Virtual Simulation Training System (VSTS):
Home healthcare hazard training

Barbara Polivka, PhD, RN
University of Louisville
School of Nursing

Amy Darragh, PhD, OTR/L
OSU College of Medicine
School of Health and Rehabilitation Sciences

Steven Lavender, PhD, CPE
OSU Colleges of Engineering & Medicine
Depts. of Integrated Systems Engineering & Orthopaedics

Carolyn Sommerich, PhD, CPE
OSU Colleges of Engineering & Medicine
Dept. of Integrated Systems Engineering & School of Health and Rehabilitation Sciences

Donald Stredney, MA
Bradley Hittle, B.S.
Ohio Supercomputer Center

Celia E. Wills, PhD, RN
OSU College of Nursing

Research reported in this presentation was supported by the National Institute for Occupational Safety and Health (NIOSH) of the Centers for Disease Control and Prevention under award number R01OH010425-02. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIOSH.
Background

- Rapid growth of home healthcare and home healthcare personnel (HHP)
- HHP incurred 352 lost time injuries per 10,000 full-time workers
- Home environmental hazards accounted for ~ 60% of injuries and illnesses
- Hazards can negatively impact job performance, job satisfaction, and health of HHP
- Most home health aide injuries in client homes occurred in the bedroom (24%), bathroom (18%), and kitchen (9%)
- Current training approaches for HHP are limited
Develop a Virtual Simulation Training System (VSTS), using an interdisciplinary, participatory design approach

Assess the usability, usefulness, and desirability of the VSTS across multiple professional disciplines

Evaluate the efficacy of the VSTS in preparing home healthcare professionals to recognize, assess, and respond to hazards in the home health environment using appropriate risk perception and decision-making processes
Phase 1 Methods

- Interdisciplinary participatory design approach

Mixed Methods
- Modified home healthcare worker questionnaire
  - Open ended questions in
    - 8 Focus groups (2-5 participants per FG)
    - 37 Interviews
  - Room drawings completed by participants

Audio-recorded interviews transcribed and validated for accuracy

Transcript data independently coded by at least 2 coders for
- Types of hazards
- Room of hazard
<table>
<thead>
<tr>
<th>Sample Characteristics (n = 68)</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Profession</strong></td>
<td></td>
</tr>
<tr>
<td>Nurse (RNs, LPNs)</td>
<td>26 (38.3)</td>
</tr>
<tr>
<td>Home health aide</td>
<td>14 (20.6)</td>
</tr>
<tr>
<td>Therapist (OT, PT, Other)</td>
<td>15 (22.0)</td>
</tr>
<tr>
<td>Educators/Managers/Health and safety experts</td>
<td>13 (19.1)</td>
</tr>
<tr>
<td><strong>Participant locations – OH, KY, FL, IL, IN, NC, IA, CO, MN, SC, WA</strong></td>
<td></td>
</tr>
<tr>
<td>Ohio</td>
<td>22 (42.3)</td>
</tr>
<tr>
<td>Kentucky</td>
<td>13 (25.0)</td>
</tr>
<tr>
<td>Other states</td>
<td>33 (32.7)</td>
</tr>
<tr>
<td><strong>Interview method</strong></td>
<td></td>
</tr>
<tr>
<td>Focus group</td>
<td>31 (45.5)</td>
</tr>
<tr>
<td>Individual interview</td>
<td>37 (54.4)</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>59 (95.2)</td>
</tr>
<tr>
<td>Male</td>
<td>3 (4.8)</td>
</tr>
<tr>
<td><strong>Race (n=50)</strong></td>
<td></td>
</tr>
<tr>
<td>Black or African American</td>
<td>5 (7.9)</td>
</tr>
<tr>
<td>White</td>
<td>45 (71.4)</td>
</tr>
<tr>
<td><strong>Age (n=61; range: 22-73 years)</strong></td>
<td>M = 49 (SD=11.8)</td>
</tr>
<tr>
<td><strong>Home healthcare work experience (n=61; range: &lt; 1-36 years)</strong></td>
<td>M = 11.9 (SD = 9.0)</td>
</tr>
</tbody>
</table>
ENVIRONMENTAL AND SAFETY HAZARDS ENCOUNTERED BY HEALTHCARE WORKERS AS REPORTED DURING FOCUS GROUPS/INTERVIEWS

- Fall/trip/slip: 41%
- Biohazards: 15%
- Pests/rodents: 9%
- Air Quality: 8%
- Fire/burn: 8%
- Allergens: 5%
- Poor lighting: 4%
- Electrical: 3%
- Illicit drugs: 2%
- Chemicals: 2%
- Unsafe objects: 2%
- Inadequate workspace: 1%
Hazard Management Dilemmas – Making Do

