Systems Engineering to Evaluate Surgical Readmission

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✓ I have no link of interest.
Engineering and Health Care

  - Identify engineering tools and technologies for delivering safe, effective, timely, patient-centered, efficient and equitable care (2001 IOM Report Crossing the Quality Chasm)
Human Factors and Systems Engineering

• Integrate qualitative and quantitative data
• Potential for quality improvement for complex medical issues
Systems Engineering Initiative for Patient Safety (SEIPS) Model

Carayon, Qual Saf Health Care, 2006
Application of SEIPS model: Readmission in Surgical Patients

Readmission

• Complex process with multifactorial etiology
  • Qualitative data not captured
• Predictive models are inadequate
  • Low PPV
• Poorly understood in surgical patients
  • Post-discharge complication vs. Patient specific socio-demographic factors

Tevis, JAMA Surg, 2015;Apr 22
Merkow, JAMA, 2015;313:483-95
Using Human Factors and Systems Engineering to Evaluate Readmission after Complex Surgery

Study Objective:

- Use SEIPS model to understand surgical readmission from a patient perspective

Index Stay Work System → Transition of Care/Discharge → Readmission

Acher, JACS, 2015 Oct;221(4):810-20
Methods

Mixed-methods approach

QUALITATIVE
Provider Focus Group
Patient Interviews

Integration & Interpretation

QUANTITATIVE
Chart Review

Patient Interviews:
- Patients readmitted within 30 days of colorectal, pancreas, liver or esophageal surgeries
- Face-to-face interviews within 48 hrs of readmission, guided by SEIPS mode
- Focus group of clinician providers
Methods

Patient interviews and focus group analyzed for emergent themes

- Theme analysis guided by the SEIPS model
- Repeated review and comparison by 2 reviewers Initial
- Coding framework developed from content
Study Participants

Patients: 21 approached, 18 enrolled
  • 86% accrual

Focus Group Participants
  • Physicians (2 surgical residents)
  • Inpatient nurses (2)
  • Case manager
  • Pharmacist

6/6 agreed to participate
## Patients

<table>
<thead>
<tr>
<th>Surgical procedures</th>
<th>n (%)</th>
<th>n (%) cancer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colorectal</td>
<td>8 (44%)</td>
<td>3 (38%)</td>
</tr>
<tr>
<td>Pancreatectomy</td>
<td>7 (39%)</td>
<td>6 (86%)</td>
</tr>
<tr>
<td>Hepatectomy</td>
<td>2 (11%)</td>
<td>0</td>
</tr>
<tr>
<td>Esophagectomy</td>
<td>1 ( 6%)</td>
<td>1 (100%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>18</td>
<td><strong>10 (56%)</strong></td>
</tr>
</tbody>
</table>
# Patient Demographics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Median or n (%)</th>
<th>range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, yrs</td>
<td>62</td>
<td>24-82</td>
</tr>
<tr>
<td>Female</td>
<td>10 (56%)</td>
<td></td>
</tr>
<tr>
<td>Non-Hispanic White</td>
<td>17 (94%)</td>
<td></td>
</tr>
<tr>
<td>Index length of stay, days</td>
<td>7</td>
<td>5-38</td>
</tr>
<tr>
<td>Time to readmission, days</td>
<td>8</td>
<td>1-25</td>
</tr>
<tr>
<td>Interview length, minutes</td>
<td>34</td>
<td>20-110</td>
</tr>
</tbody>
</table>
Patient Encounters Prior to Readmission

• 72% of patients were readmitted before their scheduled surgical follow-up appointment
  • Readmitted 1-13 days (median 7d) before scheduled appointment
## Principle Diagnosis

<table>
<thead>
<tr>
<th>Principle diagnosis for readmission</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infection</td>
<td></td>
</tr>
<tr>
<td>Abscess/intra-abdominal fluid collection*</td>
<td>9</td>
</tr>
<tr>
<td>Surgical site infection</td>
<td>6</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>1</td>
</tr>
<tr>
<td>Urinary tract infection (UTI)*</td>
<td>1</td>
</tr>
<tr>
<td>Small bowel obstruction</td>
<td>2</td>
</tr>
<tr>
<td>Delayed gastric emptying</td>
<td>2</td>
</tr>
<tr>
<td>Dehydration*</td>
<td>3</td>
</tr>
<tr>
<td>Palliative care/failure to thrive</td>
<td>1</td>
</tr>
<tr>
<td>Pleural effusion</td>
<td>1</td>
</tr>
<tr>
<td>Possible hemorrhage</td>
<td>1</td>
</tr>
</tbody>
</table>

*Recorded > 1 diagnosis: UTI and intra-abdominal fluid (1), dehydration and UTI (1), dehydration and diarrhea (1), dehydration and steroid withdrawal (1)
Summary: Themes

- Poor understanding/unrealistic expectations for recovery
- Altered cognition contributed
  - Anxiety
  - Illness severity
  - Pain medication

Acher, JACS, 2015 Oct;221(4):810-20
Study Conclusions

Multiple areas of focus for systems improvement

- Discharge Preparation
- Potential for System Improvement
- Communication & Patient Understanding
- Patient Education
Transition of Care Intervention

