# Ted Talks – Clinical Informatics Fellows Edition - 2018

- **Artificial Intelligence and Blockchain, for Medical Imaging**
  - Alaa Alsadi, MD, Clinical Informatics Fellow, University of Illinois at Chicago
- **Clinical Informatics: Understand People and Process**
  - Viper Bodar, MD, Clinical Informatics Fellow, University of New Mexico
- **A Brave New World**
  - Reza Sadeghian, MD, Clinical Informatics Fellow, University of Washington

# Blockchain to Accelerate Artificial Intelligence in Medical Imaging; the "Diagnosis Protocol"

AMDIS **TED$^{x}$** Talk: Clinical Informatics Fellow Edition

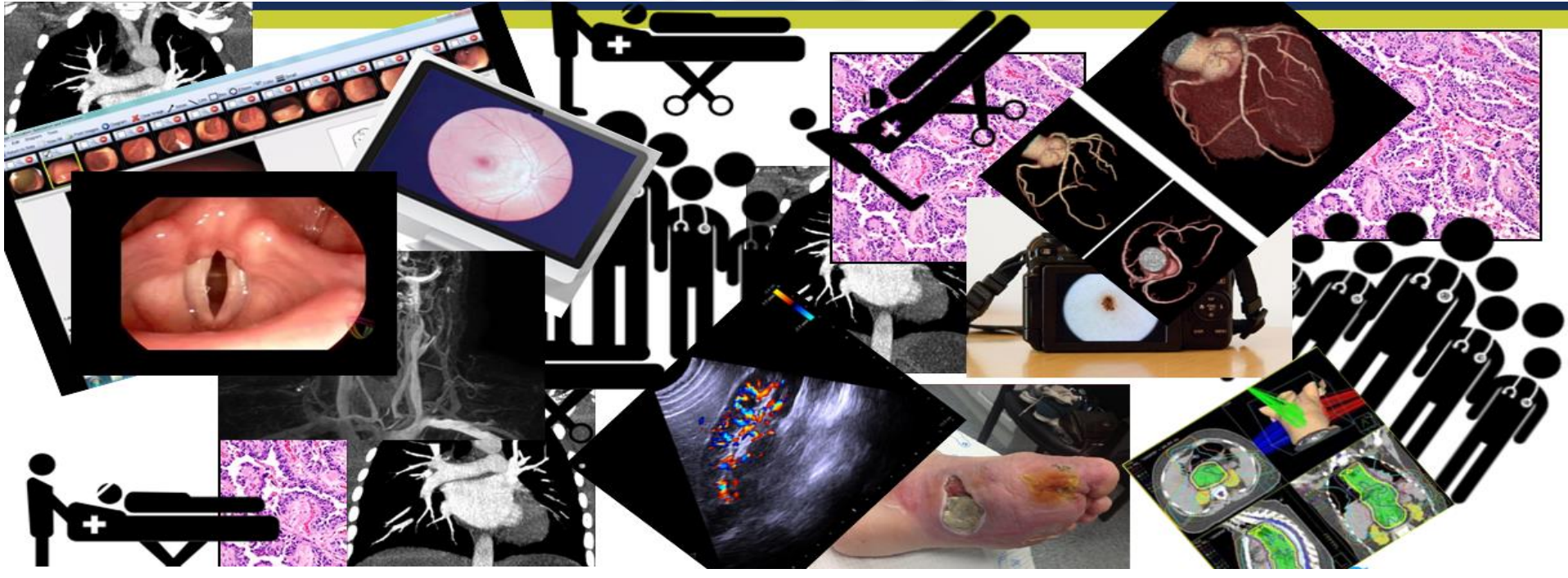
Alaa Alsadi, MD.
University of Illinois at Chicago (UIC)
Roger Boodoo, MD.
US Navy- Defense Health Agency (DHA)
6/21/ 2018

# Disclosure

- Diagnosis Protocol (co-founder equity)


- Next Gen Miners (partner equity)

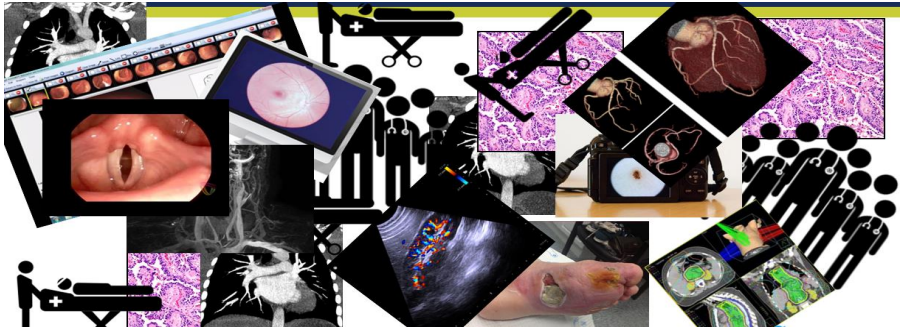
# AI Imaging Datasets: a MESS



# Not a Tech Problem

https://www.google.com/url?sa=i&rct=j&q=&esrc=s&source=imgres&cd=&cad=rja&uact=8&ved=2ahUKEwio2oOYk-DbAhWfGDQIHTexA-kQjRx6BAgBEAU&url=https%3A%2F%2Fitexperts.co.za%2F4-common-computer-problems-can-fix%2F&psig=AOvVaw1lNzox8QAG5Xzx40RJ1m3A&ust=1529512224651489

# A People Problem

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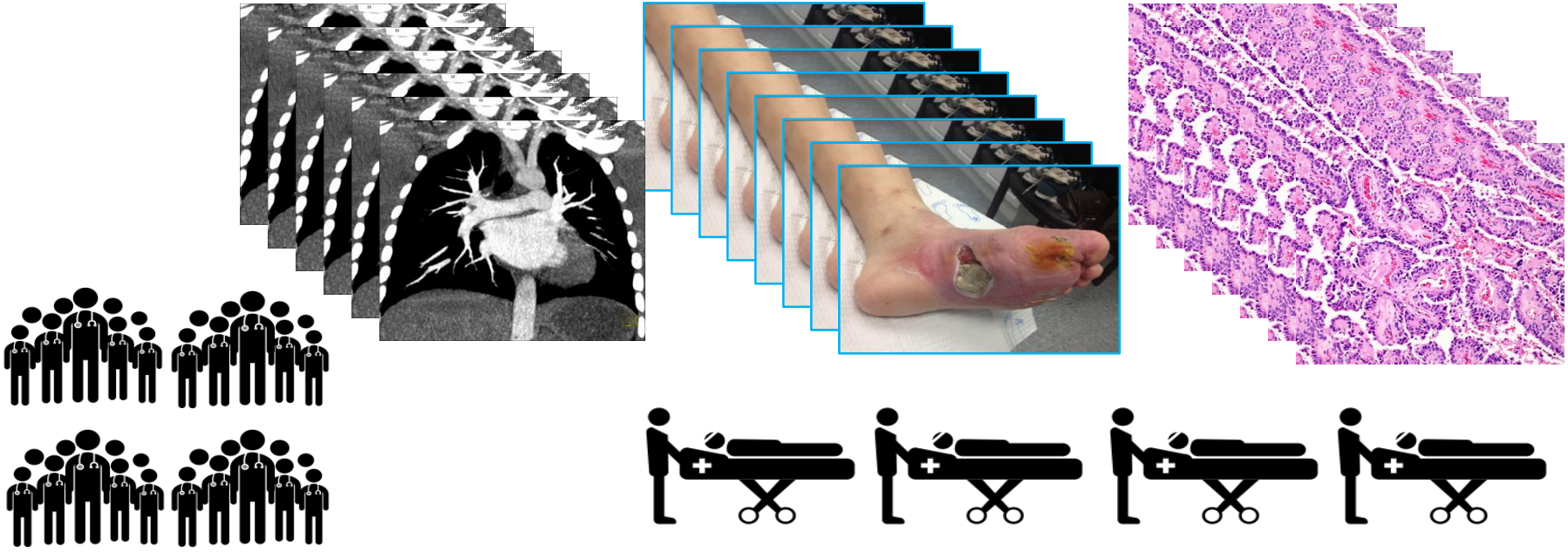
# Global Collaboration Needed to Build AI

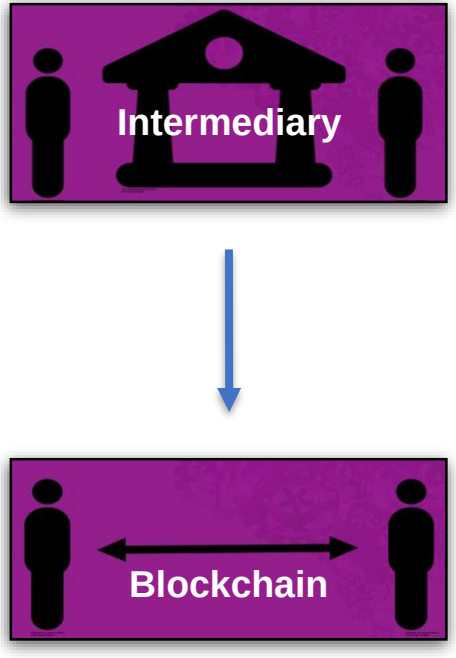


# A Solution: Blockchain


- Incentivize data structuring
- Guarantee quality of data

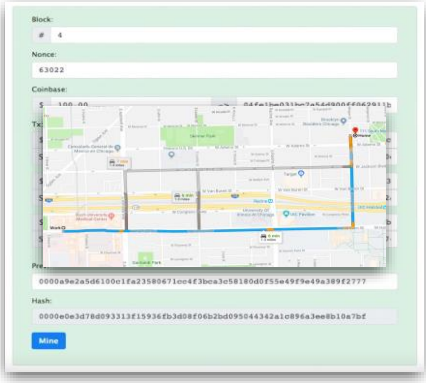
# A Word about Blockchain

- The technology for replacing intermediaries
- Ultimate audit trail, asset tracking, and security
- Direct, digital connection, between an activity and a value (Smart Contracts)