Describe decision-making of home healthcare personnel (HHPs) for managing their own health and safety needs in relation to:

- Types of hazard management dilemmas
- Hazard management decision-making (Making Do)
- Level of decision quality (optimal, mixed, suboptimal)

### Hazards Context

<table>
<thead>
<tr>
<th>Hazards Context</th>
<th>Examples of Dilemmas</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Electrical and Fire Hazards</strong></td>
<td></td>
</tr>
<tr>
<td>• Smoking with oxygen</td>
<td>• Client does not refrain from smoking with oxygen</td>
</tr>
<tr>
<td><strong>Slip, Trip, &amp; Lift Hazards</strong></td>
<td></td>
</tr>
<tr>
<td>• Throw rugs, unsafe flooring</td>
<td>• Throw rugs that a client does not remove</td>
</tr>
<tr>
<td><strong>Environmental Exposures</strong></td>
<td></td>
</tr>
<tr>
<td>• Aggressive/underfoot pets</td>
<td>• Client does not confine pets</td>
</tr>
</tbody>
</table>
Hazard Management Decision Quality

Optimal
- Effective in mitigating the health hazard
- Without significant disadvantages for the Home Healthcare Provider or client
  - Example: Home health aide wears rain boots when bathing a client in the shower to prevent the aide from slipping on a wet floor

Mixed
- May or may not be effective in mitigating the health hazard
- Significant tradeoffs for the Home Healthcare Provider and/or the client
  - Example: Preventing a potential fall on snow/ice by shoveling the stairs and path to a home (not in job description; risk of injury)

Suboptimal
- Ineffective or otherwise inappropriate in mitigating the health hazard
- Involves setting aside the health needs of the Home Healthcare Provider and/or client
  - Example: Continuing to provide care without necessary safety equipment, such as grab bars, for transferring a client in the bathroom
Development of an Interactive Virtual Simulation Training System (VSTS) to Train Home Healthcare Providers to Recognize and Respond to Hazardous Conditions in Client Homes

Serious Games

"...a mental contest, played with a computer in accordance with specific rules that uses entertainment to further government or corporate training, education, health, public policy, and strategic communication objectives" (Zyda, 2010, pg. 25)

Virtual environments have successfully been used for training and education in a variety of healthcare situations

Home Healthcare Training

1. Overview
2. Conduct a Home Walkthrough
3. Training Module Tutorial
4. Electric, Fire, & Burn Training Module
5. Slip, Trip, & Lift Training Module
6. Environmental Training Module
7. Assessment Module Score Check
8. Exit
Structure of the VSTS

Based on drawings from focus groups/interviews

Created basic 4 room design:
- Living room, kitchen, bathroom, bedroom
- Added basement, upstairs bedroom with bath
Addition of Assets

Furniture
  ◦ Bed, Tables, Chairs, Desk

Appliances
  ◦ Stove, Refrigerator, Heaters, Lights, TV

Household Items
  ◦ Books, Dishes, Magazines

Special Effects
  ◦ Smoke, Fire, Pet movements
Developing the Training Modules: Floorplans
Fan on table has frayed cord

Multi-plug adapter used here

Picture with lamp – cord runs under mat in front of the door. Dogs playing poker?

Unattended candle near lampshade

Cord stapled to base board

Cord coiled

Stereo system, TV, DVD player, VHS player, x-box, phone charger all plugged in to same outlet

Non working smoke detector high up on wall or ceiling

Electric/Fire/Burn Training Module – Living Room Assets & Hazards
Garbage bags on floor block back door – trip hazard

Grease on floor

Cracked flooring in front of dishwasher and sink

Throw rug in front of sink

Cabinets on wall overfilled – objects can fall out when opened

Cat food and water bowl – in path to fridge

Throw rug in front of sink

Cat in kitchen on floor

Water on floor

Cat in kitchen on floor

Garbage bags on floor block back door – trip hazard

Ye olde newspaper stacks

Toaster oven

Coffee maker

Island with granite

Wheelchair near kitchen table

Move chairs from kitchen table and move wheelchair in

Frig

Wheelchair in kitchen table

Coffee maker

Toaster oven

Ye olde newspaper stacks

Slip, Trip & Lift Training Module – Kitchen Assets & Hazards
On night stand:
lamp, clock

Waste basket partly under desk

Lamp, Laptop computer, and small printer on desk

Environmental Hazards Training Simulation – 1st Floor Bedroom
Assets & Hazards
Developing the Training Modules: Spreadsheets
Spreadsheets developed for each module, and for each room in the module

Spreadsheets include: Item and location, Hazard picture, Hazard symbol, Why is it a hazard, What to do, Additional Information, Think About

