

Vermont Health Care Innovation Project Final Report - June 30, 2016

Pursuing High Value Care for Vermonters VMS Foundation

*Cyrus Jordan MD MPH
Director VMS Foundation*

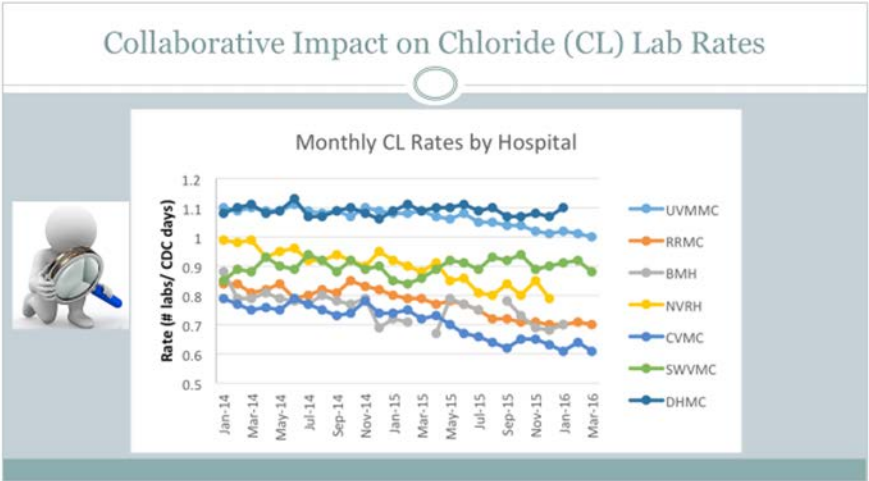


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Executive Summary

Annual expenditures on waste in healthcare exceed \$900 billion and unnecessary services represent the largest segment of this waste. Physicians are well-positioned to identify unnecessary services and improve the value of care delivery. As evidenced by the American Board of Internal Medicine Foundation's Choosing Wisely® campaign, there is broad clinician consensus around some low value practices and a shared desire to reduce waste. However, implementation and dissemination of clinical practice changes to promote high value care has proven challenging. Busy clinicians and staff often lack resources, skills and time to drive change within organizations and self-protective institutional structures often impede effective collaboration and meaningful comparisons of performance across organizations.

We developed a collaborative, multi-institutional model to facilitate implementation of specific high-value care practices in hospitalized adults across a state. We began by clearly identifying underlying problems, followed by an organized plan to test change and sustain success. Our central asset was professional social capital marked by reciprocity, trust and cooperation. Our effort was change led from the inside, not change imposed from the outside.

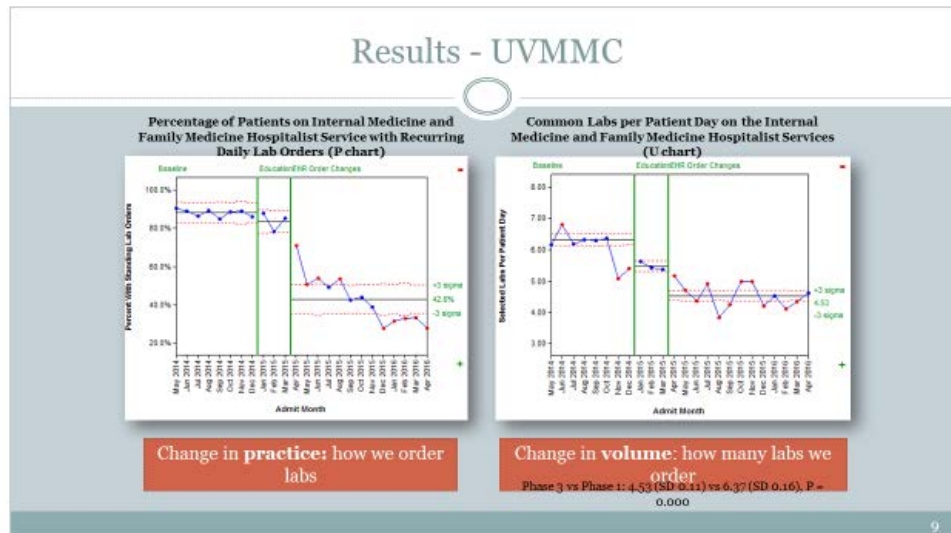
Promoting Regional Integration

In the past 2 years multi-disciplinary teams consisting of 70+ professionals from 10 regional hospitals have built a regional approach to identifying and solving problems. The [Pursuing High Value Care Collaborative](#) initially targeted optimizing laboratory testing in hospitalized adults.

Reducing waste

Our results suggest significant decreases in lab tests ordered resulting in less needle sticks, less blood loss, less interrupted sleep and less cost. Our second target was to improve COPD care across the region. We have begun to introduce a standardized diagnostic and treatment pathway for adults admitted with acute exacerbation of chronic obstructive pulmonary disease (COPD) which will lead to standardized highest value care for all patients admitted with acute exacerbation of COPD.

Results - UVMMC



This scalable model promoted collaborative, clinician-driven changes in care delivery to enhance the value of care across a region. The model was designed to obviate historical barriers to implementing clinical practice changes across non-affiliated hospitals. The first initiative resulted in decreased laboratory utilization in hospitalized adults and yielded an estimated annual blood savings equivalent to the average blood volume of 22 adults just for the several tests being monitored as common metrics across all hospitals – outcomes felt to be clinically important by participating teams.

