Positively Disruptive - Next Frontier in Point of Care

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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 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 multiple tests
• 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 tests
• Wait for result (hours or days)
• Return to clinic or discuss (hours or days)
• May require further iterations

Benefits:
• Reduce cost of care (fewer tests)
• Reduce time to accurate diagnosis
• Improve coherence of care
• Patient-centered care
• Minimize context disruption

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
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

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 – The number of transistors on integrated circuit chips (1971-2016)

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.
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

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 positively-disruptive 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
• AI-assisted management of signal and noise

Who will drive, and who will follow?