PCAST Systems Engineering in Health Care Working Group

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Systems engineering in health care: What is it and why is it important?

- Systems engineering is an interdisciplinary approach to analyze, design, manage, and measure a complex system with efforts to improve its efficiency, productivity, quality, safety, and other factors.

- Systems engineering provides a suite of tools for improvement, which have been successfully used in manufacturing, aviation, and other industries.

- **These tools have been used to good effect in health care, but too rarely and not spread widely.**

Overarching Goals: Potential actions for the Federal Government

1. Accelerate alignment of payment systems with desired outcomes: better care at lower cost

2. Increase access to relevant health data and analytics

3. Provide technical assistance in systems engineering approaches

4. Involve communities in improving health care delivery

5. Share lessons learned from successful improvement efforts

6. Train health professionals in new skills and approaches

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Goal 1: Accelerate alignment of payment systems with desired outcomes: better care at lower cost

Recommendation 1: Focus payment incentives and reported information to pay for better outcomes for individuals and broader populations.

1.1: Public and private payers should be convened to discuss how to accelerate and align improvements in payment, promote transparency, and provide tools and supports for practice transformation.

1.2: Outcome measures for patients and populations, which can be readily assessed using current and future digital data sources, should be preferentially adopted, and where there are gaps needed measures should be developed.

Goal 2: Increase access to relevant data and analytics

Recommendation 2: Accelerate efforts to develop the Nation's health data infrastructure.

2.1: A robust health data infrastructure should be created through widespread adoption of interoperable electronic health records and health information. Specific actions in this vein were proposed in the 2010 PCAST report on health information technology and the related 2014 JASON report to ONC.

Goal 2: Increase access to relevant data and analytics

Recommendation 3: Provide national leadership in systems engineering by increasing the supply of data available to benchmark performance, understand a community's health, and examine broader regional or national trends.

3.1: A senior leadership position within the Administration should be created to focus on health care transformation. HHS can be the source of information and analytics as a major resource for benchmarking, provider and community engagement and improvement

3.2: The release of public and private provider-level data on quality, safety, and cost should be accelerated to increase transparency and enable patients to make more informed decisions.

Goal 3: Provide technical assistance in systems engineering approaches

Recommendation 4: Increase technical assistance to health care professionals and communities in applying systems approaches.

4.1: A large-scale initiative is needed and should be launched to provide hands-on support to small practices to develop the capabilities, skills, and tools to provide better, more coordinated care to their patients. It could build on existing programs within CMS and ONC.

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Goal 4: Involve communities in improving health care delivery

Recommendation 5: Support efforts to engage communities in systematic health care improvement.

5.1: State and local efforts to transform health care systems should continue to be supported.

5.2: Future Federal programs centered around health care innovation should, as appropriate, incorporate systems engineering principles at the community level; set, assess, and achieve population-level goals; and encourage providers to engage stakeholders outside of the traditional health care system.

5.3: Existing Federal community-health needs assessment and planning processes should be leveraged to promote systems thinking at the community level.

Goal 5: Share lessons learned from successful improvement efforts

Recommendation 6: Promote awards, challenges, and prizes to promote the use of systems methods and tools in health care.

6.1: The Federal Government should build on existing awards programs (e.g. the Baldrige awards) to recognize health-care providers successfully applying system engineering approaches.

Goal 6: Train health professionals in new skills and approaches

Recommendation 7: Build competencies and workforce for redesigning health care.

7.1: A wide range of funding, program, and partnership levers should be used to educate clinicians about systems-engineering competencies for scalable health-care improvement.

7.2: Best practices in curricular and learning activities should be collected, cataloged, and disseminated. Knowledge sharing through regional learning communities should be encouraged.

Recommendation 7: Build competencies and workforce for redesigning health care.

7.3: Grant programs for developing innovative health professional curricula that includes systems engineering and implementation science should be created; grant products should be disseminated broadly.

7.4: Systems engineering centers of excellence should be funded to build a robust specialty in Health Improvement Science for physicians, nurses, health professionals, and administrators.

Summary and Conclusions

- Systems engineering is an important tool to help the Nation achieve safe, high quality, and affordable health care.

- PCAST identifies a comprehensive set of recommendations to encourage the use of systems engineering in health care by:

  - ❖ Accelerating alignment of payment systems with desired outcomes,
  - ❖ Increasing access to relevant health data and analytics,
  - ❖ Providing technical assistance in systems engineering approaches,
  - ❖ Involving communities in improving health-care delivery,
  - ❖ Sharing lessons learned from successful improvement efforts, and
  - ❖ Training health professionals in new skills and approaches.