<table>
<thead>
<tr>
<th>Item &amp; Location</th>
<th>Hazard picture</th>
<th>Code - EF, NEF, NC</th>
<th>Is this a Hazard</th>
<th>Why</th>
<th>What to do</th>
<th>Additional Information</th>
<th>Think About...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space heater with newspapers nearby</td>
<td><img src="image" alt="Hazard picture" /></td>
<td>EF</td>
<td>Yes</td>
<td>A space heater near flammable materials, like newspaper, is a fire hazard.</td>
<td>Because your client uses home oxygen, a space heater should not be placed within 10 feet of where oxygen is in use in the home.</td>
<td>In homes where oxygen is not in use, educate clients how to use a space heater safely: (a) Ensure the space heater is at least 3 feet away from anything flammable (such as newspapers) and, (b) Never leave a space heater unattended.</td>
<td>What other kinds of motorized appliances have you seen in homes that could cause a spark and a fire in a home where there is oxygen in use?</td>
</tr>
<tr>
<td>Location: on the floor next to the stove;</td>
<td><img src="image" alt="Hazard symbol" /></td>
<td>NEF, NC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Continuous iterative process to develop these with weekly calls/meeting of the research team, and then with home healthcare providers
Living Room – Electric/Fire/Burn Training Module
Bedroom – Slip/trip/lift Training Module
Kitchen – Slip/trip/lift Training Module
Bathroom – Environmental Training Module
# Electric/Fire/Burn Hazard Examples

(38 hazards)

<table>
<thead>
<tr>
<th>LIVING ROOM – EXAMPLES</th>
<th>BEDROOM - EXAMPLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Electrical cord under throw rug</td>
<td></td>
</tr>
<tr>
<td>- Smoke alarm non-working</td>
<td></td>
</tr>
<tr>
<td>- Outlet hanging</td>
<td></td>
</tr>
<tr>
<td>- Lit candle</td>
<td></td>
</tr>
<tr>
<td>- Ashtray smoldering with O² on</td>
<td></td>
</tr>
<tr>
<td>- Ash tray on nightstand with smoldering cigarette butts</td>
<td></td>
</tr>
<tr>
<td>- Space heater by curtain</td>
<td></td>
</tr>
<tr>
<td>- Lava lamp on dresser</td>
<td></td>
</tr>
<tr>
<td>- Daisy-chained power strips</td>
<td></td>
</tr>
<tr>
<td>- Overloaded power strip</td>
<td></td>
</tr>
</tbody>
</table>
# Slip, Trip, Lift Hazard Examples (47 hazards)

## BATHROOM - EXAMPLES
- Toilet – no grab bars
- Litter box - clutter
- Throw rug in front of vanity
- Glass shower door
- Plastic lawn chair with arm rests chair in tub

## BASEMENT - EXAMPLES
- Clutter on basement stairs landing and stairs
- Dryer sheets on floor
- Front Steps - Example
- Snow and ice
# Environmental Hazard Examples (42 hazards)

## Kitchen - Examples
- Gas stove in kitchen - no carbon monoxide monitor
- Needles sticking out of trash bag
- Roaches crawling on wall
- Broken glass in sink

## Bathroom - Examples
- Air freshener plugged into wall
- Moldy shower curtain
- Cracked toilet seat with brown in cracks
- Soiled adult diapers in trash can
Dialogue Boxes

Identify hazard – lights up, select with mouse

Dialogue box opens
Dialogue Boxes

Correct

Why 1/2

This oxygen concentrator is located too close to the space heater, which poses a twofold problem:

1) the space heater is a source of heat and, 2) it has a motor.

Both of these pose a risk when located near oxygen.
Dialogue Boxes

What to do

Explain this hazard to your client and decide with her on a safer location for the oxygen concentrator, so that is it in an open area, and at least 10 feet from any heat source.

The concentrator should never be covered by clothing or any other item.

Yes  No  Test  Continue

Additional Information

Only a non-heat generating appliance should be plugged into this empty outlet.

This cord should not be bound by a twist tie because that could cause the cord to overheat and cause a fire.

Yes  No  Test  Continue
Module: Electrical & Fire Hazards
Current Room: Kitchen
Hazards found: 2 out of 11 in this room
Hazards found: 5 out of 42 in this module
Usefulness, Usability & Desirability Findings for Training Modules (N=24)

Usability:
- Easy to use (88%)
- Not too complicated (88%)
- Took too long to finish (25%)
- Easy to move around (75%)
- Keyboard controls easy to use (50%)
- Easy to click on hazards (63%)
- Information boxes easy to click thru (100%)
- Not hard to see hazards (75%)
- Co-workers would not need help to use VSTS (12.5%)
- Co-workers would learn to use VSTS (63%)

