Adding the Human Factors Tool Set to the Infection Prevention Toolbox

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What is Human Factors Engineering (HFE)?

- “The scientific discipline concerning understanding of interactions among humans and other elements of a system, and applying theory, principles, data, and other methods to design in order to optimize human well-being and overall system performance.”
- As defined by the Human Factors and Ergonomics Society.
What is Human Factors Engineering (HFE)?

- The design of OPTIMALLY EFFECTIVE systems
- Five components
  - External Environment
  - Organization
  - People
  - Technology
  - Physical Environment
- Prominent in aviation, nuclear industry, automotive industry, and the military
Sociotechnical Systems Model

External Environment:
- federal & state regs, corporate mngt,
- hospital policies, equipment suppliers, regional demographics, transportation providers

Organization:
- policies and procedures,
- shift schedules, staff to patient ratios, work culture, work values and beliefs

Technical:
- work processes & procedures, tools, equipment, software

Physical Environment:
- layout & design, bed spacing, air & water quality, work surfaces, resource locations

Internal Environment:
- Emergency Department

People:
- clinical staff, environmental services staff, transportation services, patients, patient family members

Adapted from Kleiner, 2007
Systems Approach

- Truly integrated systems result in higher performance, higher reliability, improved safety
  - Humans are one component in a larger system
  - Focus on the interaction or interface between people and the equipment and environment.
  - Fit the tools and environment to the person; not the person to the tools and environment
- Safe systems are achieved by considering the entire system to enable performance specifications to be met.
Example

- Applying a systems approach to identifying and addressing risk factors for HAIs in an ambulatory dialysis unit (AHRQ-funded study)
- Ambulatory dialysis and EDs have several things in common
  - Patients coming in and going out all day
  - High degree of variability of health of patient
  - Large number of staff who are all multitasking
  - Large number of policies and processes in place
Identified “Variances”

- Variance is a “non-optimal” situation
  - Something that works against your goal.
- Safety culture was NOT a variance
## Identified Variances

<table>
<thead>
<tr>
<th>Domains</th>
<th>#</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>External Environment</td>
<td>5</td>
<td>There is a fistula-first policy but not all patients are eligible for a fistula or graft</td>
</tr>
<tr>
<td>Organizational Factor</td>
<td>8</td>
<td>Discrepancy between 5 hr put-on window and protocol to put on 3 patients in 30 minutes</td>
</tr>
<tr>
<td>Technical Factor</td>
<td>6</td>
<td>Work processes do not support early wound detection</td>
</tr>
<tr>
<td>Physical Environment</td>
<td>10</td>
<td>Surface contamination on high touch areas</td>
</tr>
<tr>
<td>People Factor – clinical staff, environmental services staff, patients</td>
<td>28</td>
<td>Knowledge of ES staff regarding types of infections in the Dialysis Unit</td>
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</table>
Grouped Variances by Six Risk Factors Identified in Literature

- Surface contamination
- Workflow/Work Stress
- Hemodialysis-specific risk factors
- Feedback
- Patient education
- Standard of care
Interventions

- Developed 10 interventions in collaboration with ADU physicians, nurses, technicians, and environmental services that addressed the five of the six risk factors.
# Interventions by Risk Factor

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Recommended Intervention</th>
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<tbody>
<tr>
<td>Surface contamination</td>
<td>• Provide dedicated ES resources to the dialysis unit</td>
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<td>• ES staff communication regarding the types of infections in the dialysis unit and provide <em>C. diff</em> notices</td>
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<td>• Add self-cleaning materials to high touch areas.</td>
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<td>Workflow/Work stress</td>
<td>• Put curtains on Main unit window from waiting area into room</td>
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<td>• Enforce policy of keeping patients out of unit until scheduled time to dialyze by posting a person at the door for admission.</td>
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<tr>
<td>Wound- &amp; BSI-Specific Factors</td>
<td>• Identify patients who have not washed their arm prior to put on.</td>
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<td>• Perform arm/leg/foot exams for patients at each visit</td>
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<td></td>
<td>• Use chlorahexidine impregnated patch at catheter exit site</td>
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<tr>
<td>Feedback/Patient Education</td>
<td>• Optimize HAI surveillance system to quality assessment</td>
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<td>• Post monthly HAI rates in waiting rooms and staff areas</td>
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<tr>
<td></td>
<td>• Educate patients on how they can protect themselves</td>
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</tbody>
</table>
Note about “HF Interventions”

- There is not a set of interventions that belong to HF. Instead, HF brings way of thinking about the problem to make sure that the interventions selected are really addressing the problem.

- Even teaching hand hygiene can be an HF intervention if the problem is truly that people do not know how to wash their hands.
  - It isn’t an HF intervention if the real problem is that the work environment doesn’t support the hand washing process.
The Advantage of the Approach

- This is a systematic method to identify many “variances” contributing to many risk factors.
- Identifies what is working (great culture).
- Identifies a comprehensive set of problems.
- Provides a means to develop a comprehensive set of solutions.
- Allows one to understand how a change in one domain will affect other domains to avoid unintended consequences.
Contacts for HF Advisement

- Human Factors and Ergonomics Society
  - HFES.org
  - Consultant directory
  - 1 (310) 394-1811
  - info@hfes.org
    - Ask to be put in contact with the Chair of the “Health Care Technical Group” (HCTG)

- If you have a specific workflow/process problem, a person trained in Lean Six Sigma could be helpful.
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