

Title: Redesigning inpatient care: testing the effectiveness of an Accountable Care Team model.

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Background: US healthcare underperforms on quality and safety metrics.

Inpatient care constitutes an immense opportunity to intervene to improve care.

Objective: Describe a model of inpatient care and measure its impact.

Design: A quantitative assessment of the implementation of a new model of care. The graded implementation of the model allowed us to follow outcomes and measure their association with the dose of the implementation.

Setting and Patients: Inpatient medical and surgical units in a large academic health center.

Intervention: Eight interventions rooted in improving inter-professional collaboration (IPC), enabling data driven decisions and providing leadership were implemented.

Measurements: Outcome data from August 2012 till December 2013 was analyzed using generalized linear mixed models for associations with the implementation of the model. Length of stay (LOS) index, case-mix index adjusted variable direct costs (CMI-adjusted VDC); 30-day readmission rates, overall patient satisfaction scores and provider satisfaction with the model were measured.

Results: The implementation of the model was associated with decreases in LOS index (p -value < 0.0001) and CMI-adjusted VDC (p -value 0.0006). We did not detect improvements in readmission rates or patient satisfaction scores. Most providers (95.8%, $n=92$) agreed that the model had improved the quality and safety of the care delivered.

Conclusions: Creating an environment and framework in which IPC is fostered, performance data is transparently available and leadership is provided may improve value on both medical and surgical units. These interventions appear to be well accepted by front line staff. Readmission rates and patient satisfaction remain challenging.

Key words: acute care, quality improvement, inter-professional collaboration, accountable care.

Background:

Despite an estimated annual \$2.6 trillion expenditure on healthcare, the US performs poorly on indicators of health and harm during care.¹⁻³ Hospitals around the nation are working to improve the care they deliver. We describe one model developed at our institution and report the evaluation of the outcomes associated with its implementation on the general medical and surgical units. The Indiana University Institutional Review Board approved this work.

Setting and definitions:

Indiana University Health Methodist hospital (MH) is an academic center in Indianapolis serving over 30,000 patients annually.⁴ In 2012, responding to the coexisting needs to improve quality and contain costs, the MH leadership team redesigned care in the hospital. The new model centers around **Accountable Care Teams (ACTs)**. Each ACT is a geographically defined set of providers accepting ownership for the clinical, service and financial outcomes of their respective inpatient unit. The units studied are described in Table 1.

The ACT Model:

The model comprises of eight interventions rooted in three foundational domains.

- 1- Enhancing interprofessional collaboration (IPC).
- 2- Enabling data-driven decisions.
- 3- Providing Leadership.

Each intervention is briefly described under its main focus. Further details are provided in Appendix A.

1-Enhancing interprofessional collaboration:

Geographical cohorting of patients and providers: Hospitalist providers are localized for four consecutive months to one unit. An interdisciplinary team including a case manager, clinical nurse specialist, pharmacist, nutritionist and

social worker also serves each unit. Learners (residents, pharmacy and medical students) are embedded in the team when rotating on the hospital medicine service. The presence of unit based nurse managers and charge nurses predates the model and is retained.

Bedside collaborative rounding: Geographically cohorted providers round on their patients with the bedside nurse guided by a customizable script.

Daily Huddle: The hospitalist, learners and the interdisciplinary team for the unit meet each weekday to discuss patients' needs for a safe transition out of the hospital. Each unit determined the timing, location and script for the huddle while retaining the focus on discharge planning. A sample script is provided in Appendix A2.

Hospitalist and specialty co-management agreements: Guidelines delineating responsibilities for providers of each specialty were developed. Examples include orders pertaining to the management of a dialysis catheter in a patient with end stage renal disease, the removal of drains in post surgical patients, wound care etc.

Unit white board: Each unit has a white board at the nursing station. Similar to the huddle it is focused on discharge planning.

2- Enabling Data-Driven Decisions:

Monthly review of unit level data: The department of data analytics developed a 'data dashboard'. Key metrics including length of stay (LOS), patient satisfaction scores, readmission rates and costs are tracked and attributed to the discharging unit. The data is collated monthly by the ACT program director and distributed to each unit's leadership. Monthly interdisciplinary meetings are held to review trends. Learners are encouraged but not required to attend.

Weekly patient satisfaction rounding: The unit's nurse manager and physician leader conduct weekly satisfaction rounds on patients. The conversation is open ended and focused on eliciting positive and negative experiences.

3- Providing Leadership:

Designated hospitalist and, where relevant, specialty leaders are committed to serve each unit for at least one year as a resource for both medical and operational problem solving. The leader stays closely connected with the unit's nurse manager. In addition to day-to-day troubleshooting, the leader is responsible for monitoring outcome trends. There is currently no stipend, training or other incentive offered for the role.

