PERSONALIZED HEALTHCARE
CHALLENGES FOR THE FUTURE IN INFECTION PREVENTION & CONTROL

dr. Annemarie Braakman-Jansen
Prof. dr. Lisette van Gemert-Pijnen

Persuasive Health Technology Lab
Dept. Psychology, Health & Technology
University of Twente
Enschede, the Netherlands
OUR PROFILE: HIGH TECH HUMAN TOUCH

The University of Twente is noted for:

• Excellent education & research
• New technology as a catalyst for change, innovation and progress
• Combination of technology & social sciences
• Entrepreneurial attitude

Themes: ICT, Nano-, Bio- Engineering, Geo-information, Management & Behavioral Science
the technology sciences

the social sciences

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3TU Federatie
THIS TALK

• What are the paradigm shifts in Healthcare?
• What are the challenges? Value creation of Big Data
• What are we doing? Our new research projects in infection prevention & control
1) From disease centered towards patient centered care
   - health as the ability to adapt and to self manage, (Huber, 2011)

   - Disease-centered care:
     - Decision making is centered around clinical expertise & data from medical evidence & tests

   - Patient centered model:
     - Patients actively participate in their own care
     - Services are focused on individual needs and preferences
     - No one size fits all...

Patients are empowered to take an active role in the decisions about their own health
2) Growth in collection of Medical & Personal data

- There is boundless data in healthcare about every patient, condition, procedure and drug use across multiple providers & organizations.
- Rapid growth of data collected by wearable technology by individuals (Quantified Self Movement).

Potential for personalized healthcare:
- Tailoring decisions, medication, products to the needs of an individual, instead of what’s best for a group of patients.
3) Amount of data is growing explosively and is available for anyone
   - Breaking the wall of knowledge
   - Health Industry blurs medicine

Systems determine our behavior!
4. Pervasive tech: breaking wall of connectivity
   • A fusion of Technologies (mobile health environments)
   • Cloud based Healthcare Information Technology

5. Science: tech needed to collect, store, analyse, interpret data
   • Flow of data management; Safety, security
   • Age of Algorithms: real-time personal coaching (UT/UMCG)

Healthcare informatics and advanced analytics (data science) will increasingly be important
The datification of our world gives us boundless data in terms of **Volume, Velocity, Variety & Veracity**.

Advanced analytics allows us to leverage all types of data to gain insights and add **Value**.

**CHALLENGE: BIG DATA; NOT ALL DATA IS BIG**

Marr 2015
Wisdom is the effective use of knowledge in decision making.
WHAT ARE THE CHALLENGES?

VALUE OF BIG DATA
BOTTOM-UP MEDICINE
DATA GENERATED BY PATIENTS; 24 H MONITORING

VALUE: MEANINGFUL Real-Time FEEDBACK
Super surveillance... Smart Blood to track 24h, everywhere
The Next Chapter for Flu Trends

Thursday, August 20, 2015

Posted by The Flu Trends Team

When a small team of software engineers first started working on Flu Trends in 2008, we wanted to explore how real-world phenomena could be modeled using patterns in search queries. Since its launch, Google Flu Trends has provided useful insights and served as one of the early examples for "nowcasting" based on search trends, which is increasingly used in health, economics, and other fields. Over time, we’ve used search signals to create prediction models, updating and improving those models over time as we compared our prediction to real-world cases of flu.

Instead of maintaining our own website going forward, we’re now going to empower institutions who specialize in infectious disease research to use the data to build their own models. Starting this season, we’ll provide Flu and Dengue signal data directly to partners including Columbia University’s Mailman School of Public Health (to update their dashboard), Boston Children’s Hospital/Harvard, and Centers for Disease Control and Prevention (CDC) Influenza Division. We will also continue to make historical Flu and Dengue estimate data available for anyone to see and analyze.

Flu continues to affect millions of people every year, and while it's still early days for nowcasting and similar tools for understanding the spread of diseases like flu and dengue fever—we’re excited to see what comes next. To download the historical data or learn more about becoming a research partner, please visit the Flu Trends web page.
COMPUTERS WITH ATTITUDE NOT ON THE HORIZON

“Watson is a cognitive technology that processes information more like a human than a computer—by understanding natural language, generating hypotheses based on evidence, and learning as it goes. And learn it does. Watson “gets smarter” in three ways: by being taught by its users, by learning from prior interactions, and by being presented with new information. This means organizations can more fully understand and use the data that surrounds them, and use that data to make better decisions.”

