

## Positively Disruptive - Next Frontier in Point of Care

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#### **Disclosures**



- Johns Hopkins University receives research grant support from miDiagnostics, Inc., including laboratory research overseen by Dr. Ray
- The terms of this arrangement are being managed by the Johns Hopkins University in accordance with its conflict of interest policies

### This speaker's context



- Internal medicine, infectious diseases physician at Johns Hopkins Hospital
- Laboratory researcher dedicated to eliminating HCV
- Performing sponsored research to develop technology that would enable "point of need" tests

## Disruption of healthcare diagnostics



- What's currently broken?
- How can we foster positive solutions?

## We do want positive solutions





### **Point of Care diagnostics**



- Niche solutions
- Diverse definitions
  - Disposable/embedded/wearable
  - Handheld
  - Portable
  - Benchtop
  - Transportable

### **Disruptive POC testing**



- Turn around time less than visit length
- Clinical accuracy comparable to central lab
- Accessible in all patient locations
- 2-way data interface with EHR

## Centralized testing is efficient (a) JOHNS HOPKINS for the lab doing the test



- The Core lab at JHH performs about 10 million tests/year, no downtime, extensively automated
- It's often said that a CBC costs less than \$1 to run, based on volume of testing and device costs

What are the costs outside of the lab?

## Cycles of Centralization & Decentralization



#### Centralization fosters:

- (+) Process consistency
- (+) Enhanced reliability
- (+) Cost control

• (-) Process over service

Larry Thaler, 2016

### Where does your blood go?



- Specimen collection via venipuncture
- For CBC, blood tubes are 3-5 milliliters

 The blood volume inspected by the analyzer is less than 30 microliters

### **Getting into patient context**



The clinician must re-load the patient context into her mind each time:

- A patient visit occurs
- A test result is reviewed
- A test result is discussed

Time and error accumulate with each context disruption, because each is a gap in care

# Example: Complete Blood Count (CBC)

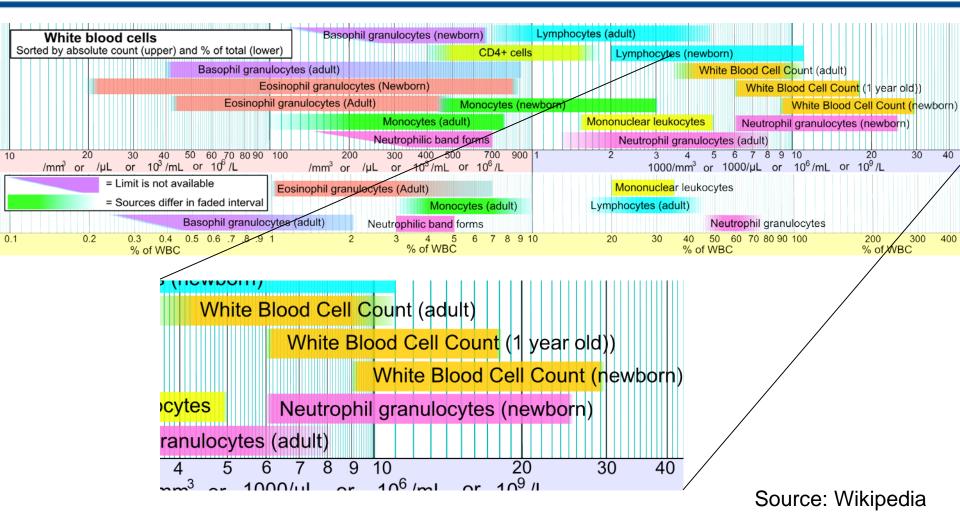


- White blood cells (WBC)
  - Differential (neutrophils, lymphocytes, etc)
- Red blood cells (RBC)
  - Indices (MCV, RDW, etc)
- Platelets

Among the most ordered of all tests

## High-level view of WBC proportions





#### Complete blood count (CBC)



#### Unexplained bleeding (bleeding from gums)

#### Current

- Visit doctor's office
- At end of visit, check out and go to lab for <u>multiple tests</u>
- Wait for result (hours or days)
- Return to clinic or discuss (hours or days)
- May require further iterations

#### **Future**

- Visit doctor's office
- Perform CBC at PON
- If normal, look for other causes
- If abnormal (low platelets, anemia, abnormal WBC), make next decision in context

#### Complete blood count (CBC)



#### Unexplained bleeding (bleeding from gums)

#### Current

- Visit doctor's office
- At end of visit, check out and go to lab for multiple te Benefits:
- Wait for re Reduce cost of care (fewer tests) or days)
   Reduce time to accurate diagnosis anemia,
- Return to discuss (h Improve coherence of care WBC),
   Patient-centered care decision
- May requie Minimize context disruption

#### **Future**

- Visit doctor's office
- Perform CBC at PON
- If normal, look for other causes

### Parallel testing



- Hard to resist for clinicians
  - Numerous tests have the veneer of getting to the answer quickly, reducing cycles of context disruption
- Antithesis of Choosing Wisely initiatives
- Unnecessary tests are wasteful, directly and indirectly
- Follow-up on all tests can be challenging

