



2018 SKILLS BUILDING PROGRAM



# BIG DATA, ARTIFICIAL INTELLIGENCE AND DECISION SCIENCE IN HEALTH AND NUTRITION

## AI and Health: Promise, Probability, Possibility and Pitfalls

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*In partnership with*





- TechEmergence's goal is to examine the bottom-line impact of AI, and help enterprises and governments adopt the technology strategically in order to achieve outcomes
- TechEmergence interviews hundreds of AI executives and practitioners every year
- Focus on:
  - **Possibilities** (applications) of AI
  - **Probabilities** (impacts / trends) of AI

# Outline



- The advantages of a fresh start with AI and data science in health in LMIC contexts
- Health and AI – a compelling vision for efficiencies and improved population health, 5-year vision
- Understanding AI's capabilities in 5 minutes
- AI Use-Cases – low-hanging fruit
  - **Focus 1:** Leveraging existing data assets with more advanced analytics
  - **Focus 2:** Health service delivery scaling expertise with AI
  - **Focus 3:** Disease and epidemic response prediction and technology
  - **Focus 4:** Health financing applications
  - **Focus 5:** Health information system basics
- Concluding thoughts – takeaways for MOH Senior Management

# A Fresh Start Has its Advantages



## Low and Middle-Income Countries

### AI Advantages

- Huge opportunity to augment existing health workers with expert knowledge and abilities
- Ability to start from scratch with more agile and accessible data infrastructures
- Decades of development in HMISs – can often report more than developed countries
- Significant leapfrog potential

### AI Disadvantages

- Lack of trained medical professionals and data science experts
- Lack of existing digital infrastructure to collect and leverage electronic medical health records
- Lack of data governance and interoperability
- Lack of data science skills
- Digital divide and the lack of data for poorer populations

# A Compelling Future



- The consequences of AI in health have the promise of being vastly more impactful than the internet alone ever was
- Countries beginning to leverage AI and data from a fresh slate can make significant improvements – potentially without significant upfront cost
- Experts today envision a future where:

# A Compelling Future



- People in the most isolated communities receive fast, efficient healthcare
- Health facilities built in locations to best serve a community's needs (staffed appropriately)
- Ongoing patient treatments make care incrementally better and faster for all future patients
- Health resources /staff expand – not through more funds, but from removing tech inefficiencies
- Countries without “legacy” health IT infrastructure can “leapfrog” more established countries with faster, more mobile patient care

# Understanding AI's Capabilities in 5 Minutes



- What are all the factors required in making a judgment or decision?
  - To diagnose this disease or that disease, to prepare for an outbreak, or determine the staffing needs of a given hospital in a given season, etc.
- Which of the types of info that are used to make that decision could be stored in a reliable data format?
  - A column in a spreadsheet, a number, an image, an audio file, etc.
    - If all / most of it could be stored: **GOOD for AI** (example: Staffing needs for emergency room, detecting skin cancer)
    - If all / most of it could not be stored: **BAD for AI** (example: Diagnosing more complex multi-faceted diseases / conditions)
- How many of those necessary data types have we stored or has someone else stored?
  - If someone else has stored that data, have they also already trained an algorithm to make this decision? If so, that's the easiest place to start with AI applications.

# Focus 1: Leveraging Existing Data Assets



- Capability requirements:
  - Some semblance of data infrastructure
  - Data science staff with health data experience
  - Health subject-matter experts
- Data requirements:
  - Requires data with some of the following qualities:
    - Must be accessible
    - Must be reasonably clean and complete
    - Must have a common format
- Cost requirements:
  - Most important “cost”: Time and effort from AI staff and subject-matter expert staff. AI is an iterative process.

# Focus 1: Leveraging Existing Data Assets



- Example 1: Care Pathway Improvement
  - Flagler Hospital leveraged various data sources (EMR, Surgical, Analytics, EDW, Financials) to determine customized care pathways to reduce costs and readmissions for pneumonia. [Ayasdi]
  - <https://www.ayasdi.com/blog/artificial-intelligence/innovators-are-everywhere-how-a-community-hospital-set-the-standard-for-ai/>

# Focus 1: Leveraging Existing Data Assets



- Example 2: Reducing Falls

- El Camino Hospital predicts which individuals are most likely to fall by combing over electronic health records for risk factors and merging the data discovered there with real-time tracking of patients.

- <https://www.usnews.com/news/healthcare-of-tomorrow/articles/2017-10-31/hospitals-utilize-artificial-intelligence-to-treat-patients>

# Focus 1: Leveraging Existing Data Assets



- Example 3: “White Collar Automation” in Health
  - Hill Physicians Medical Group helped to automate the data extraction from its health records, collecting more patient charts for its risk adjustment efforts. [Apixio]
  - <https://www.healthcareitnews.com/news/how-one-medical-group-uses-ai-machine-learning-improve-value-based-care>

# Focus 1: Leveraging Existing Data Assets



- Leveraging existing data assets almost always requires:
  - Existing data science talent
  - Months of data cleaning
  - Lengthy periods of testing / adjusting algorithms
  - Vendors who say otherwise are often lying
- The best source of health data AI ideas is: Learning from existing precedents from other organizations.