The robust data set is being maintained to support both health policy and clinical articles in the peer reviewed literature and with the hope that continued funding will be secured to continue the quality improvement interventions at participating hospitals. The data set now allows assessment of the effectiveness of individual interventions and performance comparison on clinically meaningful measures. We anticipate future evaluation of patient-centered outcomes such laboratory-free (“needle free”) days and the incidence of hospital-acquired anemia. Planned health economic analyses will help to determine cost-effectiveness. Moving forward, this model offers a novel tool in healthcare reform efforts.

It is the hope of all the 70+ clinicians and health care workforce professionals who took part in the Collaborative, that those in health policy making positions in the State will see the cost effectiveness and value of continued support of the next phase of this effort, and a statewide consensus be reached on a process allow the improvement construct that developed to continue to mature.

We truly believe this kind of work (working with our colleagues to rationalize care delivery, improve quality, reduce variation and shift the focus to health improvement) is at the center of health system transformation in Vermont and in the country. Everything else should aim to support this work, or our efforts to control costs and improve quality will be fleeting.

Acknowledgments

Funding for this report was provided by the State of Vermont, Vermont Health Care Innovation Project, under Vermont's State Innovation Model (SIM) grant, awarded by the Center for Medicare and Medicaid Services (CMS) Innovation Center (CFDA Number 93.624) Federal Grant #1G1CMS331181-03-01

Discussion

Collaboratively, multi-disciplinary teams from eight regional hospitals built a foundational improvement construct for retooling regional care processes. The Collaborative represents change not forced from the outside in, but change led from the inside out; change based on professionalism and trust among leaders across multiple disciplines who work in the trenches every day.

“Our global aim is to reduce harm to patients and conserve system resources by optimizing the use of laboratory tests for patients cared for in our region’s hospitals. We are using a collaborative approach considering the best medical evidence and quality improvement (QI) science. We began with an evaluation of current test ordering profiles and patterns followed by an organized plan to optimize testing; our effort ends with a plan to sustain these practices.”

The core elements of the model include:

1. A neutral convener – in this case, the state medical society education and research foundation
2. Voluntary participation from hospitals
3. Interdisciplinary teams from each participating hospital that included physician champions
4. Cooperative identification of a low value clinical practice as an improvement aim for all hospital teams – coupled with customized goals and implementation at individual hospitals
5. Standardized electronic data extracts that included administrative, charge, and laboratory data, regularly uploaded to a secure data enclave
6. Centralized resources for data analytics, quality consultation, project management and physician leadership
7. Shared comparative measures of performance

Participating hospitals have uploaded 27 months of billing and laboratory data of all adult inpatients to a secure data enclave at University of Chicago. The baseline data base comprises more than 90% of hospital beds in the region. Participating hospitals submit monthly updates. The database and analytic tools supporting it allow all-collaborative and hospital specific performance reports to be sent to multi-disciplinary hospital improvement teams to support their investigations of problems and tests of changes targeting reducing harm and conserving resources.

The first clinical focus was reducing unnecessary laboratory testing in hospitalized adults. Teams from eight hospitals initially enrolled in the project: two critical access hospitals, four community hospitals and two academic medical centers. The hospital sizes ranged from 45 to 562 licensed beds. The data set included patients 18 years or older hospitalized for more than 24 hours. Patients with maternity-related diagnostic related-group codes and patients admitted to inpatient psychiatry, inpatient rehabilitation, and swing beds were excluded. The primary measures were utilization rates of commonly overused laboratory studies. Changes in baseline laboratory testing rates were used to extrapolate estimated changes in the volume of patient blood drawn annually.

Building on the success and learning of the initial lab-testing effort, the same group of institutions and individuals has begun its second regional clinical improvement effort, focusing on improving and standardizing the care for adult patients admitted with acute exacerbations of Chronic Obstructive

Pulmonary Disease (COPD). Participating hospital teams worked together to develop and implement a pathway for adult patients hospitalized with acute exacerbation of chronic obstructive pulmonary disease (COPD). The pathway will offer a standardized, evidence-based approach to initial diagnostic testing, medical therapies, consultations, lifestyle modification, education and transitions of care in this population of patients. The effort will leverage the opportunity of a hospital admission to provide education to patients regarding disease management and to connect them to resources in their community after discharge. The process recognizes local variability in staffing, formularies and resources and attempts to incorporate options that work best for the patients within each community.

We encountered a number of challenges, most notably: (a) team participation was often hampered by competing clinical and administrative duties, and (b) the data set required extensive refinement and validation, precluding regular measurement reports to the hospital teams.

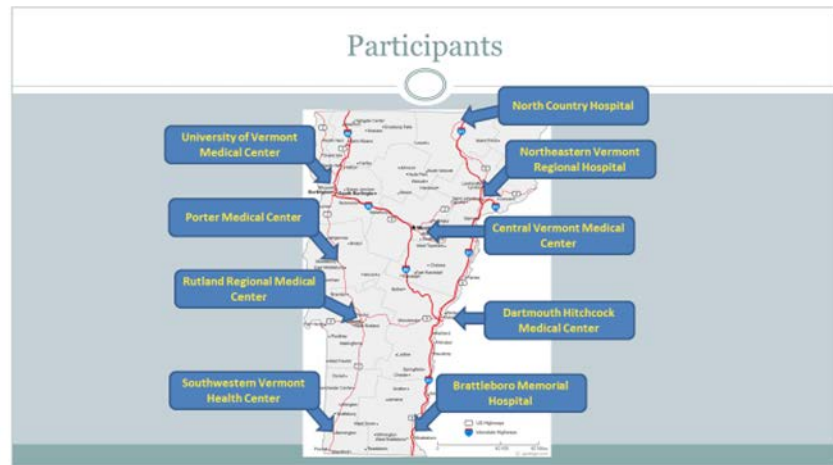
The COPD phase of the project is maturing independently at participating hospitals building on the work accomplished while VHCIP funds supported their collaboration. Several of the hospitals have made implementation of the first iteration of the regional consensus guideline for inpatient care of acute exacerbations of COPD as a priority for clinical improvement in their institutions. The remainder of the report will focus primarily on the results of the laboratory improvement of the Collaborative as we have no Collaborative-wide outcome results for improvement in COPD care across the region.

