What is Healthcare Engineering?

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Definition

Engineer
…applies scientific knowledge, mathematics, and ingenuity to develop _**solutions**_ for technical problems. Engineers design materials, structures and systems while considering the limitations imposed by _**practicality, safety and cost**_.

The work of engineers forms the _**link**_ between scientific discoveries and their subsequent _**applications to human needs and quality of life**_.

Bureau of Labor Statistics, U.S. Department of Labor (2006). "Engineers". Occupational Outlook Handbook, 2006-07 Edition.

National Society of Professional Engineers (2006). "Frequently Asked Questions About Engineering". Archived from the original on 2006-05-22. http://web.archive.org/web/20060522214617/http://www.nspe.org/media/mr1-faqs.asp.

Wikipedia – search 14 February 2013: http://en.wikipedia.org/wiki/Engineer

2

Definition

Healthcare
… the _**diagnosis, treatment, and prevention**_ of disease, illness, injury, and other physical and mental impairments in humans. Health care is _**delivered by practitioners**_ in medicine, chiropractic, dentistry, nursing, pharmacy, allied health, and other care providers. It refers to the work done in providing primary care, secondary care and tertiary care, _**as well as in public health.**_

Wikipedia Search, 14 February 2013: http://en.wikipedia.org/wiki/Healthcare

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Definition

Healthcare Engineering
… employs concepts and principles of engineering and applies them to healthcare situations. Engineers look at problems or systems and design _**new**_ or _**improved**_ ways of **making those systems work** —

… healthcare engineering includes all facets, from medication safety to patient and family engagement.

Purdue University, Regenstrief Center for Healthcare Engineering, 14 February 2013: http://www.purdue.edu/discoverypark/rche/about/healthcare_engineering.php

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Complications

1937 - Boston City Hospital
- Warmth, food, shelter, & care of a nurse
- Unless the patient presented with one of the few symptoms/diseases for which their was a known treatment
- The individual craftsman, i.e. doctor, did it all!

2000 - Most US Hospitals
- Treatments for nearly all the tens of thousands of ailments a human may present
- 4,000 medical procedures, 6,000 drugs
- 1970 - 2 FTEs; 2000 – 15 FTEs

TED Talk - Atul Gawande: How do we heal medicine? Accessed 14 February 2013: http://www.youtube.com/watch?v=L3QkaS249Bc

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Complications

Healthcare Fragmentation - USA
5,754 general acute hospitals
161,200 medical practices
379 operators of health insurance plans
$590 billion annually in prescription drugs
6,000 medical device companies
4,000 biotech companies

Paul Keckley, My Take, Deloitte – Center for Health Solutions, Health Care Memo, May 7, 2012: http://www.deloitte.com/view/en_US/us/Insights/Browse-by-Content-Type/Newsletters/health-care-reform-memo/379884of0b627310VgnVCM3000001c56f00aRCRD.htm
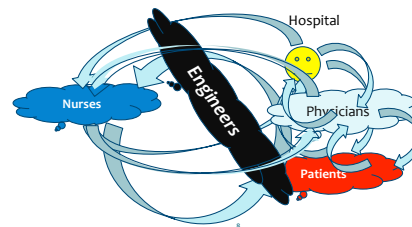
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Complications

17% of the US – Gross Domestic Product
$2.5 trillion annually
$8,000 per person per year
US Patient Protection Affordable Care Act – 14,000+ pages

http://en.wikipedia.org/wiki/Patient_Protection_and_Affordable_Care_Act

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Healthcare System Opportunities!
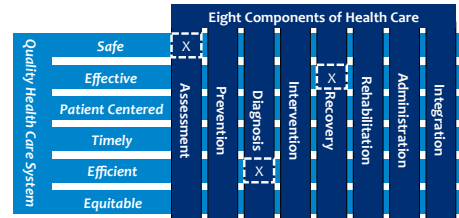
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System Engineering

Skill Set/Tools

- Concurrent engineering
- Quality function deployment
- Failure mode effect analysis
- Queuing theory & methods
- Discrete event simulation
- Supply chain management
- Game theory
- Systems-dynamic models
- Productivity measuring and monitoring

- Stochastic analysis
- Value-at-risk analysis
- Individual decision support
- Distributed decision support
- Data mining
- Predictive modeling
- Neural networks
- Statistical process control
- Scheduling

Building a Better Delivery System: A New Engineering/Health Care Partnership, Proctor P. Reid, W. Dale Compton, Jerome H. Grossman, and Gary Fanjiang, Editors, Committee on Engineering and the Health Care System, National Academy of Engineering, Institute of Medicine , ISBN: 0-309-65406-8, 276 pages, (2005)

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An Alternative ➡ Targeted Improvement

Eight Components of Health Care

Quality Health Care System		Assessment	Prevention	Diagnosis	Intervention	iRecovery	Rehabilitation	Administration	Integration
	Safe	X							
	Effective					X			
	Patient Centered								
	Timely								
	Efficient			X					
	Equitable								

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Summary

Healthcare Engineering

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