Usefulness:
- Training help me identify hazards (100%)
- “What to do” Information was useful (100%)
- Program taught me something new (88%)
- Information was too simple (0%)
- VSTS showed too many hazards out of my control (0%)
- Info can help keep home healthcare workers safe (100%)
- Overall rating: M=6.5 (SD=.5) (7=very useful)

Desirability:
- Liked the VSTS (89%)
- VSTS was boring (0%)
- I wish we had this at my agency (100%)
- Co-workers would like this training program (100%)
UUD Feedback resulted in addition of Overview, Walkthrough, clarity in opening screen....
Overview, Walkthrough, Tutorial

Overview and Walkthrough - Voice over slides

**Overview ~ 5 min.**
- Discuss Job Safety Analysis
- Safety Check of each room
- How to move through the Training Simulations

**Walkthrough ~ 3 min.**
- A guide through each room in the home

**Tutorial - Interactive**
- How to manipulate through the VSTS
- Using the mouse and the WASD keys or the Arrow keys
Assessment Module

Combines in one simulated home:
- Electric, Fire, Burn hazards
- Slip, trip, lift hazards
- Environmental hazards

Assesses:
- Ability to identify hazards (yes/no)
- Why it’s a hazard (multiple choice)
- What to do about the hazard (multiple choice)
Efficacy Testing (ongoing)

- Experimental Group
- n = 45 Overview Walkthrough Tutorial
- VSTS Training Modules
- VSTS Assessment Module

- Control Group
- n = 45 Written Overview
- Written Training Materials
- Walkthrough Tutorial
- VSTS Assessment Module
Efficacy Testing-Data Collected

Assessment Module
- Correct answers to:
  - Hazard identification
  - Why a hazard
  - What to do about the hazard
- Time spent deliberating why and what to do

- Training Modules
  - Hazard identified
  - Time spent with dialogue boxes

- Pre-Training:
  - Modified Home Healthcare Worker Questionnaire
  - Demographic Form

- Post
  - Usefulness, Usability, Desirability (UUD) Assessment

- Think-Aloud
Efficacy Testing – Think Aloud Protocol (n=32)

Purpose – To gather formative and in depth cognitive information processing data on participant perceptions of:
- Hazard characteristics
- Beliefs about (hazard) information usefulness (importance) for responses to hazards
- Affective responses to risk, as represented in the VSTS Assessment Modules

Randomly selected participants, random assignment to room in Assessment Module

Participants asked (responses digitally recorded):
- Describe hazards they see in the room, how likely they are to be harmed by the hazards, how severe the harm would be, how often they see that type of hazard
- How important is the hazard, how could they manage the hazard
- What feelings, if any do they have about the hazard
Next Steps

Next steps:
◦ Finalizing 3D version of the training simulations
◦ Adding client avatars to the training simulations
◦ Submitting next grant proposal to assess effectiveness, generalizability, and outcomes of the virtual training simulation system
Questions?

Barb Polivka: barbara.polivka@louisville.edu
The COMPASS Total Worker Health® program for home care workers: 

*Impact and dissemination*

Ryan Olson, Kelsey Parker, Jennifer Hess, Sharon Thompson, Kristy Luther Rhoten, & Miguel Marino
PARTNERS & Team Members

Cheryl Miller et al.

Co-investigator
Diane Elliot, MD

Olson lab alumn
Katrina Bettencourt
Brad Wipfli
Sharon Thompson
Kristy Luther
Robert Wright
Annie Buckmaster

Jereme Grzybowski et al.

Students
Shalene Allen
Afsara Haque
Faith Raspante
Colleen Hunter
Natasha Gulati
Jacob Wilhite
Autumn Graves
Veronka Larova

Consultants
Daniel McClintick
Linda Mabry, PhD
Diana White, PhD
Thuan Nguyen, PhD
Where are we going?

• Why TWH for home care workers?
• Overview of COMPASS iterations
• Research Impacts
• Dissemination
Why TWH for Home Care Workers?

- Isolated work structure
- Unique hazards and stressors
- Injuries 4x average
- Psychological and physical health
- 46% growth by 2018
- Research and Practice Gap
  - Most interventions address wellness
  - A few address safety
  - **Need for structural and supportive TWH approaches**
How did we address this problem?