Project Evaluation

Participating hospitals

All Vermont hospitals and Dartmouth Hitchcock Medical Center in New Hampshire were invited to participate. Eight hospitals agreed to participate initially. All but one of these eight continued to participate during the entire 24 month project. One critical access hospital stopped supporting their data uploading process and improvement team because of financial problems. After a period of several months staff returned to uploading data on their own time, though no improvement team was reconvened.

The champion at one of the initial community hospitals was not able to get administrative support, in part, because hospital laboratory staff did not support the effort stating that if anything they were concerned about not performing enough inpatient labs. The VMS Foundation gave VHCIP grant funds to that institution to pay for an



automated monthly uploading program. That hospital never was able to commit to an improvement team. Their data served as an internal control for those hospitals that were able to commit to an improvement team. The other internal control was a hospital that was able to contribute to the data set, but was never able to convene an improvement team able to test any changes.

At the end of the first 12 months a 9th hospital chose to join the Collaborative after learning more about the effort. Both the hospital and the Collaborative Faculty chose not to initiate a data uploading process as by that time we had learned how resource intensive the data standardization process was due to lack of data standards across institutions. The hospital, led by the head of its clinical laboratory participated in Webinars and all subsequent Learning Sessions, and became a leader of innovation among the group.

A 10th hospital became an active participant once the COPD aspect began and also became as leader in that Collaborative dimension. This institution had tried to participate in the initial laboratory effort, but because of staff turnover in the laboratory chose to wait until the Collaborative moved into an area not asking for more of their already stressed laboratory staff.

Five Vermont critical access hospitals did not participate in the Collaborative. In spite of their non-participation and because of their low inpatient census, more than 90% of hospital beds used by Vermont residents were included in the Collaborative. Two of the non participating hospitals considered participating, had a formal discussion among their senior leadership team, but chose not to

as they felt that could not commit the resources because of their low inpatient census. Both of these hospitals followed the effort closely and have expressed interest in participating in a sequel collaborative if it targeted a significant improvement opportunity for them.

One of the other non- participating hospitals chose not to because the head of the hospitalist service had the opinion that he did not want to reduce lab testing.

The remaining two hospitals had no clinical champion for the effort. Neither of these hospitals had any clinical staff that had been part of the VMS Foundation Hospitalist Community of Practice from which the effort had its origins. One of these hospitals has an average daily census of less than ten and no hospitalist service; the other hospital staffs their hospitalist service through an out of state agency.

Patients

80,830 discharges are included in the Collaborative dataset at the end of the VHCIP support. The actual number of individual patients is less than that as this number necessarily includes individuals hospitalized more than once. The analytic methodology was designed to focus

Shared Data System: Target Population

- **Inclusion Criteria**
 - Adults, >=18yo at time of admission
 - >=24 hours in the institution
- **Exclusion Criteria**
 - Maternity related (MDC & DRG codes)
 - Inpatient Psych or Rehab
 - Swing beds

on hospital stays rather than individuals. This large number of discharges includes all discharges for the 8 data contributors for the full calendar year of 2014 and for the full calendar year of 2015, except for the above mentioned critical access hospital who had to stop their data upload due to administrative decisions. That hospital's clinical staff has since submitted all their data to the present day, but that hospital is only represented in the baseline year of 2014. Data uploads on all other hospitals are complete up to April 2016.

Not all inpatients are included in the data set. The exclusion criteria are summarized in the display above. The average age of the patients in the data set is 65 years old, they are 50% male. The average length of stay is 5.5 days (using the agreed upon CDC definition of an inpatient day); the range of length of stay ranged from a single day to 468 days.

Providers

There were an aggregate of 70+ hospital staff that participated on the teams. There was a fair amount of turnover on the teams. Teams were multi-disciplinary including physicians, nurses, lab techs, IT and database staff, quality improvement staff and administrators.

The physician participants were principally hospitalists; several pathology physicians participated as well. The principal group of patients that were affected by test of change were medical patients. However, nearly all the analyses presented in this report reflect all inpatients except those excluded as summarized above, i.e. all surgical patients are included.

Process

During the 24 months there were 8 Learning Sessions that took place at 5 different hospital locations. There were 14 Webinars that took place during the Action periods between Learning Sessions. There were 4 full in person Faculty meetings and weekly meetings of the Core Operational Faculty which included 7 key faculty members. Times, agendas and content for all the Learning Sessions and Webinars can be found on the Project website.

<http://www.vmsfoundation.org/simgrant/sessions-webinars>

Data transfers

Data was submitted intermittently by most institutions until the end of the Collaborative. Towards the end of the Collaborative, the data upload process had sufficiently matured to allow most institutions to upload on a monthly basis. As mentioned above the current data set contains all discharges for the 8 data contributors for the full calendar year of 2014 and for the full calendar year of 2015, except for the one critical access hospital who had to stop their data upload due to administrative decisions. That hospital's clinical staff has since submitted all their data to the present day. Data uploads on all other hospitals are complete up to April 2016.