## Focus 2: Service Delivery Scaling Expertise



- Capability requirements:
  - Smartphones or tablets, internet connections
- Data requirements:
  - Many simple diagnostic applications require no data handling (systems are already trained)
- Cost requirements:
  - Many solutions are available open-source, or can be used free for humanitarian purposes, often via partnerships

## Focus 2: Service Delivery Scaling Expertise



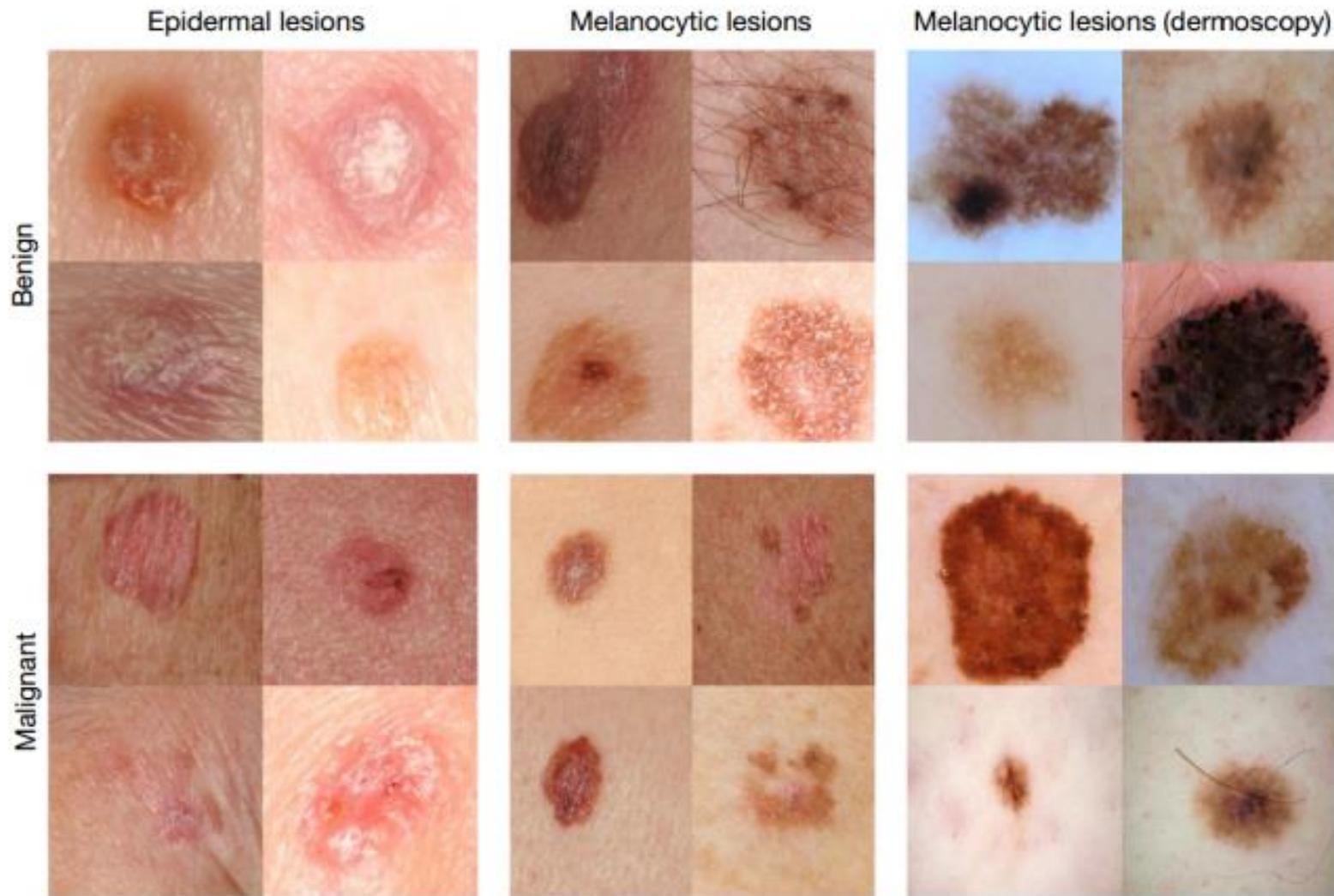
- AI can help countries with many hard-to-reach communities (lack of PhDs, or simply geographical distance)
- AI allows health workers with mobile devices to make diagnostic / treatment decisions at a higher level
- Nearly **80%** of the AI health innovators feel that this dynamic would make the biggest impact in LMICs in 5 years

