Building Genomic Medicine Capability

Challenges and opportunities of big data

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Personalised medicine will enable the much needed paradigm shift in clinical care delivery, but we will need appropriate tools & know-how to realize the model and implement the vision.

→ How to accelerate this paradigm?
• The selected cancers are:
  • **Triple Negative Breast Cancer**
  • **High-grade Serous Ovarian Cancer**
  • **Leukemia (AML/MDS)**
  • **Leukemia (CLL)**
  • **Lung**
  • **Melanoma**
  • **Prostate**

• Focus on patient impact and reduction in mortality world-wide
• Comprehensive, spanning the cancer care continuum
• Collaborative, internal and external
• Innovative, in organizational constructs and technology
Moonshot Platforms

- Center for Co-clinical trials
- Institute for Personalised Cancer therapy
- Cancer Control
- Early detection/Diagnostics
- Clinical Genomics
- Immunology
- Institute for Applied Cancer Sciences
- Translational Research Continuum
- Research Genomics/Informatics
- Big Data
- Adaptive Learning
Adaptive Learning in Genomic Medicine

Clinical information and tests

Consent, Biospecimen Collection, QC, Banking, Biomolecule Processing

Integrated Patient Data Warehouse

Big-Data Analytics

Research Data:
- Omic profiling
- Systems Pharm
- Preclinical Rx- TRC

TCGA/ICGC
- Pubmed
- Patent db
- Social media
- Other

Decision Support

Research & Operations

Big Data Environment
Big (well, it is Texas after all) Data Analytics

Longitudinal Patient Data Warehouse

Clinical & Genomic Data

Massive Data Analytics

Research & Development
Support and enable research

Operation Efficiency
Efficacy/Efficiency/Cost analyses

Clinical Decision Support
IBM-Watson Cohort design

Knowledge Base:
End user interface with understandable & actionable data

Clinicians
Researchers
Bioinformaticians
Leukemia Project

• 1000 leukemia patients by fall 2013– MDS/AML/CLL focus
• Focused on but not limited to newly diagnosed patients
• Samples taken at diagnoses/presentation and thereafter at each patient visit.
• Saliva/buccal for normal, bone marrow and/or peripheral blood
• Bone marrow/bloods accessed in context of normal clinical workup/care
• All samples collected and held in CLIA compliant chain of custody
Leukemia Project

- Exome sequencing, low-pass WGS
- Data generated on normal/tumor (presentation) and from relapse sample(s)
- All clinical data currently collected in Departmental database plus extraction from patient records
- A few early potential questions –
  - MDS to AML progression
  - risk of death during induction chemotherapy
  - subclonality and risk of relapse/progression
• Other Opportunities (some of them)

  – Genetic/genomic heterogeneity

  – Comprehensive cancer patient genomics –
    • Interplay of germline and somatic genomics in the same patient

  – Impact of genomics on outcomes
    • adverse events
    • survivorship
Genetic heterogeneity is a key determinate of variation in outcomes

- What are the cancer genes operative?
- What is the level of intra-tumor heterogeneity?

- What are the germline/somatic sequence variants that are influencing factors including:
  - Drug metabolism
  - Immune response
  - Cancer susceptibility
  - Toxicity

- How do these factors interact and influence outcomes?
Comprehensive Cancer Patient genomics
a tale of (at least!) two genomes

- Risk and response to exposure: Tobacco, UV radiation, diet, stress
- Treatment: Response, acute toxicity, resistance
- Survivorship: Long term toxicity, recurrence, second primary cancers
Adaptive Learning/Leukemia Team

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