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QUALITY

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2015

*“Quality for Future
of the World”*

The Role of Quality Improvement Methods in Healthcare Delivery Science and Translational Research

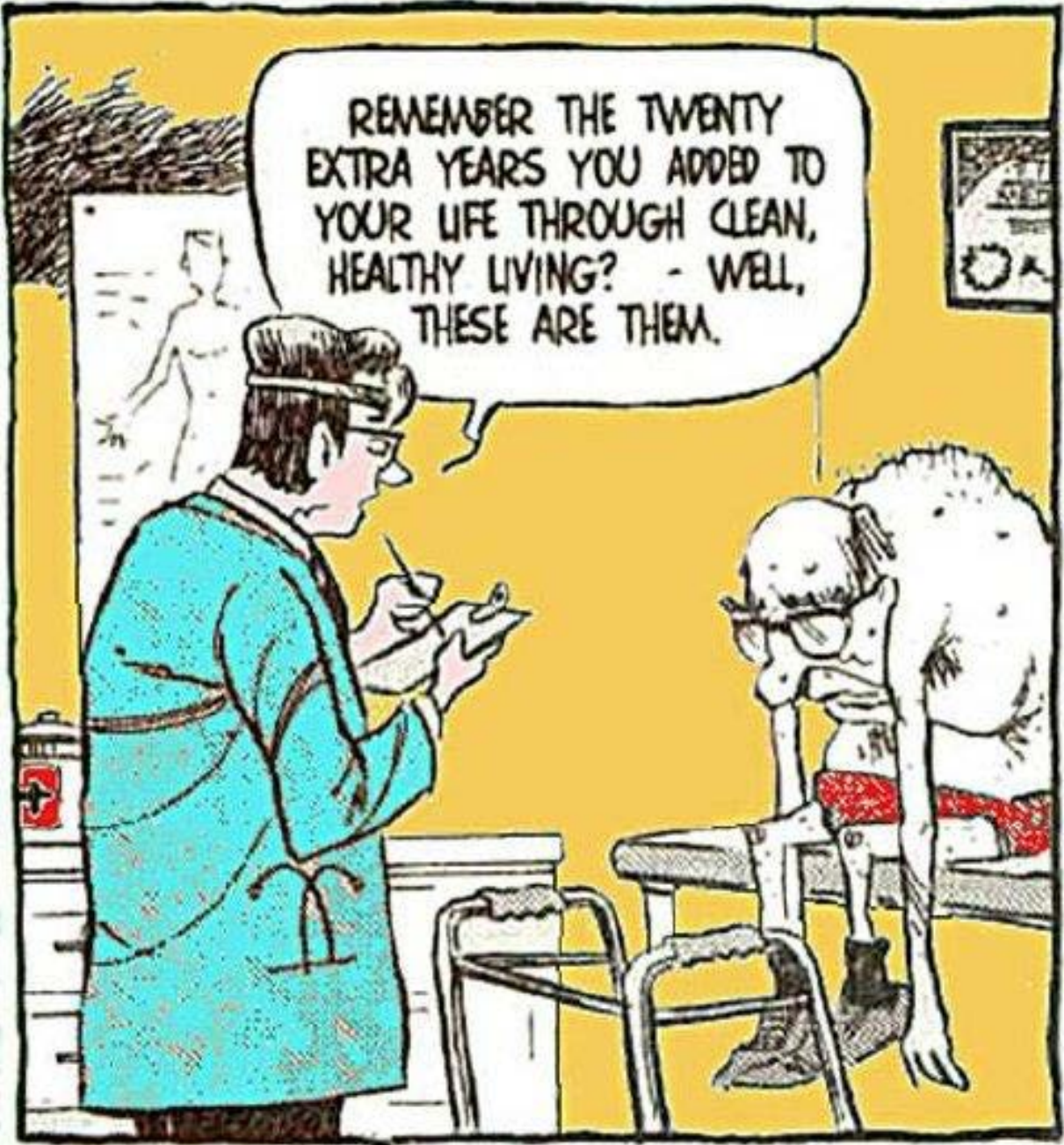
Harriet B. Nembhard, PhD

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ASQ Fellow and Certified Six Sigma Black Belt

Academician, International Academy for Quality

Joint work with **David Munoz, PhD** – 2015 IE/OR



REMEMBER THE TWENTY
EXTRA YEARS YOU ADDED TO
YOUR LIFE THROUGH CLEAN,
HEALTHY LIVING? - WELL,
THESE ARE THEM.