## Focus 2: Service Delivery Scaling Expertise



- Machine vision applications:
  - Retinal diseases, Inner ear issues
  - Skin lesions, infections, or skin cancers
- Chemical testing:
  - Projects like CellScope are working on detecting parasites from blood samples
- Possibly treatment suggestions:
  - Recommending a course of treatment for an infection
  - Recommending cataract surgery
  - Determining when no treatment is needed, or it may be too early to tell
  - Recommending when a physician needs to be consulted, or when a PhD needs to be seen (will vary per application)

# Focus 2: Service Delivery Scaling Expertise



## Focus 2: Service Delivery Scaling Expertise



- Mobile AI health-tech exists on continuums:
- Solutions must be assessed individually, factors to be considered might include:

Easier	Harder
Open-source	Not open-source
Works without internet connection	Requires internet connection
Works with almost any android phone	Requires more modern cell phones (Samsung, more recent models)
Currently working with repeatable success in the field	Currently in research and development

# Focus 3: Disease Prediction



- Capability requirements:
  - Some semblance of data infrastructure
  - Data science staff with specific experience in infectious diseases
- Data requirements:
  - Tremendous sums of variable data
- Cost requirements:
  - Data science talent
  - Time to experiment with features / data (not easy!)

## Focus 3: Disease Prediction (Bespoke Data Needed)



- For example, predicting Dengue outbreak in Malaysia by epidemiologist Dr Dhesi Raja required:
  - *“The system developed by AIME analyses not only public health data, but other data from other sources, such as weather, wind speed, previous outbreaks and a location's proximity to large bodies of water - anything which might influence the behavior of the mosquitoes that carry the disease. They also look at things like population density in the area, peoples' health records and their income level.”*
    - <https://reliefweb.int/report/world/could-artificial-intelligence-help-us-predict-next-epidemic>

# Focus 4: Health Financing Applications



- Capability requirements:
  - Some semblance of data infrastructure for billing and finance
  - Data science staff with experience in finance
- Data requirements:
  - (Varies widely depending on application)
- Cost requirements:
  - Data science talent
  - Time to experiment with features / data
    - ^ Arguably much easier than epidemic prediction

# Focus 4: Health Financing Applications



- Use-Case 1: Insurance Risk Prediction
  - More nuanced data can be used to inform risk models (beyond health / financial records, including social media, purchase history outside of health, and more) – very useful for LMICs
- Use-Case 2: Cost Reduction for Care Pathways
  - AI can be used to suggest less costly care pathways for patients – using treatment and billing data from previous patients
- Use-Case 3: Billing or Medical Claims Fraud Detection
  - Data from previous fraudulent claims / payments can be increasingly used to inform powerful fraud detection models, “flagging” suspicious activity for human analysis

# Focus 5: Health Information System Basics



- Health AI experts and practitioners around the world agree on one thing:
  - Data collection / storage needs to be fundamentally changed in order to allow for the cost savings and improved outcomes of AI solutions to be realized
- They agree on something else:
  - They don't know how to do this yet
  - Many AI practitioners are skeptical of the timelines for high-income countries to develop these strategies



- While there is no “blueprint”, there are best practices:
  - Build data / health IT infrastructures in a way that makes them accessible to APIs and data science tools
    - Network with peers who are at the cutting-edge of innovation, and learn the technologies / API requirements to be able to access the most cutting-edge tech
  - Create laws and regulations to protect privacy and focus on anonymity, but to keep data access open and available

# Takeaways for MOH Senior Management



- Avoiding “toy” applications, prioritizing meaningful objectives (in this respect, AI is not unique, it’s tech):
  - Understand the capability-space of the technology (resources page)
- A process for adoption of diagnostic and predictive technologies:
  - Assessing skill and expertise assets and needs
  - Assessing current high-priority health challenges (geographic regions, specific diseases, etc)
  - Assessing technology capabilities available

# Takeaways for MOH Senior Management



- **Need to customize AI to needs of country:** While AI poses significant, low-cost opportunity for diagnostics (and has plenty of other valuable use-cases), it is best implemented wherever it serves the needs of the country – factoring for the resources and time required.
- **An AI identification assessment** might be useful to link biggest challenges in the health sector with AI-derived solutions to address them

Health system challenge	Current solutions	AI-derived solutions to enhance challenges

# Conclusion



- That's all folks!
- Feel free to stay in touch, or follow up with questions:



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- AI in health executive overview:
  - <https://www.techemergence.com/machine-learning-in-healthcare-executive-consensus/>
  - <https://www.techemergence.com/investing-in-ai-healthcare-steve-gullans/>
- Diagnostic AI – representative use-caes:
  - <https://www.techemergence.com/machine-learning-medical-diagnostics-4-current-applications/>
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  - <https://www.techemergence.com/diagnosing-and-treating-depression-with-ai-ml/>