Implementation Timelines and ACT scores:

The development of the ACTs started in the spring of 2012. Physician, nursing and pharmacy support was sought and a pilot unit was formed in August 2012. The model was cascaded hospital wide by December 2013 with support from the ACT program director (AN). The program director observed and scored the uptake of each intervention by each unit monthly. A score of '1' denoted no implementation while '5' denoted complete implementation. The criteria for scoring are presented in Table 2. The monthly scores for all eight interventions in each of the eleven units were averaged as an 'overall ACT score' which reflects the implementation dose of the ACT model. Monthly 'domain scores' for enhancing IPC and enabling data driven decisions were also calculated as the average score within each domain. This yielded three domain scores. Figure 1 plots by month (A) the overall ACT score for the medical and surgical units, and (B) the implementation score for the three domains between August 2012 and December 2013 for all units. The uptake of the interventions varied between units. This allowed our analysis to explore the dose relationships between the model and outcomes independent of underlying time trends that may be affected by concomitant initiatives.

Outcomes: Monthly data between August 2012 and December 2013 was analyzed.

Measures of Value: MH is a member of the University Health Consortium (UHC), which measures outcomes of participants relative to their peers. MH

measures length of stay (LOS) index as a ratio of observed LOS to expected LOS that is adjusted for severity of illness.⁵

Variable direct costs are costs that a hospital can save if a service is not provided.⁶ A hospital's case-mix index represents the average diagnosis-related group relative weight for that hospital. We track variable direct costs adjusted for case mix index (CMI-adjusted VDC).⁷

Thirty-day readmission rate is the percentage of cases that are readmitted to MH within 30 days of discharge from the index admission.⁸

Measures of Patient Satisfaction: The Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey covers topics relevant to a patient's experience in the hospital.⁹ Patient satisfaction scores are tracked by responses to the HCAHPS survey.

Measures of Provider Satisfaction: Hospitalist and specialty providers, leadership and case management teams were surveyed via email through Survey Monkey™ in July 2014. The survey included Likert responses that elicited opinions and comments about the ACT model.

Statistical Methods:

The primary predictor of interest was the monthly 'overall ACT score'. We also

explored the 'domain scores' as well as the individual scores for each intervention. Generalized linear mixed models were fit to investigate the association between each predictor (overall ACT score, ACT domain scores and individual implementation scores) and each outcome (LOS Index, CMI-adjusted VDC, 30-Day readmission rate, and overall patient satisfaction). The model for testing each ACT score also included covariates of inpatient units as a random effect, as well as date and type of unit as fixed effects. We set the statistical significance level at 0.01 and reported 99% confidence intervals.

Descriptive statistics were used to report the provider satisfaction survey results.

Results:

The overall ACT score was associated with LOS index and CMI-adjusted VDC (both $p < 0.001$). For every one-unit increase in the overall ACT score, LOS index decreased by 0.078 and CMI-adjusted VDC decreased by \$273.99 (Table 3).

Looking at domains, enhancing IPC resulted in statistically significant decreases in both LOS index and CMI-adjusted VDC, but providing leadership and enabling data-driven decisions decreased only the LOS index. Most of the eight individual interventions were associated with at least one of these two outcomes (Even where the associations were not significant, they were all in the directions of decreasing LOS and cost). In these models, the covariate of type of units (medical vs. surgical) was not associated with LOS or cost. There was no significant time trend in LOS or cost except in models where an intervention had

no association with either outcome. Inclusion of all individual effective interventions in the same statistical model to assess their relative contributions was not possible because they were highly correlated (correlations 0.45-0.89). Thirty-day readmissions and patient satisfaction were not significantly associated with the overall ACT score, but exploratory analyses showed that patient satisfaction increased with the implementation of geographical cohorting ($p=0.007$).

Survey Results

The response rate was 87% (96/110). Between 85-96% of respondents either agreed or strongly agreed that the ACT model had improved the quality and safety of the care delivered, improved communication between providers and patients and improved their own engagement and job satisfaction. 78% of the respondents either agreed or strongly agreed that the model improved efficiency (Table 4). Suggestions for improvements revolved around increasing the emphasis on patient centeredness and bedside nursing engagement.

Discussion:

The serious problems in US healthcare constitute an urgent imperative to innovate and reform.¹⁰ Inpatient care reflects 31% of the expenditure on health care and in 2010; 35.1 million patients were discharged from the hospital after spending an average of 4.8 days as an inpatient.¹¹ These figures represent an

immense opportunity to intervene. Measuring the impact of quality improvement efforts is often complicated by concomitant changes that affect outcomes over the interval studied. Our approach allowed us to detect statistically significant changes in LOS index and CMI-adjusted VDC associated with the ACT implementation dose that could be separated from the underlying time trends.