Center for Integrated Healthcare Delivery Systems (CIHDS)

Harriet B. Nembhard, PhD, Director

Chris DeFlicht, MD, Co-Founder



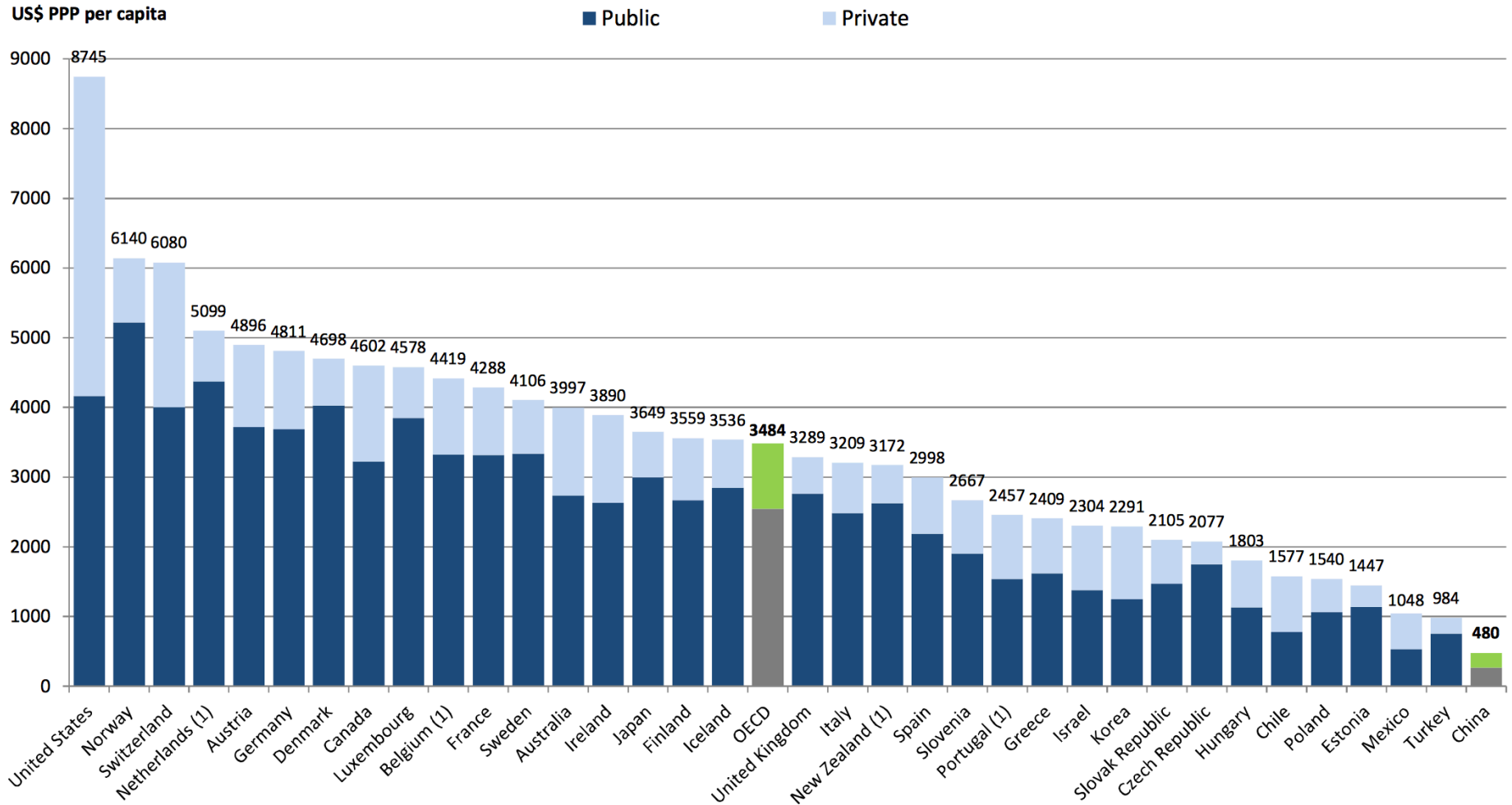
- Industrial Engineering
- Engineering Design
- Computer Science Engineering
- Emergency Medicine
- Family Medicine
- Pediatrics
- Information Sciences & Technology
- Nursing
- Health Policy & Admin.
- Public Health



An abundance of medical devices, pharmaceuticals, facilities, and clinical trials *exist* ... but do not function as a *system*.



