	0.9957	0.9967
% N Top 10	0.9276	0.9971	0.9970
% N Top 20	0.9371	0.9980	0.9978
Three Finger:			
% N Rank 1	**0.9168**	**0.9981**	**0.9975**
% N Top 5	0.9360	0.9991	0.9987
% N Top 10	0.9450	0.9995	0.9990
% N Top 20	0.9543	0.9999	0.9993



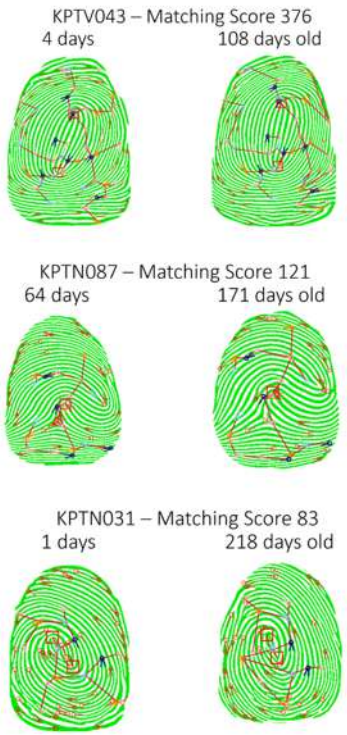
Kidprint Mexico. Clinical Trial, Unpublished data, Aronoff-Spencer et al, 2019.

Persistence

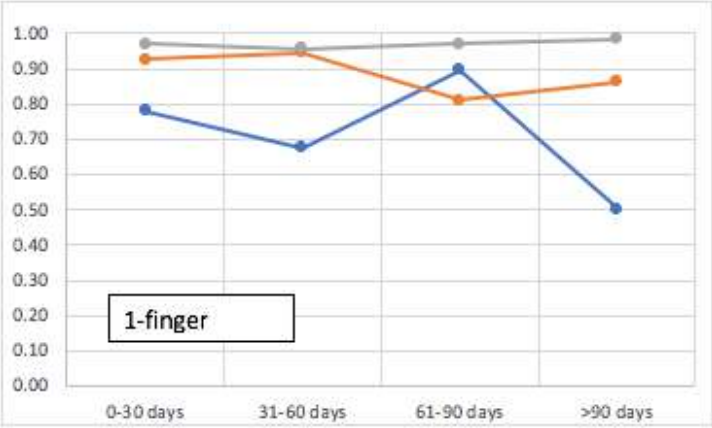
Stability over Time

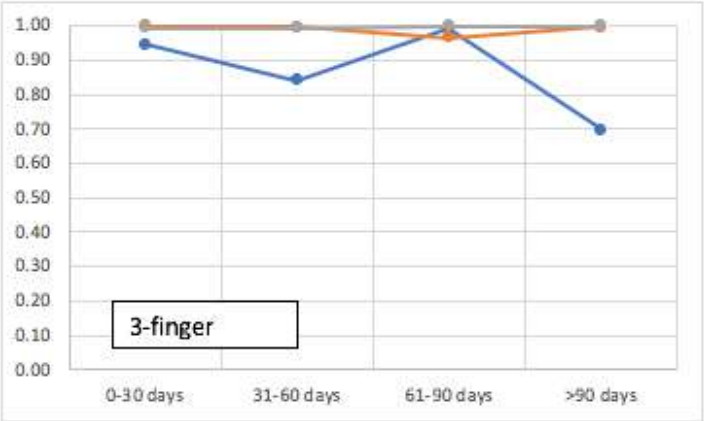
Delta T (Time between visit) between 0 (same day) and 218 days

