LEE KONG CHIAN
SCHOOL OF
MEDICINE

NANYANG TECHNOLOGICAL UNIVERSITY | Imperial College London

REDEFINING MEDICINE, TRANSFORMING HEALTHCARE

Major Trends in Changes to Healthcare Delivery

The Need for Bold Actions in Great Times

Healthcare challenges in developed nations
(also relevant to Singapore)

- Rapidly increasing cost of health care
  - rising medication, labor, and energy costs
  - expected annual average growth of 5.3 percent until 2017

- Rapidly ageing population
  - In 2030, 560 million people will be age 65 and above

- Global shortage of 7.2 million healthcare workers and would increase to 12.9 million by 2030

- Increasing incidence of chronic diseases
  - uses a disproportionate amount of healthcare resource (e.g., end-of-life care takes up 25% of healthcare spending in USA)

(Economist Intelligence Unit 2013; WHO 2013)

A chasm in healthcare delivery remains amidst the pressures from the great challenges and inertia–individuals and organizations–for change

But current measures are at best incremental improvements

- How far do quality improvement projects create a systemic level improvement of healthcare delivery?
  - Good efforts to improve processes within a service delivery paradigm
    - But what needs to change is the paradigm; not the process

- Current models of healthcare are physician-centric
  - Despite measures to delegate previously physician duties to other healthcare professionals
    - Healthcare delivery models are not patient centric
    - Interprofessional healthcare teams are not nimble and not effectively integrated within practice and within healthcare neighborhood

The dogmas of the quiet past are inadequate to the stormy present. The occasion is piled high with difficulty, and we must rise with the occasion. As our case is new, so we must think anew and act anew.
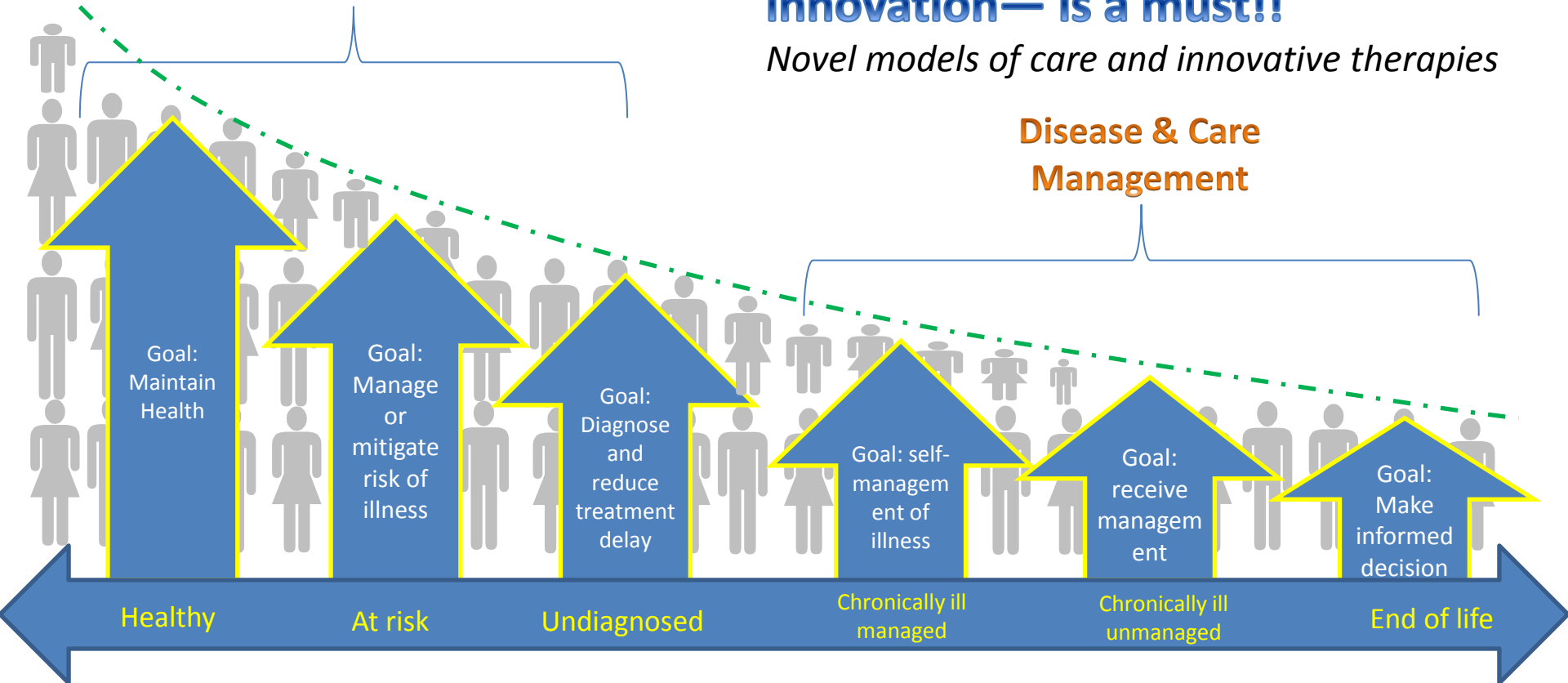
Abraham Lincoln