# Smart Contracts; an Example


- Bitcoin is the prototypical Blockchain 1.0; currency/ money transactions
- Ethereum is the prototypical Blockchain 2.0; VALUE transactions
- Made available via SMART CONTRACTS



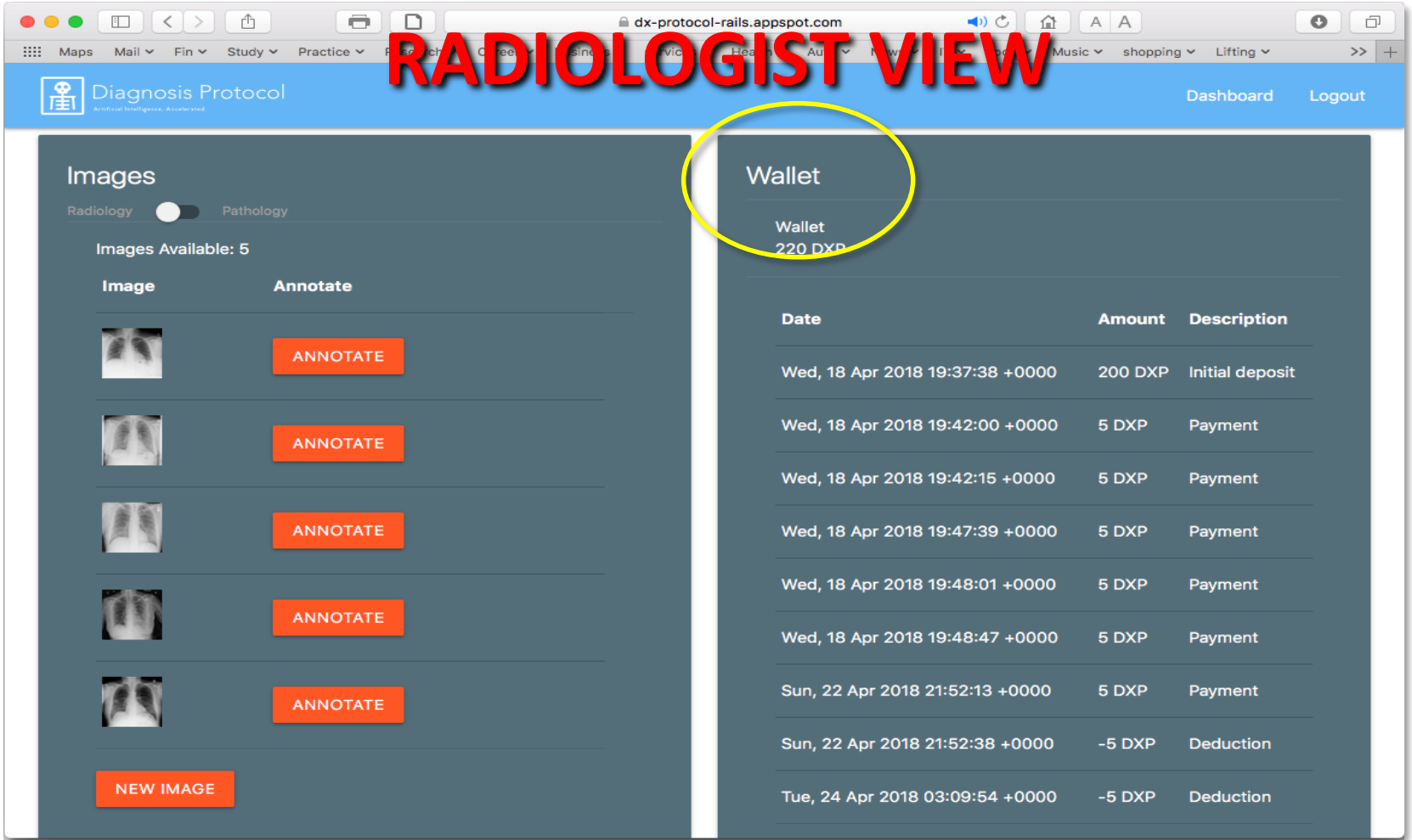
# The Future of Value Exchange


Information Exchange

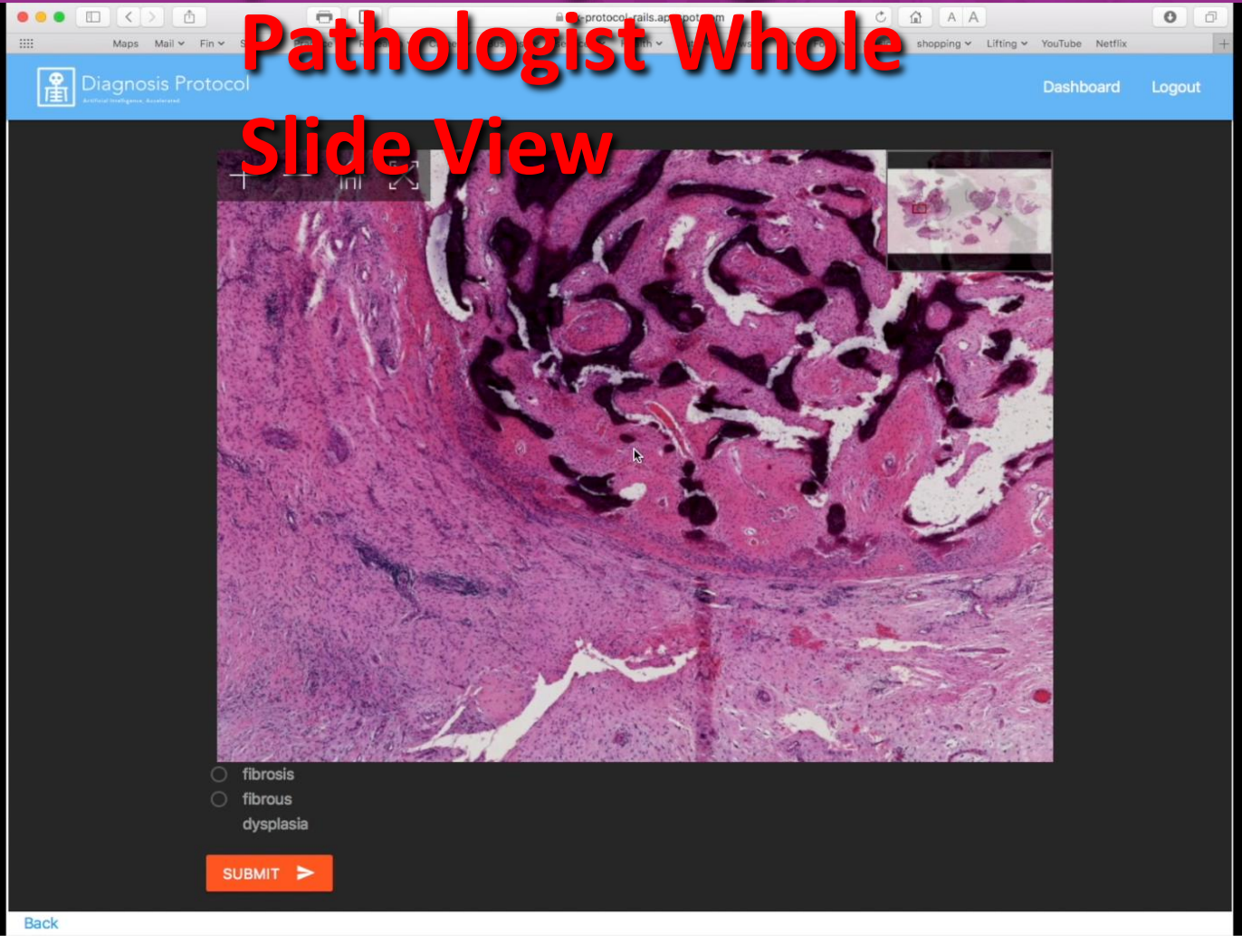
Value Exchange

https://www.google.com/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=2ahUKEwjSmP-SpeDbAhUIG3wKHVOMDvIQjRx6BAgBEAU&url=http%3A%2F%2Fwww.ibmbigdatahub.com%2Fblog%2Fwhat-blockchain-and-what-does-it-have-do-internet-things&psig=AOvVaw1ioQhIYG04-GzDWDzrxYn8&ust=1529516996916360