What is IBM Watson?

It Was A Bad Idea For Watson The Supercomputer To Learn The Urban Dictionary…

Value: Sense making Communication (NLP, contextualized)
WHAT ARE WE DOING? SOME EXAMPLES

DIGGING INTO THE VALUE OF DATA

- Big Data experts’ views
  - Psychology
  - Philosophy
  - Computer Science
  - Business Administration
  - Law
  - Data Science

- HCWs’ experiences
  - Cardiology
  - Microbiology
EMPOWERMENT
CRITICAL THOUGHTS

Profiling
• Filter bubble: algorithms decide what information you get...
• Personalizing without knowing persons
• Once assigned to a group...always assigned to that group?

Autonomy
• Data sharing > data ownership
• Liability, who is responsible when wrong decisions are made based on an algorithm?
• Algorithms rule; are we still in control?

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Disruptive business models; who benefits?
Liability; Who is liable when things go wrong?
Accountability; Who has to prove what and how it is regulated?
Interpretation; algorithms versus a ‘clinical eye’

“Before I write my name on the board, I’ll need to know how you’re planning to use that data.”
• Knowing what vs. knowing why
  • Relationships are correlational, not causal
  • Quantity above quality
  • Requires a shift in attitudes towards (medical) decision making

• Trustworthiness of data: Reliability & validity of measures
  • Those who generate data, do not have the knowledge to analyse. Those who analyse lack domain insights
  • Data education to support critical and creative thinking
  • Multidisciplinary Data-skills
EVIDENCE
CRITICAL THOUGHTS

• Search for patterns rather than testing hypotheses
• Critical volume, variety, veracity of data
• Beyond RCTs; Life Logging
• Power of Analytics (Machine learning)
• Bottom up evidence (reverse epidemiology)

... with knowledge from large populations we are able to tailor and personalize treatments
OUR RESEARCH: BIG DATA IN INFECTION PREVENTION
COOPERATION HEALTH-BUSINESS-SCIENCE

- **Real time** platform to monitor surveillance and HRMO problems (IDMC system) to detect MDRO problems
- Pathogens and HRMO are monitored real-time (over 5 years)
- We will transform the **smart surveillance system** towards an **Early Warning system (EWS)** for HRMO by:
  1. Integrating geospatial data with epidemiological and clinical data
     - Path of movements (HCWs inside/outside hospital)
Patient Mobility & Infections
eSurveillance for just in time Interventions
2. Development of **Predictive model** to analyse geospatial, laboratory, epidemiological and clinical data

1. Exploratory spatial analysis of historical data to investigate emerging patterns

2. Regression model will be developed to estimate the posterior distributions of outbreaks (integrating clinical, epidemiological & geospatial data)

3. Predictive modelling will be used at the level of (sub)units in a hospital
3) **User centred methods** to design a data dashboard
   - To tailor the predictive decision model to **end users (A-Team members)**
   - CeHReS- roadmap for eHealth design will be used
   - Persuasive design and usability principles to optimize the system and comprehensible visualization of data
eZoon Platform; Learning environment

Solve the Outbreak

Your mission, if you choose to accept, is to get clues and analyze data to solve the outbreak and save lives! In this fun app, you get to be the Disease Detective.

Do you quarantine the village? Interview people who are sick? Run more lab tests? The better your answers, the higher your score - and the quicker you'll climb the ranks to become a decorated Disease Detective. In level 1, you'll start out as a Trainee and can earn badges by solving scenarios, with the goal of earning the top rank: Disease Detective.

- Geodata for real time decision support (e.g., MRSA; avian influenza);
- Game-based simulations to train decision making: how to deal with dilemmas?
- Geoinformatics to develop adaptive online question-answering services to inform the general public (Q&A database Germany, Netherlands)
Digital surveillance systems to support proactive decision making

- Technology can help:
  - information can be more easily stored, accessed and tailored
  - real-time monitoring capability (mobile, pervasive tech)
  - automated and just in time feedback can be generated (machine learning)
  - personalized and persuasive visualizations to understand data
  - interoperability and connectivity (semantic, system, social) to support standardization and mobility
MOOC eHealth

https://www.futurelearn.com/courses/ehealth
QUESTIONS?

@ l.m.a.braakman@utwente.nl
@ j.vanGemert-Pijnen@utwente.nl