The ACT model we describe is rooted in improving three foundational domains; quantifying each intervention's compartmentalized contribution however proved difficult. Each intervention intertwines with the others to create changes in attitudes; knowledge and culture that are difficult to measure yet may synergistically affect outcomes. For example, although geographical cohorting appears to have the strongest statistical association with outcomes, this may be mediated by how it enables other processes to take place more effectively. Based on this analysis therefore, the ACT model may best be considered a bundled intervention.

The team caring for a patient during hospitalization is so complex that fewer than a quarter of patients know their physician's or nurse's name.¹² This complexity impairs communication between patients and providers and between the providers themselves. Communication failures are consistently identified as root causes in sentinel events reported to the Joint Commission.¹³ Interprofessional collaboration (IPC) is “the process by which different professional groups work together to positively impact health care”. IPC overlaps with communication,

coordination and teamwork, and improvements in IPC may improve care.¹⁴ Some elements of the model we describe have been tested previously.¹⁵⁻¹⁷ Localization of teams may increase productivity and the frequency with which physicians and nurses communicate. Localization also decreases the number of pages received and steps walked by providers during a work day.¹⁵⁻¹⁷ However, these studies reported a trend towards an increase in the LOS and neutral effects on cost and readmission rates. We found statistically significant decreases in both LOS and cost associated with the geographic cohorting of patients and providers. Notably, our model localized not only the physician providers but also the interdisciplinary team of pharmacists, clinical nurse specialists, case managers and social workers. This proximity may facilitate IPC between all members that culminates in improved efficiency. The possibility of delays in discharges to avoid new admissions in a geographically structured team has previously been raised to explain the associated increases in LOS.^{16,17} The accountability of each unit for its metrics, the communication between nursing and physicians and the timely availability of the unit's performance data align everyone towards a shared goal and provides some protection from such an unintended consequence.

Structured interdisciplinary rounds decrease adverse events and improve teamwork ratings.^{18,19} The huddle in our model is a forum to collaborate between disciplines that proved to be effective in decreasing LOS and costs. Our huddle aims to discuss all the patients on the unit. This allows the team to assist each other in problem solving for the entire unit and not just the patients on the

geographically cohorted team. This approach, in addition to the improved IPC fostered by the ACT model, may help explain how benefits in LOS and costs permeated across all eleven diverse units despite the presence of patients who are not directly served by the geographically cohorted team.

High performing clinical systems maintain an awareness of their overarching mission and unit-based leaders can influence the frontline by reiterating the organizational mission and aligning efforts with outcomes.²⁰ Our leadership model is similar to the ones described by other institutions in the strong partnerships between physicians and nursing.²¹ As outlined by Kim et al, investing in the professional development of the unit leaders may help them fulfill their roles and serve the organization better.²¹

The fragmentation and lack of ownership over the continuum of patient care causes duplication and waste. The proposal in the Accountable Care Act to create ACOs is rooted in the understanding that providers and organizations will seek out new ways of improving quality when held accountable for their outcomes.²² To foster ownership and accountability, reporting of metrics at the unit level data is needed. Furthermore, an informational infrastructure is critical as improvements cannot occur without the availability of data to both monitor performance and measure the effect of interventions.^{10,23} Even without any other interventions, providing feedback alone is an effective way of changing

practices.²⁴ According to Berwick et al, this phenomenon reflects practitioners' intrinsic motivation to "simply want to be better".²⁵ Our monthly review of each unit's data is an effective way to provide timely feedback to the frontline that sparks pride, ownership and innovative thinking.

Based on our mean ACT score and CMI-adjusted VDC reductions alone, we estimate savings of \$649.36 per hospitalization (mean increase in ACT implementation of 2.37 times reduction in cost index of 273.99 per unit increase in overall ACT score). This figure does not include savings realized through reductions in length of stay. This is a small decrease relative to the mean cost of hospitalization, yet when compounded over the annual MH census, would result in substantial savings. The model relied on the restructuring of the existing workforce and the only direct additional cost was the early salary support for the ACT program director.

Limitations:

We recognize several limitations. It is a single center's experience and may not be generalizable. The diffusion of knowledge and culture carried between units and the relatively rapid implementation timeline did not allow for a 'control' unit. A single observer assigned our implementation scores and therefore we cannot report measures of inter-rater reliability. However, defined criteria and direct observations were used wherever possible. Although administratively available

data has its limitations, where available, we used measurements that are adjusted for severity of illness and case mix index. We therefore feel that this data set is an accurate representation of currently reported national quality indicators.

Further Directions:

Although there is a need to improve our healthcare system, interventions should be deliberate and evidence based wherever possible.²⁶ Geographic cohorting may decrease the frequency of paging interruptions for physicians and practitioners while increasing face-to-face interruptions.²⁷ The net effect on safety with this trade off should be investigated.