- Integrated elements of effective peer-led social support groups with scripted team-based programs
- Targeted Total Worker Health® outcomes

(Delbecq et al, 2012; Toseland et al, 1989, 1990; Goldberg et al., 1996 and colleagues)
Overview: COMPASS Iterations

- **Pilot with Guidebook 1** *(published 2015; n=16)*: 6 monthly meetings
- **Pilot with Guidebook 2** *(unpublished; n~6)*: 6 additional monthly meetings, different style
- **Randomized Controlled Trial** *(published 2016; n=149)*: 12 monthly meetings with Guidebooks 1 and 2
- **Oregon Home Care Commission (OHCC) adaptation pilot** *(unpublished; 5 groups)*: 7 bi-weekly meetings
- **OHCC adaptation v2 for statewide dissemination**: soft launch July 2017
COMPASS pilot: Guidebook 1 (n=16)
(April - Nov 2012)

• Well attended (90%) and liked (4.1/5 pt. scale)
• 18% pre/post meeting knowledge gains
• 60% reported making changes between meetings
• Life satisfaction and negative affect significantly improved (p<.05).
• 21 of 28 safety/health outcomes changed in expected directions and 11 had standardized effects d > 0.20 (max d = 0.65)

Randomized Controlled Trial
(April 2013 – Oct 2015)

16 Groups (N = 149)

8

COMPASS
Baseline (n=75)
6 mo (n=55)
12 mo (n=54)
24 mo

CONTROL
Baseline (n=74)
6 mo (n=63)
12 mo (n=58)
24 mo

Intervention

Both Groups:
- Survey
- Health Assessment
- Interviews
RCT participants (n=149)

- Female **89%**
- Caucasian **74%**
- Average
  - 51.6 yrs old
  - BMI 31.9
  - 7.4 yrs home care experience
  - 24.1 weekly work hrs
- **39% depression diagnosis**
  (at some time in life)
IMPACT:
Experienced Community of Practice

Green = intervention

\[ d = \text{Effect Size} \]
- Small = .20
- Medium = .50
- Large = .80

* statistically significant

Olson et al. (2016) American Journal of Public Health
IMPACT: Behavior Changes (p<.05)

- Using new tools for housecleaning (6 mo. $d=.51$, 12 mo. $d=.64$)
- Using new tools for moving objects and/or CEs (6 mo. $d=.65$)
- Communicating with CEs about safety hazards (12 mo. $d=.84$)
- Correcting slip, trip, fall hazards (12 mo. $d=.45$)
- Eating more fruits and vegetables (12 mo. $d=.31$)

Consumer-employers independently confirmed significant safety improvements
IMPACT:
Physical Health and Symptoms (p<.05)

• 6 mo HDL ($d=.22$)
• 6 mo lost work days due to injury ($d=-.66$)
• 12 mo grip strength ($d=.29$)
• Symptoms/injuries trended downward (ns)
IMPACT: Qualitative results from in-depth interviews

Stories of job demands, resources, resource gaps, and experienced support

If you say you're going to be there at 9:00 for someone, you're going to be there at 9:00! Now, if you have a person who's waiting for you and laying in bed because they can't get up by themselves, and you're 20 minutes late, . . . can you imagine -- "I can't get up by myself, and I gotta go to the bathroom. I don't want to wet my pants. . . . I'll be so humiliated!" (Clara, May 19, 2015)

I'm starting to realize that I need some assistance from durable medical equipment . . . There's things my [CE] should be having that would make the care worker's job easier ... There's days that my [CE] can't stand up and use her legs. (Tate, July 3, 2015)

I had been holding it all in, [but after sharing with my team], I felt good. Sometimes . . . you're just thinking you're going to scream, but you cannot scream. I felt that way . . . I felt like I got rid of something (Olive, May 23, 2015).

DISSEMINATION: Setting/Context

Oregon Home Care Commission (founded in 2000)

• Training system
  – Available to 60% of Oregon’s home care workers who care for consumer-employers enrolled in publicly funded programs (12,500+)
  – 24 courses, nearly 100 classes offered monthly
  – Workers paid for all non-repeated classes per year
  – Registry benefit IF...
    • Four classes annually, one safety class every two years

– Professional Development Certification:
  • Nine specific classes, CPR/first aid, 80% on assessment test, no show <20%
  • 50 cents more per hour
DISSEMINATION: Adaptations

- Trainers as “facilitators”
- Rotating peer leaders
- Bi-weekly meetings
- Goal setting options
- No food, step counters, knee pads, or certification incentives
Adaptation pilot results (5 groups):

Still changing stuff?

✓ Experienced Community of Practice (d=.95)
✓ Tools/practices for housecleaning (d=.39)
✓ Fruit and veggies (d=.31)
✓ Sugary snacks (d=-.39)
✓ Sugary drinks (d=-.35)

Observation: “Directive-ness” of trainer-facilitators seemed to create different dynamics in groups
Expect the unexpected!

