Nurse-Driven Innovations to Improve Health

April 17, 2018
Today’s Webinar

- Examine strategies to prepare nurses as leaders in innovation to improve health and well-being of individuals, families, and communities.
- Examine the use of virtual and augmented reality to improve training and education for sudden cardiac arrest.
- Explore business and design tools and skills required for nurses to be transformative drivers of better patient and health care outcomes.

Winifred V. Quinn, PhD
Director, Advocacy and Consumer Affairs
Center to Champion Nursing in America
Today’s Presenters

Therese S. Richmond
PhD, CRNP, FAAN
Andrea B. Laporte
Professor, University of Pennsylvania, School of Nursing
Associate Dean for Research & Innovation, University of Pennsylvania, School of Nursing

Marion Leary, RN, MSN, MPH
Director of Innovation Research, Center for Resuscitation Science, Penn Innovation Specialist, University of Pennsylvania School of Nursing

Nancy P. Hanrahan, PhD, RN, FAAN
Professor and Dean of the School of Nursing, Northeastern University
Senior Associate Dean of Innovation & Entrepreneurship for Bouvé College of Health Sciences
Nurse-Driven Innovations to Improve Health: Strategies in Education

Therese S. Richmond PhD, CRNP, FAAN
Andrea B. Laporte Professor of Nursing
Associate Dean for Research & Innovation
University of Pennsylvania School of Nursing
Why Innovation?

• Health & well-being are in peril

• Systems are broken

• Continued health inequity & health disparity
Innovation

• Transformative

• Broadly define innovation in the nursing space
Why Nursing?

• Improving health & well-being is central to the work of nurses

• Committed to vulnerable populations

• On the front lines

• Cross all settings where people live, play, work and heal

• Inherent problem solvers
  – “Necessity is the mother of all invention”
  – Expert at work arounds
Untapped Potential

- Innovation not core component of nursing curricula
- Solutions are typically “one and done”
- Enough!
The Good News

- Nurses are natural innovators
  - Identify problems
  - Compelled to solve problems for patient’s sake
  - Creative in variety of environments

Innovative solutions are often in the moment and not repeated

- Nurse researchers straddle research-innovation chasm
The Better News

Clinicians: one-off solutions

Researchers: science

The Missing Link
Foundational Principles

• Start early
• Create innovative educational programs
• Move beyond the health care system
• Keep health and well-being front and center
• Conceptualize innovation broadly – well beyond ‘widgets’
• Provide rigorous innovation toolboxes
• Bolster complex system thinking

Foundational Principles

• Be true to the inherent interdisciplinary nature of innovation
• Create a culture of inquiry in all places nurses practice
• Infuse a rigorous methodological approach to innovation
• Get faculty up to speed

Penn Nursing Motto
Every product & process that touches a patient goes through a nurse
Infusing Innovation into the Curriculum

• Exemplars
  – Hillman Scholars Program in Nursing Innovation
  – Preparing Students
  – Getting Faculty up to speed
Hillman Scholars Program in Nursing Innovation

- Vision
  - Cultivate the next generation of cutting edge researchers, leaders, & nurse innovators
- Integrated BSN-PhD

Penn Nursing Motto
Move from “Why we can’t” to “How do we?”

Funded: Rita and Alex Hillman Foundation
Program Overview

• Integration
  – Fully integrated curriculum
  – Rigorous but streamlined

• Innovation
  – Smash molecules together
  – Challenge assumptions
  – Innovation lessons
  – Make new connections

• Impact
  – Rapid prototyping
  – Co-creation & co-problem solving
  – Principle-driven vs. rule-bound
“Play is a fundamental part of who we are, because we all grow up playing games. Today, the games we're designing are incredibly rich experiences, experiences that have the power to entertain, teach, and inspire.

As a designer, I consider it a priority to make sure the games I help create are thoughtful, engaging, and accessible for people from walks of life - and as a nurse, I consider building resilience and helping players develop positive mental health strategies to be a vital part of this. We have to meet people where they are, and I believe that games, as activities enjoyed by billions worldwide, and as hubs for incredibly passionate and long lasting online communities, could well be the place to do just that.”

Matthew Lee
Hillman Scholar in Nursing Innovation
Penn Nursing
Lessons Learned

• Leave behind - “Why we can’t”

• Embrace “How do we?”