The presence of an intervention does not guarantee its success. Despite geographic cohorting and interdisciplinary meetings, communication that influences physician decision making may not improve.²⁸ Although instruments to measure ratings of team work and collaboration are available, focusing on clinically relevant outcomes of teamwork such as prevention of harm may be more empowering feedback for the frontline. Formal cost benefit analyses and outcomes related to physician and nursing retention will be equally important for assessing the sustainability of the model. Involving patients and their caregivers and inviting their perspectives as care is redesigned will also be critical in

maintaining patient centeredness. Research addressing interventions to mediate preventable readmission risk and understanding the drivers of patient satisfaction is also needed.

The true value of the model may be in its potential to monitor and drive change within itself. Continuously aligning aims, incentives, performance measures and feedback will help support this innovation and drive. This affects not only patient care but creates microcosms within which research and education can thrive. We hope that our experience will help guide other institutions as we all strive in our journey to improve the care we deliver.

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References:

1. *Crossing the Quality Chasm: a New Health System for the 21st Century*. The National Academies Press; 2001.
2. Starfield B. Is US health really the best in the world? *JAMA*. 2000;284(4):483–485.
3. Landrigan CP, Parry GJ, Bones CB, Hackbarth AD, Goldmann DA, Sharek PJ. Temporal Trends in Rates of Patient Harm Resulting from Medical Care. *New Engl J Med*. 2010;363(22):2124–2134.
4. *Indiana University Health*. Available at: <http://iuhealth.org/methodist/abolut/>. Accessed October 20, 2014.
5. *University Health Consortium*. Available at: https://www.uhc.edu/docs/45014769_QSS_dashboard_FAQs.pdf. Accessed October 23, 2014.
6. Roberts RR, Frutos PW, Ciavarella GG, et al. Distribution of variable vs fixed costs of hospital care. *JAMA*. 1999;281(7):644–649.
7. *Centers for Medicare and Medicaid Services*. Available at: <http://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/AcuteInpatientPPS/Acute-Inpatient-Files-for-Download-Items/CMS022630.html>. Accessed May 4, 2015.
8. *University Health Consortium*. Available at: <https://www.uhc.edu>. Accessed

October 23, 2014.

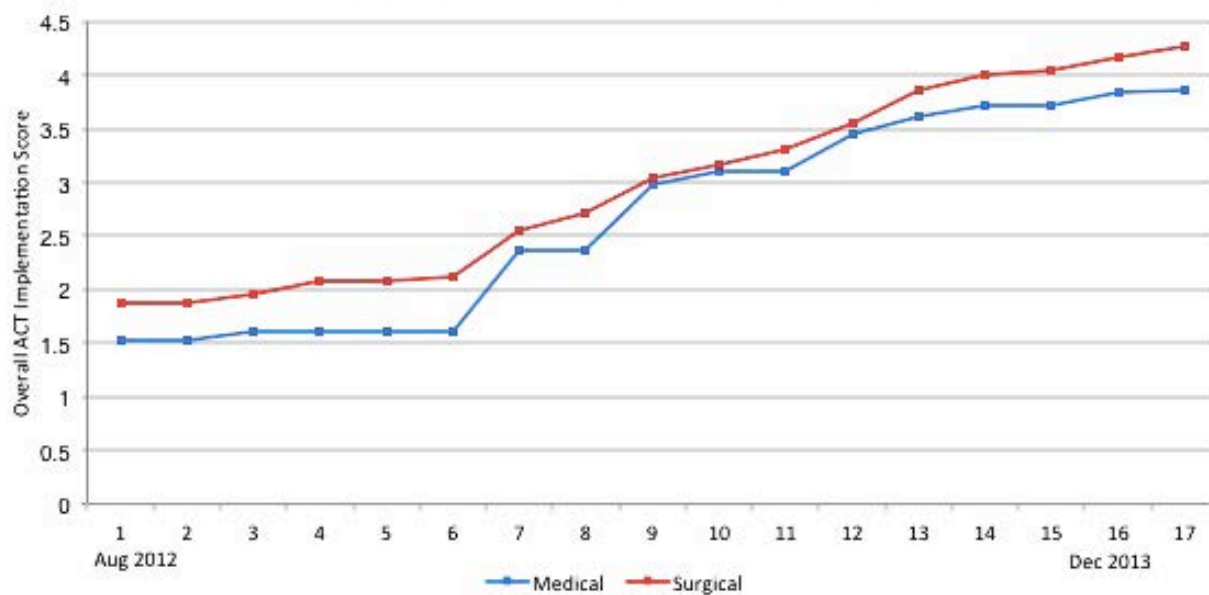
9. CMS. HCAHPS Survey Content and Administration. 2014:1–4.
10. Chassin MR, Galvin RW. The urgent need to improve health care quality. Institute of Medicine National Roundtable on Health Care Quality. In: Vol 280. 1998:1000–1005.
11. CDC Centers for Disease Control and Prevention. Available at: <http://www.cdc.gov/nchs/fastats/default.htm>. Accessed October 27, 2014.
12. Makaryus AN, Friedman EA. Does your patient know your name? An approach to enhancing patients’ awareness of their caretaker’s name. *J Healthc Qual.* 2005;27(4):53–56.
13. lindsayc. Sentinel Event Data Root Causes by Event Type 2004-Third Quarter 2011. 2011:1–29.
14. Zwarenstein M GJRS. Interprofessional collaboration: effects of practice-based interventions on professional practice and healthcare outcomes (Review). 2012:1–33.
15. O’Leary KJ, Wayne DB, Landler MP, et al. Impact of Localizing Physicians to Hospital Units on Nurse—Physician Communication and Agreement on the Plan of Care. *J GEN INTERN MED.* 2009;24(11):1223–1227.
16. Singh S, Tarima S, Rana V, et al. Impact of localizing general medical teams to a single nursing unit. *J Hosp Med.* 2012;7(7):551–556.