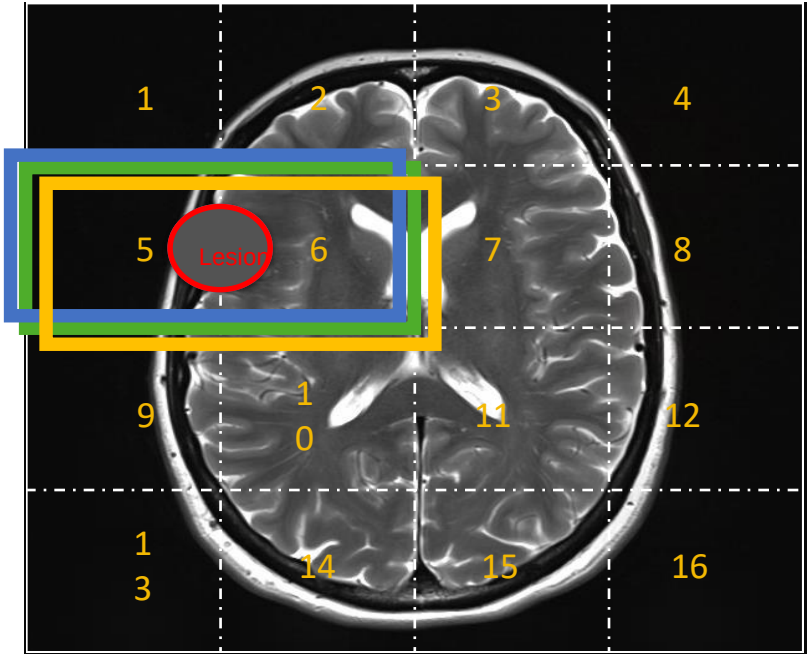
# Diagnosis Protocol: an Image Annotation Blockchain