• Revel in the fun of rapid prototyping

• Don’t be afraid to course correct

• In education we must ‘walk the talk’
Preparing Students

• Innovation club

• Student champions

• Student internships

• PhD fellowships

• Participate in accelerator/hackathon/make-a-thon programs

• Celebrate accomplishments
Infuse Innovation in Curriculum

- Innovation in Health: Foundations of Design Thinking
  - Undergraduate
  - Graduate

- Approach
  - Interdisciplinary
  - Across academic levels
  - Ways of thinking
  - Community/provider partnerships for real-life problems
  - Develop to resonate with nursing culture
  - Flipped classroom
Design Thinking

Penn Nursing
Empathy
- Define
- Ideate
- Prototype
- Iterate
- Test

Penn Medicine Center for Health Care Innovation

IDEO U “Hello Design Thinking”

Gather Inspiration - Generate Ideas - Make Ideas Tangible - Share the Story
Getting Faculty Up To Speed

- Establish Faculty Innovation Fellows
- Participate in accelerator/hackathon/make-a-thon programs
- Highlight accomplishments
- Make innovation a strategic priority

Innovation Accelerator Pitch Day
Monday, April 16 3:30 - 6PM
Nurse
Innovation
Starts at
Penn Nursing.

Every Product and Process that Touches a Patient Goes Through a Nurse.

We Create and Test Innovative Solutions to Improve Health and Health Care.

At Penn Nursing, We Are Innovators.

Tanja V.E. Kral, PhD
Associate Professor of Nursing

MaMi: Early stage interactive mHealth application to improve dietary outcomes for children with autism spectrum.

Pamela Z. Cacchione, PhD, CRNP, GNP, BC, FGSA, FAAN
Ralston House Endowed Term Chair in Gerontological Nursing

Smart Socks: Monitors fluid retention and heart failure among the elderly.

Barbara Riegel, PhD, RN, FAAN, FAHA
Edith Clemmer Steinbright Professor of Gerontology

Wellth: A start-up that has partnered with Penn Nursing to test an electronic medication adherence system.

Anne M. Teitelman, PhD, FNP-BC, FAAN, FAAN
Patricia Blenznak Silverstein and Howard A. Silverstein Endowed Term Chair in Global Women’s Health

EverHealthier Women: mHealth bi-lingual application to track cancer screenings and prevention behaviors through the web and text messaging with links to online resources.

Kathryn H. Bowles, PhD, RN, FAAN, FACMI
Professor of Nursing and vanAmeringen Chair in Nursing Excellence
Mary D. Naylor, PhD, RN, FAAN
Marian S. Ware Professor in Gerontology

Right Care Solutions: Commercialized decision-support tool embedded in the electronic health care record to improve discharge planning for vulnerable, older adults.

Penn Nursing is at the Forefront of Innovation. For more information, e-mail innovation@nursing.upenn.edu.
Questions

University of Pennsylvania School of Nursing

Therese S. Richmond
http://www.nursing.upenn.edu/live/profiles/50-therese-s-richmond
Nurse-Driven Innovations to Improve Health: Using Virtual and Augmented Reality to Improve Training and Education for Sudden Cardiac Arrest

Marion Leary, RN, MSN, MPH
Director of Innovation Research, Center for Resuscitation Science, Penn Innovation Specialist, University of Pennsylvania School of Nursing
Disclosures

-American Heart Association, Grant Support; Scientific Committee; Guidelines Writing Group; Digital Strategies Writing Group; Education Summit Education Innovation Working Group

-Laerdal Foundation, Grant Support; In-Kind Support

-Medtronic Foundation, Grant Support

-Astrazeneca Foundation, Grant Support

-ImmERge Labs, LLC, Ownership

I always wanted to be an avatar. #STEAM #art
Sudden Cardiac Arrest (SCA)

350,000/year in U.S.

High-quality bystander CPR and AED use can DOUBLE survival

Most victims DO NOT receive high-quality bystander CPR
Problem #1

Cardiac arrest by nature is **sudden**

We don’t know **who, when, or where**

*Which makes it really difficult to treat and study!*
Problem #2

CPR training has been around for 50 yrs

Survival has plateaued

Practicing on a mannequin IS NOT the same as real-life
"Please. Don’t. Die."
A Grounded Theory Study of Bystander Cardiopulmonary Resuscitation

See Editorial by Dukes and Girotra

ORIGINAL ARTICLE

BACKGROUND: Bystander cardiopulmonary resuscitation (CPR) is an... 