Goal:
• *Evidence based intervention* to address patient concerns identified in SEIPS model study
  • Discharge process and planning
  • Patient education and understanding
  • Post-discharge communication and follow up care
Coordinated Transitional Care Protocol (C-TraC)

Phone-based program utilizing:
- Specially-trained RN nurse case manager
- Transitional care protocols

Modified Coleman Care Transitions Intervention™ model
1. Educate and empower the patient/caregiver in medication management
2. Ensure the patient/caregiver has follow-up appointments
3. Educate the patient/caregiver regarding red flags
4. Ensure the patient/caregiver knows whom to contact if questions arise
C-TraC Components

1. In-hospital visit with C-TraC nurse
2. Telephone follow-up 48-72hrs post-discharge
   - Medication management
   - Medical follow up
   - Red flag identification
   - Contact information for C-TraC RN
   - Medication discrepancies or red flag prompts contact with MD office.
3. Continued follow up phone calls every few days to weekly
4. Process ends when:
   - Patient sees PCP
   - Mutual agreement that no further calls are needed
   - 4 weeks have passed

Kind, Health Aff, Dec 2012;31:2659-68
C-TraC Results

William S. Middleton VA, Madison, WI

- 731 pts, 2010-2012
- 90% of enrollees reached (engagement)
- 47% medication discrepancies
- Readmission
  - 34% (baseline group) vs. 23%, p=0.013
  - Cost avoidance $1225/patient

Kind, Health Aff, Dec 2012;31:2659-68
C-TraC Results: UW Hospital 11/13-2/15

Readmission Rates: CHF, Pneumonia, COPD

CTraC (n=1,128) vs. Control (n=1,059)
Overall readmission 10.3% vs 18%, p <0.05

<table>
<thead>
<tr>
<th>Clinical Service</th>
<th>Control Group</th>
<th>C-TraC</th>
</tr>
</thead>
<tbody>
<tr>
<td>FAMILY PRACTICE</td>
<td>24.8%</td>
<td>9.1%</td>
</tr>
<tr>
<td>HOSPITALIST</td>
<td>17.3%</td>
<td>10.2%</td>
</tr>
<tr>
<td>CARDIOLOGY</td>
<td>13.3%</td>
<td>6.1%</td>
</tr>
<tr>
<td>GENERAL MEDICINE</td>
<td>19.2%</td>
<td>13.5%</td>
</tr>
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Adaptation: Surgical C-TraC

• Can a readmission reduction program that has been proven to reduce medical readmissions be successful in surgical patients?
• Modification to address surgery-specific issues

Surgical C-TraC (sC-TraC)
- Discharge process and planning
- Patient education and understanding
- Post-discharge communication and follow up care
Successful graduation:
• Patient and RN agree that no further phone follow-up is needed
• 4-6 weeks have passed

Enrollment discontinued:
• Patient is readmitted
• Unable to contact patient after 3 successive attempts
• Patient refuses follow-up

Enrollment Criteria:
• Pancreatectomy
• New ostomy
• Home with drain
• Major in-house complication
• Provider discretion

4 Focus Areas:
• Medication management
• Red flags
• Post-hospital care plan
• NCM contact information

Within 24-72 hrs of discharge:
• RN contacts patient
• Discussion of 4 focus areas

Within 3-4 days of previous follow-up call:
• RN calls patient to monitor 4 focus areas

RN contacts patient/caregiver every 3-4 days to monitor 4 focus areas

IDEN TIFICATION
1ST VISIT
INITIAL PHONE CONTACT
TELEPHONE FOLLOW-UP NO. 1
FOLLOW-UP PHONE CALLS
GRADUATION

RN meets patient
sC-TraC Implementation Results
10/12/2015 – 1/10/2016

• Enrollment: 100%
  • 100 patients
• Engagement: 95%

• Readmission: 11/95 pts (11.6%)
  • Historical data FY2014:
    • Colorectal 12%
    • Surg Onc 20%
    • Combined readmission rate 14.5%

• Medication Discrepancy – 30% at first phone call

<table>
<thead>
<tr>
<th>Procedure</th>
<th>N</th>
</tr>
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<tbody>
<tr>
<td>Pancreatectomy</td>
<td>12</td>
</tr>
<tr>
<td>New ostomy</td>
<td>44</td>
</tr>
<tr>
<td>Bowel resection</td>
<td>16</td>
</tr>
<tr>
<td>Ostomy takedown</td>
<td>8</td>
</tr>
<tr>
<td>Other</td>
<td>20</td>
</tr>
</tbody>
</table>
Adaption: Surgical C-TraC

- Complete protocol adaptation
  - Focus group stakeholders/clinician providers
    - Barriers/facilitators to implementation
    - Process mapping
- Pilot test final protocol
  - Acceptability evaluated
    - Focus group clinician providers and patients/caregivers
    - Assess patient activation
    - Interrupted time series analysis: Unplanned health care utilization (readmissions/ER visits)
- Multisite RCT

Conclusion

• Human Factors and Systems Engineering can be used to study complex medical systems

• Allows integration of qualitative and quantitative data
  • Specifically the patient and provider perspective

• Essential to include patient concerns into design of transitional care programs for surgical patients
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