Designing Patient Flow in the Hospital to Make Patients Safer

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Why should we care about patient flow?

1. To make our patients safer
2. To increase throughput (volume, $$)
3. To reduce expenses (cost, $$)
4. To improve staff satisfaction
5. To improve patient satisfaction
A question to run on ……

What can I do as a healthcare leader to improve patient flow?
Agenda

• Introduction 5 minutes
  – What is the fundamental problem?
  – What management model will help us improve it?

• Some examples of designing flow 15 minutes
  – Smoothing Flow at Boston Medical Center: Changing the Surgical Schedule
  – Designing Flow out of the Emergency Department at Caritas Norwood Hospital
Luckily, this type of communication does not happen in commercial aviation…….

• **US Air 562 from Boston to Albany in its final approach**

• **Captain: “Albany this is US Air 562”**

• **Air Traffic Controller: “Roger US Air 562 this is Albany Control. You’ll have to hold at your present altitude. We’ve got a lot more planes in our airspace than usual. The airlines decided to add some flights but no one told us and we’ve got some rerouted planes due to bad weather in metro New York.”**
• US Air 562 from Boston to Albany in its final approach

• Co-pilot: “Boy, we’ve got to get this plane down or we’ll have some angry passengers. There’s the airport. Let’s pick a runway. I usually call the gates myself and find out if any are open and then I just go for it. If you don’t, the controller will give it to someone else”
A Physician and Two Nurses Discussing a Patient in the ED Waiting to Be Admitted

Physician: “This guy is ready to go upstairs. It’s now 5pm, he came in at 10 this morning. The unit clerk called admitting but I guess they are at dinner”.

First Nurse: “Ok, I’ll call around to the floors and see if there are any empty beds….I know who to call.”

Second Nurse: “Oh, I usually call the supervisor. Did you call report?”

First Nurse: “Oh no, I leave it on the floor’s voicemail just before I leave the ED with the patient so they can’t slow the transfer down”.

Caritas Norwood Hospital
Hospitals have been managed sub-optimally

- Too much is happening by chance. Too little is happening by design and therefore *we function at low reliability*
- Managers have been managing inputs: studies per FTE; deviation from budget, etc. but not *the system*.
- The hospital is full of *batching*; Patients are admitted and discharged in batches. Tests are run in batches. Surgeries are done in batches without consideration of *the effect on the system*.
- *Safe patient care* is easier to reach with continuous flow and not with the artificial variability of batching!
- There is a need for scientific management in the hospital industry
Reason’s Swiss Cheese Model of Error

We are managing the efficiency of individual inputs and not the system.

We allow patients to aggregate and move in batches that overwhelm our staff.

Latent failures at the managerial levels

Psychological precursors

Unsafe acts

Defence-in-depth

Local triggers
Intrinsic defects
Atypical conditions

Trajectory of accident opportunity
“Hard work and good intentions are necessary but insufficient for exceptional care”. 
“Every System is perfectly designed to get exactly the results that it gets.”
Variability

1. “Natural”: you can’t control it … you just have to manage it. (e.g. sick patients coming to the ED). Tool to manage it: queuing theory

2. “Artificial”: you can control it .... you must eliminate it to create flow. (batching) (e.g. elective surgery scheduling, reading stress tests)
When we “batch and push” we create artificial peak loads that create overcrowding

- Internal Diversion – patients sent to alternative floors\Intensive Care locations
- Internal Delays – PACU backs up
- External Diversion - ED diversion; inability to accept transfers
- Staff overload – increased errors and staff unhappiness
- System Gridlock – Increase in LOS
- Decreased Volume
- Unhappy patients
What business model should we use to improve flow?
Performance Improvement

1. Focus on the patient and his or her family
2. Deep Process knowledge (*Design*)
3. Decisions driven by data
4. Teamwork
5. Empowerment

“How can we use the ideas of individuals on the team to redesign our systems to measurably improve the health and satisfaction of our patients and their families while driving out waste?”
Flow Teams at Boston Medical Center

Flow Leadership Team

- ED Team
- Inpatient Team
- Surgical Scheduling Team
Average total ED throughput time
Boston Medical Center

Weeks

Hours

Improvement from 4.5 to 3.75 hours
30 minutes x 1050 cases = 31,500 minutes or 525 hours per week saved
Improving Inpatient Flow
Team

- Janet Gorman
- John Chessare
- Linda Guy
- Jane Damata
- Dina Brauneis
- Brian Brisbois
- Sue Doherty
- Jacque O’Shea
- Cil Weekes
- David Roney
- Kim Wood
Maximizing Throughput: Smoothing the Elective Surgery Schedule to Improve Patient Flow

James M. Becker, MD
Keith P. Lewis, MD
John B. Chessare, MD, MPH
Eugene Litvak, PhD

Richard J. Shemin, MD
Gail Spinale, RN
Demetra Ouellette
Abbot Cooper
Surgical Smoothing