Conclusions: Our study suggests that current CPR training programs may not adequately prepare lay rescuers for the reality of an OHCA and identifies several key knowledge gaps that should be addressed. The long-term psychological consequences of bystander intervention in OHCA remain poorly understood and warrant further study.
Solutions

Virtual Reality
Sudden Cardiac Arrest Training System

Virtual Reality
Sudden Cardiac Arrest mApp

Augmented Reality
CPRality
Using Virtual Reality to Observe Bystander Response to Cardiac Arrest

- Using a VR wearable device (HTC Vive) combined with a CPR recording mannequin, we created a three-minute multisensory SCA scenario.
- We sought to characterize lay bystander response to an unannounced SCA.
- Subjects were unaware of the nature of the emergency event but were told to respond however they would to an emergency situation.
## Results

From June 2016 – June 2017, 119 subjects enrolled

<table>
<thead>
<tr>
<th>Age, mean±SD</th>
<th>37±14*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender, n (%)</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>53 (45)</td>
</tr>
</tbody>
</table>

| Race, n (%) |        |
| White       | 60 (51) |
| Black       | 38 (32) |
| Other       | 19 (17) |

| Education, n (%) |        |
| Some high school | 1 (1)  |
| High school or GED | 9 (8)  |
| Some college/voc | 40 (34) |
| Bachelors        | 31 (26) |
| Masters          | 43 (29) |
| Doctorate        | 4 (3)   |

| Annual income, n (%) |        |
| Less than $20,000   | 20 (17) |
| $20,000-$34,999     | 8 (7)   |
| $35,000-$49,999     | 19 (16) |
| $50,000-$74,999     | 17 (15) |
| $75,000-$99,999     | 17 (15) |
| $100,000-$149,999   | 20 (17) |
| $150,000-$199,999   | 13 (11) |
| $200,000 or more    | 3 (3)   |

| CPR Training |        |
| Less than 2 years | 36 (31) |
| 2-5 years       | 44 (36) |
| 6-10 years      | 9 (8)   |
| Greater than 10 years | 6 (5)   |
| Not trained     | 24 (21) |

| Know how to use an AED |        |
| Yes                    | 60 (51) |
| No                     | 43 (36) |
| Unsure                 | 13 (11) |
| Don’t know what that is | 2 (2)  |
82 percent of subjects felt as if they were involved in a real SCA event
Results

Of the 96 subjects who attempted CPR, we were able to obtain CPR quality data from 81 subjects.

<table>
<thead>
<tr>
<th>CPR Quality</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CC Rate</td>
<td>94±22 cpm</td>
</tr>
<tr>
<td>CC Depth</td>
<td>38±13 mm</td>
</tr>
</tbody>
</table>

*Guidelines:*  
CC rate: 100-120 bpm  
CC depth: at least 2 inches (50 mm)
Observed lay bystander response to an unannounced SCA with randomization of the victim (race and gender)

Enrolled 75 subjects between September 1, 2017 – December 31, 2017
Men were 1.23 times more likely to receive CPR.
### Results

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>n=75</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Age, mean±SD</strong></td>
<td>31±11*</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Gender, n (%)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>26 (35)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Race, n (%)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>35 (49)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>11 (15)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>26 (36)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Education, n (%)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Some college/or less</td>
<td>24 (32)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bachelors</td>
<td>33 (44)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Masters or higher</td>
<td>18 (24)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Annual income, n (%)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$49,999 or less</td>
<td>33 (46)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$50,000-$99,999</td>
<td>16 (22)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$100,000 or more</td>
<td>21 (30)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CPR Training</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 years or less</td>
<td>25 (33)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 years</td>
<td>10 (13)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-10 years</td>
<td>4 (5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Greater than 10 years</td>
<td>4 (5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not trained</td>
<td>32 (43)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Know how to use an AED</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>28 (37)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>35 (47)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unsure</td>
<td>7 (9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Don’t know what that is</td>
<td>5 (7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Post-intervention</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Called 911</td>
<td>70 (93)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Performed CPR</td>
<td>44 (59)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asked for AED</td>
<td>13 (17)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Used AED</td>
<td>8 (11)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Results

No CPR

46%

35%

No AED

85%

79%

P=NS
Comparing the impact of a VR SCA training mobile application (mApp) with a standard CPR training mApp via randomized trial.
Virtual Reality Mobile Application
Virtual Reality Mobile Application

Welcome to SCA-VR Cardboard!
Bienvenido a SCA-VR Cardboard!

This woman has fallen! To start performing compressions click the button on the top of your Cardboard Viewer!

Once the power button is clicked, the AED will begin providing instructions just as you hear now.

