Integrating Social Determinant of Health Data Into Population Health Analytics: A Proposed Framework and Suggested Road Map

Presenter: Jonathan P. Weiner, DrPH
Professor, Center Director &
ACG System Scientific Director / Co-Developer
During this webinar presentation I will:

• Offer conceptual frameworks for the integration of social and behavioral determinants of health (SDH) into the population health analytic process applied within provider, health plan and government organizations.
• Take stock of the recent social determinants of health “awakening” in the US health care / population health context.
• Elucidate practical, real world approaches for integrating medical, administrative, public health and social service agency “Big Data.”
• Offer a “road map“ and suggestions as we move forward in this domain.
• Provider examples of SDH analytic applications at the population level successfully applied by the Johns Hopkins Center for Population Health IT.
• Identify some challenges and potential solutions in this field.
Population Health Analytics: An Integration of Three Disciplines

Medical Care / Clinical Sciences

Health Informatics / Data Sciences

Population / Public Health Sciences

Unless otherwise noted – All slides in this presentation copyright © 2019, The Johns Hopkins University. All rights reserved.
The Johns Hopkins Center for Population Health Information Technology
(CPHIT or “see-fit”)

Mission: To improve the health and well-being of populations by advancing the state-of-the-art of Health IT across public and private health organizations.

Focus: The application of electronic health records (EHRs), advanced analytics and social/behavioral “big data” targeted at communities and populations.

R&D for the Johns Hopkins ACG System® is based at CPHIT.

www.jhsph.edu/cphit
https://www.hopkinsacg.org/
Social Determinants of Health – From Buzz Feed to Data Feed

Graphic: USDHHS – Healthy People 2020
For every 100 negative health outcomes:

10 are due to The Environment
This includes safe workplaces and communities; well-designed cities and roadways; clean air, water and soil; etc.

15 are due to Biology and Genetics
This includes the basic biology and organic make-up of the human body, including genetic and biological variations, which predispose certain individuals to particular diseases or other health outcomes.

25 are due to Health Care
Regardless of the funding it receives, health care only accounts for 25% of the health of a population. This includes access to health care, the quality of health care, medical advances, wait times, etc.

50 are due to The SDOH
This includes:
• Early childhood development
• Education
• Culture
• Gender
• Housing
• Personal health practices
• Income and social status
• Social support networks
• Employment and working conditions

Source: Canadian Ministry of Health

Risk factors as a percentage of disability-adjusted life-years

- Tobacco use
- High body mass index
- Dietary risks
- Alcohol and drug use
- High fasting plasma glucose
- High systolic blood pressure
- High total cholesterol
- Impaired kidney function
- Occupational risks
- Air pollution
- Low physical activity
- Child and maternal malnutrition
- Low bone mineral density
- Unsafe sex
- Sexual abuse and violence
- Residential radon and lead exposure
- Unsafe water, sanitation, and handwashing

Source: JAMA April 10, 2018, US Burden of Disease
A Conceptual Model for Understanding Community Level Population Health in Maryland

Source: JHU CPHIT

Examples of measurable and amenable SDH risk factors (at the individual or community level)

<table>
<thead>
<tr>
<th>Economic Stability</th>
<th>Neighborhood and Physical Environment</th>
<th>Education</th>
<th>Food</th>
<th>Community and Social Context</th>
<th>Health Care System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employment</td>
<td>Housing</td>
<td>Literacy</td>
<td>Hunger</td>
<td>Social integration</td>
<td>Health coverage</td>
</tr>
<tr>
<td>Income</td>
<td>Transportation</td>
<td>Language</td>
<td>Access to healthy</td>
<td>Support systems</td>
<td>Provider availability</td>
</tr>
<tr>
<td>Expenses</td>
<td>Safety</td>
<td>Early childhood education</td>
<td>options</td>
<td>Community engagement</td>
<td>Provider linguistic and cultural</td>
</tr>
<tr>
<td>Debt</td>
<td>Parks</td>
<td>Vocational training</td>
<td></td>
<td>Discrimination</td>
<td>competency</td>
</tr>
<tr>
<td>Medical bills</td>
<td>Playgrounds</td>
<td>Higher education</td>
<td></td>
<td>Stress</td>
<td>Quality of care</td>
</tr>
<tr>
<td>Support</td>
<td>Walkability</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Zip code / geography</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Kaiser Family Foundation
This presentation features a new article by The Johns Hopkins Center for Population Health IT

Integrating Social and Behavioral Determinants of Health into Population Health Analytics: A Conceptual Framework and Suggested Road Map

Zachary Predmore, AB,1 Elham Hafez, MD, MPH,1,2 and Jonathan P. Weiner, DrPH1

A Proposed Population Health Analytics Framework for Integrating Social Determinants of Health Data Sources & Applications

SDH DATA SOURCES

Clinical/Health System/Payers
- EHRs/HIT Structured & Free Text
- Claims/Admin.