The dissemination partnership odyssey
Sept 2015 through today
...but we’ve reached a fabulous destination!
Jan 2016 - Today: *Bi-weekly partnering calls*

**COMPASS-OHCC v2**
- OHSU-OHCC agreement signed
- Facilitators mix of community health workers and professional trainers
- SEIU EAP resources in “extras”
- COMPASS earns safety credits
- Data
  - Training evaluation changes
  - Workers comp data
- July 2017 soft launch
- Systematic statewide rollout

Cheryl Miller, Executive Director
Oregon Home Care Commission
DISSEMINATION: Next targets

- Maintenance “drop-in” groups
- Oregon’s Personal Support Workers
  - 1 yr contract with OHCC to expand/adapt
  - Dr. Parker’s pilot grant from Northwest Center for Occupational Health & Safety (U Wash.)
- R01 proposal (NIH) with SEIU 775 Benefits Group (Seattle, WA):
  Tailoring for workers with persistent pain
  - Tool provision with hands-on training
  - Cognitive-behavioral pain self-management

Katie Coombes, SEIU Local 503 Care Provider Division Director
Take Home Points

SAFETY

HEALTH

olsonry@ohsu.edu
Go Partners!
Hospital Patient Room Ergonomics: Getting it right for all hospital staff working in these spaces

Steve Lavender, Ph.D.
Carolyn Sommerich, Ph.D.
Elizabeth Sanders, Ph.D.
Kevin Evans, Ph.D.
Jing Li, M.S.
Radin Zaid Radin Umar, Ph.D.
Emily Patterson, Ph.D.
Why Patient Room Design?

• Hospital patient rooms are workplaces
• Substantial construction in the healthcare sector (Gamble, 2011; Terry, 2011).
• Need for evidence-based design recommendations
  • Meet the needs of all stakeholders providing patient care and services in these rooms.
  • Hignett and Lu’s (2007) review of twenty sources of space recommendations for critical care rooms showed that none were based on empirical evidence.
Our Research Objective

Long term: Enhance safety and efficiency of all staff who work in med/surg patient rooms

How: Develop design guidelines for patient rooms that meet the physical and cognitive needs of those providing direct and indirect patient care, based on input from all stakeholders.
Research Hypothesis

Work methods of healthcare workers and hospital staff

- Work performance
- Worker health and safety
- Patient safety & outcomes

- Job satisfaction
- Patient satisfaction

THE OHIO STATE UNIVERSITY
Emerging Trends in Healthcare

- Movement toward acuity–adaptable rooms
  - Improved operational cost, patient safety and error reduction, and patient satisfaction levels (Hendrich, Fay, Sorrells, 2004).
- Increased provision of in-room clinical services (Patel et al. 2006).
- Patients are getting heavier
  - larger beds, larger furnishing for visitors and less work space for healthcare workers
Opportunities for HF in room design

• Historically this has been the domain of architects and interior designers (Stichler and Cesario 2007).

• Limited HF Studies on room design:
  • Ceiling and other mechanical lift devices (Ulrich et al. 2008)
  • Space requirements in patient rooms in a critical care unit (Hignett and Lu (2007).
  • Design of bathrooms (Hignett and Evans 2006)
  • Limited published input on patient room design from human factors specialists (France et al. 2005).
  • Bayaban, Mendoza, Pentecostes, and Tangsoc, 2015.
Opportunities for HF in room design

• Prior Work
  • Solicited input primarily from nursing staff (Gallant and Lanning 2001, Hignett and Lu 2007; Bayaban et al., 2015),
  • Use of effectiveness measures focused almost exclusively on patient-related outcomes and issues related to the nursing staff (Ulrich et al. 2008).
• Nurses are a critical element of the patient care system, but other workers are also are
  • In short supply,
  • Leave the healthcare profession due to the excessive physical workload and incurred injuries (Naomi, 2004).
4 Phase Study Design

• **Phase 1:** Focus groups and interviews of all stakeholders
  • *How do room parameters facilitate or interfere with what you do in the room?*

• **Phase 2:** Build the room you would like to work in

• **Phase 3:** Assess the needs of patients and their visitors

• **Phase 4:** Resolve conflicts

Develop guidelines for architects and interior designers
Phase I:
Identify Stakeholder Issues and Needs
Hospital Patient Room Design: The Issues Facing 23 Occupational Groups Who Work in Medical/Surgical Patient Rooms

Steven A. Lavender, PhD¹,², Carolyn M. Sommerich, PhD¹, Emily S. Patterson, PhD³, Elizabeth B.-N. Sanders, PhD⁴, Kevin D. Evans, PhD³, Sanghyun Park, PhD¹, Radin Zaid Radin Umar, MS¹, and Jing Li, MS¹
23 Occupational Stakeholder Groups