17. Roy CL, Liang CL, Lund M, et al. Implementation of a physician assistant/hospitalist service in an academic medical center: impact on efficiency and patient outcomes. *J Hosp Med*. 2008;3(5):361–368.
18. O'Leary KJ, Wayne DB, Haviley C, Slade ME, Lee J, Williams MV. Improving Teamwork: Impact of Structured Interdisciplinary Rounds on a Medical Teaching Unit. *J GEN INTERN MED*. 2010;25(8):826–832.
19. O'Leary KJ, Sehgal NL, Terrell G, Williams MV, for the High Performance Teams and the Hospital of the Future Project Team. Interdisciplinary teamwork in hospitals: A review and practical recommendations for improvement. *J Hosp Med*. 2011;7(1):48–54.
20. Huber TP, Godfrey MM, Nelson EC, Mohr JJ, Campbell C, Batalden PB. Microsystems in health care: Part 8. Developing people and improving work life: what front-line staff told us. *Jt Comm J Qual Saf*. 2003;29(10):512–522.
21. Kim CS, King E, Stein J, Robinson E, Salameh M, O'Leary KJ. Unit-based interprofessional leadership models in six US hospitals. *J Hosp Med*. 2014;9(8):545–550.
22. Fisher ES, Staiger DO, Bynum JPW, Gottlieb DJ. Creating Accountable Care Organizations: The Extended Hospital Medical Staff. *Health Affairs*. 2007;26(1):w44–w57.
23. Galvin RS, McGlynn EA. Using performance measurement to drive

improvement: a road map for change. *Med Care*. 2003;41(1 Suppl):I48–60.

24. Greco PJ, Eisenberg JM. Changing physicians' practices. *N Engl J Med*. 1993;329(17):1271–1273.
25. Berwick DM, James B, Coye MJ. Connections between quality measurement and improvement. *Med Care*. 2003;41(1 Suppl):I30–8.
26. Auerbach AD, Landefeld CS, Shojania KG. The tension between needing to improve care and knowing how to do it. *New Engl J Med*. 2007;357(6):608–613.
27. Singh S, Fletcher KE. A Qualitative Evaluation of Geographical Localization of Hospitalists: How Unintended Consequences May Impact Quality. *J GEN INTERN MED*. 2014.
28. Zwarenstein M, Rice K, Gotlib-Conn L, Kenaszchuk C, Reeves S. Disengaged: a qualitative study of communication and collaboration between physicians and other professions on general internal medicine wards. *BMC Health Serv Res*. 2013;13:494.