Non-Medical Organizations/Agencies
- Community/Geo Level Agencies
- Consumer Social/Human Services
- Commercial Services

Direct from Consumer
- Surveys/PROs
- Social Media
- Biometrics
- "Consumer" Data

Key SDH Use-Cases/Applications

Patient Care
- Clinical Decision Support
- Consumer Empowerment/Support

Predictive Risk Modeling
- "Social" Predictive Modeling/Case Finding
- SDH Adjusted Payment Models

Community Engagement/Investment
- Community Assessment/Intervention
- GIS - Hot Spotting/Analytics

CDC “BUCKETS” OF PREVENTION

1st Bucket
- Pt. Level Preventive Interventions

2nd Bucket
- Provider Demographics/Pop Targeted Interventions

3rd Bucket
- Community-wide Interventions

HEALTHCARE SYSTEM STAKEHOLDERS

Patient

Provider/ Clinician

IDS/ACO/ Delivery Systems

Payers/ Plans

Agencies/ Policy Makers

Improved Health

Lower Cost

Better Care

SDH DATA SOURCES

Clinical/Health System/Payers
- EHRs/HIT
  Structured & Free Text
- Claims/Admin.

Non-Medical Organizations/Agencies
- Community/Geo Level Agencies
- Consumer Social/Human Services
- Commercial Services

Direct from Consumer
- Surveys/PROs
- Social Media
- Biometrics
- "Consumer" Data
Linking big data across medical, public health and human service organizations: Key challenges that need to be addressed and participating sectors

Nine Components of Interoperability

- Behavioral and Workflow Change
- Governance
- Organizational Capacity and Readiness
- Partner, Stakeholder, Community Engagement
- Privacy and Security
- Regulations and Policy
- Sustainability
- Systems Integration and Technical Infrastructure
- Trust and Shared Values

Nine Sectors

- Health
- Human Services
- Public Health
- Emergency Response
- Education
- Transportation
- Information Technology (IT)
- Energy
- National Security

Source: National Interoperability Collaborative: https://nic-us.org/
See CDC Article: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5558207/
Key SDH Use-Cases / Applications

Patient Care
- Clinical Decision Support
- Consumer Empowerment/Support

Predictive Risk Modeling
- "Social" Predictive Modeling/Case Finding
- SDH Adjusted Payment Models

Community Engagement / Investment
- Community Assessment & Intervention
- GIS - Hot Spotting/Analytics
The R&D Mission at Johns Hopkins CPHIT: Incorporating SDH Risk Factors into Population Health Analytics

• Review evidence base.
• Develop taxonomies and measurement frameworks.
• Methods to extract information from EHRs.
• Collate and share available community level data.
• Methods to integrate social services/consumer data.
• Develop advanced analytic models using HSR, GIS and computer science approaches.
• Contribute to the peer reviewed evidence base.
• Integrate SDH models within our widely used (25+ nations) Johns Hopkins ACG analytic platform.
• Collaborate with government and private sector to deploy and disseminate tools to leverage our impact.
Example of SDH Focused “Big” Data Population Health Analytics Applications at JHU CPHIT

To address the **opioid crisis** we are working with one State to link available data across data “silos” (e.g., PDMP/controlled Rx (PDMP), hospitals (HSCRC), coroner (OCME), Police/Corrections (DPSCS), juvenile services (DJS). Goal is to identify persons at risk. Of those who died from opioid RX, about 80% were identifiable from available data.

Identifying **falls among elderly** HMO cohort using NLP of millions of pages of MD/RN notes (green) vs. EMR (blue) & claims (orange)

**Source:** https://www.ncbi.nlm.nih.gov/pubmed/30985862
Obesity heat map of US counties based on 20+ M Veteran’s BMIs from VA EHR records.

Source: CPHIT Work in Progress

Linking, EHR, geo & social data to identify cohorts with potential hospital overuse within all VA primary care regions considering SES, race, and morbidity.

Some Challenges Facing the Integration of SDH Big Data into Population Health Analytics

• Standards and interoperability frameworks for integrating across EHRs and other IT Systems.

• Using disparate data to identify “numerators” & “denominators” to define true populations.

• Policy/legal frameworks and financial structures that support data integration and sustainability.

• Tools for extracting and analyzing unstructured data.

• Privacy, confidentiality and security protections (and the consumer concerns associated with this area).

• Avoiding the Hype of SDH and “Artificial Intelligence / Machine Learning” as panaceas.

• Closer collaboration between government, providers, payers/regulators, IT industry and academia.
Some “Guideposts” to Ensure that Integrated SDH/Medical Analytics Will Impact the Health of Populations

• Support incentives and policies addressing technical & organizational issues on previous slide.

• Support evidence based research and evaluation.

• Make SDH central to future “Value Based” Care Transformation, but avoid inflated expectations.

• Providers/Plans must more effectively introduce SDH related interventions into medical care process with assistance from pop health colleagues.

• Increase alliances with public health agencies. Timing is good; there is now a paradigm shift to “public health 3.0” involving greater provider collaboration.
Thank you!

More Information at URLs in presentation and at URLs and QR code below.

Feel free to contact me:

Professor Jonathan Weiner
jweiner1@jhu.edu

www.jhsph.edu/cphit

https://www.hopkinsacg.org/