Nurses and Engineers
Partnering for Patient Safety

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21st Century Technology Challenges

- Diffusion of complex technology
  - Increased complexity of environment
  - Increased acuity and complexity of patients
  - Technology is *not* just in the ICU / ORs
    - General Care Floors
    - Skilled Nursing
    - Nursing Homes
    - Home Care
Nurse & Engineer Partnerships
National Coalition to Promote the Safe Use of Complex Technology

- National Coalition on Alarm Safety
- National Coalition to Promote Continuous Monitoring of Patients Receiving Opioids
- National Coalition on Infusion Therapy Safety
Nurse and Engineer Partnerships

- Design and Implement New Technologies
- Ensure data security
- Establish safe patient care environments
- Develop effective information technologies for communication
Interdisciplinary Areas of Collaboration

- Patient Safety
- Symptom Monitoring & Health Mgt
- Information System and Nursing HR Mgt
- Health Education
- Nurse Patient Communication

Define healthcare issues
Collect the information
of users expectations

Translate user needs into design
Make a detailed design protocol
Revise the design

Test in real HC setting
Conduct pilot studies
Train users and get feedback

Conduct in a large scale users
Perform the users acceptance / satisfaction study

Identify the technical needs
Discover current limitations

Revise the design
Develop the prototype
Choose available materials

Examine Feasibility
Discover strengths / weaknesses
Refine the prototype

Examine the function and technical factors

NURSE IDENTIFIES UNMET CLINICAL NEED

Some patients lack the physical ability to push the PCA button to admin medications

MULTI-DISCIPLINARY TEAM, INCLUDING ENGINEERS

Pain service, clinical engineers, pharmacist, nurse

DEVELOP AND TEST EFFECTIVE SOLUTIONS

Nurse identifies unmet clinical need

Need for face shields during the pandemic:
  Rapid production
  Ease of Use

Multi-disciplinary team, including engineers

Engineers
Clinical nurses
Engineering and nursing students

Develop and test effective solutions


https://www.umass.edu/ials/covid19/umass-face-shield
Collaboration During COVID

- COVID Crisis
  - Goal of moving equipment, including pumps, ventilators, etc to the hallways.
  - PPE design and distribution
  - Post pandemic role transformation: Nurse-Engineer
Clinical Engineers need to spend more time not only in the clinical corners of the hospitals, but also experiencing what nurses experience.

Nurses need to spend time with clinical engineers to understand the how and why of equipment and the intricacies of repair & maintenance.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medicated Infusions</td>
<td>Can we improve accuracy?</td>
</tr>
<tr>
<td>Central Venous pressure</td>
<td>What is the best position for accurate measurements?</td>
</tr>
<tr>
<td>Cardiac / Telemetry monitoring</td>
<td>What are best practices?</td>
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Who are your Partners?

**Clinical Partner**
- Clinical nurse specialist (CNS)
- Nurse educator
- Clinical Nurse Leader (CNL)

**Operational Partner**
- Nurse manager / director
- Manager of Products / Technology
- Director of Operations
## Nurse / Engineer Project Partnerships

<table>
<thead>
<tr>
<th>Selection</th>
<th>Define the need</th>
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<tbody>
<tr>
<td></td>
<td>Evaluation</td>
</tr>
<tr>
<td></td>
<td>Safety and efficacy</td>
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<tr>
<td></td>
<td>Human factors</td>
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<td>Risk assessment</td>
<td>FMEA</td>
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<td>Business case</td>
<td>Financial analysis</td>
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<tr>
<td>Organizational processes</td>
<td>Decision making</td>
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<tr>
<td>Education and competency</td>
<td>Education</td>
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<td></td>
<td>Competency</td>
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<tr>
<td>Adoption</td>
<td>Strategies</td>
</tr>
<tr>
<td>Evaluation</td>
<td>Did practice change and is it effective</td>
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</tbody>
</table>