Outcomes

The 5 most frequent DRGs across institutions for the entire collaborative timeframe are:

1. Major joint replacement;
2. Septicemia;
3. Pulmonary edema;
4. Simple Pneumonia; and,
5. Heart Failure

As cited above, 80,830 discharges are included in the database. Not all inpatients are included in the data set due to the exclusion criteria cited above. The average age of the patients in the data set is 65 years old, they are 50% male. The average length of stay is 5.5 days (using the agreed upon CDC definition of an inpatient day); the range of length of stay ranged from a single day to 468 days.

Lab test rates

The data base contains values for every clinical chemistry test for all 80,830 discharges. Biologic testing is not included, e.g. urine culture results. The data set is unique in the country in that it is multi-institutional and contains actual lab values. That being said, collectively, all participants elected to focus on a common set of test results across all institutions. The data set supports individualized analyses by hospital, but that will only take place if the project secures subsequent funding. The following section will focus on the common lab metrics. Two institutions, SWMC and DHMC, contributed data, but did not engage in any tests of change, acting as internal controls for the 5 institutions who had some level of change testing. PMC, is not included in the analyses presented as it was not able to participate during the full 24 months.

For the following displays, the “pre” and “post” analyses are comparing the first 3 months of 2014 to the first 3 months of 2016 and only for those 7 hospitals with complete data for the entire study period.

Overall, our estimate of amount of blood not drawn for just these basic hematology and chemistry tests in the 7 hospitals included in the pre and post analyses is 105 liters, assuming 3 mls. blood drawn for these tests;

Collaborative Impact on Estimated Annual Avoided Blood Loss (mL)

Hospital	Average Annual Discharges	Estimated mL avoided blood loss*
BMH	888	3,060
CVMC	2616	9,216
DHMC	12,888	18,864
NVRH	912	2,952
PMC	1,152	-
RRMC	4,620	16,920
SWVMC	2,484	936
UVM MC	11,892	54,936
Total	37,452	105,012

* Blood loss estimated to be 3mL per HGB & 3mL per combined CREA, CL or ALT

and 2,917 lab tests avoided (8,751 mls. blood loss/ 3 ml. per lab test)

Collaborative Impact on Estimated Monthly Avoided Blood Loss (mL)

Hospital	Average Monthly Discharges	Avoided HGB labs	Avoided CREA labs	Avoided CL labs	Avoided ALT labs	Estimated mL avoided blood loss*
BMH	74	44	41	41	3	255
CVMC	218	96	128	160	0	768
DHMC	1074	393	65	131	0	1572
NVRH	76	23	45	59	3	246
PMC	96	-	-	-	-	-
RRMC	385	184	286	265	0	1410
SWVMC	207	0	+26	+26	+17	+78
UVM MC	991	763	763	545	218	4578
Total	3121	1503	1302	1175	207	8751

* Blood loss estimated to be 3mL per HGB & 3mL per combined CREA, CL or ALT

Specific Common Laboratory test Metrics

The following displays of hospital specific rates show the number of labs per hospital day for all patients in each hospital that meet the patient inclusion criteria. Each display shows the monthly rates from January 2014 through March 2016. Only the 7 hospitals whose data was complete and validated for that time period are shown. PMC's data was incomplete at the time these analyses were done. That hospital's data is now up to date. The seven hospitals have agreed to continue monthly uploads through the end of 2016. Subsequent data uploads will be dependent on securing continuing support for the project.

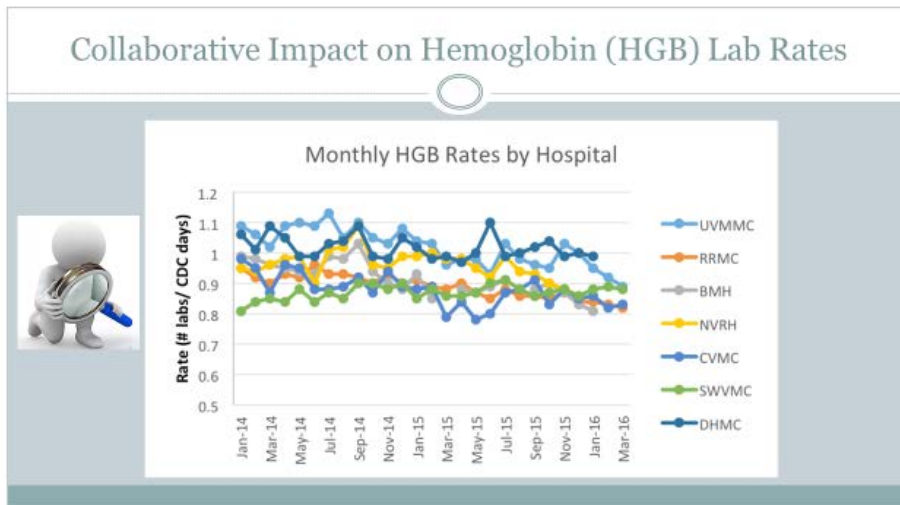
The reader should note that DHMC and SWVMC are the two institutions who uploaded data but did not engage in any targeted quality improvement. Thus these two institutions serve as internal controls. The reader will not in most of the displays that the daily rates for these 2 institution remain relatively stable during the 27 months of surveillance. The reader will also notice more month to month variation in the smaller hospitals whose monthly rates can vary significantly due to the small numbers of patients that are being tracked in each institution. The rates at the larger institutions are more stable across months. Some suggestions of seasonal variation can also be seen.

Overall, the daily rates at those institutions supporting any process improvement effort decreased in the range of 10% to 20%. This magnitude of change is also seen in the pre and post analyses which look at the rates during the first 3 months of 2014 compared to the first 3 months of 2016.