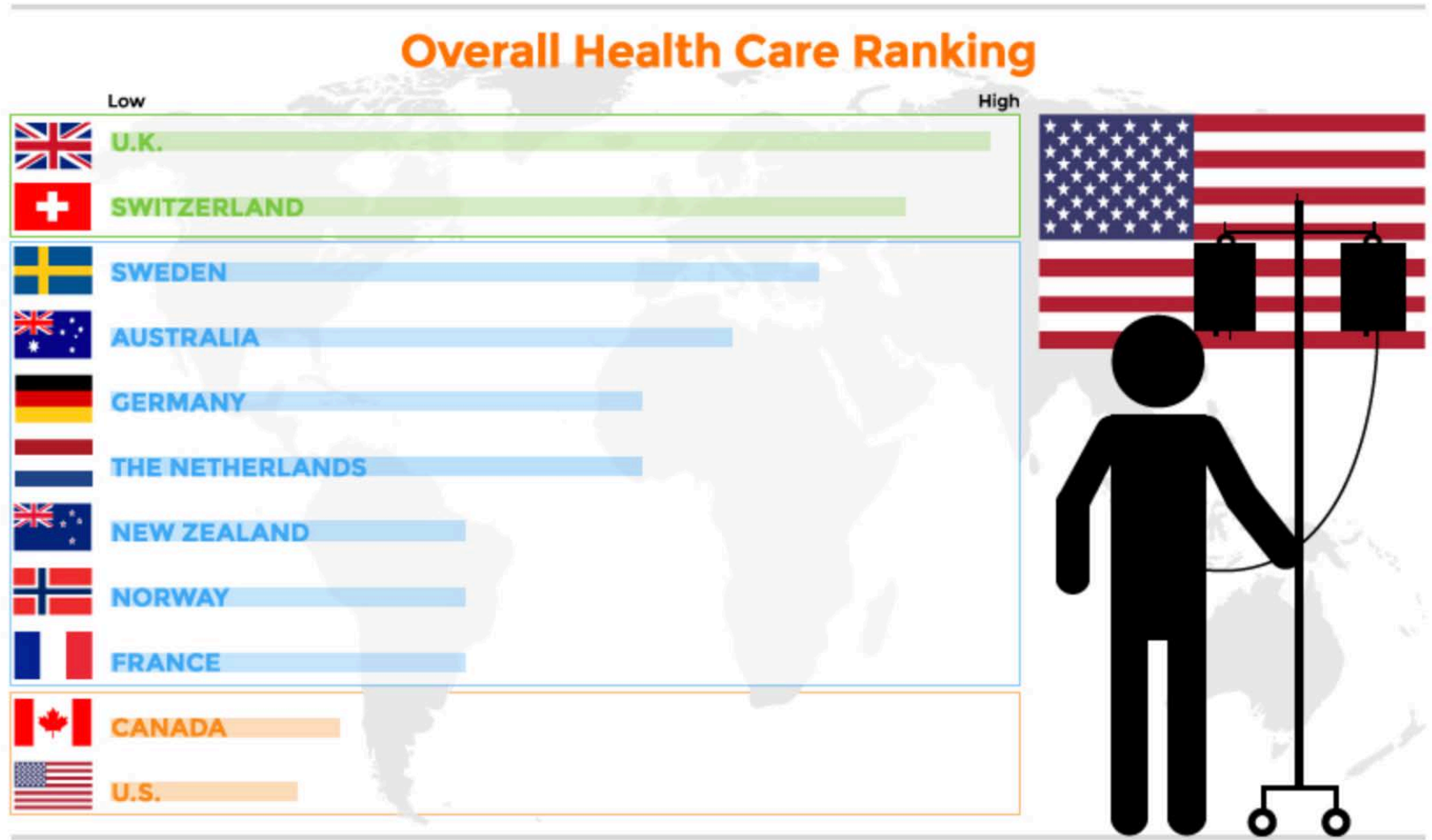
The US spends more than two-and-a-half times more than most developed nations in the world on healthcare.



1. Total expenditure excluding capital expenditure.

Source: OECD Health Statistics 2014; WHO Global Health Expenditure Database <http://www.oecd.org/els/health-systems/Briefing-Note-CHINA-2014.pdf>

The US ranks last of 11 wealthy nations on healthcare quality, access, efficiency, and equity.



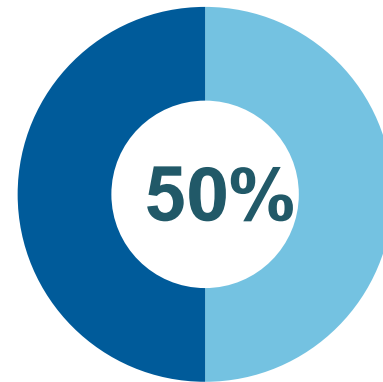
<http://www.commonwealthfund.org/publications/fund-reports/2014/jun/mirror-mirror>

There is a huge gap between proven knowledge and its impact on people's health.

IOM, 2001; Green, et al., 2009; Glasgow, et al., 2012

Americans receive only about half of their recommended care

McGlynn et al., 2003



In order to close this gap, new designs and solutions must be explored...

Glasgow, et al., 2012; Davies, et al., 2010; McHugh & Barlow, 2010; Reid, et al., 2005

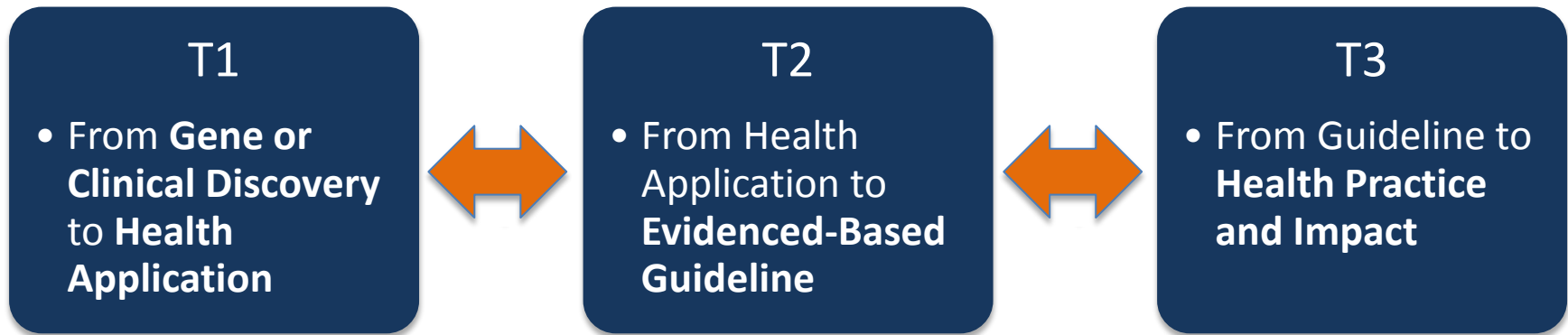
Healthcare delivery science is “applying rigorous, high-quality science to the evaluation of real-world innovations aimed at improving the quality, safety and value of health care.”