Systems Approach to Healthcare: Recent Examples

- Institute of Medicine & National Academy of Engineering partnerships on bridging engineering and healthcare

- Gordon & Betty Moore Foundation initiative on engineering healthcare delivery to eliminate preventable harms

- CMS Healthcare Systems Engineering Center (at Northeastern), ONC Regional Extension Centers, NIST Baldrige Awards
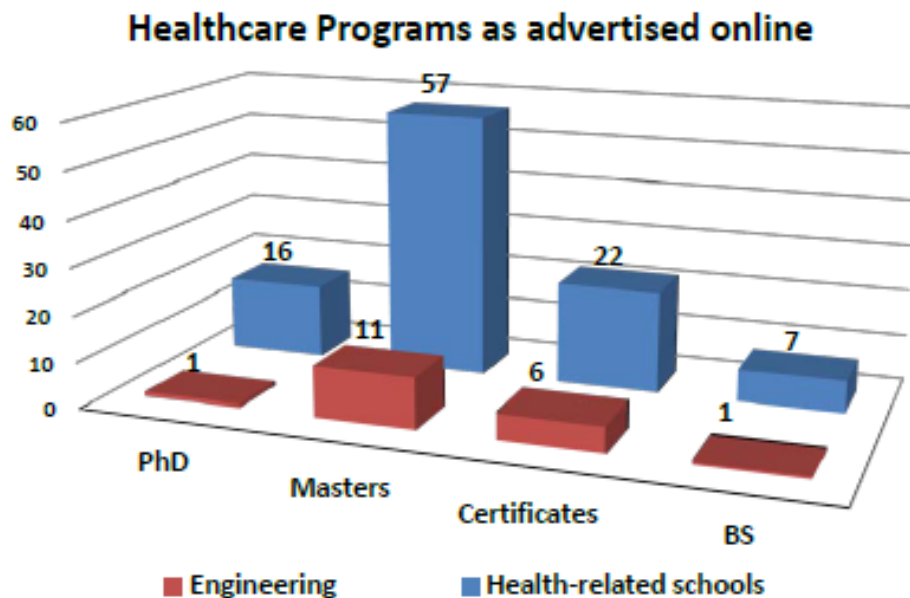
Intensified Federal Focus on Quality and Data

HHS announces "measurable goals and timeline to move the US health system toward paying providers for quality, rather than the quantity of care they give patients.

- 30% of fee-for-service Medicare payments to be tied to quality or value through ACOs or other alternative payment models by the end of 2016; 50% achieved by 2018

Niall Brennan named CMS's new chief data officer; oversees improvements in data collection and dissemination

Health System Engineering:
A Growing Academic Focus

Healthcare Programs as advertised online

(Bar chart values: PhD — Engineering 1, Health-related schools 16; Masters — Engineering 11, Health-related schools 57; Certificates — Engineering 6, Health-related schools 22; BS — Engineering 1, Health-related schools 7)

Legend: ■ Engineering ■ Health-related schools

- Most offered through
  - Public Health,
  - Schools of Medicine,
  - Health Administration, or
  - Health Care Management Departments
- Engineering certificates
  - Graduates: 2
  - All professionals : 3
  - Undergrads and 1st year grad-students: 1
- Health school certificates
  - Graduate: 19
  - All professionals: 3