- X-ray tech (7)
- Ultrasound tech (4)
- Echocardiographer (5)
- Vascular tech (2)
- Dietitian (5)
- Nutrition aides (7)
- Diet tech (5)
- Nurses (17)
- Physicians (6)
- Personal Care Assistants (10)
- Case manager (2)
- Sitters (3)
- Housekeeper (10)
- Transporter (10)
- Physical Therapy (11)
- Occupational Therapy (9)
- Speech language pathologist (4)
- Respiratory therapist (5)
- Clinical engineer (8)
- Building operation (3)
- Zone tech (3)
- System shop (2)
- Mechanical shop (plumber) (4)

n=146
Entering the Room

Challenges

See patient as they enter
- PCA
- Diet-T
- Nurse
- Dietitian
- MD

Narrow doorway
- PCA
- X-ray
- Vascular
- Nutr-Aids
- Nurse
- Transport
- Resp-T
- Sitter
- Dietitian

Navigating cluttered entryways
- PCA
- Vascular
- Echo
- Diet-T
- Nurse
- Transport
- Speech
- Sitter
- MD

Locating and accessing PPE
- PCA
- X-ray
- Echo
- Diet-T
- Nurse
- OT/PT
- Clin Eng
- Sitter
- Case Mgr
- MD

Hand sanitizer or sink locations
- PCA
- X-ray
- Echo
- Diet-T
- Nurse
- Resp-T
- Dietitian

Lack of a staff sink.
- PCA
- X-ray
- Echo
- OT/PT
- Nurse
- Resp-T
- MD

Number of Stakeholder Groups Describing Challenge
Preparation

Documented Challenges

- Space in the room and around bed
- Work around visitors/staff/things
- Lack of a work surface
- Time and effort to move things
- Lack of space to move things
- Location of light switch, window shade
- Finding / creating a place to sit
- Lack of switch labels

Number of Stakeholder Groups Describing Challenge
Doing

http://www.wordle.net/
Phase II:

Ideal Room Design
**Objective**

- To identify patient room design layouts that enable different occupational stakeholder groups to work more effectively in patient rooms.
Participants

• 27 participatory design workshops
  • 104 Participants
    • Mixed groups of occupational stakeholders
    • 24 Occupational Stakeholder groups
Approach

• Simulation space was 27.9 m\(^2\) (300 ft\(^2\)) for a single patient room.
  • 4.6 m by 3.0 m (15 by 10 feet)
  • Moveable bathroom walls
• Initial room contents
  • Bed (on wheels)
  • Bathroom walls
  • Sofa (on wheels)
• “Build the room”
  • Starting with the bathroom
Making the room
Room testing
Process Limitation
Analysis: Room characterization

- Bathroom location
  - Inboard
  - Outboard
- Bed location / Orientation
  - View patient from doorway?
  - Distance from doorway
  - Distance from bathroom
- Family space
- Entry space
Bed located adjacent to inboard bathroom

(a) Group 1
(b) Group 2
(c) Group 3
(d) Group 4
(e) Group 6
(f) Group 8
Bed located adjacent to inboard bathroom (continued)
Bed across the room from inboard bathroom

(a) Group 7

(b) Group 13

(c) Group 22

(d) Group 24
Bed offset from corner door with outboard bathroom

(a) Group 10

(b) Group 11

(c) Group 14

(d) Group 23
Bed angled with inboard bathroom

(a) Group 9

(b) Group 16

(c) Group 18
Clustering process

• 27 sessions = 27 Room Layouts
  • Unique features in each room!

• Designs clustered based on:
  • bathroom location,
  • bed location/orientation
  • Family zone location
Room Layout #1: Bed located adjacent to inboard bathroom (n=12)
Room Layout #3: Bed in front of door with inboard bathroom (n=5)

- Shower chair
- Shower shelf
- Shower curtain
- NC
- Clean bedpan holder
- Trash can
- Storage for clean linen with direct access from hallway
- Soiled linen basket
- Swinging door

- Shower
- Sink
- Patient recliner
- Staff hand-washing sink
- Biohazard can
- Staff work surface
- Staff work surface

- Storage for patient belongings and towels
- Privacy curtain

- Patient / family storage
- Window sill
- Surface for belongings

- Family seating / sleeper sofa
- Visitor chair
- Visitor chair

- Staff work surface
- Staff hand-washing sink

- Mobile workstation
- Supply storage
- IV
- Headwall
- PTD
- Milestone

- Glove
- Sharps container
- Storage for clean linen with direct access from hallway

- Window
- O L D
- Artwork
- Sofa area (when extended)

- Patient whiteboard
- Clock
- TV
Room Layout #5: Inboard Bed, mid-room door, outboard bathroom (n=2)
Phase III

Assess the needs of patients and their visitors
Methods

Study participants:
• 3-day stay in med-surg in last 12 months as patient/family
• 15 evaluation sessions
• 61 participants (37 patients, 24 family caregivers)

Data collection:
• Walkthrough (2 rooms) and audio-recorded reactions
• Written survey
• Audio-recorded “likes and dislikes” discussion

Data analysis:
• Calculate survey question frequency, median values
•Straussian approach to grounded theory analysis
Patient Needs and Expectations

• A single patient room that is adequately sized, comfortable, and comforting for patient and visitors.