Center for Healthcare Delivery Science
Beth Israel Deaconess Medical Center
Harvard Medical School Teaching Hospital



“**Translational research** fosters the multidirectional integration of basic research, patient-oriented research, and population-based research, with the long-term aim of improving the health of the public.”

Rubio et al., 2010



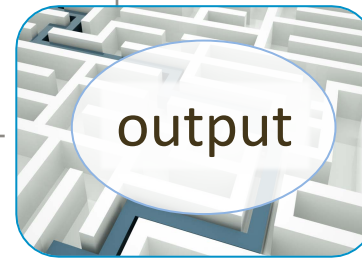
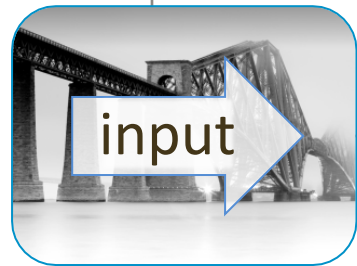
Three-phase translational research model.

There is a **process** of moving a new idea into clinical practice and health outcomes

This process map (research plan) shows how quality practitioners can engage in healthcare delivery science and translational research.

- Identifying drivers in translational research
- Prioritizing the technical requirements

- Formalize and operationalize strategy of an organization
- Incorporate multiple criteria into the resource allocation problem
- Incorporation of cost-effectiveness into the resource allocation process



- Strong collaborative networks
- Leaders, influencers and bridgers
- Gaps in collaboration
- Collaboration and team science metrics

The US National Institutes of Health (NIH) has invests approximately \$500 million/year in the Clinical and Translational Science Award (CTSA) program to **accelerate discoveries toward better health.**



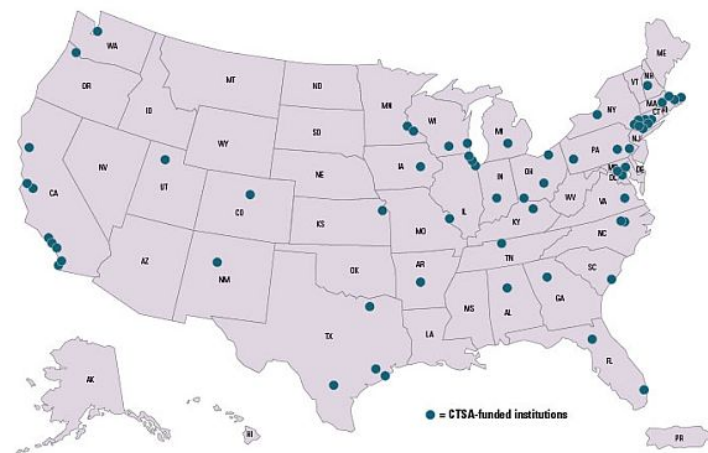
2003 The NIH made translational research a central priority

2006 The CTSA was launched

2011 

2014 **62** medical research institutions across the US

CTSA Clinical & Translational Science Awards



Some stated goals...

- Develop **data-driven tools** to measure process milestones
- Tools for process evaluation and improvement

The quality improvement framework cannot remain static.

