Systems Engineering of the US Population Health Ecosystem

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Overview

• Definition of Population Health
• Views of Health Ecosystem
• Case Studies
  – Substance Abuse and Opioid Epidemic
  – Assistive Technologies for Disabled & Older Adults
• Architecture of Health Enterprise
• Path To Success
  – Enterprise Transformation
  – Model-Based Decision Making
  – Immersive Decision Making
• Technology Enablers
• Summary
Population Health

Population health involves integration of health, education, and social services to keep a defined population healthy, to address health challenges holistically, and to assist with the realities of being mortal.
Congress, Executive, Judiciary

Laws, Regulations → Money

HHS, CMS, MHS, VHA, FDA, et al

Regulations → Money

State Agencies for H, E & S Services

Higher Ed Laws → Money

Local Agencies for H, E & S Services

Public Hos. K-12 Housing, etc.

Housing, etc.

Health Services

Education Services

Social Services

Patients, Families, Clinicians, Teachers, Social Workers
In OECD, for every $1 spent on health care, about $2 is spent on social services.
In the US, for $1 spent on health care, about 55 cents is spent on social services.
Substance Abuse and Opioid Epidemic

• Long waiting times, across the healthcare ecosystem, due to inadequate and poorly organized treatment capacities, increase the likelihood of patients avoiding or postponing treatment, and a higher rate of missed appointments. Mental disorders reduce lifespan by 10 years.

• Demands for substance abuse treatment have been increasing much faster than capacities. Average delays have been found to range from over two months to over a year. HHS has projected project that by 2025 most of the needed specialties will have shortages exceeding 10,000 full-time equivalents.

• Services that are not highly reimbursed have longer waits, in the US at least, e.g., mental health services and the elderly with chronic diseases. Waiting times are increased by prioritization of highly reimbursed patients and under-investment in capacities for poorly reimbursed services.

• Substance abuse, which includes tobacco, alcohol, illicit drugs, and prescription opioids, costs the US $740 billion annually in terms of crime, lost work productivity, and healthcare. $232 billion (31%) is for healthcare.
Assistive Technologies for Disabled and Older Adults

• Populations
  – There are 40 million Americans with a disability in 2015, representing almost 13% of the civilian non-institutionalized population. Older Americans are more likely to have a disability, 25% of those 65-74 and 50% of those 75 or older.
  – The number of Americans 65 and older is projected to increase from roughly 50 million today to almost 80 million in 2040. This group's share of the total population will rise to nearly 24 percent from 15 percent.

• Market
  – “The global elderly and disabled assistive devices market was valued at $14 billion in 2015 and is expected to surpass $26 billion by 2024.”
  – “The U.S. market for assistive technologies is projected to grow from $40.6 billion in 2014 to $43.1 billion in 2015 and $58.3 billion in 2020.”
  – “The U.S. market for assistive technologies is projected to grow from $39.5 billion in 2010 to $55 billion in 2016.”
Population Ecosystem (Society)

Business Models & Incentive Structures

System Structure (Organizations)

Human Productivity & Returns on Investments

Competitive Positions & Economic Investments

Delivery Operations (Processes)

Health & Education Performance & Costs

Service Capabilities & Associated Information

Health, Education & Service Outcomes

Service Interactions (People)
# Levels vs. Concerns

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<th>Level</th>
<th>Example Concerns</th>
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<td>Outcomes Targeted, Services Covered, Reimbursement Models (i.e., fee for services vs. payment for outcomes), Policy, Regulations</td>
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<td>Organizations</td>
<td>Planning &amp; Strategy, Capacity Investments, Decision Analysis, Optimization, Performance Assessment, Risk Management</td>
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<td>Processes</td>
<td>Demand Forecasting, Patient Scheduling, Outpatient Scheduling, Inpatient Scheduling, Work Force Planning and Scheduling</td>
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<td>People</td>
<td>Disease Incidence &amp; Progression, Screening, Clinician &amp; Patient Decision Making, Patient Engagement</td>
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## Levels vs. Models

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<td>Disease Progression</td>
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Path to Success

- Enterprise Transformation
- Model-Based Explorations of “What if?”
- Immersive Decision Making Environments
Enterprise Transformation

Enterprise transformation is driven by experienced and/or anticipated value deficiencies that result in significantly redesigned and/or new work processes as determined by management’s decision making abilities, limitations, and inclinations, all in the context of the social networks of management in particular and the enterprise in general.
Immersive Decision Making
Technology Enablers

• IT-enabled capabilities to foster information sharing and care coordination

• AI-based cognitive assistants that understand work domains, workflows and preferences of patients, disabled and older adults, and clinicians.
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