# Specialty Agnostic



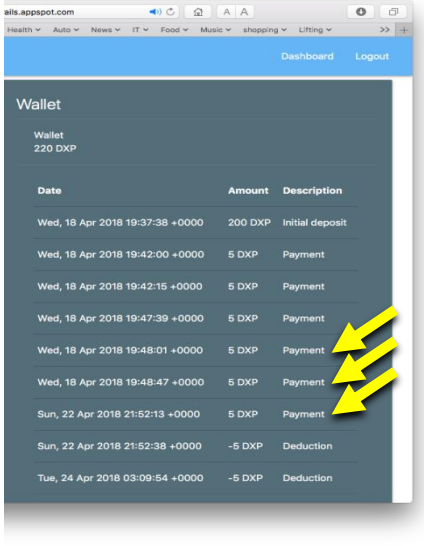
# Smart Contracts: Annotation ➔Reward



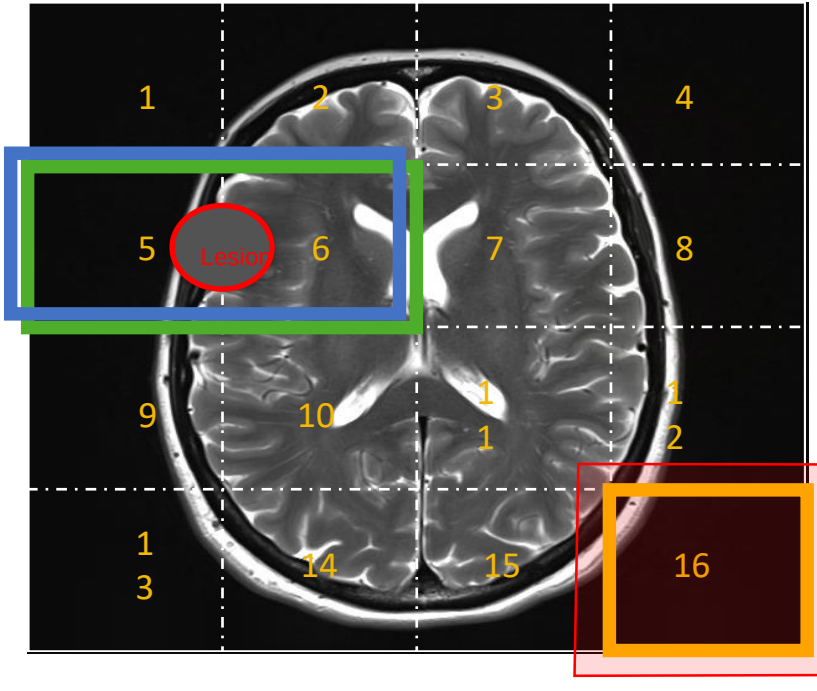

Doctor # 1; zones 5&6

Doctor # 2; zones 5&6

Doctor # 3; zones 5&6



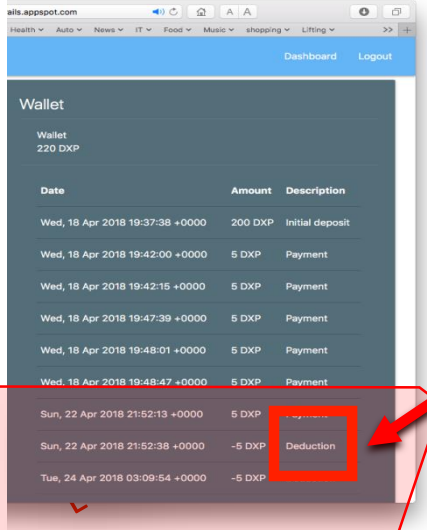
# Smart contracts: Data Quality



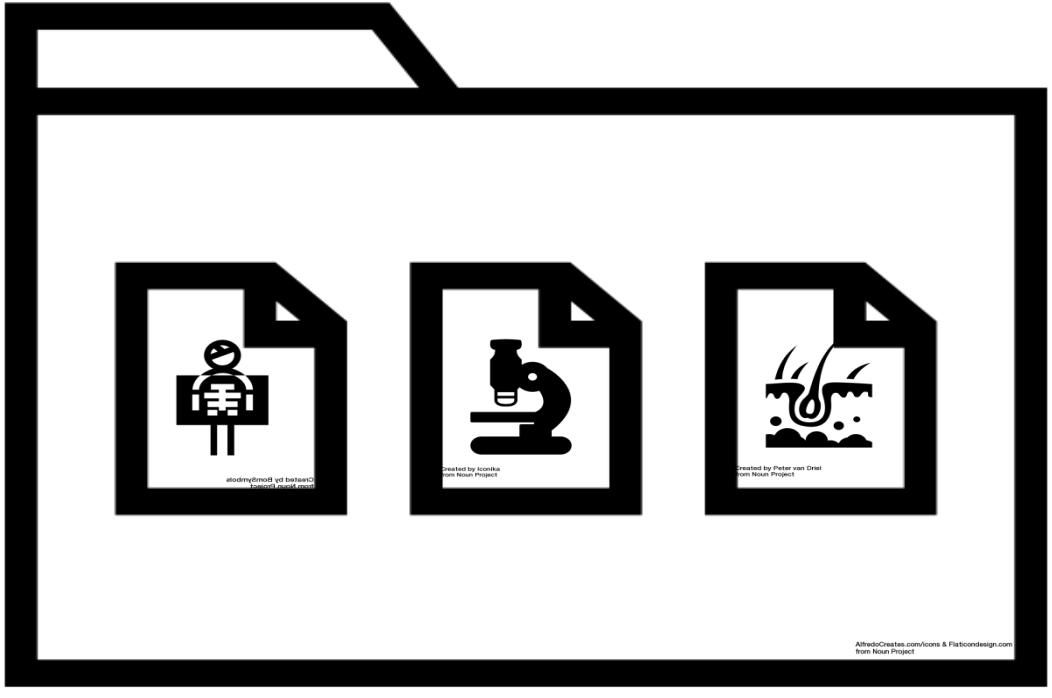

Doctor # 1; zones 5&6

Doctor # 2; zones 5&6

Doctor # 3; zone 16



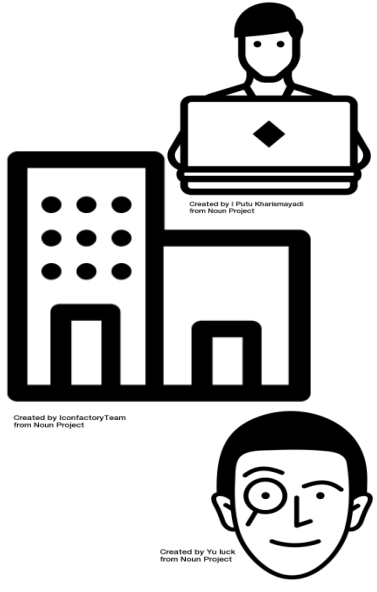
# Annotated Medical Imaging Datasets



# Token Economy

Developers

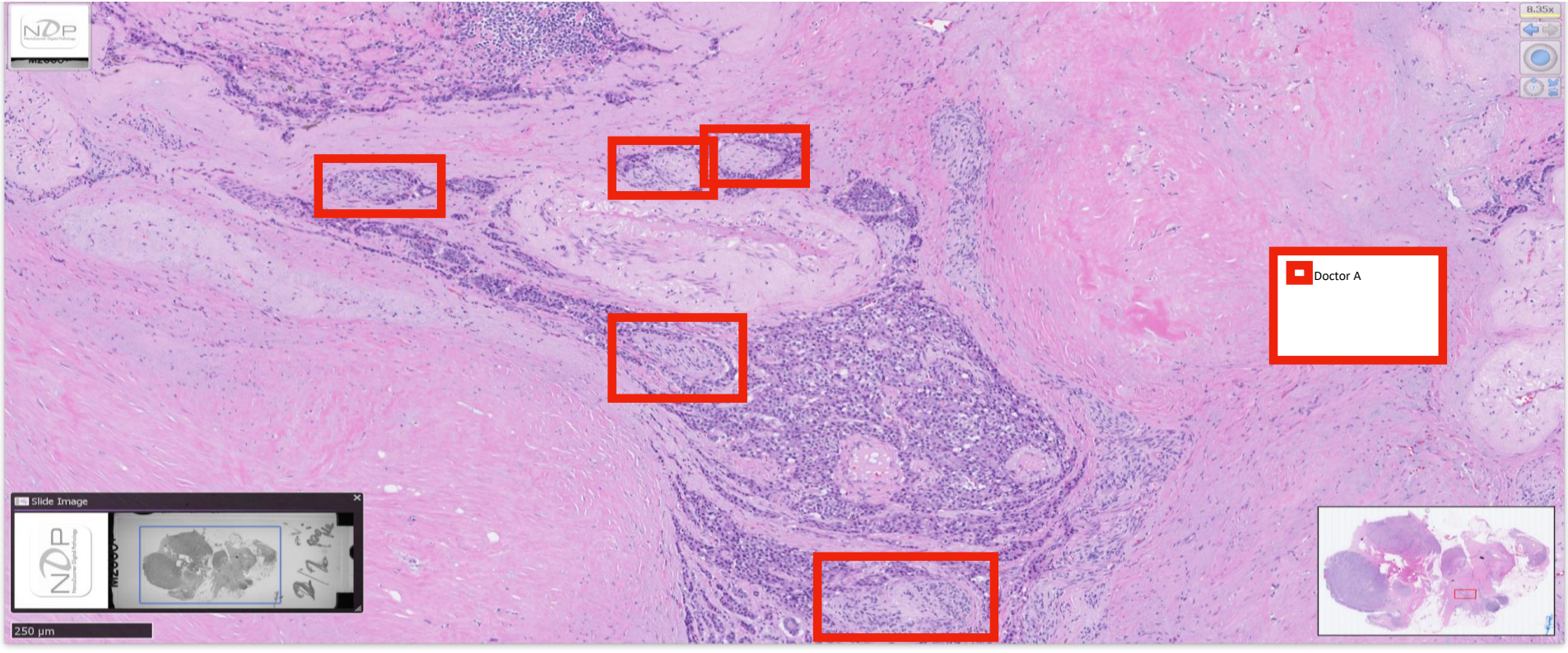
(Imaging, AI/ Tech, Device Manufacturer, etc.) **Companies**



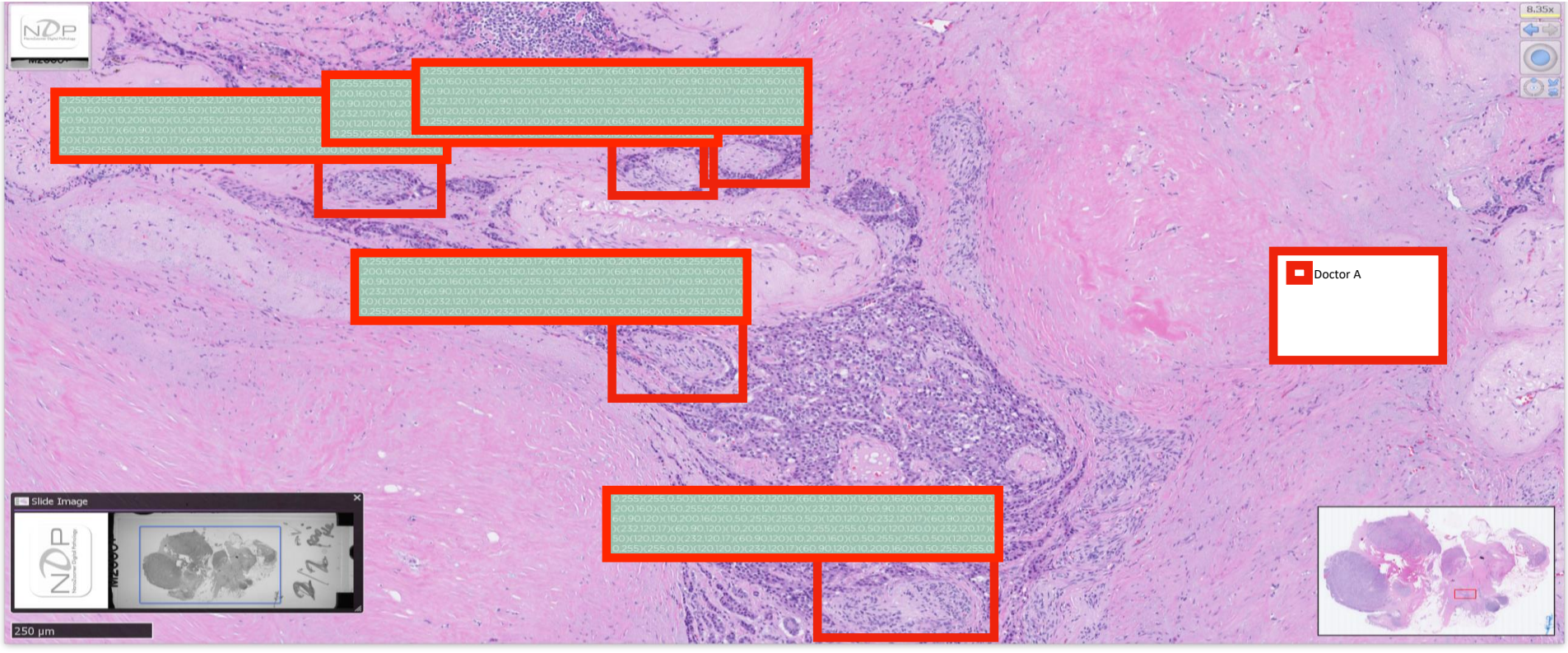



Researchers

# Blockchain Audit Trail

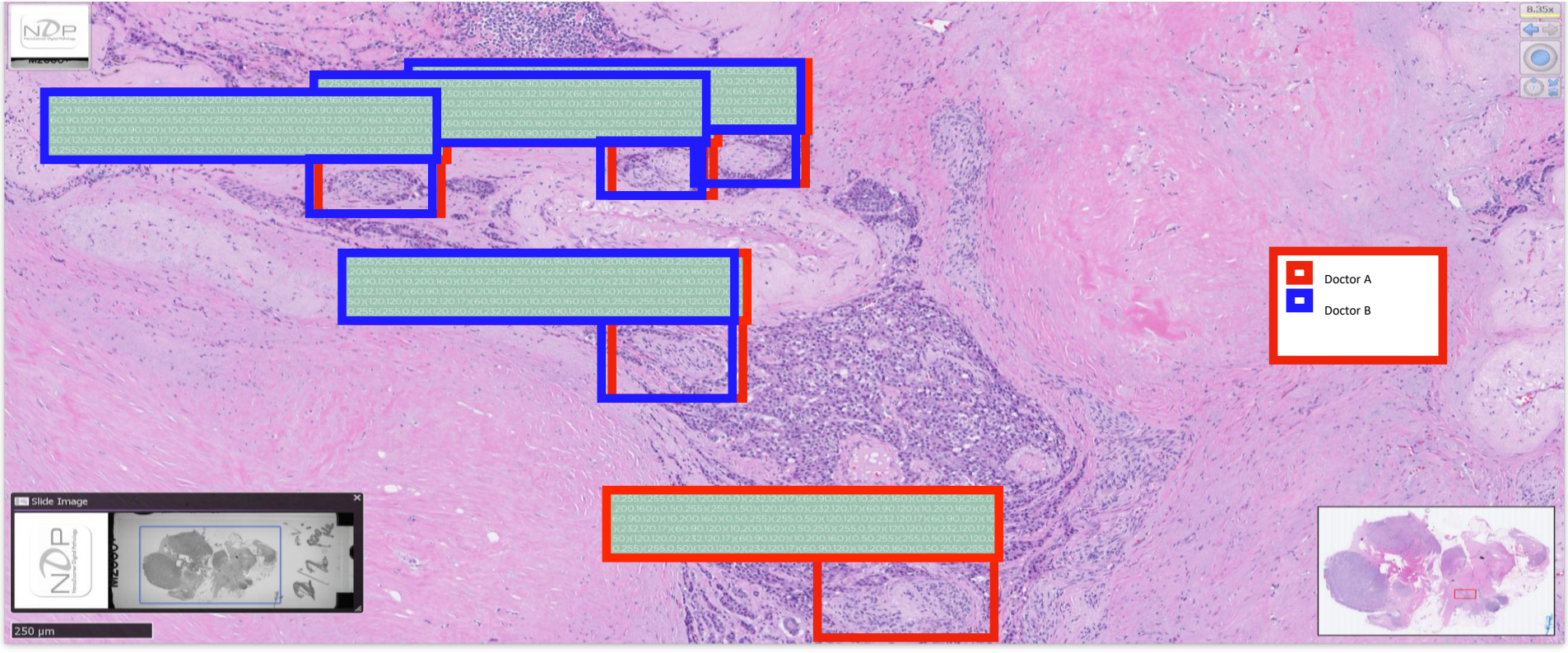


# Blockchain Audit Trail




**Metadata stored on blockchain**

# Blockchain Audit Trail




**Proof images were worked on; Verifiable by anyone**

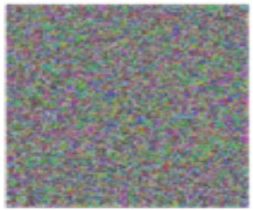
**Regulatory requirements?**

# Cybersecurity in Deep Learning

- Adversarial examples are inputs to machine learning models that an attacker has intentionally designed to cause the model to make a mistake