A fortification with OR/MS techniques is needed. Tang et al., 2007

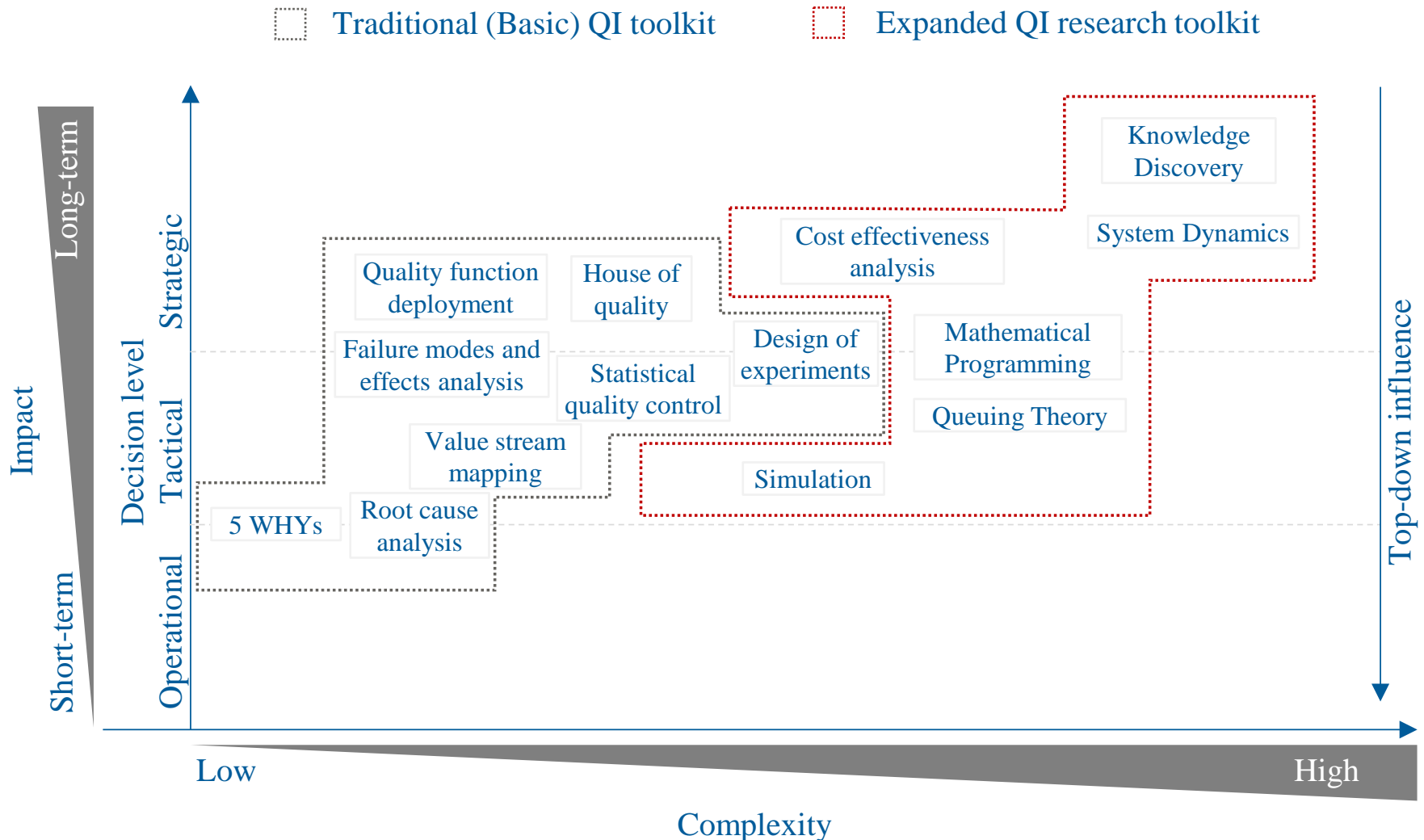
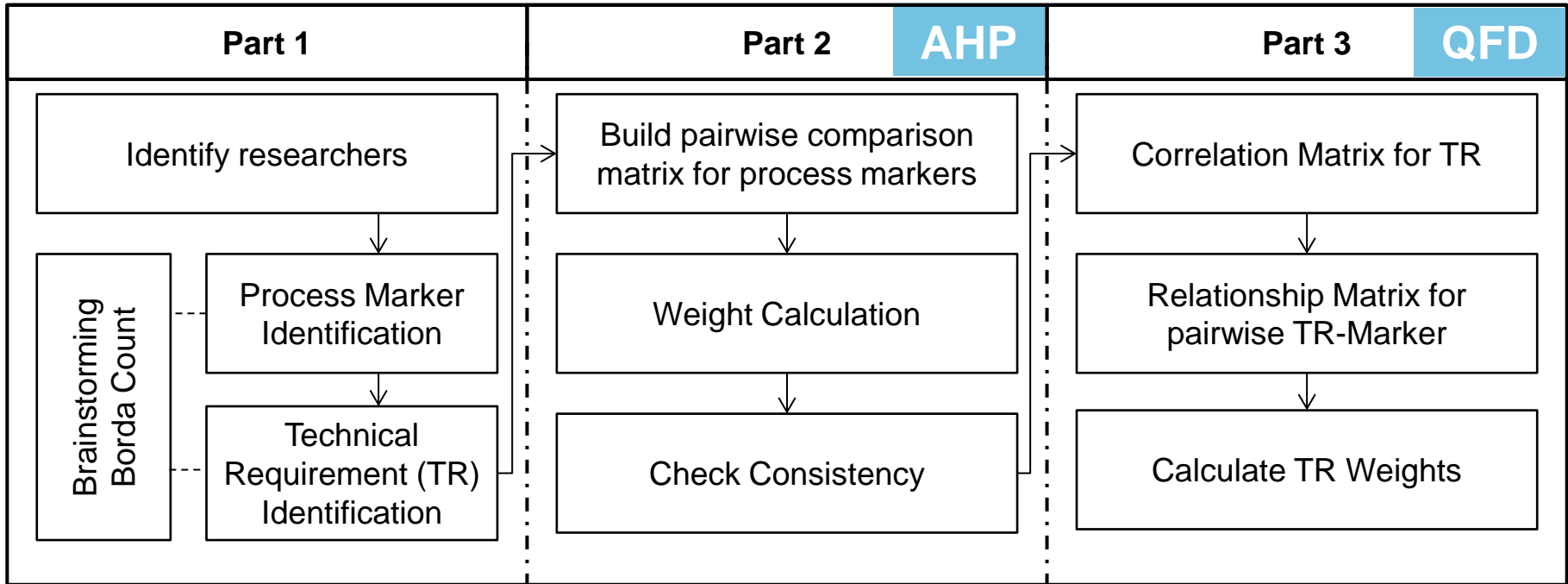


Figure 7. 12 in *Healthcare Systems Engineering* by Griffin, Nembhard, et al. (2016), to appear, Wiley-Blackwell.