100 % individual rematch for age > 30 days



All 6x6 Combinations Match



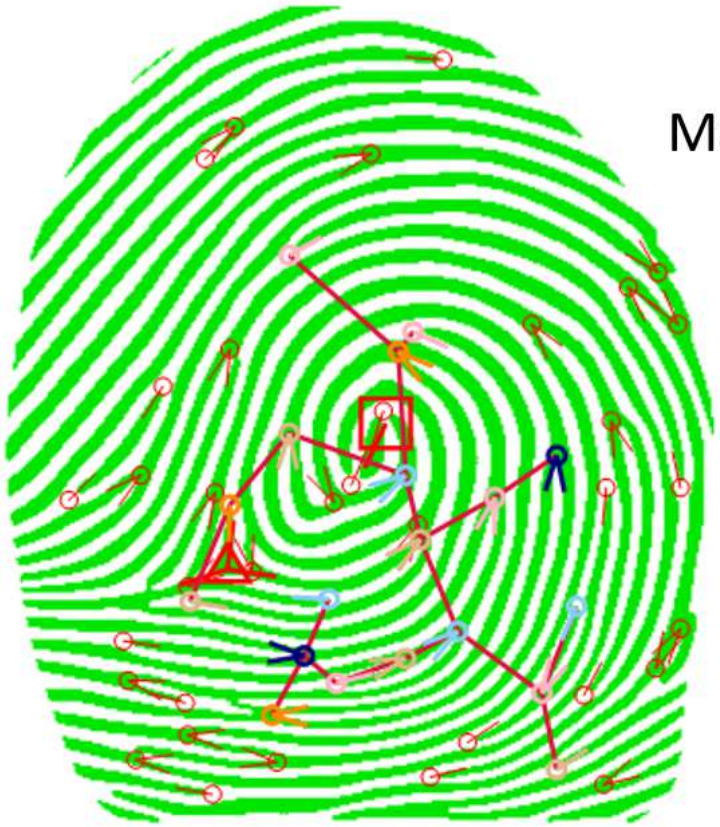


Kidprint Mexico. Clinical Trial, Unpublished data, Aronoff-Spencer et al, 2019.

Interoperability

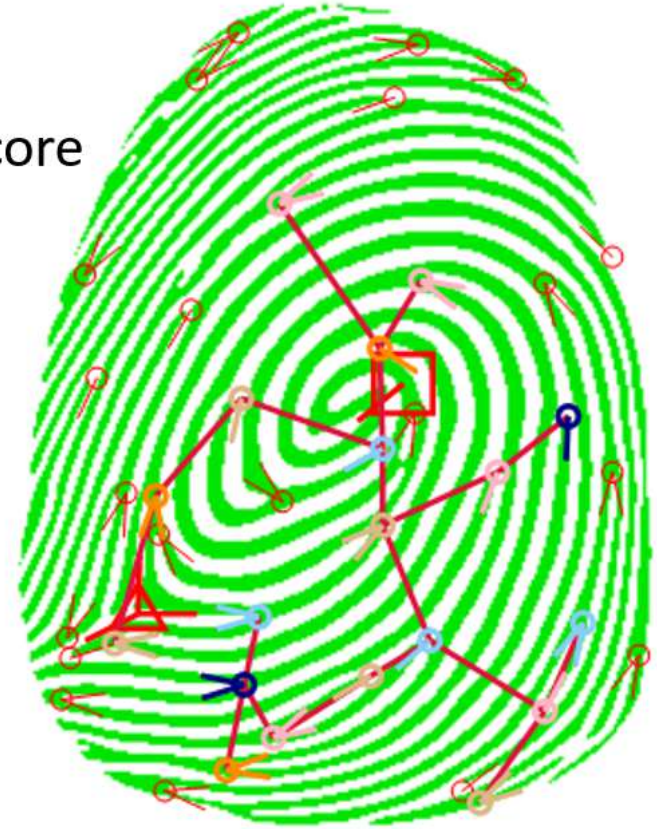
High Resolution Contact to Non-Contact Same Day

23 Days Old Infant



Quality score 84

Matching Score
145



Quality score 75

Kidprint Mexico. Clinical Trial, Unpublished data, Aronoff-Spencer et al, 2019.

PART 4

PANDA GOES TO AFRICA

Panda goes to Mali
Bamako, Jan 2019

Mali results

- Reported to be well liked and easy to use by providers
- Acceptable to caregivers and babies
- Quality images and perfect same day matching scores
- Noted need for weather and dust proofing
- Shovel-ready plan to deploy devices at select clinics and rural outposts

PART 5

Summary and Next Steps

Summary

Key Features

ALL AGES

PERSISTANT

ACCURATE & INTEROPERABLE

Non-Contact for Enhanced Imaging

Adjustable Sizing for Different Ages

Integrated Blue Light for High Contrast Imaging

High Quality Camera with 3500PPI Resolution

IDENTITY + HEALTH
COMING SOON

/01 Universal, multimodal ID, vital health measurements including temperature, heart rate, respiration, oxygen and HRV

/02 Interpreted heart and lung sounds, high blood pressure, anaemia and even sepsis

/03 Analytics, Telemedicine, ID Capture and data integration facilitates better care

Conclusions

- **Non-Contact Fingerprinting for Infant biometric identification**
  - High accuracy with all ages
  - Stability over time
  - Interoperability with existing methods
  - Meets legal standards for identity

- **Next steps**
  - Multimodal biometrics
  - Scale Pilots
  - Build Partnerships

SPECIAL THANKS

TO JOSEPH ATICK AND ID4AFRICA,
TO ANIL JAIN,
TO OUR OUR PARTNERS & FRIENDS,
TO THE KIDPRINT TEAM
TO OUR HOSTS IN SOUTH AFRICA,
& TO THE BILL & MELINDA GATES FOUNDATION

UC SAN DIEGO TEAM

kidprint.ucsd.edu

Funded By BILL & MELINDA GATES foundation