**Intact Model** + **Pixel “white noise”** → **Compromised Model**

**Nevus 98% confidence**

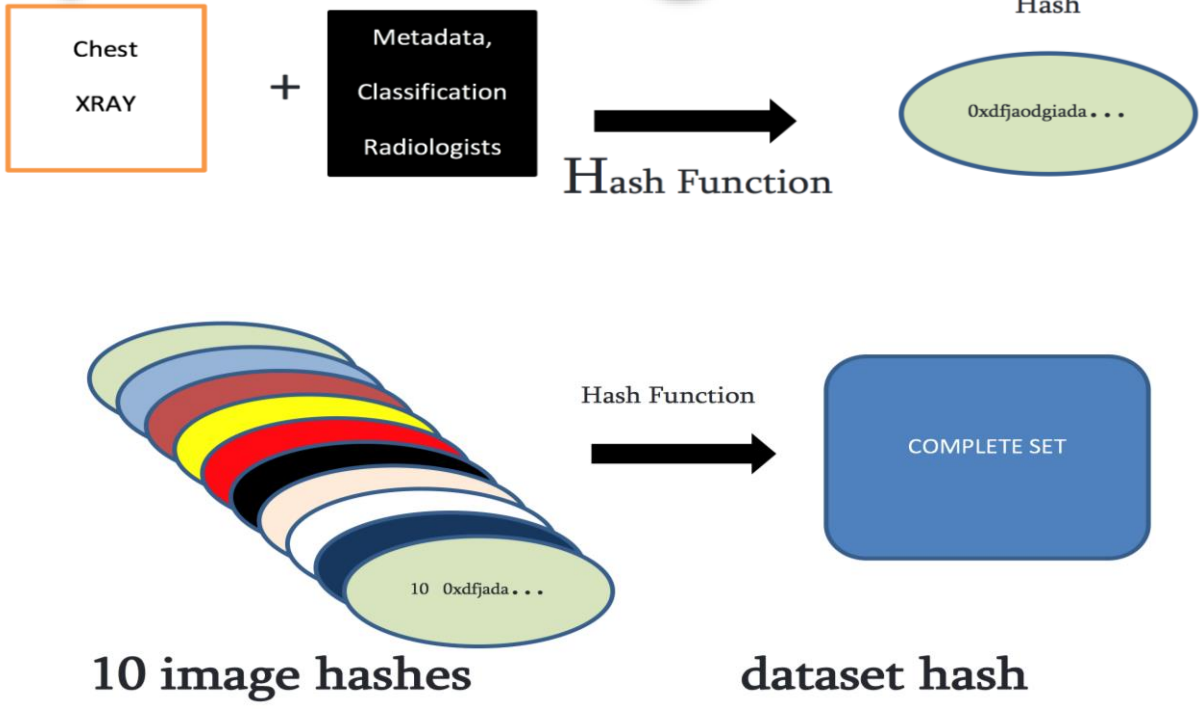


**Melanoma 97% confidence**

https://arxiv.org/abs/1804.05296

# Cybersecurity in Deep Learning

- The image and associated metadata should be hashed to ensure that the data has not been altered by bad actors
- Furthermore, the hash of many hashes (Merkle tree) can represent the entire dataset. One can verify that work was performed on the entire dataset prior to purchasing.



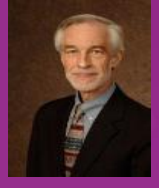
# Diagnosis Protocol at SIIM





# UIC CI Fellowship Program

K. Kochendorfer
CHIO



F. Behm
Chairman, Pathology

T. Patel

Shane Borkowsky
and CHIO team


- One of the first ACGME accredited programs in the country (9/2014)
- 4 Core Components (2 years)

Clinical Service
Didactics
Projects
Rotations

Proposed
Blockchain in Pathology

MATTER

# Thank You!

Updates at **AMIA Annual Symposium**
San Francisco Nov 3 - 7

**Blockchain Fundamentals for the Healthcare Professional:**

Realities, Use-cases, and Future Implications.