We applied a QFD-AHP (quality function deployment combined with analytical hierarchy process) methodology to peer-led obesity counseling.



The QFD-AHP method has three parts that serve to quantify the complexity in the translational research problem.

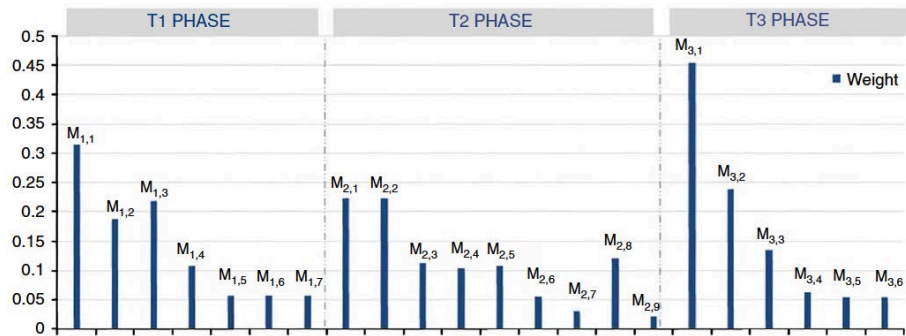


Munoz, D., Nembhard, H. B. and Kraschnewski, J. (2014). "Quantifying Complexity in Translational Research: An Integrated Quality Function Deployment – Analytical Hierarchy Process Methodology," *International Journal of Health Care Quality Assurance*, 27, 8, 760-776.

Complexity is captured by assessing the operational steps (AHP) and determining the correlation of the technical requirements (QFD).

AHP

What is the relative importance of the operational steps?

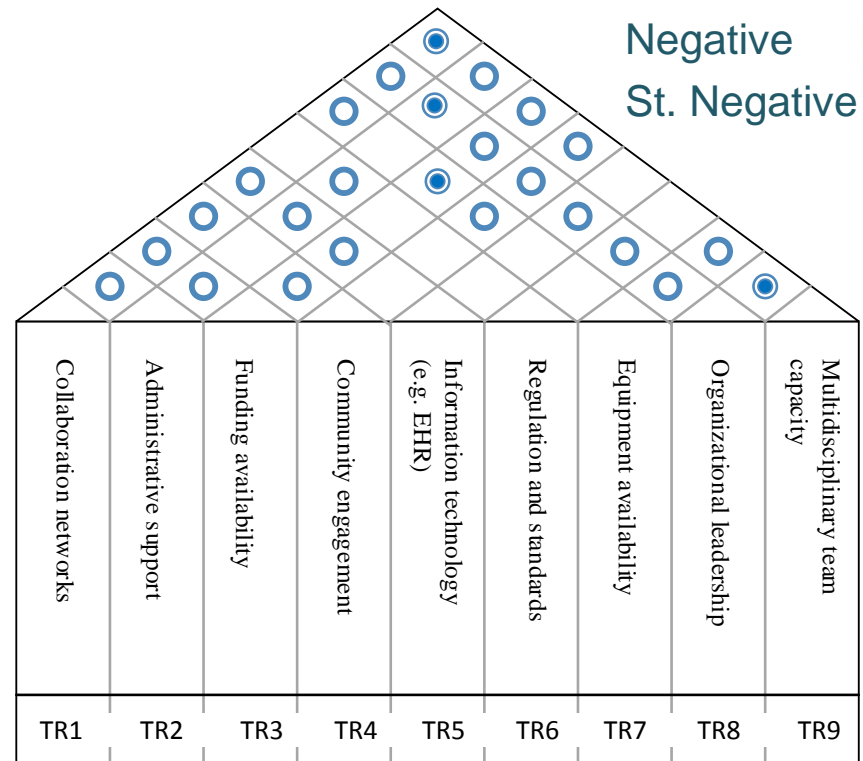


Phase	Code	Marker description
T1	M1,1	Pilot proposal
T1	M1,2	Pilot funded
T1	M1,3	Study proposal
T1	M1,4	Study proposal funded
T1	M1,5	Lab intervention
T1	M1,6	Result analysis
T1	M1,7	Guidelines for clinical trial
T2	M2,1	Develop obesity program and select target
T2	M2,2	Submit IRB
T2	M2,3	Recruit volunteers
T2	M2,4	Training volunteers
T2	M2,5	Program implementation
T2	M2,6	Measure efficacy in sample population
T2	M2,7	Larger sample and validity
T2	M2,8	Patenting program
T2	M2,9	Publish results
T3	M3,1	Pressing for public health reform
T3	M3,2	Implementing research
T3	M3,3	Study dissemination
T3	M3,4	Population study and measure effectiveness on different populations
T3	M3,5	Dissemination and best practices included in health policy
T3	M3,6	Healthcare outcomes