### Failure to follow up

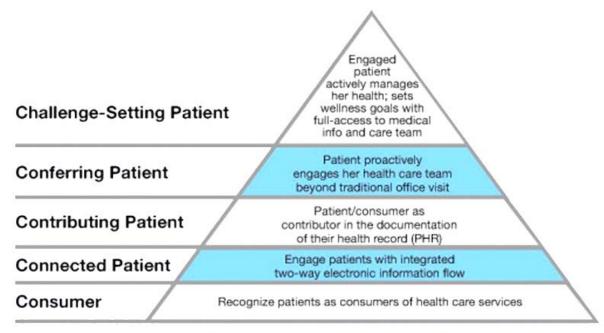


- Failure to follow up on test results:
  - can result in significant errors including delayed/missed cancer diagnosis, yet
  - it occurs for 7-62% of laboratory tests sent from ambulatory clinics [Callen, 2012].
- There are many potential IT/EHR tactics, including automated notifications and reminders; none solves the problem

Callen JL, et al. <u>J Gen Intern Med</u> 2012; 27(10): 1334–1348

# Diagnostic testing is a gap in patient engagement



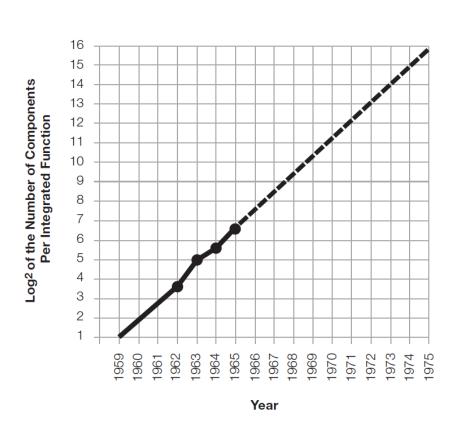


#### Patient Engagement Pyramid

Stephen Armstrong https://hellohealth.com/blog/the-patient-engagement-pyramid/

# Was Moore's Law a prophecy?





 "Cramming more components into integrated circuits" (1965)

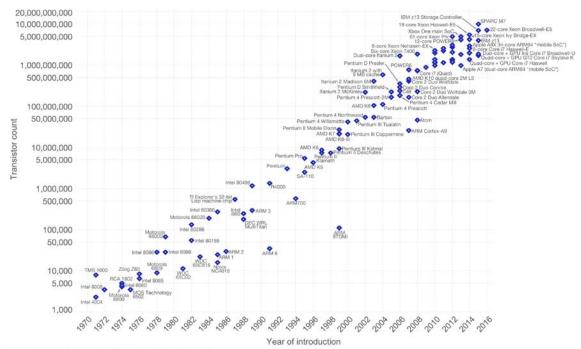
#### Moore's Law



#### Moore's Law – The number of transistors on integrated circuit chips (1971-2016) Our World



Moore's law describes the empirical regularity that the number of transistors on integrated circuits doubles approximately every two years. This advancement is important as other aspects of technological progress - such as processing speed or the price of electronic products - are strongly linked to Moore's law.



Data source: Wikipedia (https://en.wikipedia.org/wiki/Transistor\_count) The data visualization is available at OurWorldinData.org. There you find more visualizations and research on this topic.

Licensed under CC-BY-SA by the author Max Roser.

ourworldindata.org

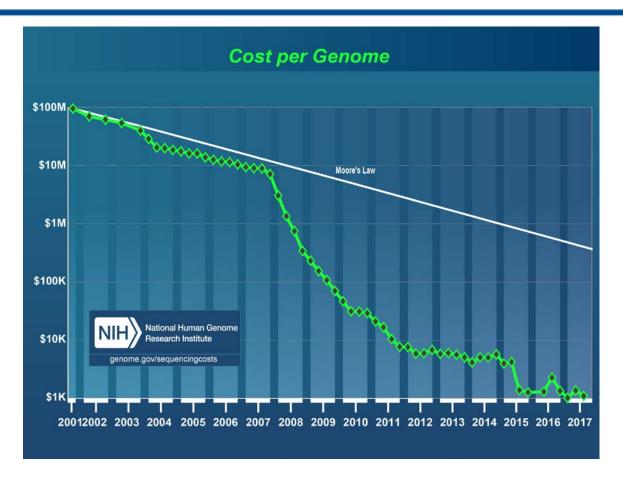
## Moore's Law was a *self-fulfilling* prophecy



- Staying on the curve has depended on investments, by many players, to developing innovative processes years ahead of revenue
- Anticipation enabled innovation

#### Not all curves are like Moore's A JOHNS HOPKINS





https://www.genome.gov/sequencingcosts/

#### Relevant needs



- Prevent iatrogenic harm
- Prevent/reveal errors
- Reduce time to accurate diagnosis
- Reduce wasteful care
- Improve coherence of care
- Patient-centered care (empowerment)
- Minimize context disruption for providers

## How can health systems foster positive disruption?



- Identify testing pathways that could be short-circuited by specific POC tests for common diagnoses/problems
- Estimate total costs of current versus anticipated solution
- Articulate the value of positivelydisruptive technology solutions

## What does the future look like?



- Rapid, accurate, inexpensive diagnostic devices in the hands of clinicians and then patients
- Multi-omic integration of tests on chip
- Al-assisted management of signal and noise

Who will drive, and who will follow?