Boodoo R MD, Diaz M MD, Taylor J MD, **Alsadi A MD**

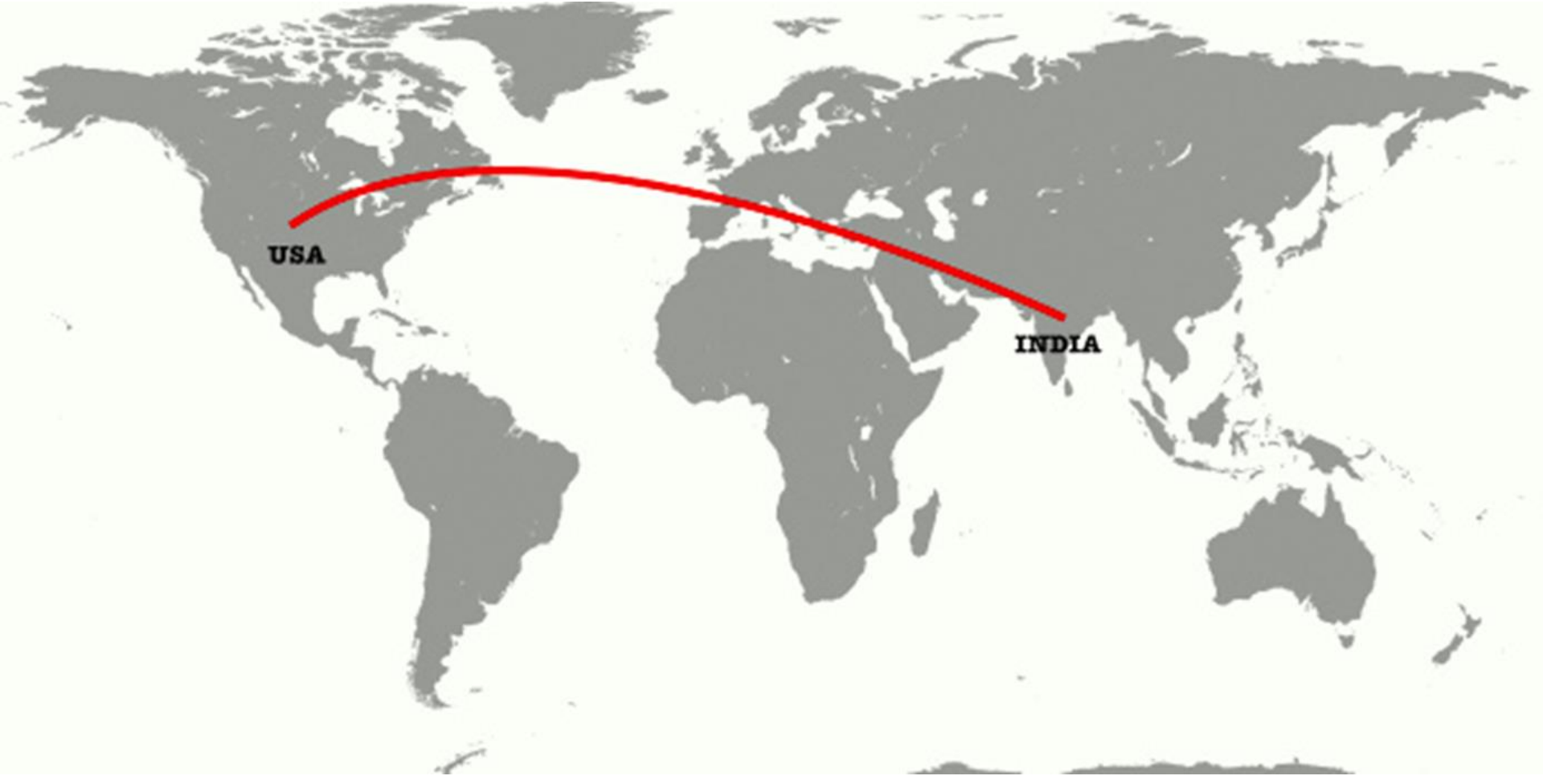
# AMDIS 2018

# Clinical Informatics: Understand People and Process

Viper Bodar, MD,

Clinical Informatics Fellow

University of New Mexico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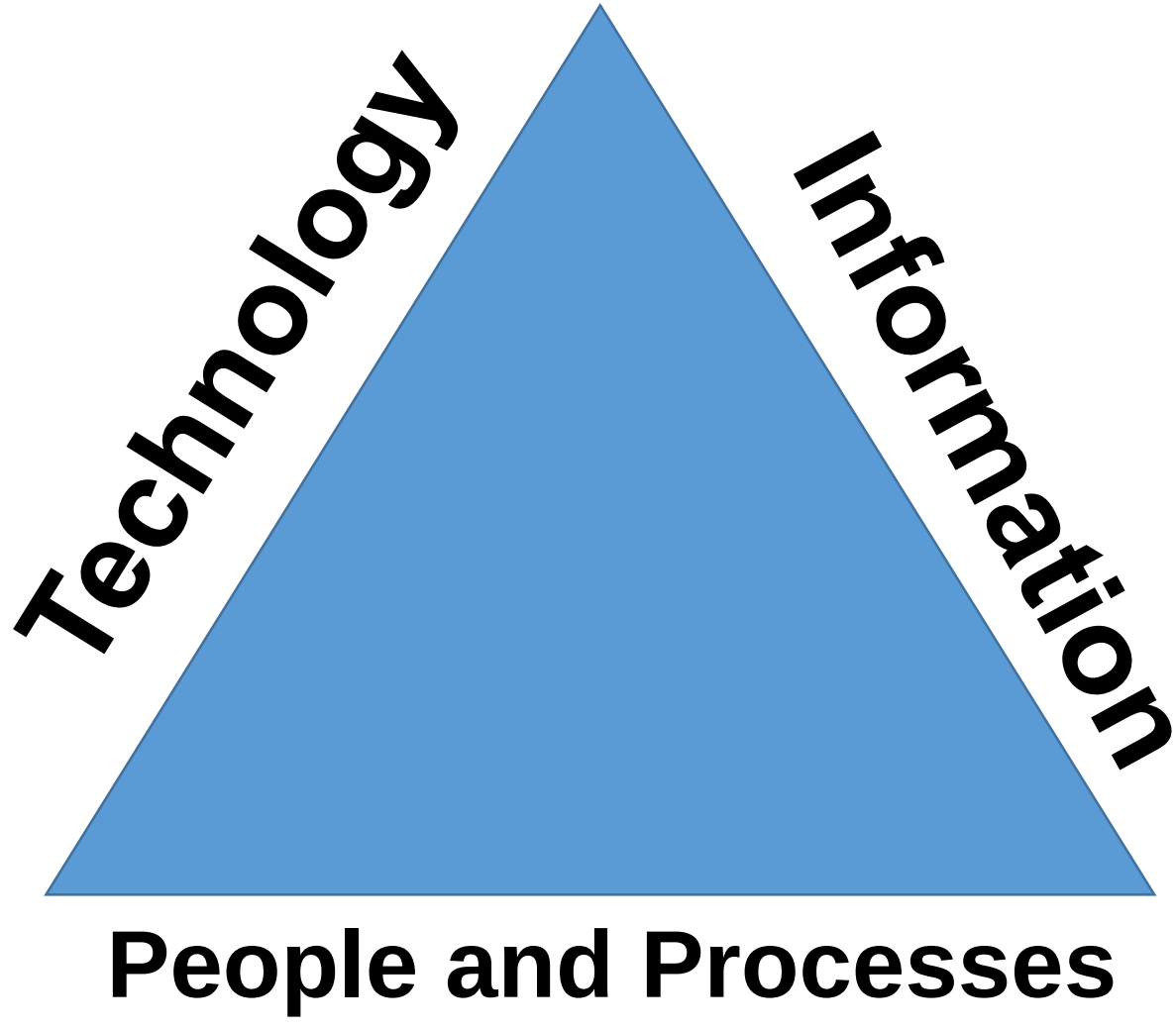
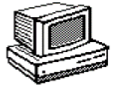
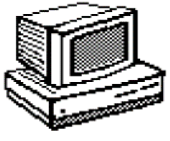

Technology
Information
People and Processes

# Goal

(  +  ) > 

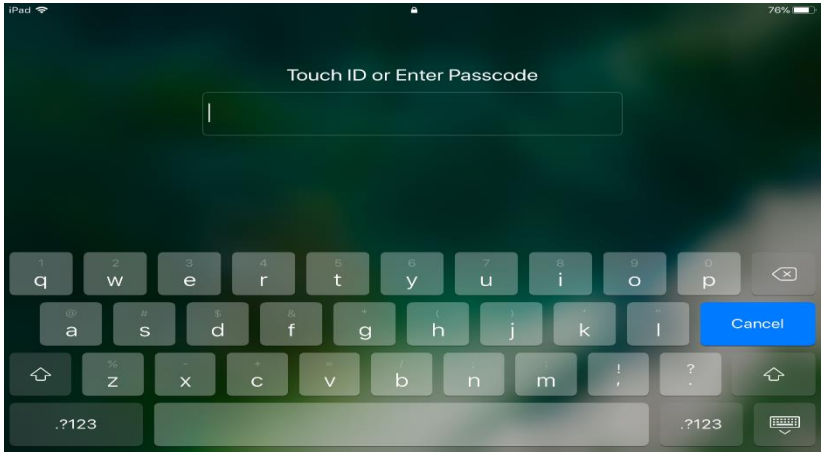
# NOT Goal

 > 

*From Chuck Friedman


Most used
Word
Mail
People
News
Camera
Calculator
Suggested
Microsoft Mahjong
Free
A
Accuweather
Afterlight
Alarms
B
BBC Store
BT Sport
Ask me anything
Welcome Lily!
How can I help you today?
Cortana
Photos
UBER
News
WSJ
Play
BT Sport
NETFLIX


9:41
Tuesday, September 12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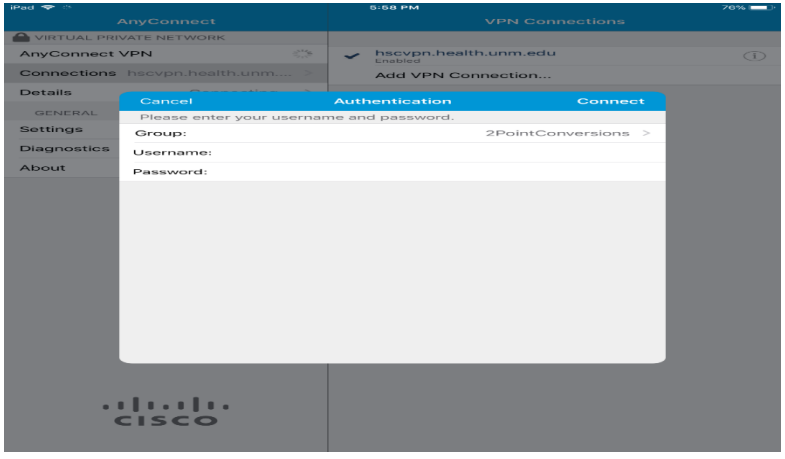
AnyConnect
VPN Connections
AnyConnect VPN
hscvpn.health.unm.edu
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Details
Settings
Diagnostics
About
Cancel
Authentication
Connect
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Group:
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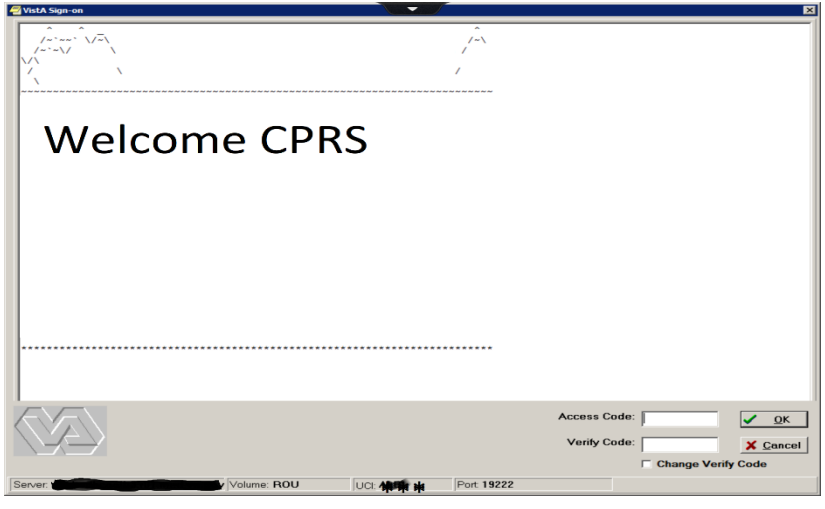
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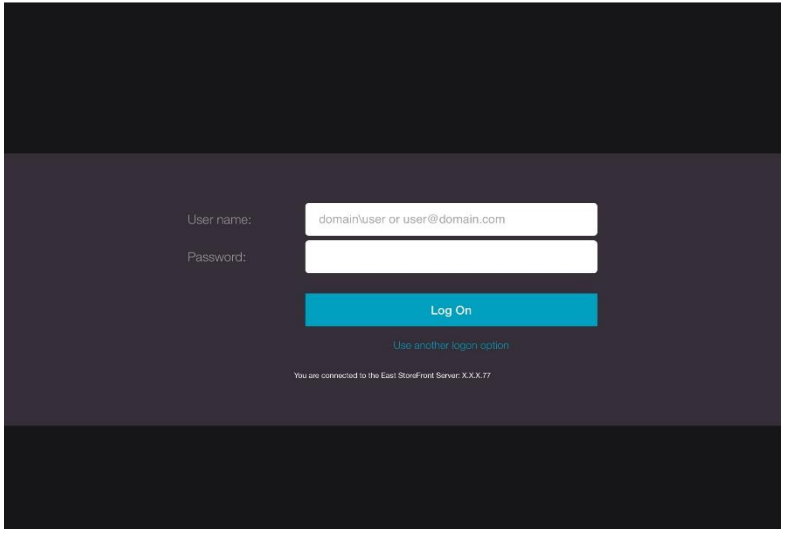
User name:
domain\user or user@domain.com
Password:
Log On
Use another logon option
You are connected to the East StoreFront Server: X.X.X.77