1. Smoothing Elective Vascular Surgery
2. Smoothing Elective Cardiac Surgery
3. Separating Elective From Urgent Surgery in the Menino Pavilion
   - Creating reliable urgency data
   - Separating a room for urgent/emergent cases
   - Eliminating Block Scheduling
Bed Need by Day of Week for Vascular Surgery (18 months of data)
Vascular Elective PCU Cases by Day
Random Month July 2002
Vascular Scheduled PCU Cases - Weekdays Only
(October 2003)
E6W Direct Nursing Hours per Patient Day

Prior to Vascular Smoothing: 8.66
After Vascular Smoothing: 8.16
March Daily PCU Census - 2003 vs. 2004

2003 range  10 – 1 = 9

2004 range  7 – 2 = 5

55% reduction in variability
Operating Outside of the Block at BMC

Separating the Flow of Elective Surgery from Urgent/Emergent Surgery
### Menino Pavilion compared to Newton Pavilion

<table>
<thead>
<tr>
<th>Variable</th>
<th>NP</th>
<th>MP</th>
</tr>
</thead>
<tbody>
<tr>
<td># Rooms</td>
<td>13</td>
<td>8</td>
</tr>
<tr>
<td># Cases Day</td>
<td>30-35</td>
<td>25-32</td>
</tr>
<tr>
<td># Cases Year</td>
<td>8601</td>
<td>6608</td>
</tr>
<tr>
<td>Cancellation Rate</td>
<td>10%</td>
<td>20%</td>
</tr>
<tr>
<td># Add Ons Per Day</td>
<td>1-2</td>
<td>5-12</td>
</tr>
<tr>
<td># Weekend Cases</td>
<td>0-4</td>
<td>5-20</td>
</tr>
<tr>
<td>Unique Services</td>
<td>Cardiac, Ophth</td>
<td>Pediatrics, Trauma, Gastric Bypass, OB</td>
</tr>
</tbody>
</table>
Pre-change Problems with the Daily Schedule – Menino Pavilion

• Urgent/emergent bump elective cases
• Overall 50% block utilization
• Variable use of block (vacation, meetings)
• Most cases booked 3-4 days out
• 33% of daily schedule is “add ons”
• Variable release time between services
• Cases can be lost waiting
• People live in fear of losing their block
The Radical Changes

#1
Eliminated Block Booking

#2
One Urgent Room Created

OR 5
### Bumped Cases Before and After Separating “Flows”

<table>
<thead>
<tr>
<th>Before</th>
<th>After</th>
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<tbody>
<tr>
<td>April 03 – April 04</td>
<td>April 04 – April 05</td>
</tr>
<tr>
<td>• 349 emergent cases (M – F) 7:00 AM to 3:30 PM</td>
<td>• 354 emergent cases (M – F) 7:00 AM to 3:30 PM</td>
</tr>
<tr>
<td>• 771 elective patients were delayed or cancelled</td>
<td>• 7 elective patients were delayed or cancelled</td>
</tr>
</tbody>
</table>
Norwood: Biggest Operational Dilemma

Daily ED Admits and Time from Decision to Departure

Time
Range = 176 – 418 minutes (3 hours – 6 hours)
Mean = 300 minutes (5 hours)

Number of ED Admits
Range = 23 – 45
Mean = 30

Goal = 120 minutes
What is the true constraint?  
Physician workup in the ED.

Find it and *elevate it*.  
Moved to the inpatient unit.

What is now the true constraint?  
Floor not ready.

Find it and elevate it.  
Create Transfer Time.
Some other constraints

- **No transporter**: included transport in synchronization and added transport capacity

- **No nurse to staff an inpatient bed**: stopped staffing to monthly historic mean; create prediction software based on historic natural variability and today’s census for tomorrow
1. ED MD evaluates new patient and decides that this is a medical patient (non-ICU) that needs to be admitted.

2. ED MD informs ED primary RN of admission (probably when informing pt.).

3. ED MD completes admission order and submits to ED secretary.

4. ED secretary enters order into Meditech, which generates print out in Admitting office.

5. ED secretary updates admission log.

6. ED secretary informs ED charge RN of admission.

7. ED charge RN denotes admission on white board.

8. ED MD signs out patient to Lead Hospitalist (LH).

9. ED MD informs charge RN of LH contact (during board run).

10. ED charge RN denotes LH contact on white board (during board run).

11. Is a bed likely available for the patient?

12. Bed availability summary sent by BPC

13. ED charge RN instructs primary RN to tape voicemail report.

14. ED charge RN fields call from BPC confirming bed and transfer time.

15. ED charge RN puts bed and transfer time on board.

16. ED charge RN informs primary RN of bed and transfer time.

17. Primary RN tapes voicemail report (if not already done).

18. Primary RN calls receiving floor to deliver the voice-mailbox number.

19. Primary RN prepares patient for transfer, copies chart, and places copy of chart in order bin.

20. ED secretary fields call from BPC with bed and transfer time. **If bed and transfer time are not written on the white board, ED secretary makes sure ED charge RN is aware of bed and transfer time.

