INNOVATION TO ADDRESS PUBLIC HEALTH IMPERATIVES

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U.S. PUBLIC HEALTH SERVICE: ABBREVIATED HISTORY

1798 The Beginning: Act for the Relief of Sick and Disabled Seamen
1870 Marine Hospital Service
1871 First Supervising Surgeon (later Surgeon General) Dr. John Maynard Woodworth
1878 National Quarantine Act
1889 Legislation created the Commissioned Corps
1912 Public Health Service (with broadened powers)
1930 Parker Act: Expanded PHS to Non-Physicians
1955 Establishment of the IHS
1979 Department of Health and Human Services established
1999 First Disaster Response Mission for Commissioned Corps
U.S. LIFE EXPECTANCY: 1900 - 2015

PUBLIC HEALTH SUCCESSES

- Influenza and Pneumonia
- Enteric Diseases
- Stroke and CV Disease
- Tuberculosis
- Cancer
- Accidents

U.S. HEALTH CHALLENGES IN THE 21st CENTURY

U.S.: Highest spending on health care in the world ($3.3 trillion, or 17.9% of GNP)

Spending is predicted to reach $5.7 trillion by 2026

U.S. HEALTH CHALLENGES IN THE 21st CENTURY

• Life Expectancy
  - Among the 36 OECD* nations, the U.S. ranks 28th in life expectancy; 33rd in infant mortality; 32nd in suicide rate
  - In 2015 and 2016 life expectancy decreased in the United States

• Sexually Transmitted Diseases
  - Highest number ever reported in U.S. in 2016
  - >2 million; 50% in adolescents and young adults

• Influenza and Infectious Diseases
  - Enhanced risks from pandemic influenza, emerging infectious diseases, anti-microbial resistance

• Rogue States and Organizations
  - Intentional chemical, biological, radiological, and nuclear attack

*Organization for Economic Development and Cooperation
U.S. DRUG OVERDOSE DEATHS
THE MOST CRITICAL PUBLIC HEALTH CHALLENGE OF OUR TIME

Note: 2017 figures are provisional
Source: Centers for Disease Control and Prevention
Recruits' Ineligibility Tests the Military

More Than Two-Thirds of American Youth Wouldn't Qualify for Service, Pentagon Says

“...the Defense Department estimates 71% of the roughly 34 million 17- to 24-year-olds in the U.S. would fail to qualify to enlist in the military if they tried....”

Physical Fitness, Drug Abuse, Education
PREDICTED OBESITY OF TODAY’S TWO YEAR OLDS

![Graph showing predicted obesity prevalence over age](image)
INEQUALITIES IN LIFE EXPECTANCY AMONG U.S. COUNTIES

• Inequalities in life expectancy among counties are large and increasing over time

• Difference in life expectancy between the lowest ranking county and the highest ranking county is 20.1 years (66.8 – 86.9 years)

• Lowest life expectancies: Kentucky, West Virginia, Alabama, Mississippi, North Dakota, South Dakota
GLOBAL HEALTH CHALLENGES IN THE 21st CENTURY

**INFECTIONIOUS DISEASE**

- **Malaria:** 216M cases and 445,000 deaths annually
- **Tuberculosis:** 25% of world population infected 1.7M deaths annually
- **HIV/AIDS:** 36.9M people infected 1.8M new cases in 2017
- **Neglected Tropical Diseases:** >140 diverse communicable diseases affecting the poorest 1B people on the planet (examples include Dengue, Hookworm, Schistosomiasis)

**NON COMMUNICABLE DISEASE**

- **Cancer, Cardiovascular Disease, Diabetes, Chronic Lung Disease**
  caused 37% of deaths even in low income countries

16,000+ Children Die Every Day of Preventable Diseases

*Organization for Economic Development and Cooperation*
MODEL OF DISRUPTIVE INNOVATION

GPS

NASA

Siri

AUTONOMOUS VEHICLES

UAVs

STEALTH

ARPANET

REVOLUTIONIZING PROSTHETICS
THE DARPA MODEL: WILL IT TRANSLATE TO PUBLIC HEALTH?

• Few (if any) single technologies are transformative

• Solutions
  - Must address information, beliefs, human behavior, social determinants, historical biases and inequities
  - Generally depend on venture capital or public markets to reach critical milestones (valley of death)

• Multiple barriers to development and dissemination
  - Regulatory
  - Human subjects protections
  - Slow adoption by health professionals and systems
  - Global financial and cultural barriers; conflicts
THE DARPA MODEL: TRANSLATES TO PUBLIC HEALTH

- “DARPA” is a model of innovation and translation that is independent of the problem’s domain, and uniquely American in its approach and implementation.

- Has been highly effective for developing novel systems and systems of systems.

The DARPA Model will only work in an appropriate environment and continuum, which do not currently exist for medicine and public health.
PROVIDING THE INNOVATION CONTEXT AND CONTINUUM

**BASIC RESEARCH**
- NIH
- NSF
- NGOs
- Biotech

**TRANSFORMATIONAL APPLICATIONS**
- **DARPA**: High risk early and intermediate development (tech and capabilities push)
- **BARDA**: Intermediate and advanced development within authorized areas
- **Accelerating Clinical Innovation**: Clinical needs and opportunities pull; systems demonstrations

**TEST AND EVALUATION**
- USPHS Commissioned Corps (a “SOCOM” for Public Health)
- ASPR: Disasters, PHEs
- Public health turnaround teams and missions
- Clinical care in underserved environments

**DISSEMINATION AND ADOPTION**
- HHS Operational Divisions: CMS, HRSA, CDC, SAMHSA, others
- Integrated Health Systems
- NGOs, WHO, and international partners
PRIORITIES FOR PUBLIC HEALTH INNOVATION ENVIRONMENT

• Orthogonal technologies and paradigms for the current most costly medical issues (for example, hemodialysis, falls, sepsis, pain)

• Technologies and approaches that allow for more advanced care outside of hospital settings including in rural environments

• Socio-behavioral approaches and distributive technologies to transform the current “sick care system” into a “health promoting system”

• Leverage big data, social networks, and digital platforms for public health, including epidemiology, prediction, prevention, and treatment
PRIORITIES FOR PUBLIC HEALTH INNOVATION ENVIRONMENT

• End U.S. infectious disease epidemics within our technical control: HIV, HCV, HPV

• Genetic cures and immunotherapies

• A new paradigm for understanding and treating neurodegeneration

• Global health security: an endogenous global capacity, early warning, detection, diagnosis, rapid mitigation, and assured effective response

• The Commissioned Corps as an agent of change
WHERE WILL WE STAND ON BEHALF OF PUBLIC HEALTH?

The New York Times

“The flying machine which will really fly might be evolved by the combined and continuous efforts of mathematicians and mechanicians in from one million to ten million years”

October 9, 1903

“We started assembly today”

Orville Wright’s Diary

October 9, 1903