A: Overall ACT score over time by unit type



B: Mean domain scores over time for all units

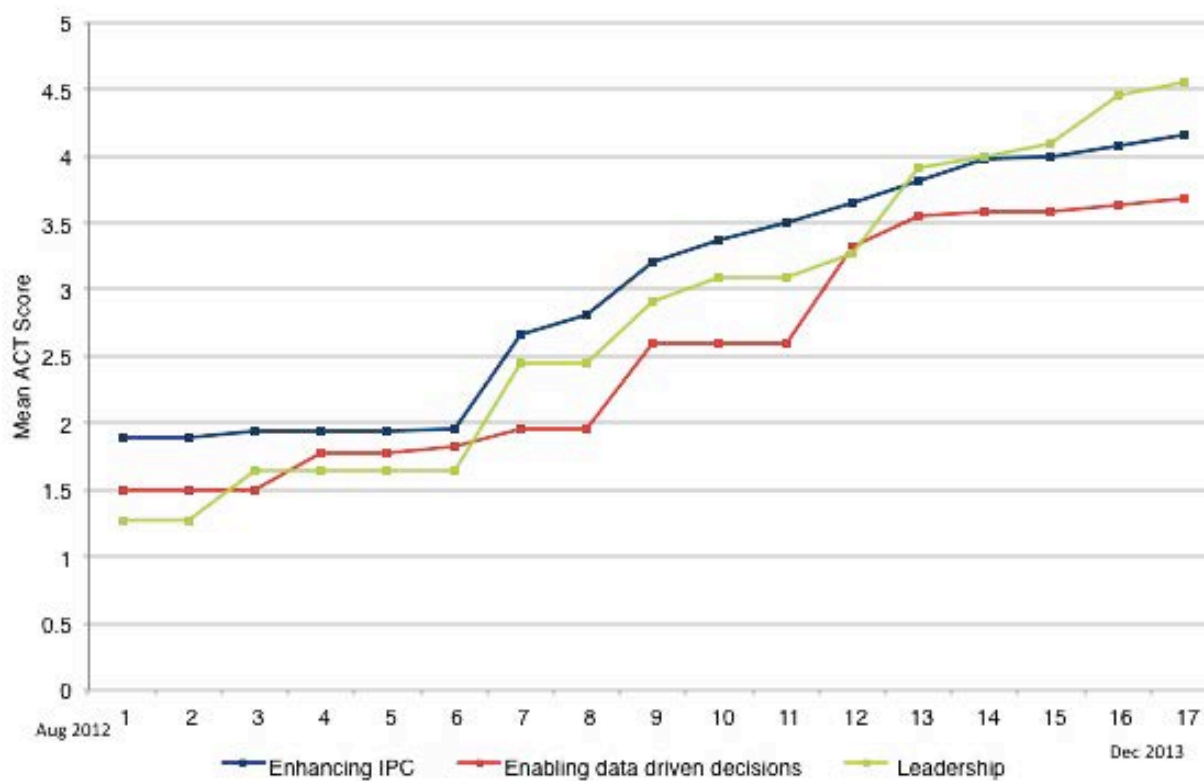


Table 1: Description of the units

	Unit	Number of Beds	Predominant Diagnosis (maximum domain score)*
Medical Units with Progressive Care Beds	1	33	Pulmonary (3.4, 3.5, 5)
	2	28	Cardiology (4.8, 3.5, 4)
	3	24	General Medical (4.8, 3.5, 4)
Medical Units without Progressive Care Beds	4	36	Renal/Diabetic (4, 3.5, 5)
	5	24	General Medical (3.75, 4, 5)
Surgical Units with Progressive Care Beds	6	51	Cardiothoracic Surgery/Cardiology (4, 4, 5)
	7	29	Trauma/General Surgery (3.75, 3.5, 5)
	8	23	Neurosurgical/Neurological (4.8, 5, 5)
	9	24	Neurosurgical/Neurological (4.4, 4.5, 5)
Surgical Units without Progressive Care Beds	10	29	General/Urologic/Gynecologic/Plastic Surgery (3.4, 3, 2)
	11	26	Orthopedic Surgery (4.6, 4, 5)

*Maximum score attained in the domain in the following order: enhancing interprofessional collaboration, enabling data-driven decisions, providing leadership.

Table 2: Scoring Grid

	1	2	3	4	5
Geographical cohorting of patients and the ACT *	None	At least one discipline comprising the ACT is unit based	All disciplines comprising the ACT except the hospitalist unit based	All disciplines including the hospitalist unit based	4+ 80% of hospitalist provider's patients on the unit
Bedside collaborative rounding	None	Occurring one day a week on at least 25% of the patients on the unit	Occurring two to three days a week on at least 50% of the patients on the unit	Occurring three to four days a week on at least 75% of the patients on the unit	Occurring Monday-Friday on all patients on the unit
Daily Huddle	None	Occurring daily, one out of four ACT disciplines represented, at least 25% of patients on the unit discussed	Occurring daily, two out of four ACT disciplines represented, at least 50% of patients on the unit discussed	Occurring daily, three out of four ACT disciplines represented, at least 75% of patients on the unit discussed	Occurring daily, all disciplines of the ACT represented, all patients on the unit discussed
Hospitalist and specialty co-management agreements **	None	One out of three specialists represented on the unit collaborating with the hospitalists on at least 25% of relevant patients	One out of three specialists represented on the unit collaborating with the hospitalists on at least 50% of relevant patients	Two out of three specialists on the unit collaborating with the hospitalists on at least 75% of relevant patients	All specialists on the unit collaborating with the hospitalists on all relevant patients on the unit
Unit white board	None	Present but only used by nursing	Present and used by all ACT disciplines except physician providers	Present and used by entire ACT. Use inconsistent	Present and used Mon-Friday by all disciplines of ACT
Monthly review of unit level data	None	Nurse manager reviewing data with ACT program director	Nurse manager and unit leader reviewing data with ACT program director	Meeting either not consistently occurring monthly or not consistently attended by entire ACT	Monthly meeting with entire ACT
Weekly patient satisfaction rounding	None	Nurse manager performing up to one week a month	Nurse manager performing weekly	Nurse and physician leader performing up to three times a month	Nurse and physician leader performing weekly
Leadership	None	For units with specialties, either hospitalist or specialist leader identified	Both hospitalist and specialist leader identified***	Both hospitalist and specialist leaders (where applicable) identified and partially engaged in leadership role	Both hospitalist and specialist leaders (where applicable) identified and engaged in leadership role

