The Emerging Role of Digital Diagnostics in Precision Medicine

Harnessing data to transform patient care

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Healthcare Sustainability
A growing global concern

- Aging population
- Declining reimbursement
- Chronic disease
- Skilled workforce
- Quality standards & complexity

Health systems are facing pressure to do more with less
The need for a sustainable solution

*Leveraging data and insights to achieve healthcare's triple aim*

The **power of data and technology** to enable the **transformation from volume to value-based healthcare**.

Source: Institute of Healthcare Improvements

http://www.ihi.org/Engage/Initiatives/TripleAim/Pages/default.aspx

accessed 3/5/2019
Information Overload

Exponential growth in medical knowledge is overwhelming cognition

By 2020, medical knowledge will double every 2 months!

“[The average oncologist] would have to read 29 hrs each work day to stay abreast of new insights... and despite the availability of pathways and guidelines, compliance with evidence is extremely low.”

Source: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3116346/; accessed 1/22/2019
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Changes in Healthcare Environment

_Fundamental changes in science & medicine..._

- **Increased understanding of DISEASE BIOLOGY**
- **Advances in DISEASE CHARACTERIZATION and MOLECULAR INFORMATION**
- **Novel DIAGNOSTIC TECHNOLOGIES enter clinic**
Changes in Healthcare Environment
...and fundamental changes in data & IT

REAL WORLD DATA

New and alternative DATA SOURCES available at scale

INTEGRATION & ANALYTICS

Initiation of DATA INTEGRATION AND ANALYTICS

PAYERS

Increased focus on OUTCOME and VALUE-BASED CARE
Challenges - Increasing Complexity

*Layers of interdependent data adds complexity at various levels*
Personalized Healthcare

Next wave of Personalized Healthcare coming within reach

- **Individuals**
- **Specific groups**
- **Broad segments**

Patient scope: until 1990s, 2000/2010s, 2020+
Opportunity – Leverage Healthcare Data

More data will be captured and stored than ever before

1 International Data Corporation, US only;
2 ONC/American Hospital Association (AHA), AHA Annual Survey Information Technology Supplement
3 Big data analytics in healthcare: promise and potential (Raghupathi and Raghupathi);
"I think you’ll find that mine is bigger..."
Meaningful data

High quality data with a purpose: to answer key scientific questions

AT SCALE

Covering enough patients to be generalizable
Advanced Analytics to derive new insights from MDAS
Opportunity Of Digitalization in Healthcare

*Data-driven insights improve patient care & enable R&D*

**Access Meaningful Data at Scale (MDAS)**

- Clinical trial data
- Diagnostic / molecular data
- Longitudinal Real-world data

**Create Insights**

Advanced analytics of integrated data & decision support

**Realize Value**

- Improve access & personalized patient care
- Drive more effective and efficient R&D

Feedback & learning
Clinical Decision Support For Precision Medicine

Turning insights into action

Opportunities for decision support

Growing complexity of DATA

Growing complexity of DISEASE

CURRENT FOCUS

Oncology

OTHER AREAS OF POTENTIAL FOCUS

Neurology

Immunology/ID

Cardiology

Respiratory

Diabetes

Coagulation

Complexity of data and disease requires Decision Support
Digital Transformation

*Clinical Decision Support supplements physician knowledge*
Data, Analytics & Decision Support – Examples Overview
*Transforming data into actionable insights*

- **R&D**
  - Antibiotic susceptibility testing

- **Digitally-Augmented Diagnostics**
  - HIV monitoring

- **Clinical Workflow**
  - Workflow solutions for multidisciplinary care teams
The Cancer Patient Journey
A complex workflow with multiple stakeholders

- Pre-Diagnosis: Emergency, Primary Care, Screening
- Diagnosis: Labs, Image, Organ Specialist, Pathol, Radiol
- Decision: Tumor Board, Decision-maker
- Treatment: Clinical Specialist, Nurse Specialist
- Survivorship: Recurrence, Remission