Great job delivering a shock with the AED! Keep compressing hard and fast on the center of the chest until Emergency Services arrive!

Congratulations on Saving a Life!
You Got Four Hearts!

Remember: Call 911, Perform Chest Compressions, and Use an AED!!
Augmented Reality

- Overlay a holographic circulatory system over the mannequin
- View blood flow to vital organs based on the actual quality of CPR being performed

https://www.youtube.com/watch?v=QfiP62A-2qk
Augmented Reality
Future Directions

- Surgery
- Anaphylaxis
- First aid
- Stroke
- Mass casualty
- Heimlich maneuver
- Trauma
- Heart attack

Future Directions
Connect

--- Connect ---

@marionleary  marionleary  marionleary

Marion_Leary

http://marionleary.strikingly.com/
Nurse-Driven Innovations to Improve Health: The Innovation Economy

Nancy P. Hanrahan, PhD, RN, FAAN
Executive Director, Associate Dean of Innovation & Entrepreneurship
Northeastern University
Objectives

- Forces shaping health care reform
- Forces shaping the future of nursing practice
- Business and design tools/strategies required for nurses to be transformative drivers of better patient and health care outcomes

- What is innovation?
- How do nurses become valued innovators?
- What are some design tools and skills?
Demand for Digital Health Solutions

• In 2016, the global digital health market was at $179.6 billion. Growth is anticipated to rise 13.4 percent between 2017 and 2025, reaching $536.6 billion.

• Clinical decision support system (CDSS), EHR/EMR, computerized physician order entry (CPOE), telehealth, mHealth, and population health management are the key segments of innovative solutions.

https://www.transparencymarketresearch.com/digital-health-market.html
Forces Shaping Health Care Reform

- Explosion of knowledge within a health system that is too fragmented and disorganized to absorb it
- Radical transformation about how we manage health and health care
- Forces shaping digital health innovation include:
  - Human
  - Policy
  - Economic
  - Technology

Nurses take notice!
Key Challenges

• **Problem #1: Escalating medical costs**
  Aging population—growing need for medical care, changes in legislative policy, and more costly treatment options—expenses related to medical care are increasing day by day.

• **Problem #2: Outdated medical business models**
  Standard medical business models are widely understood to be lacking, yet these approaches still dominate how health care is delivered.

• **Problem #3: Patients confused and not supported**
  -Dealing with diseases or conditions can be a solitary experience
  -Multiple providers don’t communicate
  -Support from family, friends, and other patients can often be missing or lack coordination
Skills Needed to Address Challenges

Nurses:

• Not educated to meet today’s health challenges
• Need new competencies
  – *Radical collaborative teams* that inspire creative thinking among practitioners from all disciplines, perspectives, and backgrounds. Different points of view are key in pushing “out of the box” thinking, radical/unreasonable ideas.
  – *A focus on real-world projects:* Nurses and other health providers want to make an impact. Need the space and coaching to evolve an idea into a prototype.
  – *Decision-making processes* that empower rapid and iterative decision-making, while fostering co-creation and co-ownership. High tolerance of failures.
Nurse Education Challenge

• **Nurse leadership** competencies include expertise in state of the art communication skills that integrates provider teams and are driven by information technology.

• **Nurses** must understand how to apply data to understand the “context of care” and support decision-making across the health care enterprise.

• **Nurse researchers** must go beyond regression models in their research and integrate social determinants using big data and machine learning.

• **Health professionals** must be able to "(1) provide patient-centered care, (2) work on interdisciplinary teams, (3) employ evidenced-base practice, (4) apply quality improvement and, fundamental to the preceding four, (5) make use of informatics.”

(IOM. 2003, cited in Dreher and Fitzgerald-Miller 2006: 29)
Patients Are Central to Innovation

- Dave deBronkart *Let Patients Help*
  - Knowledgeable and empowered patient patients can—and must—be a central part of the treatment process.
- Tom Ferguson coined the term ePatients, or “individuals who are equipped, enabled, empowered, engaged in their health and health-care decisions.”
What Is Innovation?