* The ACT disciplines used for this scoring include the hospitalists, clinical nurse specialists, pharmacists, case managers and social workers. Members of the ACT team not included in the scoring scheme include unit nurse managers, nursing, charge nurse, physical therapists, nutrition support and occupational therapists.

** The maximum number of specialists on any unit is three (e.g. cardiothoracic surgery, cardiology and vascular surgery on the cardiovascular surgery unit)

*** For general medical units, a score of 3 would be the next score possible after "1"

Abbreviations: ACT: Accountable care team

Table 3: The impact of ACT implementation scores on length of stay index and case mix index adjusted variable direct costs adjusting for unit type and time trend

	Length of stay index		CMI adjusted VDC	
	Estimate ^a (99% CI)	<i>p</i> - value ^b	Estimate ^a (99% CI)	<i>p</i> - value ^b
Overall ACT Score	-0.078 (-0.123, -0.032)	<0.001	-274.0 (-477.31, -70.68)	<0.001
Enhancing IPC	-0.071 (-0.117, -0.026)	<0.001	-284.7 (-488.08, -81.23)	<0.001
Enabling data driven decisions	-0.044 (-0.080, -0.009)	0.002	-145.4 (-304.57, 13.81)	0.02
Providing leadership	-0.027 (-0.049, -0.005)	0.001	-69.9 (-169.00, 29.26)	0.07

^a Estimate reflects change in outcome for each unit change in implementation score

^b *p*- values < 0.01 considered statistically significant

Abbreviations: ACT: accountable care team, CMI adjusted VDC: case mix index adjusted variable direct cost, CI: confidence interval, IPC: inter-professional collaboration

Table 4: Results of the provider survey

	Strongly Agree	Agree	Disagree	Strongly Disagree
The ACT model:	n (%)	n (%)	n (%)	n (%)
Has improved the quality and safety of patient care	46 (47.9)	46 (47.9)	2 (2.1)	2 (2.1)
Has improved communication with patients and families	42 (43.7)	47 (49.0)	5 (5.2)	2 (2.1)
Has improved your efficiency/productivity	31 (32.6)	43 (45.3)	17 (17.9)	4 (4.2)
Has improved your engagement and job satisfaction	33 (34.4)	49 (51.0)	10 (10.4)	4 (4.2)
Is a better model of delivering patient care	45 (47.4)	44 (46.3)	2 (2.1)	4 (4.2)

Abbreviations ACT: accountable care team

The ACT Model:

The model comprises of eight interventions rooted in three foundational domains.

- 1- Enhancing interprofessional collaboration (IPC).
- 2- Enabling data-driven decisions.
- 3- Providing leadership.

Below follow further details on each intervention and a description of the implementation process.

1-Enhancing Inter-professional collaboration:

Geographical cohorting of patients and providers: Previously, a hospitalist provider would travel to several units daily depending on the location of his or her patients. This made their presence on any single unit fleeting. Similarly, case management and pharmacist support was assigned on the basis of team lists, which spanned several units. In contrast, similar to other hospitals, patients at Methodist Hospital (MH) were already targeted to specific units based on their disease state. The presence of unit level nursing managers also predates the ACT model. To simultaneously enhance IPC and patient centeredness, the structure of the team was changed to become unit based. In order to achieve this, the support of case managers, social workers and pharmacists was first sought. After these disciplines were geographically cohorted, the hospitalists

changed their workflow. Hospitalists were asked to articulate preferences for the unit they would like to be localized to. Teams were renamed and each team was assigned a unit. A date for the implementation of the new workflow was set. On the agreed date, the clinical manager of the hospitalist group arrived early in the morning and the entire census of the hospitalist service was redistributed by 7 am. To maintain geographical cohorting on a day-to-day basis, new patients are now assigned teams once a specific bed has been targeted. The goal for the geographically cohorted team is to have a minimum of 80% of their patients on that unit. Providers are localized for at least 4 consecutive months at the end of which they may choose a different unit. The case managers, unit physician leaders and pharmacists are assigned to a unit permanently. The ACT model initially targeted the cohorting of hospitalists, case managers and social workers, pharmacists and clinical nurse specialists. However as the model has matured other disciplines are also following. Learners including residents, pharmacy and medical students are embedded into the team when rotating on hospital medicine.