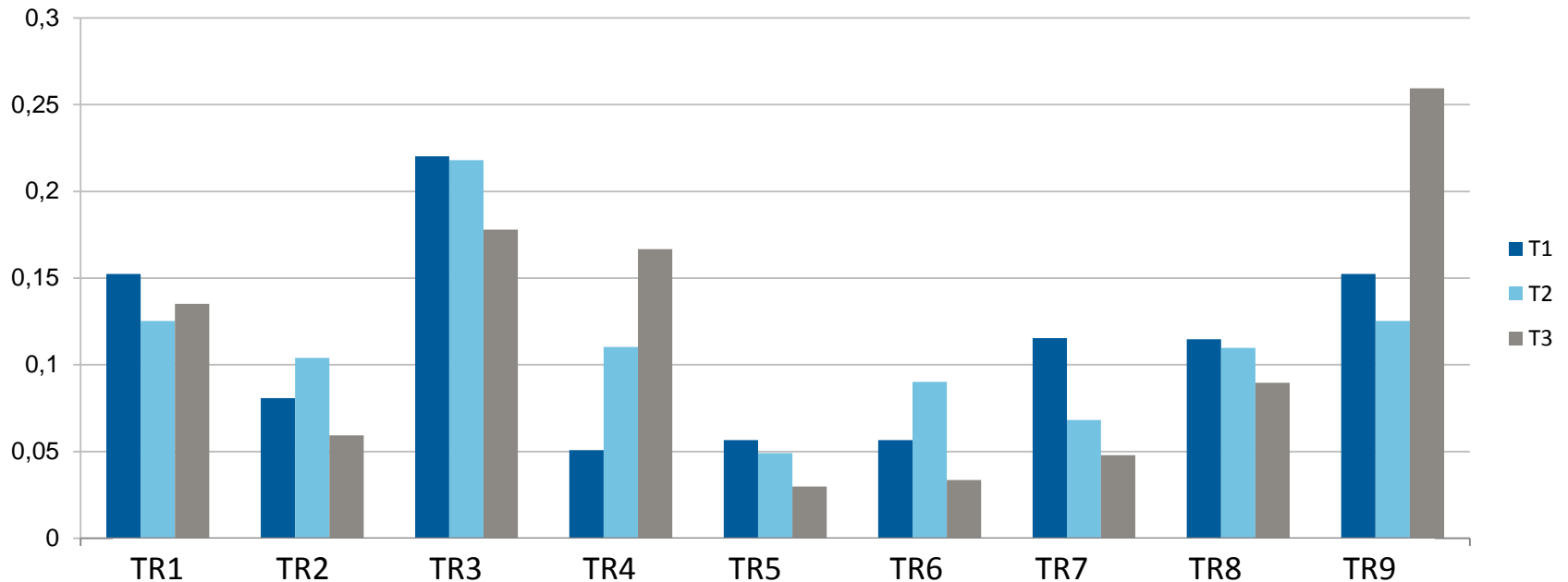
QFD

How correlated are the TR?

- St. positive
- Positive
- Negative
- St. Negative



We found that collaboration networks, multidisciplinary team capacity and community engagement are crucial for translating new discoveries into practice.



Relative importance of TR changes over time

Of course... funding (TR3) is important

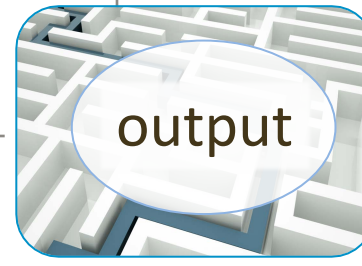
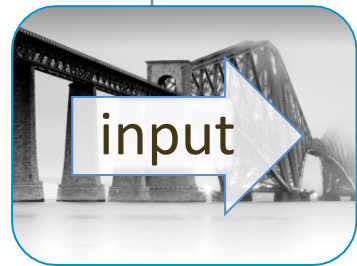
Collaboration networks (TR1) and multidisciplinary team capacity (TR9) are essential



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A social network analysis (SNA) was used to show how the CTSI has evolved as a research engine through the intentional and directed focus on translational research and interdisciplinary teams.

Early-CTSA (2011-2012)



Developing CTSA (2013-2014)