• Desire to be in an uplifting environment that is conducive to rest/sleep

• A room that accommodates patient’s physical limitations.

• An entry way design that:
  o Affords control over visual privacy and hallway noise
  o Enables patient to see who is entering the room

• Able to have private conversations with clinical staff when needed.
Patient Needs and Expectations

• Easy access to:
  • Power: many accessible electrical outlets
  • Entertainment

• **Means to easily control** the room environment (lighting, temperature, window coverings)

• **Organized places for the patient to put things**
  • Visible and secure patient storage within reach or view:
    • A place to display items (cards, photos, flowers, etc.)
    • A clean place for personal items

• **A close bathroom** that is easy to access, even with IV pole, wheelchair, walker, etc.
  • Safe toilet access day and night
  • Barrier-free shower access
  • Privacy in the bathroom
Improving Patient Satisfaction is anticipated to:

- Increase scores on 13/18 HCAHPS survey questions
- Promote healing process by reducing stress/anxiety
- Reduce demands on hospital staff
Phase IV
Room Review and Conflict Resolution
Room Review Sessions with Hospital Staff

• Identified conflicts
  • Between occupational stakeholder groups
  • Between patients/visitors and occupational stakeholder groups

• Validated room design concepts.

<table>
<thead>
<tr>
<th>Stakeholder / Group</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case manager</td>
<td>1</td>
</tr>
<tr>
<td>Diet tech</td>
<td>3</td>
</tr>
<tr>
<td>Imaging</td>
<td>8</td>
</tr>
<tr>
<td>MD</td>
<td>5</td>
</tr>
<tr>
<td>Housekeeper</td>
<td>12</td>
</tr>
<tr>
<td>Interior designer</td>
<td>1</td>
</tr>
<tr>
<td>Nurse</td>
<td>6</td>
</tr>
<tr>
<td>Nutrition aide</td>
<td>1</td>
</tr>
<tr>
<td>OT / PT</td>
<td>6</td>
</tr>
<tr>
<td>Patient care assistant (PCA)</td>
<td>10</td>
</tr>
<tr>
<td>Respiratory therapist (RT)</td>
<td>5</td>
</tr>
<tr>
<td>Sitter (safety care associate (SCA))</td>
<td>4</td>
</tr>
<tr>
<td>Social worker</td>
<td>4</td>
</tr>
<tr>
<td>Speech language pathologist (SLP)</td>
<td>3</td>
</tr>
<tr>
<td>Transporter</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>75</strong></td>
</tr>
</tbody>
</table>
4 Phase Study Design

• **Phase 1:** Focus groups and interviews of all stakeholders
  • *How do room parameters facilitate or interfere with what you do in the room?*

• **Phase 2:** Build the room you would like to work in

• **Phase 3:** Assess the needs of patients and their visitors

• **Phase 4:** Resolve conflicts

Develop guidelines for architects and interior designers

Entry Zone  

n=14

Bathroom  

n=15

Patient/Clinical Zone  

n=20

Patient/Visitor Storage  

n=3

Family Zone  

n=8

These guidelines are currently being refined. Please contact the lead investigator (lavender.1@osu.edu) who will be very willing to share these guidelines with you.

“n=“ indicates the number of guidelines for each zone.
# Med/Surg. Patient Room Design Guidelines - Example

<table>
<thead>
<tr>
<th>Primary Item</th>
<th>Secondary Item</th>
<th>Design Recommendation</th>
<th>Constraints</th>
<th>Why (staff)</th>
<th>Why (patient)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biohazard Container</td>
<td>Room Door</td>
<td>Space should be allocated for a biohazard container near the room door.</td>
<td>• Dedicated space has to be large enough to accommodate containers holding isolation apparel and procedural materials • Container cannot obstruct the entry way.</td>
<td>• Staff needs to dispose of personal protective equipment (PPE) as they exit the room. • Cleaners wants to be able to empty waste without disturbing the patient. • Staff bringing equipment in/out of the room do not want obstructions in the path of travel.</td>
<td>• Patients do not want to be disturbed when waste is removed from the room.</td>
</tr>
</tbody>
</table>
Summary

• Many different types of stakeholders were identified that work in patient rooms.
  • Each has unique needs that determine how these people will work in the space.
• The room design process identified many design features that would enhance the work process and address many of the ergonomic issues that exist in current rooms.
• Final design recommendations are currently being developed and refined.
Team Effort

• Carolyn Sommerich
• Kevin Evans
• Emily Patterson
• Liz Sanders
• Jing Li
• Radin Umar
• Sanghyun Park
Questions?

• This work was supported by the National Institute for Occupational Safety and Health (NIOSH)
  – Award # OH 010181