Health System Engineering:
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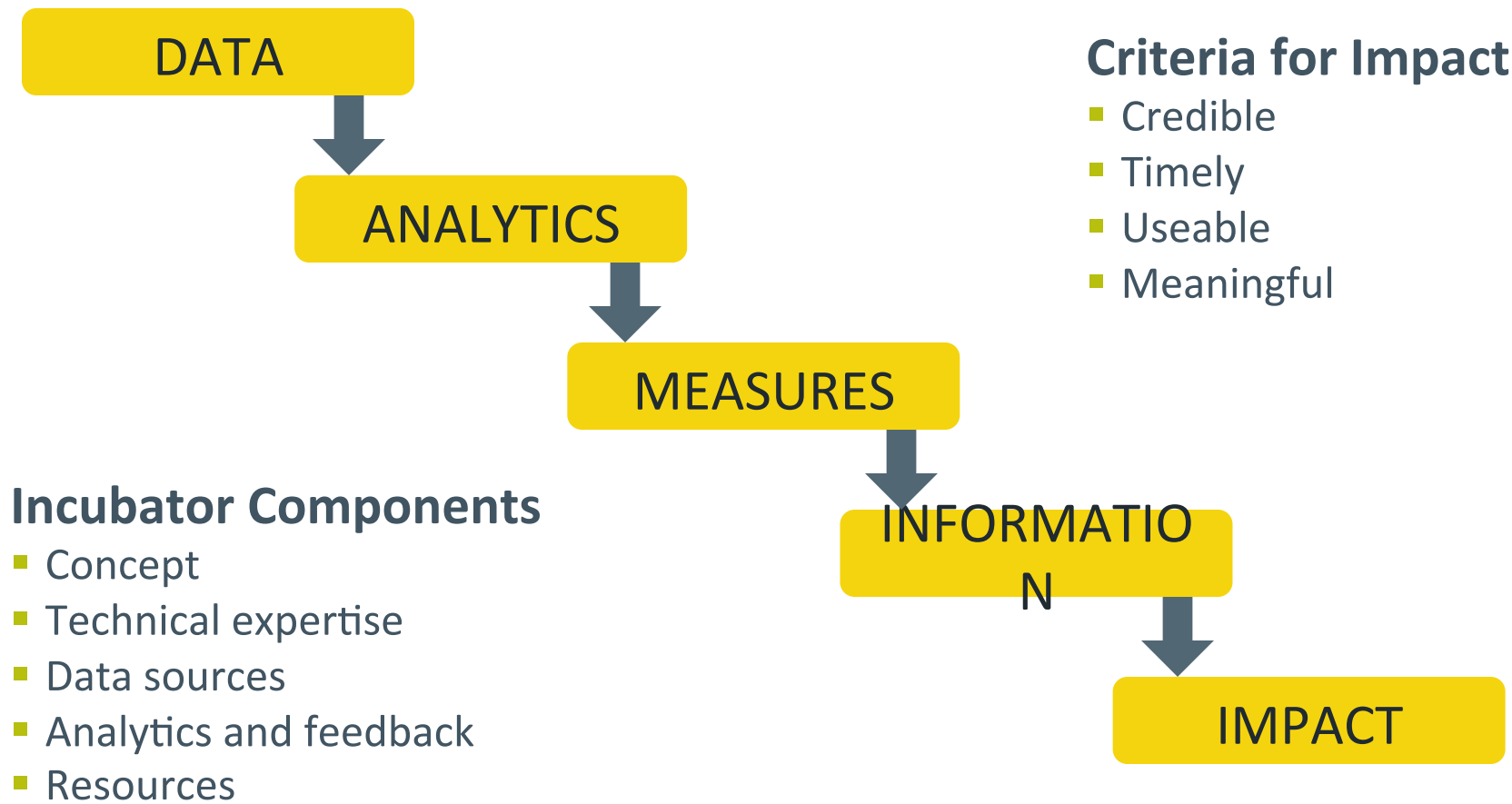

Healthcare Systems Engineering Programs*

# Program	Degree/Certificate	Location
1. University of Southern California	- Master of Health Systems Management Engineering	Los Angeles, CA
2. Texas Tech University	- MS Healthcare Engineering - Healthcare Engineering Option in the Master of Engineering Degree	Lubbock, TX
3. Georgia Institute of Technology	- MS in Health Systems	Atlanta, GA
4. Stanford University	- MS Degree in Health Services Research	Stanford, CA
5. University of Missouri	- Dual MS in Industrial Engineering (MSIE) & Master of Health Administration (MHA)	Columbia, MO
6. Lehigh University	- MS Healthcare Systems Engineering	Bethlehem, PA
7. University of Michigan	- Masters concentration on HCSE - Lean Healthcare Certificate - Lean Supply Chain for Healthcare Certificate - Six Sigma Greenbelt Healthcare Certificate	Ann Arbor, MI
8. University of Arkansas	- MSIE - emphasis on Healthcare Systems Engineering	Fayetteville, AR
9. Kettering University	- Healthcare Systems Engineering Certificate - Healthcare Systems Management Certificate	Flint, MI
10. Northeastern University	- Healthcare Industrial Engineering Minor (undergraduate)	Boston, MA
11. North Carolina State University	- Health Systems Engineering Certificate	Raleigh, NC
12. University of Wisconsin - Madison	- MSIE, Health Systems specialization - PhD, Health Systems specialization	Madison, WI
13. Massachusetts Institute of Technology	- MS Degree in Engineering Systems: Health Care Systems Track	Boston, MA

Big Opportunity Areas in Healthcare: What the Health System Needs Now

NATIONAL QUALITY FORUM

DATA

ANALYTICS

MEASURES

INFORMATION

IMPACT

Criteria for Impact
- Credible
- Timely
- Useable
- Meaningful

Incubator Components
- Concept
- Technical expertise
- Data sources
- Analytics and feedback
- Resources

Questions

- Systems Engineering Training—
  - In Medical Schools?
  - In Engineering Schools?

- Opportunities for Collaborations?

- Opportunities for Engineers in Health Systems?