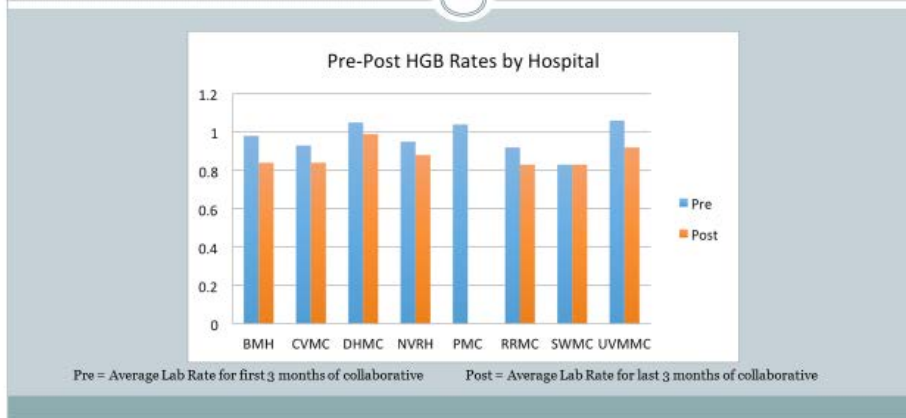
Cardiac enzymes are not included in this report as more validation is needed to give us confidence with inter institutional comparisons.

Hemoglobin (Hgb)

Hemoglobin (Hgb) rate is used as an index for basic hematology as during the baseline year, Hgb tracked with other hematology tests.



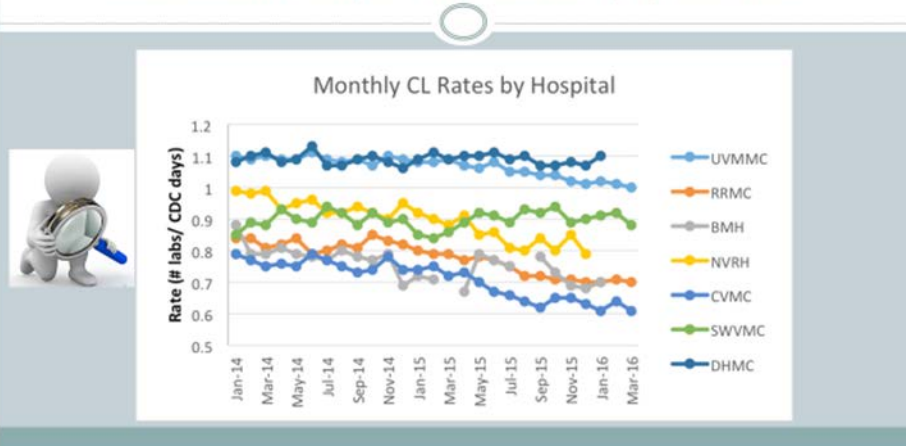
Pre-Post Change in Hemoglobin (HGB) Lab Rates



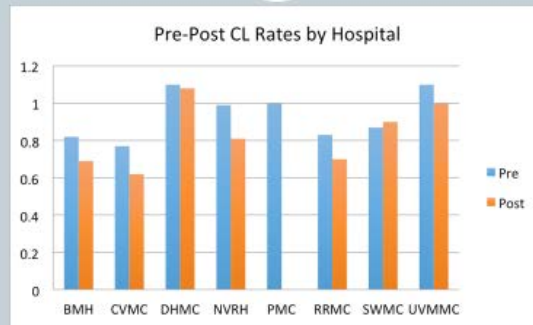
Chloride

Chloride is used as a marker for blood electrolytes. Other serum electrolytes tests tracked at the same rate as chloride.

Collaborative Impact on Chloride (CL) Lab Rates



Pre-Post Change in Chloride (CL) Lab Rates

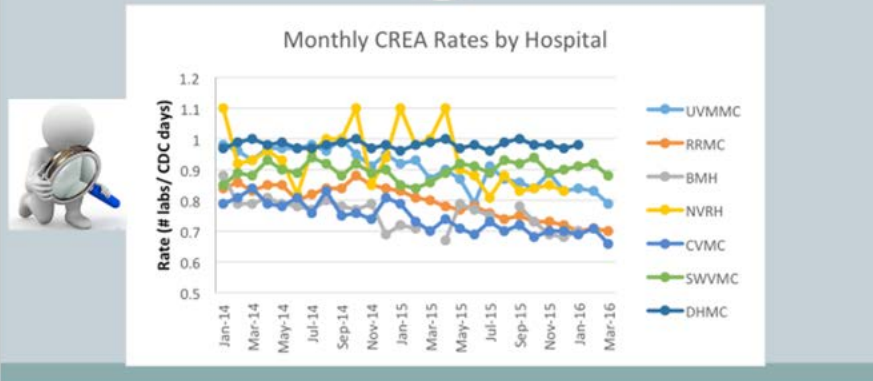


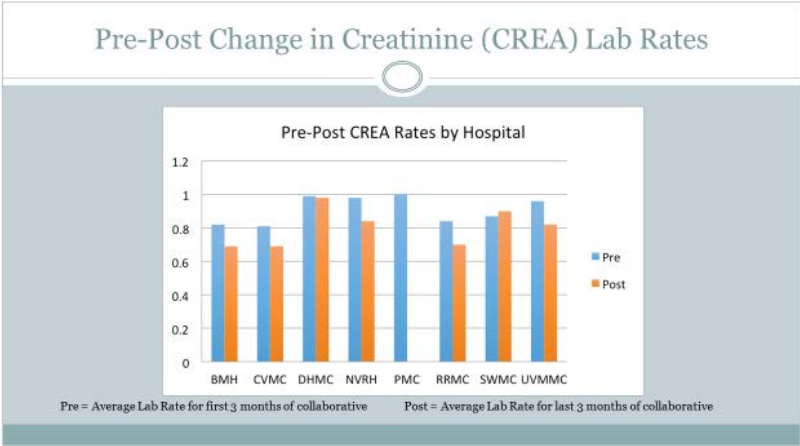
Pre = Average Lab Rate for first 3 months of collaborative Post = Average Lab Rate for last 3 months of collaborative

Creatinine

Creatinine as a marker for renal function tests.

