Two “Wicked Problems” in Healthcare: The Case of Cancer

see: https://www.wickedproblems.com/1_wicked_problems.php

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Wicked Problems

1. **Connecting Health.** How do we use CSLS to create adaptive, supportive health systems to nudge healthy behaviors, close gaps, and prevent error?

2. **Moonshot.** How do we use CSLS to integrate knowledge and double our pace against a complex set of diseases?
1. Connecting Health

“We know what kinds of things need to be done to increase the number of people who survive from 350 per day to 1,000.”

John Seffrin, CEO American Cancer Society

1. Connecting Health

Figure 1. Trends in Age-adjusted Cancer Death Rates* by Site, Males, US, 1930-2012

*Per 100,000, age adjusted to the 2000 US standard population. †Mortality rates for pancreatic and liver cancers are increasing.

Note: Due to changes in ICD coding, numerator information has changed over time. Rates for cancers of the liver, lung and bronchus, and colon and rectum are affected by these coding changes.


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1. Connecting Health

Figure 1. Trends in Age-adjusted Cancer Death Rates* by Site, Males, US, 1930-2012

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Projected Deaths in US (2016): 595,690

1. Connecting Health

- Susceptibility
- Pre-initiation
- Malignant Transformation
- Evolution/Progression
- Lethal Phenotype
- Death Due to Cancer

Life Span

Birth - Natural Death
I. Connecting Health

Projected Deaths in US (2016):

357,414

238,276 Lives Saved

Avert or Delay its Onset

e.g., 40% Reduction
(experts say 30-50% is behaviorally caused)

Eating healthy & staying active are as important as not smoking when it comes to preventing cancer.

Do your part prevent skin cancer

Birth

Life Span

Natural Death
1. Connecting Health Data Rich Learning System

1. Connecting Health

Behavioral Monitoring, Adaptive Decision Support

Genetically Informed Risk Profile

Real Time, Updated Decision Support (individuals & populations)

Patient Generated Health Data

Personalized Prevention Plans

Population-Derived Algorithms

Primary Prevention

Decision Support Needs

Risk modeling
Diagnostic support
Treatment selection
Guideline adherence
Error detection/correction

Situational awareness
Population health
Continuity of care
Identify side effects
Inform discovery
I. Connecting Health

Patient Rights

Genetically Informed Risk Profile

Real Time, Updated Decision Support (individuals & populations)

Personalized Prevention Plans

Population-Derived Algorithms

Decision Support Needs
- Risk modeling
- Diagnostic support
- Treatment selection
- Guideline adherence
- Error detection/correction

Health Information Exchange
- Hospital Based EHR Data
- Medical Team
- Hospital System
- Medical Researcher
- Patient & Family

- Subjective
  - Chief complaint
  - Patient Reported Outcomes

- Objective
  - Clinical measures
  - Laboratory findings
  - Sensor data

- Assessment
  - Diagnosis
  - Categorical reporting
  - Prognosis

- Plan
  - Treatment planning
  - Self-care planning
  - Post treatment
  - Surveillance

Primary Prevention
1. Connecting Health


Lethal Phenotype

e.g., 40% Reduction

Evolution/Progression

Malignant Transformation

Pre-initiation

Susceptibility

Burden of Disease

Birth

Life Span

Natural Death

Death Due to Cancer
1. Connecting Health

Projected Deaths in US (2016):

268,060

327,630 Lives Saved

\[ \text{e.g., 55\% Reduction} \]
\[ \text{(taking another 15\% for early detection)} \]

**Detect & Eradicate**

**Make That Call**
FOR COLON CANCER SCREENING

**EARLY DETECTION SAVES LIVES**

Burden of Disease

Susceptibility

Pre-initiation

Life Span

Birth

Natural Death
1. Connecting Health

- Proteomically Informed Biomarkers
- Personalized Patient Data Model, Just in Time support
- Data Driven Service Improvement for Practices & Hospitals

Predictive, Low Impact Screening

- Personalized Care

Population Updated Personalization

Health Information Exchange

- Subjective: Chief complaint, Patient Reported Outcomes
- Objective: Clinical measures, Laboratory findings, Sensor data
- Assessment: Diagnosis, Categorical reporting, Prognosis
- Plan: Treatment planning, Self-care planning, Post treatment, Surveillance

- Risk modeling, Diagnostic support, Treatment selection
- Guideline adherence, Error detection/correction
- Situational awareness, Population health, Continuity of care, Identify side effects, Inform discovery
I. Connecting Health

Projected Deaths in US (2016):

- Pre-initiation: 268,060
- Lethal Phenotype: 327,630 Lives Saved

Evolution/Progression

Malignant Transformation

Susceptibility

Pre-initiation

Death Due to Cancer

Natural Death

Burden of Disease

Life Span

e.g., 55% Reduction

1. Connecting Health

Control Growth
I. Connecting Health

Projected Deaths in US (2016):
178,707

Lives Saved
416,983

Lethal Phenotype

*e.g., 70% Reduction* (another 15% for long term control)

1. Susceptibility
2. Pre-initiation
3. Malignant Transformation
4. Evolution/Progression
5. Control Growth

Burden of Disease

Life Span

Natural Death
I. Connecting Health

Personalized (Precision) Treatment Plan

Dynamically Updated Care & Survivorship Plan

Life Long View of Care, Proactive Vigilance Based on Updated Models

Treatment, Survivorship

Control Growth
Wicked Problems

1. **Connecting Health.** How do we use CSLS to create adaptive, supportive health systems to nudge healthy behaviors, close gaps, and prevent error?

2. **Moonshot.** How do we use CSLS to integrate knowledge and double our pace against a complex set of diseases?
2. Moonshot

Projected Deaths in US (2016):

- 178,707 Lives Lost
- 416,983 Lives Saved

Lethal Phenotype

*e.g., 70% Reduction*

Susceptibility

Pre-initiation

Malignant Transformation

Evolution/Progression

Death Due to Cancer

Burden of Disease

Life Span

Birth → Natural Death
2. **Moonshot**

Projected Deaths in US (2016):

- **0** Lives Saved
- **595,690** Lives Saved

**Lethal Phenotype**

* e.g., *100% Reduction*

**Accelerate Research** (5 years in 10)

**Evolution/Progression**

**Malignant Transformation**

**Susceptibility**

Pre-initiation

Birth → **Life Span** → Natural Death

**Burden of Disease**
2. **Moonshot**

**Basic Discovery: Suggesting New Hypotheses from Shared Data**

**Pharmacovigilance through Collectively Donated Symptom Data**

**Faster Clinical Trials with Greater Participation among Patients**

**Network for Direct Patient Engagement**

**Imagining the Future: A Patient’s Experience**

**Health Information Exchange**

- Subjective: *Chief complaint, Patient Reported Outcomes*
- Objective: *Clinical measures, Laboratory findings, Sensor data*
- Assessment: *Diagnosis, Categorical reporting, Prognosis*
- Plan: *Treatment planning, Self-care planning, Post treatment, Surveillance*

**Decision Support Needs**

- Risk modeling
- Diagnostic support
- Treatment selection
- Guideline adherence
- Error detection/correction

- Situational awareness
- Population health
- Continuity of care
- Identify side effects
- Inform discovery
Thank You!

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