21. ED secretary enters bed and transfer time on admission log.

22. Transport arrives to move the patient and collects necessary paperwork.

23. Transport moves patient out of ED.

24. ED secretary uses copy of chart to depart the patient in Meditech, and to transfer the patient from U10 to the receiving unit.

**The secretary should use the "special comments" field to denote information that is necessary for bed placement (e.g.: "1:1", "not suitable for U31", etc.).
ED Medical Admissions Process: THE BED PLACEMENT COORDINATOR

(25) When Admit Order prints out, BPC:
   a) enters name, etc. into BPC log
   b) admits pt. in Meditech
   c) prints packet to ED printer
   d) sends text to Adm. Mgr. and Admissions RN (11a-11p) which includes name, age, Dx, bed type, potential unit (e.g. ?U31), precautions or 1:1 if known

(26) BPC receives text from Lead Hospitalist, which includes: pt. name, diagnosis, bed type, ESI, and acceptance time. BPC enters time of page and ESI into log.

(27) If there are any discrepancies or questions about an admission, BPC contacts the administrative manager. Otherwise, BPC chooses a bed for the patient.

(28) BPC calls charge RN (or secretary if charge not available) on receiving unit to inform of admission (including Dx and ESI) and to confirm bed assignment and transfer time.

(29) BPC calls ED charge RN (or sec. if charge not avail.) to confirm bed assignment and transfer time.

(30) Once bed assignment and transfer time are confirmed, BPC sends a text page to Administrative Manager, Admissions RN (11a-11p), ED Admitting, and Lead Hospitalist with the following info:
   a) pt. name
   b) bed assignment
   c) transfer time

(31) BPC calls ED secretary to deliver bed assignment and transfer time.

(32) BPC checks to ensure that patient moves upstairs on time. If patient is still in ED after transfer time, BPC contacts ED charge RN.

If the bed type is changed (whether by ED order or LH contact), BPC alerts the Administrative Manager by text page.

Our target is to set the transfer time within 30 minutes of the call to the floor. When contacting the receiving unit, the BPC should state, “We'd like to send this patient up in 30 minutes. Is there any chance we could send the patient sooner?” The floor reserves the right to request a transfer time greater than 30 minutes, but must inform the BPC of the reason.

Either the receiving unit or the ED may request a change in the transfer time. If this happens, BPC contacts the opposite unit (e.g. if ED calls, then BPC calls the receiving unit) to confirm new transfer time. BPC notes the changed transfer time in the log and then resends a text page to Administrative Manager and Lead Hospitalist beginning with “Change:” and then the pt. name, bed, and transfer time.
ED Medical Admissions Process: HOSPITALISTS AND INPATIENT UNIT

(33) Lead Hospitalist (LH) receives sign-out and determines when a hospitalist can see the patient.

(34) LH communicates the following to Bed Placement Coordinator: pt. name, diagnosis, bed type, ESI, and acceptance time.

(35) Assigned hospitalist begins work-up (regardless of patient location) as soon as possible.

(36) LH receives bed assignment and transfer time from BPC.

(37) Assigned hospitalist proceeds to floor as soon as possible.

(38) Charge RN or unit secretary on receiving unit fields call from BPC and establishes bed and transfer time.

(39) Charge RN informs receiving RN of admission.

(40) Unit secretary fields call regarding report and informs receiving RN of mailbox number.

(41) Receiving RN retrieves voicemail report and calls ED primary RN for clarification if necessary.

(42) Patient arrives on floor.

(43) If patient does not have admission orders, unit secretary texts Lead Hospitalist that patient has arrived.
SERVICE

Reduce the average time from ED admission decision to departure to inpatient unit to 120 minutes calculated monthly.

![Graph showing the average time from Decision-to-Admit to ED Departure from 6/19/2005 to 11/19/2006. The x-axis represents the week beginning on each date, and the y-axis shows the minutes. The graph indicates a trend towards reducing the time from 350 minutes to approximately 150 minutes over the period. The week of 11/19/2005 is highlighted with a red circle.]
Question Mean Score: Speed of Admission
Key change concepts of the Design

- **Do tasks in parallel**: move the patient to the floor while the workup continues
- **Synchronize**: assign a transfer to floor time (creates pull) after communication with charge nurses and hospitalist
- **Central command**: all beds are assigned by the nursing supervisor/bed facilitator
- **Direct Communication**: ED physician hands-off to Hospitalist
- **Predict Demand**: Use data on natural variability to get ready for staffing changes
Summary

• There is much artificial variability in healthcare. We can no longer afford this waste.

• We must redesign our systems to maximize flow which will make our patients safer, improve volume, staff and patient satisfaction and reduce the waste.

• Separating the flow of urgent surgery from scheduled surgery reduces waste and rework.

• No-Block scheduling is a good way to help the surgeons, patients, and staff.

• All hospitals should map inpatient flow and test changes to improve it.
References

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- Leading Change; by John P. Kotter
- The Improvement Guide; by Langley et al
- [http://management.bu.edu/research/hcmrc/mvp/index.asp](http://management.bu.edu/research/hcmrc/mvp/index.asp)