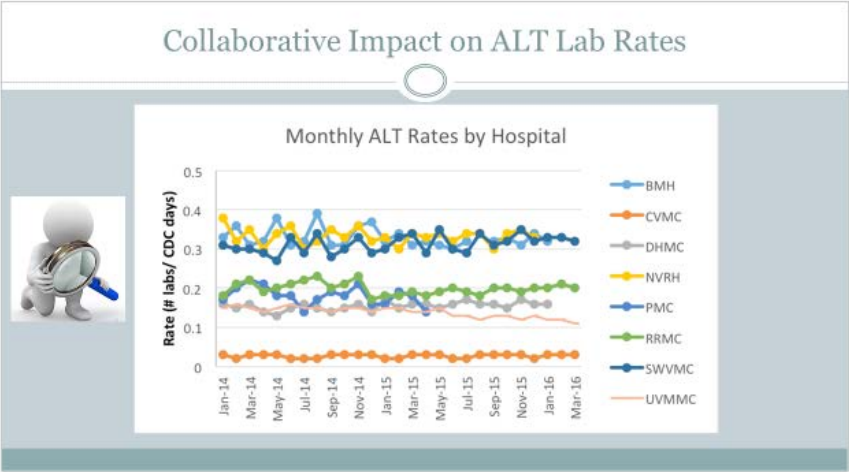
Collaborative Impact on Creatinine (CREA) Lab Rates

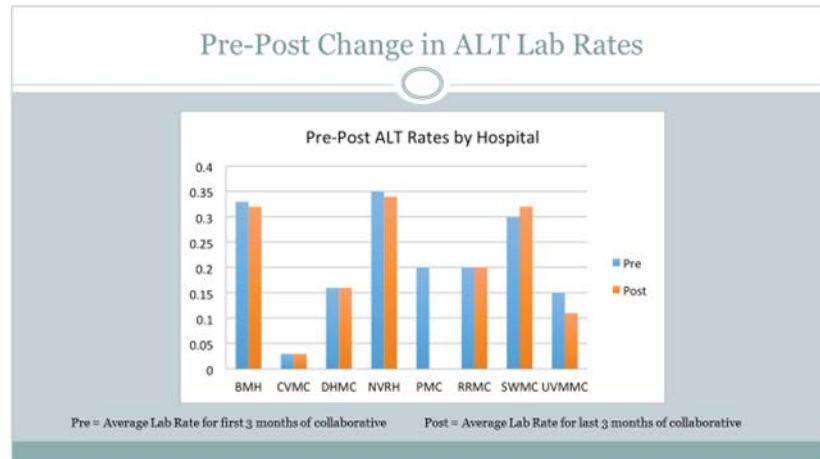




ALT

An alanine aminotransferase (ALT) test measures the amount of this enzyme in the blood. ALT is found mainly in the liver, but also in smaller amounts in the kidneys, heart, muscles, and pancreas. ALT was formerly called serum glutamic pyruvic transaminase (SGPT). The significant difference in the ALT rates at CVMC are being investigated. It appears that some of these tests are not being including in the data uploads of the CVMC data because of an idiosyncratic manner in which this hospital bills for this test compared to other hospitals. This is a typical example of the data validation process that has been necessary at each hospital for every data field. The reader should take note of how a small data base coding anomaly can make a significant difference in the monitoring of clinical events, and remember this fact whenever policy discussions assume how simple it is to standardize even billing data across hospitals.





Disseminating results

The Faculty and interested hospital team leaders are in the process of writing a paper to summarize our experience with the collaborative – and anticipate writing at least 1-2 more papers about specific aspects of the project. We will be using some results at the hospital level, but the results will all be non-identified (that is, no patient level identifiers and no explicit hospital identifiers).

We would also like to complete the data set to fully assess the impact of the collaborative. To do this, we hope that each hospital will continue institutional uploads of data to NORC through December 2016. Once we have all of the data uploads through June 2016 (this takes a few months, since there is a time lag for some hospitals), we will generate a summary report for each hospital. We hope to have this summary completed in the fall. We hope all teams will share this with your hospital administration or just take pride in the good work done.

Project Sustainability

The Faculty and interested hospital team leaders have put together a proposal that has been circulated to all hospital teams with the hope that clinical leaders at these institutions will begin discussions with hospital budget decision makers. The proposal generalizes the improvement infrastructure allowing any interested supporters to become a “stakeholder” in a regional improvement construct built on the foundation of the improvement infrastructure that has been built with VHCIP support - the Vermont High Value Care Network. Stakeholder status will purchase decision making authority over clinical focus areas the Network should address, scale and scope of projects, expected deliverables including return on stakeholder investments.

The reader will find a proposed \$431,000 annual Network budget and budget narrative at the end of this section. To put this investment in context of total 2014 Vermont hospital net patient revenue of \$2.17 billion, the estimated annual \$431,00 budget for continuation and expansion of the Collaborative represents approximately .02% of total 2014 Vermont hospital net patient revenue. This does not include net patient revenue for DHMC whose clinical staff has expressed interest in participating in a Collaborative continuation.

