The Future of Nursing:
Mobile Technology, Robotics & More

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Objectives

Audience members will:

1. Learn and discuss how emerging technologies will be used for future models of care delivery

2. Learn and discuss impacts of emerging technologies on nursing practice, education, and regulation
Precision Health

• Today: most medical care is based on expected response of the average patient

• Tomorrow: medical care will be based on individual genomic, environmental, and lifestyle differences that enable more precise way to prevent and treat disease
Precision Health

• Not entirely new idea

Prescription Eyeglasses

Blood Transfusions
IMPRECISION MEDICINE

For every person they do help (blue), the ten highest-grossing drugs in the United States fail to improve the conditions of between 3 and 24 people (red).

1. ABILIFY (aripiprazole)
Schizophrenia

2. NEXIUM (esomeprazole)
Heartburn

3. HUMIRA (adalimumab)
Arthritis

4. CRESTOR (rosuvastatin)
High cholesterol

5. CYMBALTA (duloxetine)
Depression

6. ADVAIR DISKUS (fluticasone propionate)
Asthma

7. ENBREL (etanercept)
Psoriasis

8. REMICADE (infliximab)
Crohn’s disease

9. COPAXONE (glatiramer acetate)
Multiple sclerosis

10. NEULASTA (pegfilgrastim)
Neutropenia

Based on published number needed to treat (NNT) figures. For a full list of references, see Supplementary Information at natures.com/43976B.

Precision Health

**GENOMICS**
Our genes can suggest what diseases we might be predisposed to, but it’s an incomplete picture of human health.

**PHENOTYPE**
A snapshot of the current state of health that can be used to prevent, diagnose and treat disease or improve health.

**LIFESTYLE/ENVIRONMENT**
External factors like diet, exercise, medications, microbiota and even where we live influence our metabolic state.
Precision Health

- Assess disease risks
- Customized disease monitoring
- Facilitate disease prevention
- Disease detection
There are 3 major complementary payment models being deployed in US:

- **Population-based payment**
  - Capitation

- **Episode-based payment**
  - Retrospective Episode Based Payment (REBP)
  - Bundled payment

- **Pay for performance**
  - Bonus payments tied to quality
  - Bonus payment tied to value

**Most applicable**

- Primary prevention for healthy
- Care for chronically ill (e.g., managing obesity, CHF)

- Acute procedures (e.g., CABG, hips, perinatal)
- Most inpatient stays including post-acute care, readmissions
- Acute outpatient care (e.g., broken arm, URI, some cancers, some behavior health)

- Discrete services provided by entity with limited influence on upstream or downstream costs (e.g., MRI, prescription, medical device, Health Risk Assessment)
Mobile Health Technologies
1 Ambient Intelligence Agent (Aml) Control
2 Light Sensor
3 Windows and Door Control
4 HVAC Control
5 Lighting Control
6 Automatic Pet Feeder
7 Motorized Drapes
8 Automatic Watering
9 Mailbox Sensor
10 Driveway Sensor
11 Security System
12 Lawn Moisture Sensor
13 Face Recognition Sensor
14 Motion Sensors
15 Door Sensors
16 Aml Interface with Car
17 Aml Interface with Smart Phone
Digital Health
509 Companies
$7.05B Funding
See the updated scan and more: venturescanner.com/scans/digital-health
Mobile Health

MOBILE PHONES

- >95% of US population (88% Rural)
- >92% < $30,000/year
- >77% of US population have a smart phone (67% rural)
- Socioeconomic backgrounds
- Most Geographic locations
- Direct reach

Pew 2017
Chronic Illness

#1 HEALTH RISKS¹

HEART DISEASE
ASTHMA
DIABETES
CANCER
ARTHRITIS
DEPRESSION
Chronic Illness

84% of health spending
> $2 TRILLION
The Easiest Way to Stay Slim

Texting all the time is often frowned upon. But here’s why it just might keep you thin

BY BRIAN DALEK, NOVEMBER 24, 2013

CLINICAL RESEARCH STUDY

Mobile Health Messages Help Sustain Recent Weight Loss

Ryan J. Shaw, PhD, RN, a,b Hayden B. Bosworth, PhD a,b,c,e Susan S. Silva, PhD, a Isaac M. Lipkus, PhD, a
Linda L. Davis, PhD, RN, a Ronald S. Sha, MD, PhD, a Constance M. Johnson, PhD, RN a

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Brief report

Feasibility and Smokers’ Evaluation of Self-Generated Text Messages to Promote Quitting

Ryan J. Shaw PhD, RN\textsuperscript{1}, Kathryn Pollak PhD\textsuperscript{2}, Leah L. Zullig PhD, MPH\textsuperscript{3,4}, Gary Bennett PhD\textsuperscript{5}, Karen Hawkins BA\textsuperscript{1}, Isaac Lipkus PhD\textsuperscript{1}

Do it for your health and your daughter
Episodic to Real-Time Care in Diabetes Self-Management

6 months

Medication Adherence Survey  Accelerometer & Activity  Weight  Blood sugar
Autism & Beyond
A Study of Young Children’s Mental Health

Sweep to learn more

Join Study
Already Participating?

How it Works
While your child watches a video on your iPhone, we will record your child’s face to measure emotion.