Admin = PAS
Labs = LIS
Images = PACS
Clinical = Notes or EMR
Decision time

*The tumor board – potentially the most important 3 minutes in cancer care*

Tumor boards provide a multidisciplinary approach to cancer treatment planning. *(National Cancer Institute, 2012)*

Accepted and established part of the care of cancer patients for decades. *(Keating et al, 2013)*

96% of respondents to an ASCO survey reported tumor boards to be beneficial for patients and of high-educational value *(El-Saghir et al, 2015)*
Tumor Boards...the evidence

Improving the quality of care and outcomes for cancer patients

Systematic literature review (Pillay et al, 2015)

27 studies

4-45% had their diagnostic report changed.

Patients were more likely to receive more accurate and complete pre-operative staging

Retrospective longitudinal national cohort study (Pan et al, 2015)

MDT care significantly associated with higher survival rate of patients with stage III and IV NSCLC
Tumor Boards...the evidence

Or maybe not improving quality and outcomes?

Systematic Literature Review (Taplin et al, 2015)

56 studies

MDTs improve therapy planning, adherence to recommended preoperative assessment, pain control, and adherence to medications.

No convincing evidence that MDTs affect patient survival or cost of care, or studies of how or which MDT processes and structures were associated with success.

Survey study (Keating et al, 2012)

136 VA medical centers

Observed little association of multidisciplinary tumor boards with measures of use, quality, or survival
Tumor Boards...the evidence

*Factors that impact on decision-making and decision implementation*

**Impact on decision-making**
- Inadequate clinical information
- Lack of investigation results
- Non-attendance of key members
- Teleconferencing failure

**Impact on decision implementation**
- Non-consideration of patients’ choices or co-morbidities
- Disease progression at the time of implementation
Tumor Boards...the challenges

*How to achieve positive outcomes*

1. Ensure access to the right data at the right time
2. Improve the ease of preparation for tumor board
3. Improve & standardize conduction of tumor board

1. User-centered design methodology
2. Clinicians/Hospitals as development partners
3. Goal to augment, not change, clinical workflow
Digitization of Tumor Board information
*A workflow solution for Oncology care teams*

A New Software Platform to Improve Multidisciplinary Tumor Board Workflows and User Satisfaction: A Pilot Study

Elizabeth A. Krupinski¹, Merce Comas², Leia Garrote Gallego³
Clinical Workflow Solutions

**Optimizing workflow for multidisciplinary care teams**

<table>
<thead>
<tr>
<th>Use case / need</th>
<th>Applications in infectious diseases, cardiology and oncology</th>
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<tbody>
<tr>
<td>Time-consuming process</td>
<td>Collect Patient Data, Coordinate Logistics, Prepare For Meeting, Conduct Meeting, Document Decisions</td>
</tr>
<tr>
<td>Lack of standardization</td>
<td>Lack of specialized solution</td>
</tr>
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**Example oncology**

Oncologists spent 53% & radiologists 12% less time in tumor board meeting preparation, according to new study results, published in Journal of Pathology Informatics.¹

¹ [http://www.jpathinformatics.org/article.asp?issn=2153-3539;year=2018;volume=9;issue=1;spage=26;epage=26;aulast=krupinski](http://www.jpathinformatics.org/article.asp?issn=2153-3539;year=2018;volume=9;issue=1;spage=26;epage=26;aulast=krupinski)
Tumor Board Software Solution

More of the pathologists time was spent reviewing pathology reports

Result
Pathologists performed less non-pathology related tasks.

And.....
The surgeon, oncologist & radiologist all spent more time reviewing the pathology reports prior to the tumor board.
Clinical Workflow Solutions

Advancing Clinical Decision Support for Oncology care teams
Decision Support

*Decision support connecting bench and bedside – via data*

1 electronic medical records, registries, diagnostic data incl. sequencing, a.o.
Clinical Decision Support Closing Gaps

*Providing solutions along entire patient journey*

- Diagnosis
- Clinical Decision Support
- Treatment decisions
- Monitoring / survivorship
- Treatment
- Clinical trials
- Established therapy option
Doing now what patients need next