The Vermont High Value Care Network

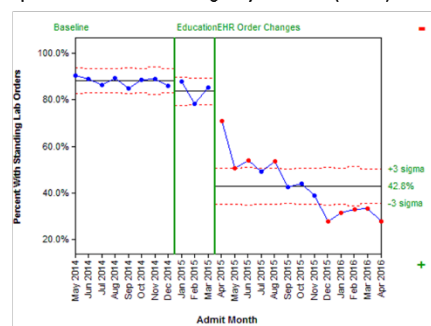
Reducing Harm and Waste

Our goal is to reduce harm and avoid unnecessary care. We use a collaborative approach considering the best medical evidence and change science. We begin by clearly identifying underlying problems, followed by an organized plan to test change and sustain success. Our central asset is professional social capital marked by reciprocity, trust and cooperation. Our effort is change led from the inside, not change imposed from the outside.

And Promoting Regional Integration

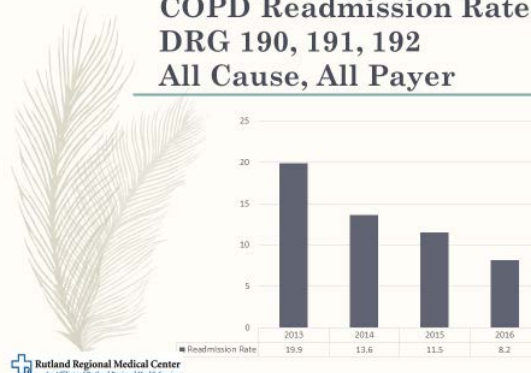
In the past 2 years multi-disciplinary teams consisting of 70+ professionals from 10 regional hospitals have built a regional approach to identifying and solving problems. The Pursuing High Value Care Collaborative initially targeted optimizing laboratory testing in hospitalized adults. Our results suggest significant decreases in lab tests ordered resulting in less needle sticks, less blood loss, less interrupted sleep and less cost. Our second target is to improve COPD care across the region. We have begun to introduce a standardized diagnostic and treatment pathway for adults admitted with acute exacerbation of chronic obstructive pulmonary disease (COPD) which will lead to standardized highest value care for all patients admitted with acute exacerbation of COPD.

Percentage of Patients on Internal Medicine and Family Medicine Hospitalist Service with Recurring Daily Lab Orders (P chart)



Description: Percentage of adult (>=18 years old) inpatient and observation patients admitted and discharged from the Internal Medicine Hospitalist Service or Family Medicine Service who have a standing daily lab order (interval > 1) for at least one of the following labs: hemagram, hemagram with diff, PT, PTT, electrolytes, creatinine, serum glucose, magnesium, calcium, phosphorous, alk phos, AST, ALT, total bilirubin or BUN.
Phase 1 = baseline, Phase 2 = Educational Interventions, Phase 3 = Educational Interventions + Electronic Health Record Lab Order changes

COPD Readmission Rate DRG 190, 191, 192 All Cause, All Payer



Our Proposal

As federal grant support for our effort expires, we seek to transition to a payer-provider supported model - **The Vermont High Value Care Network**. Our proposal is to support continuation of regional improvement efforts led by frontline professionals. The underlying concept is based on the Blue Cross Blue Shield of Michigan's model aligning payers and providers around a shared value proposition – the Michigan Collaborative Quality Initiatives¹.

The early successes of this collaborative model are notable, and reflect only a fraction of the potential for this approach. We look to build on the foundation of this model and to improve even more dramatically the value of care delivered to patients across the region.

Our Vision

We envision the **Vermont High Value Care Network** as the next step in our empiric approach to solving problems through: 1) maturing the utility of our data driven improvement engine; and 2) expanding our targets to include care across community settings. We will continue to maximize the value of inpatient care and partner with others to address problems across settings.

What We Offer

Regional Professional Leadership

Network projects will be designed and staffed by the premier professional minds and leaders in the region. The **Network** will build on the High Value Care Collaboratives social capital across the state and within the participating hospitals. Initiatives will be led by faculties of regional opinion leaders including physicians, nurses, allied health professionals, information technologists, improvement scientists and analysts. Faculty composition will reflect the key dimensions of the problems being addressed.

Cross-Disciplinary Communication and Teamwork

An improvement principle reinforced by the Collaborative is that successful change requires communication across disciplines within hospitals. Current hospital work patterns and processes at times can impede communication across disciplines. The Collaborative provided a forum for all those contributing to a wasteful or harmful process to problem solve together. As example, a key conversation had to occur among a physician leader, the Collaborative analyst and the hospital information technologist in order to produce valid test frequency reports. Before the Collaborative, neither the ordering physician nor the IT professional knew each other nor how their work effected each other. This hospital now has a model for cross-disciplinary problem solving that reduces waste, avoids harm and creates joy within the workforce.

