REDUCING TIME FROM ACCEPTANCE TO INTENSIVE CARE UNIT ARRIVAL

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Purpose

• As part of our institutional continuous improvement process we proposed to improve our intensive care unit (ICU) admission process by gaining a better understanding of the admission process though the use of industrial engineering tools.

• Our aim was to identity those aspects of the admission process that leads to delayed admissions in order to expedite care interventions with the goal of improving:
  – Patients outcomes
  – Reducing morbidity and mortality
  – Decreasing ICU length of stay and cost
Methods

- Prospective Study
- Pilot Study: Fall 2013

Industrial engineering methods used:
  - Process flow mapping
  - Ishikawa (fishbone mapping)
  - Plan-Do-Study-Act cycles (PSDA)

Collection Period: 5/21/2014 through 12/31/2014

All ICU admissions except for surgical and out of facility transfer patients
  - Date
  - Primary Service
  - Referral Location
  - Referral Time
  - Acceptance Time
  - Bed Assignment Time
  - Arrival Time
  - Type of Admission – Code, Merit (Rapid Response), Regular
  - Reasons for Delay in Transfer to the ICU
MEASUREMENT

FACILITIES / BED AVAILABILITY

TRIAGE PROCESSES

COMMUNICATION

No O2 tank or regulator available

Transportation

Procedures prior to transfer

Respiratory personnel support

Inconsistency in bed assignment processes between process

Communication breakdown between triage & primary service

Communication breakdown within the ICU

ICU or Floor RN not available for report

Lack/Delay with transfer orders

No hospital bed tracking tool for ICU

No ICU flow/bed tracking tool

Unidentified delay etiologies

Data collection errors

SICU full (no open bed)

MICU full (no open bed)

Both MICU/SICU full (except for 'code' bed)

No bed available due to staffing

No bed available - room dirty

No bed available - equipment

No open negative pressure room

Code Blue in ICU

Code Blue on floor

Multiple referrals & admissions at the same time

MERIT assessment before acceptance

Patient Arrival Delays
Pilot study Fall 2013

Data Validation 2014

Prospective data collection 2014

Re-evaluation of Fall 2013 data

Recurrent PDSA cycles
On-going data collection and evaluation

Continued real-time monitoring of ICU admission times to eliminate impediments to timely admissions

Study Design
Data Validation

- We compared our admission data to an ICU database which collects per calendar day the name, MRN, referral location, bed assignment and primary service and arrival time.

- During the first 3 weeks of our study both the charge nurse and the ICU Triage Advance Practice Provider completed a data collection form independently for all admissions and the two forms were compared.

Analysis - Variables Considered

- Pilot Study vs Current data collection (both prospective)
- Pulling patients (Code and Rapid Response Team patients) vs Pushing Patients (all others patients)
- Reasons for delays to the ICU (Delay code)
- Referring Location: EC vs Floor
- Liquid tumors vs solid tumor patients
- AM / PM Shift
- Day Of Week
- Statistical methods: 2 Sample T test, One Way ANOVA, Box Plots
Pilot Study
Fall 2013

- All Patients: 74 min (n=164)
  - Code and Merit Transported Patients: 34 min (n=54)
  - All Other Patients: 93 min (n=110)

5 to 12/2014

- All Patients: 57 min (n=881)
  - Code and Merit Transported Patients: 26 min (n=284)
  - All Other Patients: 72 min (n=597)

Interval Plot of Accept to Combined Arrival vs Range
95% CI for the Mean

- Pilot - Fall 2013: 93 min
- May through Dec 2014: 72 min

The pooled standard deviation was used to calculate the intervals.
Delayed versus Expedited Admissions
ADMISSION DELAY BY TYPE

ALL OTHER PATIENTS
72 min (n=597)

Delayed
103 minutes (n=163)

Not Delayed
60 minutes (n=434)

Triage
123 minutes (n=37)

Procedure
115 minutes (n=31)

Bed Availability
101 minutes (n=10)

Communication
95 minutes (n=35)

Non-specified
89 minutes (n=38)

Infrastructure
74 minutes (n=12)

Boxplot of Accept to Arrival Time
NON EXPEDITED (NOT CODE OR MERIT) ADMISSIONS FROM THE EMERGENCY CENTER AND FLOOR

ALL OTHER PATIENTS
72 min
(n=597)

EMERGENCY CENTER PTS
76 min
(n=346)

FLOOR PATIENTS
66 min
(n=251)

**Boxplot of EC Only, Floor**

p = 0.017 based on a two sample t-test
Effect of Cancer Type on ICU Admission

- ALL PATIENTS: 57 min (n=881)
  - CODE OR MERIT TRANSPORTED PATIENTS: 26 min (n=284)
    - SOLID TUMOR: 72 min (n=323)
    - LIQUID TUMOR: 72 min (n=274)
  - ALL OTHER PATIENTS: 72 min (n=597)

Effect of Day of the Week and Shift On ICU Admission

- ALL OTHER PATIENTS: 72 min (n=597)
  - WEEKEND PATIENTS: 71 min (n=170)
    - Day Shift: 73 min (n=100)
    - Night Shift: 68 min (n=70)
  - WEEKDAY Patients: 72 min (n=427)
    - Day Shift: 71 min (n=302)
    - Night Shift: 76 min (n=125)
Discussion

• The interventions after the Pilot study (first PDSA cycle) were successful.
• Patients that are pulled to the ICU (Merit/Code) arrive in half the time as those patients without an identified delay.
• Delayed patients take four times as long as code and merit team patients.
• Triage accounted for significant admission delays, about one per week.
• Non-uniformity of communication about bed assignments caused delays.
• Procedures prior to ICU accounts for significant delays- this process is only partially amendable to interventions
Discussion

• There was a lack of knowledge about how transportation services are allocated
  – The Transportation Services relies on the Bed Management program to assign transportation but the ICU admissions do not use the Bed Management program so our needs and requirement could not be recognized.

• Day vs. night shift arrival was not as significant as originally thought.

• There was no statistical difference between weekday and weekend in time of ICU admissions

• Floor patients arrive statistically faster than patient from the emergency center.
Conclusions

- Standard industrial engineering techniques was a valuable tool in the intensive care unit continuous performance improvement process.

- Utilization of industrial engineering allows for a systematic review of a process to determine where change and improvements can be achieved.

- The use of the LEAN ‘pulling technique’ where movement is controlled by downstream processes was significantly more effective in the ICU admission flow than the ‘pushing technique’ where patient movement is controlled by the floor and emergency center.

- We propose that a dedicated ICU driven transport team could lead to more efficient and time sensitive ICU admission for non-code and non-rapid response critically ill patient admissions. This team would work independent of and in parallel to the rapid response team for a more efficient ICU admission process.