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COMPLETED DIABETIC TELERETINAL RE Mar 30,18 DIABETIC TELERETINAL READER CONSULT REPORT (#34834709), ABQ CAC TEST CLINIC-X, ROBERT J CRAMMER
Alerted Consult
Mar 28,18 (c) ACS TELERET
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STANDARD TITLE: DIABETOLOGY NOTE
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AUTHOR: CRAMMER,ROBERT J EXP COSIGNER:
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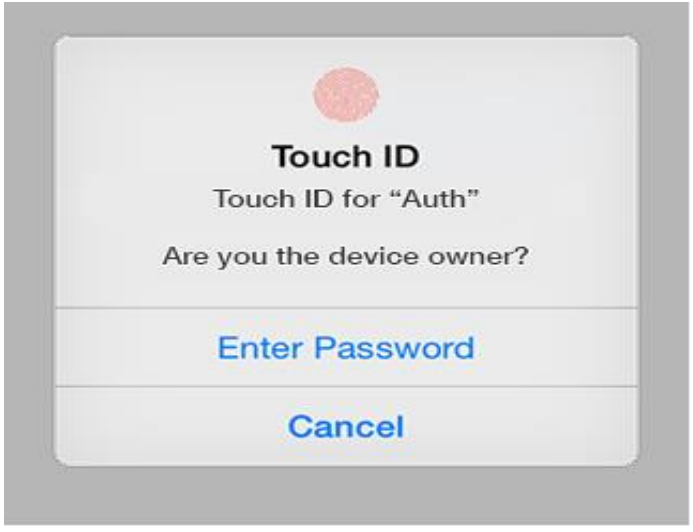
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Are you the device owner?
Enter Password
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Technology
Information
People and Processes

# AMDIS 2018

# A Brave New World

June 21, 2018

Reza Sadeghian, MD, MBA, MSc
James Metz, MD, MPH
Darren Migita, MD
Carlos Villavicencio, MD, MMI
Michael Leu, MD, MS, MHS

Seattle Children's
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# Case

- Sept 2015
- 17 m/o male brought to the ED by parents due to concerns of sexual abuse by a friend of the family
- Bruises on face and leg
- Sent home with family for follow up with PCP
- 2-weeks later was pronounced dead at home, found to have multiple rib fractures, clavicle fracture and severe abdominal trauma

# Epidemiology of Child Abuse

20,000 American kids killed in their own homes in the last 10 years

1,670-1,740 kids die each year

5 kids are murdered each day

80% of child fatalities involve at least 1 parent

https://americanspcc.org/child-abuse-statistics/

# Identifying The Root Cause Analysis And Counter Measures

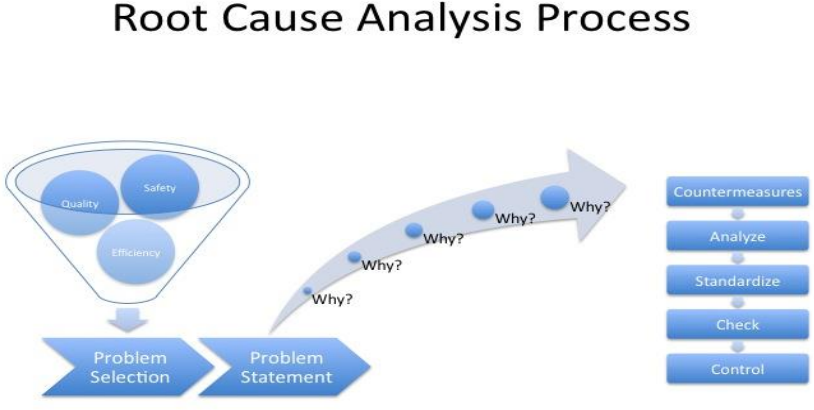
Problem: Despite good evidence on bruising as sentinel injuries of abuse, there is no standard workup among ED physicians on bruises found on children.

- Lack of Knowledge
- Inadequate process
- Lack of leveraging technology

# Identifying The Root Cause Analysis And Counter Measures

## Root Causes

- Lack of Knowledge
- Inadequate process
- Lack of leveraging technology






## Counter Measures

- Create a clinical standard pathway algorithm
- Create a standard screening power form and process for RN-
- Track the metrics to ensure the standards are followed and improved upon

# Clinical Standard Work ( CSW)

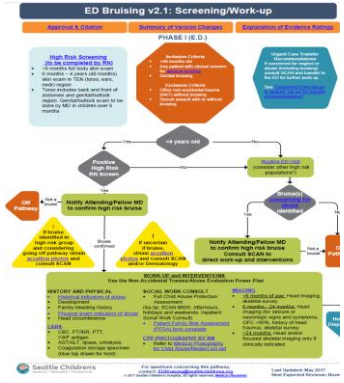
Clinical Standard Work (CSW): 3 components

- Documented approach to management and treatment
  - Based on evidence – extensive lit review
  - Team consensus when evidence not available
- Care is hard-wired
- Outcomes are measured, and *owned by someone* to assure the continual improvement of the care for this condition

# Bruising Pathway Goals

- Increase recognition of bruising as a sentinel injury for abuse
- Standardize the approach to identifying and working up bruises in the emergency department
- Reduce the number of missed cases of abuse
- Improve collaboration between ED and Child Protection Team

# Pathway Algorithm




## ED Bruising v2.1: Screening/Work-up

Approval & Citation | Summary of Version Changes | Explanation of Evidence Ratings

### PHASE I (E.D.)

**High Risk Screening (to be completed by RN)**

- <6 months full body skin exam
- 6 months – 4 years (48 months) skin exam in TEN (torso, ears, neck) region
- Torso includes back and front of abdomen and genital/buttock region. Genital/buttock exam to be done by MD in children over 6 months

**Inclusion Criteria**

- <48 months old
- Any patient with clinical concern for abusive bruising
- Genital bruising

**Exclusion Criteria**

- Other non-accidental trauma (NAT) without bruising
- Sexual assault with or without bruising

**Urgent Care Transfer Recommendations**

If concerned for neglect or abuse (including bruising) consult SCAN and transfer to the ED for further work-up

See "Suspected Child Abuse & Neglect" job aid for transfer recommendations* (*for SCH only*)

<4 years old

Yes

No

Positive High Risk RN Screen

No

Routine ED Visit (consider other high risk populations*)

Yes

Off Pathway

Not a bruise

Notify Attending/Fellow MD to confirm high risk bruise

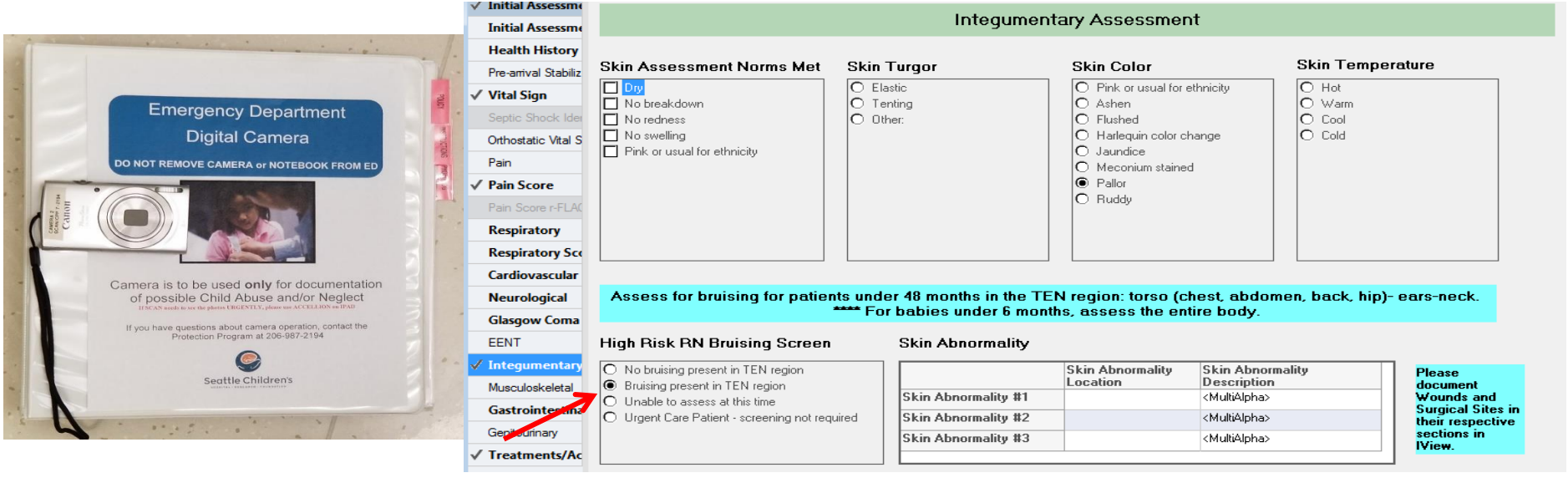
Bruise(s) concerning for abuse identified