You can choose to share the video or only the facial expressions.
Empatica E4 Specifications

Battery life
Streaming Mode: 20+ hrs
Memory mode: 36+ hrs

Data Management
Flash memory
Bluetooth LE (Smart)

Certification
CE certification
FCC certification

Sensors
Photoplethysmography (PPG)
Continuous Heart Rate (HRV, Stress, Relaxation)

Form Factor
Small and comfortable
Case: 44 mm x 40 mm, height: 16 mm
Weight: 25 g

3-axis Accelerometer
Movement, Activity

Event Mark Button

Temperature + Heat flux
Activity, Context

Electrodermal Activity (EDA)
Skin conductance (Anxiety, Excitement)

Measure both branches of the autonomic nervous system.

Electrodermal Activity
Continuous Heart Rate
2 Hours

Friday, May 12, 19:23:56 - 19:23:57
- Temperature: 32.30
- Deltia acc: -1.72
- EDA: 0.13
- BVP: 0.09
The (near) Future
Clinical Overflow

Population

Adjust behaviors/environmental exposures

Automated Computer Algorithm

Level 1

Care team/PCMH

MD
NP
PA

Level 4

RN

Level 3

IT
Pt Tech

Level 2

Individual patient and Family

Reporting/Alerts
A1c (HbA1c): -0.4%

SBP & DBP: -3.68 mm Hg and -1.56 mm Hg

Total cholesterol: -9.37 mg/dL

Low-density-lipoprotein cholesterol: -12.07 mg/dL
Future

• Point-of-care diagnostics
• Environmental sensors
• Biomechanics
• Wearable tattoos
• Ingestibles
• Implantables
• Genomics - DNA
Interdisciplinary Research Example
Care Delivery Robotics
Interdisciplinary Research Example
Care Delivery Robotics

Tele-Robotic Intelligent Nursing Assistant (TRINA)
Feasibility of Patient Caring Tasks

Jane Li, Peter Moran, Carrina Dong,
Ryan J. Shaw, Kris Hauser
Electrical and Computer Engineering Department
School of Nursing
Duke University
Future of Nursing
2010 Public Forum Findings

• Rapidly changing knowledge base

• New technologies throughout nurses’ careers

• Care shifting outside of acute care settings

• Technology—such as that used in high-fidelity simulations—fosters problem-solving and critical-thinking skills in nurses
Impact on Education, Practice and Regulation

- Healthcare landscape...changing with expansion of technology
- Nursing profession is changing with new jobs...we must teach nurses in new ways
- Importance of exposing nursing students to new care delivery models
- Many jobs as we know will be taken over by technology
- Nursing Education needs to think about Augmented Reality, Mitigating distance as a barrier in education and other technologies
4 Innovative Projects in the Simulation Lab
Meet “RQI”...Using Technology to Learn CPR

PI - Dr. Marilyn Oermann
Project Manager- Dr. Suzie Kardong-Edgren

Student Using RQI
Use of Google Glass™ in High Fidelity Simulation

Winner, BAYADA Award for Technological Innovation in Health Professional Education and Practice for 2015

CND’s team ... designed a simulation activity that incorporated augmented reality into nurse training scenarios using Google Glass™
What the Student Sees

Student looking at manikin

What student sees through Google Glass™
Innovation in Teaching: Meet Our Robot

JaMMeR

Visit: Double Robotics JAMMER
Telepresence Robot

- Distance-based NP student connects via web interface
- Drive robot around simulation rooms
- Communication between on-campus and remotely located students in real time
Telepresence value in the nursing curriculum?

• Gave students opportunity to participate in clinical simulation using emerging technologies for patient assessment, surveillance and education.

• Facilitates teamwork, communication, and role development skills required for safe clinical practice.

• Exposure in academic setting prepares students in health professions to use technology in clinical practice.
National Simulation Study
How much simulation should be used in nursing programs and what are best practices?

NCSBN’s landmark study of simulation use in prelicensure ADN and BSN nursing programs across the country.
Study Conclusions
Up to 50% simulation can effectively substitute traditional clinical experience in core courses across prelicensure nursing curriculum.

Recommendations for Educators and Regulators
• Formally train faculty in simulation pedagogy
• Use theory-based debriefing methods with subject matter experts
• Adequate numbers of simulation faculty to support the learners
• Equipment and supplies to create a realistic environment
NLN: A Vision for Teaching with Simulation

- Simulation is more than a way to teach and practice psychomotor skills
- Evidence-based strategy to facilitate high quality experiences that foster thinking and clinical reasoning skills for students
- Imperative to embed quality simulation experiences throughout learning programs
  - Changes in healthcare access
  - Technological advances in care delivery
  - Increasing complexity of care
  - Lack of clinical placements
State Boards of Nursing: Implications

1. Faculty development in the effective use of simulation and simulation teaching methods is vital for the implementation of effective and high quality simulation experiences.

2. Each simulated experience must have clearly stated objectives that are presented to the student prior to engaging in the simulation experience (INACSL, 2013).

3. Students must be orientated to both the simulation technology and the environment.
Other Emerging Technological Media

- Virtual worlds
- Computer simulations
- Serious video games
- Augmented reality
- HoloLens

How can nurse educators bridge the gap between theory and nursing practice?
Thank You!

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References