- **Regulatory issues; FDA approval**
- **Physical and cognitive ergonomics**
- **What if?**
- **Upfront cost, disposable cost, maintenance costs**
- **Who makes the final decision?**
- **Both nurses and engineers**
- **Initial and ongoing**
- **Barriers?**
- **Did the new technology deliver the proposed outcomes?**

## Engineers: Next Steps

<table>
<thead>
<tr>
<th>Publicize your team</th>
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</table>
| Nurses should know who you are... and what you can do for them and with them  
| Engineers or techs unit based? |

<table>
<thead>
<tr>
<th>Listen First</th>
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<tbody>
<tr>
<td>Do not fix and leave without showing the nurses what the issue was and a brief explanation of how you fixed it</td>
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<tr>
<th>Speak the same language</th>
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<tbody>
<tr>
<td>Speak the language, be respectful of nurses who are not “tech savvy”</td>
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<tr>
<th>Make rounds</th>
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<tbody>
<tr>
<td>Safety is in relationships. Nurses might say “oh, while you are here...;” “I was wondering about‘,,,,”</td>
</tr>
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<table>
<thead>
<tr>
<th>Attend clinical meetings</th>
</tr>
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</table>
| Nursing Practice  
Medication Safety |

<table>
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<th>Involve nursing staff in purchasing decisions</th>
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<tbody>
<tr>
<td>End users, they are the ones using the equipment</td>
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## Education and Innovation Centers

<table>
<thead>
<tr>
<th>Institution</th>
<th>Program Description</th>
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<tbody>
<tr>
<td>University of Massachusetts / Amherst</td>
<td>Elaine Marieb Center for Nursing and Engineering Innovation</td>
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<tr>
<td>Johns Hopkins</td>
<td>Fellowship Opportunity in Nursing and Engineering</td>
</tr>
<tr>
<td>University of Connecticut</td>
<td>Nursing and Engineering Innovation Center: NursEng Innovation Fellowship</td>
</tr>
<tr>
<td>Florida Atlantic</td>
<td>Nursing and engineering combined degree programs</td>
</tr>
<tr>
<td>Duquesne University</td>
<td>Dual Degree in Engineering and Nursing</td>
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[FAU | New Degree Programs Combine Nursing with AI and Biomedical Engineering](https://www.fau.edu)
[New Interdisciplinary Fellowship Opportunity in Engineering and Nursing - Johns Hopkins Whiting School of Engineering (jhu.edu)](https://www.jhu.edu)
[Home | Nursing and Engineering Innovation Center (uconn.edu)](https://www.uconn.edu)
Nurse & Engineer Partnerships

Take Aways:

- Find out **who your partners** are
- How can you develop relationships with the front-line nurses? It will be mutually beneficial.
- Is there anything that you can think of right now that you want to discuss with your nurse partners?
- Find out what clinical meetings would be beneficial – Nursing practice? Medication safety?
- What can you ask of the nurses? Don’t be afraid – something as simple as defining what is wrong instead of just writing “broken.”
- Ensure that the right stakeholders are present when discussing the purchase of new equipment
Resources

ANA: [Nurse-Engineer Teams: Creating the Next Gen of Innovation | ANA (nursingworld.org)]


Duquesne University: [Biomedical Engineering and Nursing Dual Degree - Duquesne University](https://www.duquesne.edu/)

Giuliano, K. (ND). Nurse-Engineer Teams: Creating the Next Generation of Health Care Innovation Leaders


Johns Hopkins: [New interdisciplinary fellowship opportunity in engineering and nursing - Johns Hopkins Malone Center for Engineering in Healthcare (jhu.edu)](https://www.jhu.edu/)


University of Connecticut: [Home | Nursing and Engineering Innovation Center (uconn.edu)](https://www.uconn.edu/)

University of Massachusetts at Amherst: [Homepage : Elaine Marieb Center for Nursing & Engineering Innovation : UMass Amherst](https://www.umass.edu/)

Thank you!