Bedside collaborative rounding: Geographically cohorted providers round on their patients with the bedside nurse guided by a customizable script. The goal is to have a shared understand of the pressing issues and plans for the day, address patient and nursing concerns and identify any barriers to the transition of care.

Daily Huddle: The hospitalist and the interdisciplinary team for the unit meet each weekday to discuss patients' needs for a safe transition out of the hospital. Each unit determined the timing, location and script for the huddle. The goal is to cover all patients on the unit with 1-2 minutes spent per patient. The hospitalist, pharmacist, case manager, unit charge nurse, clinical nurse specialist and learners are expected to attend. Nutritionists, bedside nurses, respiratory therapists, physical and occupational therapists and social workers also attend the huddle whenever possible. Appendix A2 is a sample of the script utilized for the huddle, delineated by the different roles of the members of the team.

Hospitalist and specialty co-management agreements: Guidelines delineating responsibilities for providers of each specialty were developed. The hospitalist group's physician leader who met with the different specialty representatives led this effort. Examples include orders pertaining to the management of a dialysis catheter in a patient with end stage renal disease, the removal of drains in post surgical patients, wound care etc.

Unit white board: Each unit has a white board at the nursing station. Similar to the huddle it is focused on discharge planning with a focus on articulating endpoints for the current hospitalization for each patient and barriers to achieving

that endpoint. Members of the ACT team are responsible for populating the section relevant to their focus. This is often done as the huddle is conducted.

2- Enabling Data-Driven Decisions:

Monthly review of unit level data: The department of data analytics developed a 'data dashboard'. Key metrics including length of stay (LOS), patient satisfaction scores, readmission rates and costs are tracked and attributed to the discharging unit. The data for every unit is available to the unit's leadership at all times. The data can both be 'drilled' down to patient and/or provider level specificity or viewed at the level of the unit. Unit specific data is also collated monthly by the ACT program director and distributed to each unit's leadership. Monthly meetings lasting one hour are held in the unit's classroom to review trends. Hospitalists, specialty physicians (where relevant), case managers, unit nurse managers, clinical nurse specialists, social workers and pharmacists are expected to attend.

Weekly patient satisfaction rounding: The unit's nurse manager and physician leader conduct weekly satisfaction rounds on patients. Patients whose mentation is altered (and there is no family member present) or who are belligerent are excluded. The conversation is open-ended and avoids 'quizzing' patients. The unit leaders are expected to reflect on the information garnered with a focus on actionable information. If a patient identifies an issue the leaders

are advised to **apologize, correct, take action, listen, empathize, apologize** without placing blame, **respect and negotiate** (ACT & LEARN). These rounds are more real-time feedback that supplement the information obtained through post discharge patient satisfaction surveys.

3- Providing Leadership:

Hospitalist and specialty leaders are committed to serve each unit for at least one year as a resource for both medical and operational problem solving. General medical units only have a hospitalist physician leader while specialty units have both a hospitalist and the specialty represented. The leader stays closely connected with the unit's nurse managers, other leaders and other physicians on the unit. In addition to day-to-day troubleshooting, the leader is responsible for monitoring outcome trends including reviewing the monthly unit-level data, participating in quality improvement efforts and leading the daily huddle. There is currently no stipend, training or other incentive offered for the role.

Implementation and the role of the ACT program director:

The Methodist Hospital Executive Leadership team recognized that the care provided in the hospital was fragmented, lacked accountability and resulted in large variations in clinical practice. The conceptual framework of the ACT

emerged to both improve the quality of care delivered and contain costs. A pilot unit was formed in the cardiovascular surgery ward as there was strong support from the specialty team there. The successes of that unit were shared with the other units, specialists and hospitalists which helped the model gain traction. The interdisciplinary teams (including case management and pharmacy) were approached to restructure their workflow geographically. This restructuring was viewed favorably both because of the results of the pilot unit and as it provided improved efficiency for the workforce by eliminating commuting between units and consolidating the number of physicians they had to communicate with. Once the interdisciplinary team was unit based, the hospitalist teams followed. Concomitantly, the data dashboard was developed. The ACT program director's role included rounding on units to resolve barriers to the huddle, bedside rounding and communication between practitioners. In addition to day-to-day problem solving, the program director served as a reminder of the commitment of the executive leadership team to the success of the model and as a resource for the new unit leaders. The program director also collated outcome data and distributed it to the units and helped expand the model to the critical care units.