Prevention/Wellness

Innovation—disruptive innovation— is a must!!
Novel models of care and innovative therapies

Disease & Care Management

Goal: Maintain Health

Goal: Manage or mitigate risk of illness

Goal: Diagnose and reduce treatment delay

Goal: self-management of illness

Goal: receive management

Goal: Make informed decision

Healthy

At risk

Undiagnosed

Chronically ill managed

Chronically ill unmanaged

End of life

Continuum of care

The Key

Personalization of Healthcare

- **Diagnostics**: Help to reach right diagnosis

- **Therapeutics**: Provide effective treatment

- **Prevention**: Enable us to spot the disease even before symptoms appear

- **Predictive Medicine**: Identify our own predisposition to disease

Intergation of Healthcare

Coordinated system of care

- Provides both medical and mental/behavioral health services

- Address the whole person, not just one aspect of the consumer's healthcare needs

- Across life cycle

Industrialization of Healthcare

changes in the organization of work in the healthcare sector which mirror those that began in other industries a century ago with:
- increasing division of labor

- standardization of roles and tasks

- rise of a managerial superstructure

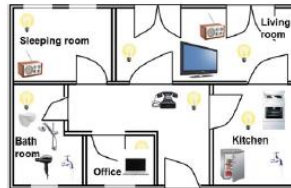- degradation (or de-skilling) of work

Empowered patients

- Patients will be in charge of their care management

- "Shared care" between patient and healthcare provider

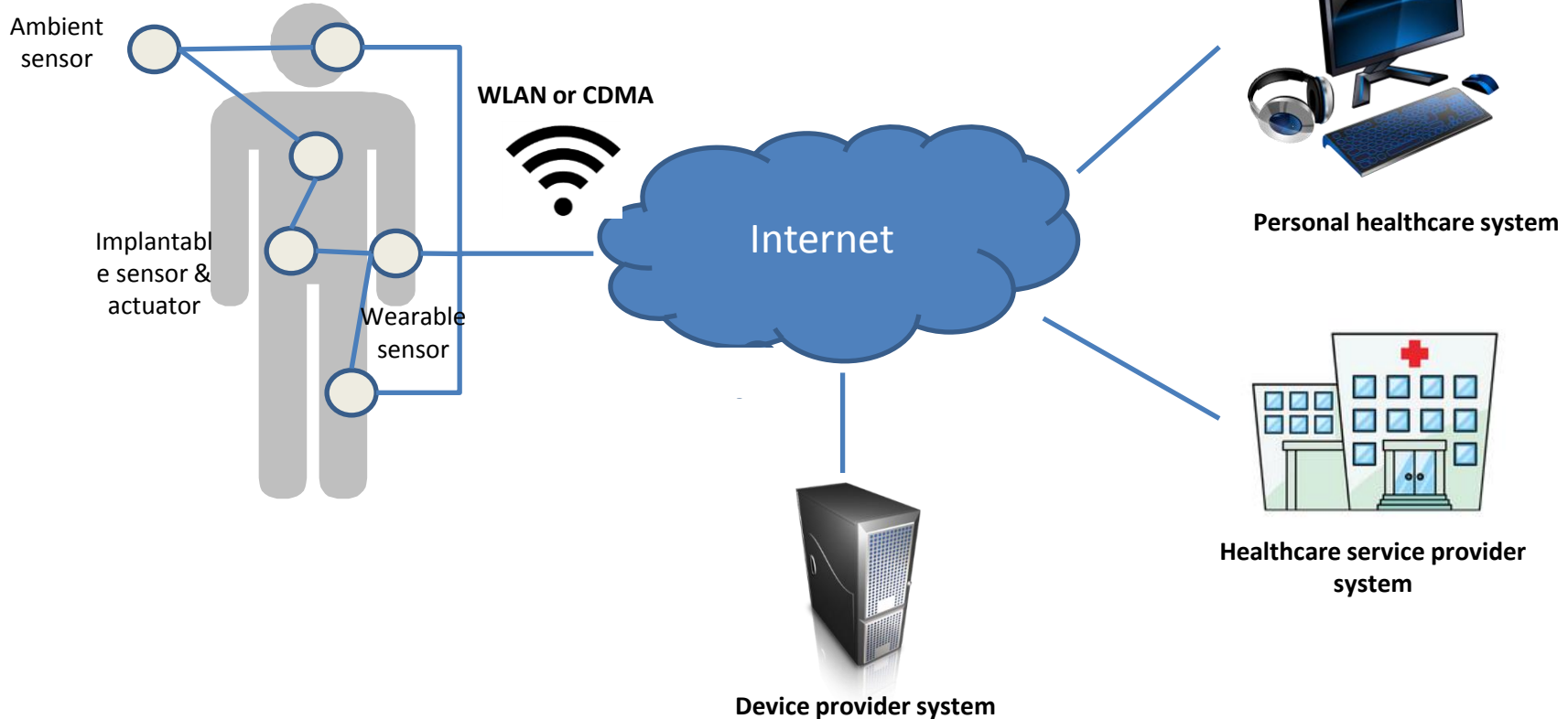Wearable devices that sends data wirelessly to a smartphone