Yes

No

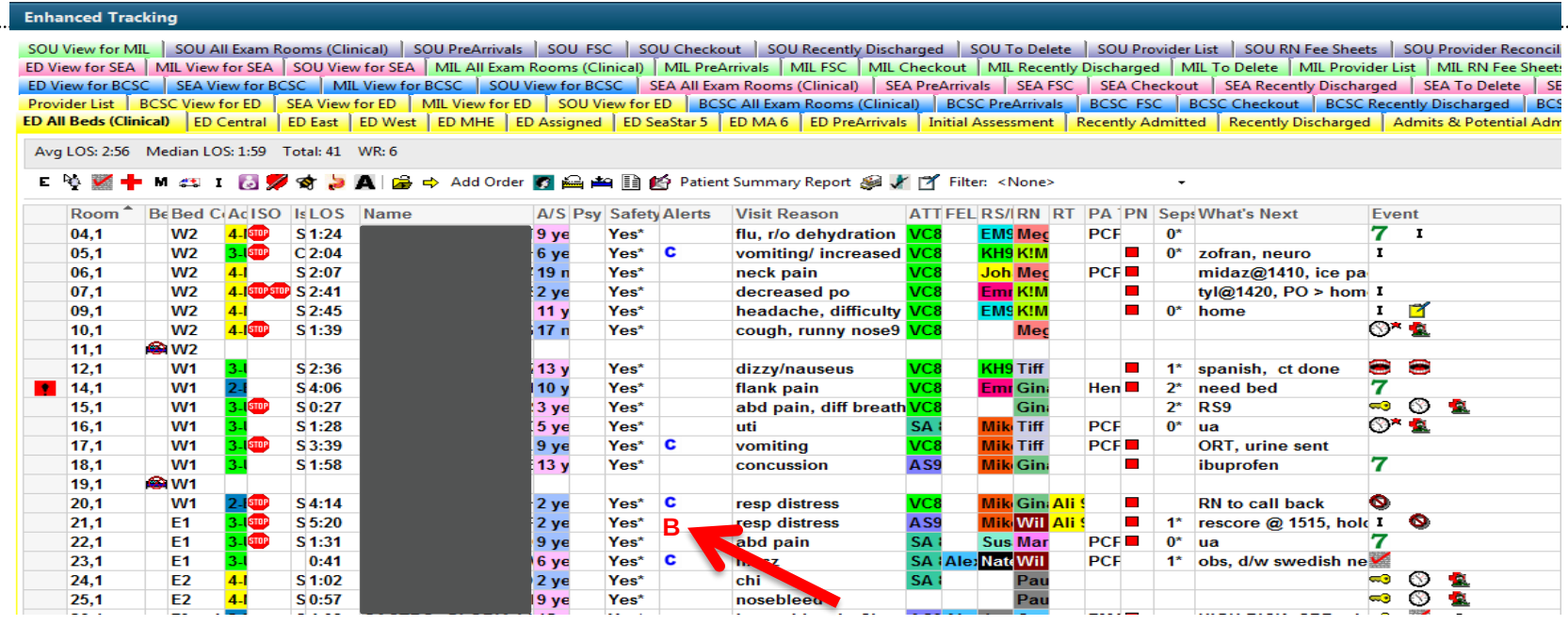
# CIS Clinical Decision Support Tools- EMR

- Order set required P/E fields to be filled out by the RN in Cerner




This varies based on age of child (if <6 months, bruising anywhere on the child)

# EMR Updates – ED White Board

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# Tracking the metrics through Tableau

**ED Bruising Screening Documentation**
Ages Included: *All*

| | FY 2017 | FY 2018 | Total |
|---|---|---|---|
| Screened | 15,379<br>89.0% | 13,093<br>86.8% | 28,472<br>88.0% |
| Screening Not Documented | 675<br>3.9% | 600<br>4.0% | 1,275<br>3.9% |
| Documented: Unable to assess at this time | 1,281<br>7.4% | 1,450<br>9.6% | 2,731<br>8.4% |
| **Grand Total** | 17,285<br>100.0% | 15,086<br>100.0% | 32,371<br>100.0% |

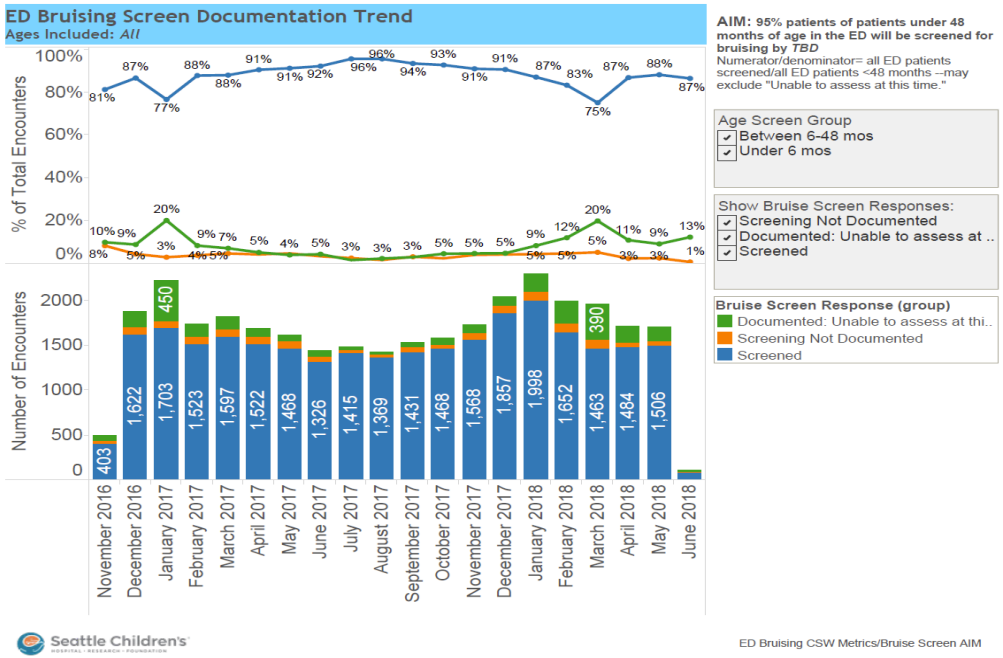
**ED Bruising Screening Assessment**
Ages Included: *All*

| | FY 2017 | FY 2018 | Total |
|---|---|---|---|
| Bruising Present | 260<br>1.7% | 194<br>1.5% | 454<br>1.6% |
| No bruising present | 15,120<br>98.3% | 12,901<br>98.5% | 28,021<br>98.4% |
| **Grand Total** | 15,379<br>100.0% | 13,093<br>100.0% | 28,472<br>100.0% |

CSW Implementation Status
PostImplementation

Show Bruise Screen Responses:
- Screening Not Documented
- Documented: Unable to assess at this time
- Screened

Age Screen Group
- Between 6-48 mos
- Under 6 mos




Seattle Children's

ED Bruising CSW Metrics/Bruise Screen AIM

28,472 children screened since implementation (18 months)
Screening rate ~88%

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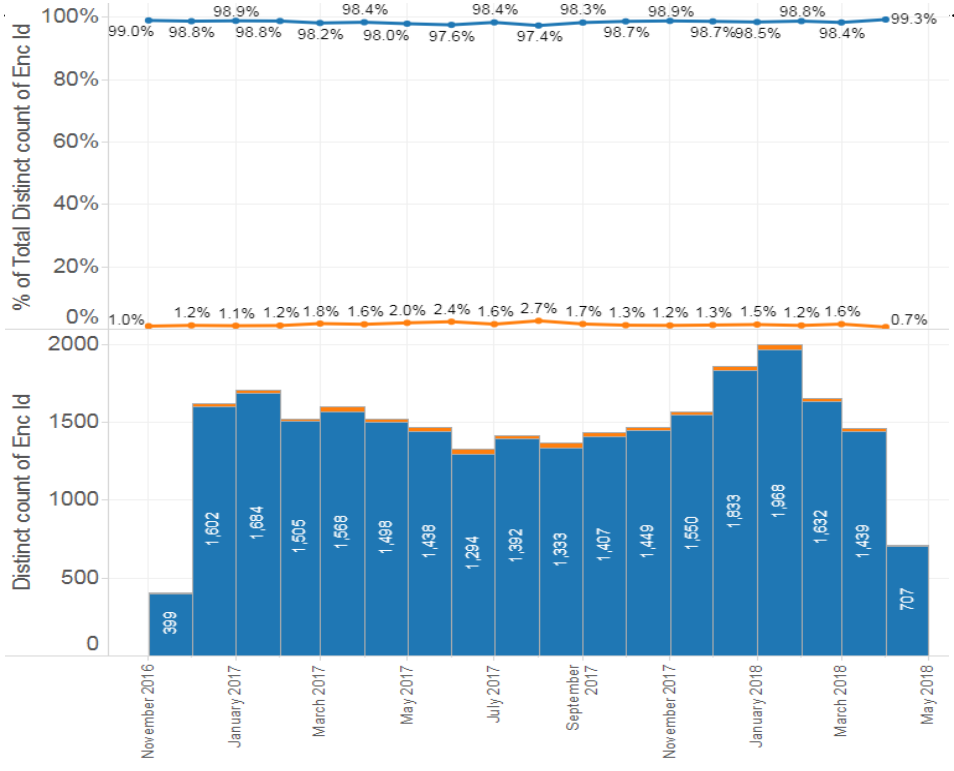
# Metrics – positive screen




- Out of 28,000 cases, 402 children (1%) screened positive for high risk bruise since go live.

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# Summary

- Child abuse is a significant problem and it is under recognized by physicians
- Informatics can be used for screening to improve the recognition of child abuse
- Analytics can help track our Clinical pathways to ensure standards are being followed and to measure clinical effectiveness

# Be Brave!

## Thank You

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Happy Birthday!

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# Ted Talks – Clinical Informatics Fellows Edition - 2018

- **Artificial Intelligence and Blockchain, for Medical Imaging**
  - Alaa Alsadi, MD, Clinical Informatics Fellow, University of Illinois at Chicago
- **Clinical Informatics: Understand People and Process**
  - Viper Bodar, MD, Clinical Informatics Fellow, University of New Mexico
- **A Brave New World**
  - Reza Sadeghian, MD, Clinical Informatics Fellow, University of Washington