Innovation is the accomplishment of the impossible, the unbelievable, the unreachable, the unattainable—until it is done and then it is the possible, the believable, the reachable, the attainable.
The First Nurse Innovator

*Florence Nightingale, the founder of modern nursing, challenged the conventional practice and long-held beliefs in medicine that people did not need to wash their hands or sterilize their tools between patients to prevent disease. She challenged the status quo, the way things had always been done, and led to the creation of the Nursing Profession.*
Nurse Innovators

• Marybeth Pompei, RN – who from simply touching her husband’s forehead to see if he had a fever, led to inventing the Exergen Temporal Thermometer.
• Maggie McLaughlin, RN – who through her experience as an IV nurse saw a better Luer lock system to prevent injuries to patients.
• Marion Leary, RN – a resuscitation nurse who recognized that using artificial reality could better train nurses in CPR.
• Matthew Lee, RN – developed a game for college students to understand depression and use mindful techniques.
How to Become Valued Innovators?

• For the past 16 years, nurses have been valued by patients as the top ethical and honest profession.
  – In 2017, the Gallup organization once again announced that nurses continue to hold top honors for ethics and honesty, with 84% of those polled rating those characteristics as high or very high.
  – More than 8 out of 10 Americans describe nurse ethics as "very high" or "high."

• The nursing profession continues to serve as the very lifeblood and connective tissue of the U.S. health care system.

*What would it take to transform nurses into leading agents for the redesign of the health care system?*
A leader takes people where they want to go. A great leader takes people where they don’t necessarily want to go, but ought to be. Rosalyn Carter

- Our mission is to advance nurses to the forefront of health care innovation and entrepreneurship.
- We provide experiential lifelong learning opportunities for all nurses to grow competence in business/finances, technology, and policy in addition to the practice of patient care.
- We provide a space away from the busy clinical settings to relax and innovate with colleagues.

https://www.northeastern.edu/nurseinnovation/
Opportunities

- **Nurse Accelerator**: Educates, incubates, and launches innovative ideas from students, nurses, and faculty. The Nurse Accelerator exposes them to interdisciplinary opportunities from business, engineering, design, and computer science. Through partnerships with health systems, businesses, and foundations, we source funding opportunities to start new companies and become leaders in the innovation economy.

- **Feasibility and pilot random control trials for new devices**
Opportunities

• **Nurse Leadership and & Entrepreneurship Courses + Certificates:** [https://www.northeastern.edu/nurseinnovation/leadershipcertificate/](https://www.northeastern.edu/nurseinnovation/leadershipcertificate/)

• **Nurse Hackathon** May 18-20 2018 Opioid Hackathon: A three-day event set to tackle the opioid epidemic in new, innovative ways. [https://www.northeastern.edu/nurseinnovation/hackathon-2018/](https://www.northeastern.edu/nurseinnovation/hackathon-2018/).

• **Reverse Pitch Hackathon with AARP**: June 4, 2018 Technology to let people age at home. Nurse SharkTank that is designed to support nurse and healthcare entrepreneurs. This event brings bright minds together to help their product gain traction and support. This is a fantastic opportunity to expand awareness of a product and potentially receive funding to further its development. [https://www.northeastern.edu/nurseinnovation/nurse-sharktank-2018/](https://www.northeastern.edu/nurseinnovation/nurse-sharktank-2018/)

• **Nurse Practitioner Entrepreneurship Conference**: This conference is for NPs who want to grow their understanding of the business side of health care, regardless of their work setting. [https://www.northeastern.edu/nurseinnovation/np-entrepreneurship-conference-2018/](https://www.northeastern.edu/nurseinnovation/np-entrepreneurship-conference-2018/)

• **Nurse Innovation & Entrepreneurship Summit**: September 2018. Interpreting innovation pedagogy for nurses and nursing education. [https://www.northeastern.edu/nurseinnovation/nurse-innovation-and-entrepreneurship-summit/](https://www.northeastern.edu/nurseinnovation/nurse-innovation-and-entrepreneurship-summit/)
Spread the word: Nurses are key leaders in health reform. See online our Gallery of Nurse Innovators & Entrepreneurs: 
https://www.northeastern.edu/nurseinnovation/gallery-nurse-innovators-entrepreneurs/

THANK YOU!
Facilitated Dialogue

Molly K. McCarthy
MBA, RN-BC
National Director, US Provider Industry and Chief Nursing Officer
Microsoft US Health & Life Sciences

Christel Anderson, MA
Senior Director, Interoperability Initiatives
HIMSS
Questions or Comments?

Press *1 on your telephone key pad to ask a question
(Please be sure to record your name after the prompt)
OR
Use the “chat” feature to send “everyone” a question.

If you are having trouble asking a question, please click the “Raise Hand” button on the bottom right of your screen.

You can find the recording, webinar summary, and additional resources by going to: www.campaignforaction.org/webinars.