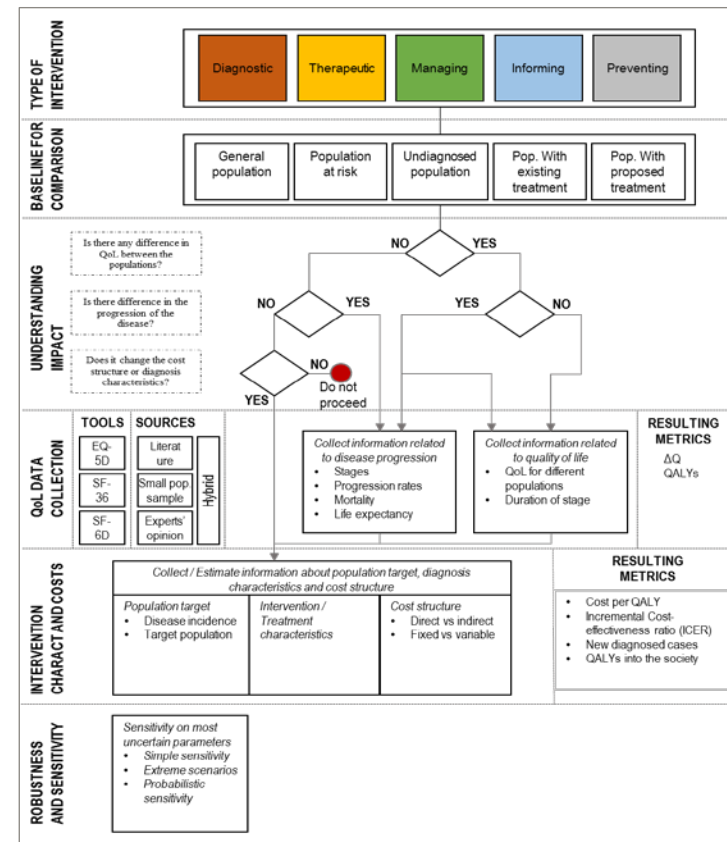
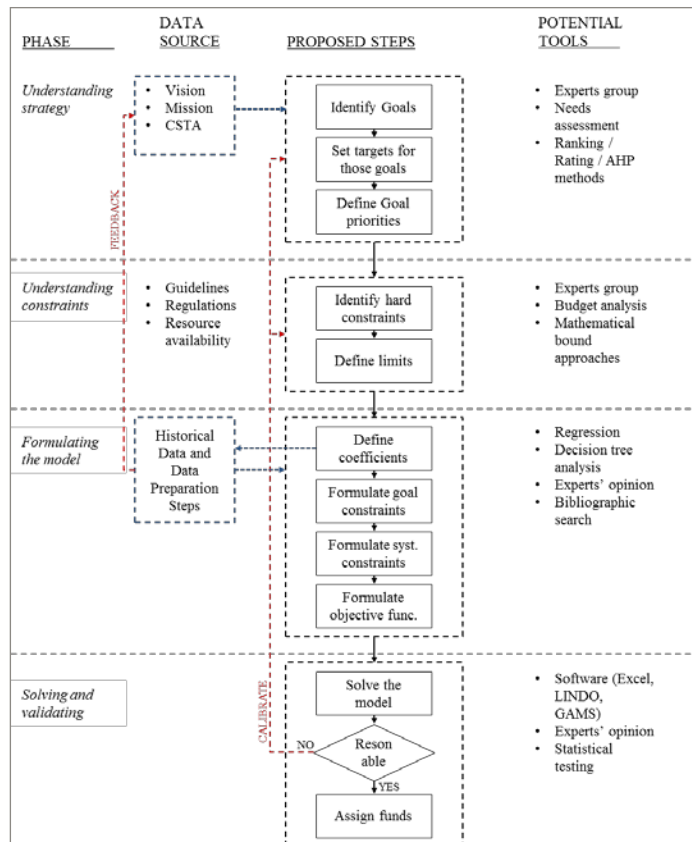


Each node (dot) is a researcher; each arc is a published paper indexed in PubMed.
Results shown are for the Penn State CTSI only.

Goal programming (GP) and cost-effectiveness analysis (CEA) are used to determine the mix of translational research proposals that should be funded.

Goal Programming

Cost-Effectiveness Analysis



Healthcare Delivery Science Research Project Planning Template

What is the specific need for improving the quality, safety, value of healthcare in your organization or department?

What would constitute a success in solving/addressing this need?

What innovations or technology breakthroughs are required?

Who should be involved?

What resources will the team need?

What will be the estimated impact on health (QALY) and estimated value (CEA)?

Our interdisciplinary research team includes engineers, physicians, and nurses.



Penn State IE/CIHDS/CHOT
David Munoz, PhD – 2015 IE/OR
(now with McKinsey & Company)

Penn State CTSI
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Internal Medicine

Larry Sinoway, MD, PI
Susan McHale, PhD, Co-PI
Rebecca Jenkins, Administrator
Kate Camargo, Project Director

University of Washington CTSI
Andrea Lazarus, PhD

University of South Carolina CTSI
Pam Gillam





PennState
College of Engineering

THANK YOU

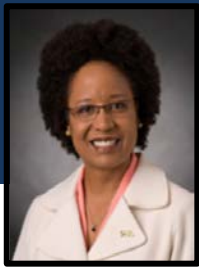
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SPEAKER BIO

Dr. Harriet Nembhard has been a dedicated professor of Industrial Engineering for over 20 years. She also directs the Penn State Center for Integrated Healthcare Delivery Systems (CIHDS) and is the Penn State site-director for the NSF Center for Health Organization Transformation (CHOT) which focus on applied research and industry engagement to bring better modes of care to patients.

Dr. Nembhard has an extensive history of research and teaching in quality engineering and quality improvement. She is most well known for applying engineering and statistics principles to hospitals, but also has been recognized in the medical community for developing healthcare data visualization tools, monitoring the mammograms of women with breast cancer, and a patented manufacturing process for making small-scale medical devices. She is the author or co-author of over 50 research publications and has been the PI or co-PI on six federally-funded grants. Her textbook entitled *Healthcare Systems Engineering* will be published by Wiley in Spring 2016.

In addition to her many contributions to Penn State and the healthcare and engineering fields, Dr. Nembhard has served as a technical consultant for several major companies. She is an Academician of the International Academy for Quality and a Fellow of the American Society for Quality.