Social networking websites

Sensor rich homes

# Empowerment of patient in an ubiquitous healthcare system

Ambient sensor

Implantable sensor & actuator

Wearable sensor

WLAN or CDMA

Internet

Personal healthcare system

Healthcare service provider system

Device provider system

Earlier Detection

- Acceleration of the ability for early diagnosis that is vital for early treatment and illness prevention

Breath tests using nanotechnology; breathalyzer test embedded with a nanotech chip

"Sniffing" out cancer
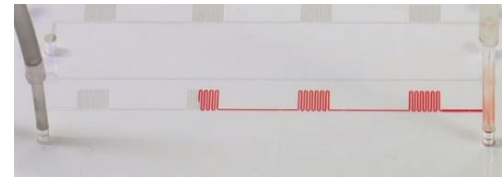
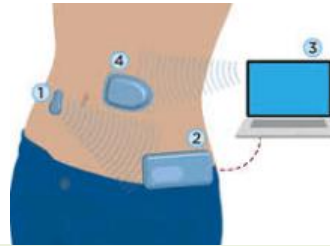A low-cost integrated microfluidic-based diagnostic device
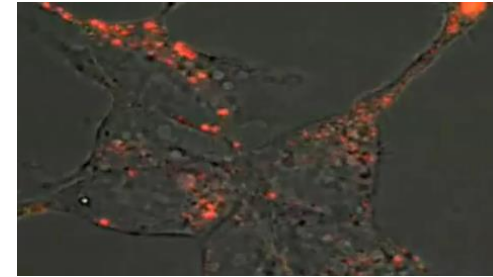
Lab-on-a-chip

Genetic testing

High tech healing

- Next generation implants and ingestible

  - Monitor disease progression

  - Dispense medications

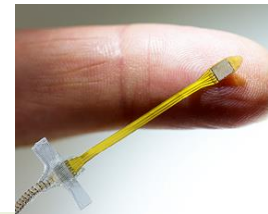 - Assist and replace malfunctioning organs and limbs

A nanosensor injected into the skin (like a tattoo dye); the "tattoo" will fluoresce under IR informing the diabetic patient of his glucose level

Glucose-Monitoring Tattoo

The glucose sensor wirelessly transmits glucose readings to the receiver and laptop contains algorithm that determines insulin dose

Artificial pancreas for diabetics

Image data sent from a spectacle-mounted camera are processed by a mini-computer and sent to a neuron-stimulating array of 60 electrodes

Artificial retinas for blind patients

12

Resources

- Roles of care providers will change

- More resource widely available through remote technologies and online communities

Sensor laden robots (with emotions too!)

Robots that can localize itself, navigate autonomously, and approach a user in a socially acceptable manner

ELearning for undergraduate professional education customizable to local context

Summary

- Innovation is the key in transforming healthcare delivery
  - Personalization
  - Integration
  - Industrialization

- Innovation
  - Generates ripple effects on processes → requires ongoing attention to maintain and adapt changes

- Singapore is well-poised to
  - But
    - Singapore needs more champions of health system innovation, specifically 202 of them by 2020

People – not diseases or technologies – are the central concern of health care and people are much more than their illnesses

Institute of Medicine 1998

LKC School of Medicine
Population Health Sciences and Health Services and Outcome Research Strategy

Population health measurement, quality and cost-effectiveness of care

Innovative models of healthcare delivery

Preventive medicine: sustainable health care

eHealth

1. Innovative approaches to population health measurement and management

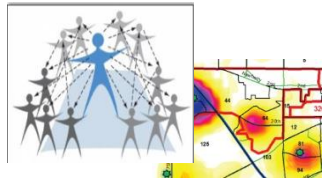2. Assessment of performance and quality

1. Health City

2. Primary care, home-based care, day care

1. Smart sensing

2. Health promoting hospitals

1. Digital healthcare solutions

2. Basic right: clinical and health information

Grooming a new generation of population health science practitioners

- Institute of Population Health Sciences (IPHS)
  - Will be created jointly with Imperial College School of Public Health
  - Foster interdisciplinary collaborations and partnerships within NTU and NHG

- Training, teaching, and capacity building
  - Potential Master's of Science in Health Services Research or PhD study

Thank you

A/Professor Josip Car

Director of Health Services and Outcomes Research Programme

Lee Kong Chian School of Medicine

Imperial College & Nanyang Technological University

&

Director of Global eHealth Unit

School of Public Health, Imperial College London

Email josip.car@ntu.edu.sg