Common Labs per Patient Day on the Internal Medicine and Family Medicine Hospitalist Services (U chart)



Description:

- Numerator = lab charges for at least one of the following labs: hemogram, hemogram with automated diff, PT, PTT, electrolytes, creatinine, serum glucose, magnesium, calcium, phosphorous, alk phos, AST, ALT, total bilirubin, BUN, screening glucose, CK, CKMB, or troponin.
- Denominator = number of patient-days for adult (>=18 years old) inpatient and observation patients admitted and discharged from the Internal Medicine Hospitalist Service or Family Medicine Service at UVM Medical Center.
- Phase 1 = baseline, Phase 2 = Educational Interventions, Phase 3 = Educational Interventions + Electronic Health Record Lab Order changes
- Phase 3 (Electronic Health Record Changes) vs Phase 1 (baseline): 4.53 (SD 0.11) vs 6.37 (SD 0.16), P value = 0.000

¹ Arora J, Aisenbrey J. Aligning payers and providers around value: Blue Cross Blue Shield of Michigan's Collaborative Quality Initiatives. Cambridge, MA: International Consortium for Health Outcomes Measurement (ICHOM), June 2015 (available at www.ichom.org)

Multi-Institutional Collaboration

The potential of institutional teams is exponentially increased by regular forums for teams to interact. As example, two community hospitals decreased the amount of blood drawn from each needle stick by learning that their phlebotomists were drawing more blood per patient than other hospitals in the region. A critical access hospital reduced by 2/3rds the number of tests ordered to monitor heparin therapy by learning what was current protocol at the tertiary centers. These cross- hospital lessons have reduced risk for hospital acquired anemia, discomfort from needle sticks and waste.



Standardization of Data and Measures

The current database includes three types of data – a discharge record (similar to the state’s VHDDS), one record per lab test / panel, and a detailed list of services provided during the stay and their charges. While some of this data is subject to national standards, much of our data development has been focused on standardization across the collaborative to support inter-hospital comparisons. Examples of areas of focus are inclusion and exclusion criteria for discharges; reporting of lab results; and standardization of fields used for severity adjustment, such as DRGs.

The data are currently stored in NORC, an extremely secure “data enclave” used by academic and government researchers. While there are advantages to the NORC solution, we are also exploring the use of the existing Vermont Hospitals and Health Systems (VAHHS) hospital data warehouse. This warehouse is currently limited to discharge data and that data closely parallels our discharge record. Initial analyses suggest that VAHHS discharge data could be used in place of our discharge data, reducing the reporting burden on hospitals. Additionally, hospitals have been submitting data to VAHHS for many years, so are used to those data submission protocols.

VAHHS can also support analyses performed by individual hospitals.

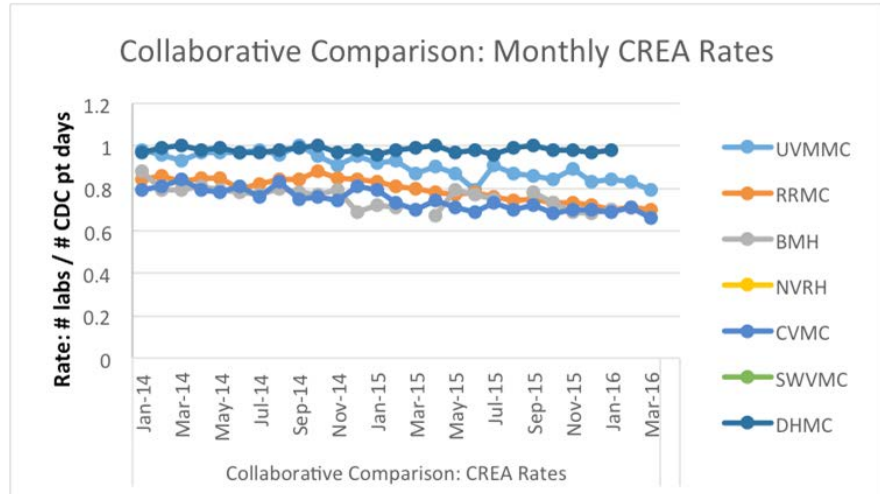
We are also beginning to explore the integration of hospital-supplied data with other data sources, most importantly the state’s all-payer claims system, VHCURES. This integration would support additional analyses such as exploration of payments (current data includes only charges) and population-based analyses.

Analysis, Institutional and Community Reports, Regional Benchmarking

One of the most powerful components of the collaborative model is the ability of individual hospitals to compare their results to their peers, an essential quality improvement tool.

The capacity to make these comparisons is built on a foundation of:

- willingness to share data
- consistent definitions and data edits
- cooperation in exploring differences (e.g. are differences attributable to practice patterns or data issues)



Problem Solving Infrastructure

Clinical and improvement science exists that can be used to reduce waste and avoid harm. Much of this science lies fallow and unused in daily work. There is a gap between what we know and what we do. The Collaborative created a structure for interested organizations to close the gap by learning from each other and from recognized experts, at the front line of care, in topic areas where they want to make improvements. The Network proposes to continue and expand this learning system bringing together a large number of interprofessional teams from hospitals or clinics to seek improvement in a focused topic area.²

Network Organization and Management

The Network will be housed within the VMS Education and Research Foundation nonprofit public benefit organization. Payer and provider stakeholders will join Network professional leaders on a **Network Steering Committee** to jury and evaluate improvement proposals. Improvement targets will be chosen through a consensus process. Projects will have clear deliverables, timelines and budgets. The effectiveness of the Network will be reviewed on a two year cycle. Initiatives will be designed to affect patient populations that matter to stakeholder payers and providers. Commitment by stakeholders will not be expected to have a duration of more than 2 years.

The Network will have a single full time staff person, the **Network Director**. The Director will be employed by the Foundation board of directors.

² *The Breakthrough Series: IHI's Collaborative Model for Achieving Breakthrough Improvement*. IHI Innovation Series white paper. Boston: Institute for Healthcare Improvement; 2003. (Available on www.IHI.org)

Budget

Vermont High Value Care Network			
September 2016 - August 2018			
	Year 1 Sept '16 - Aug '17	Year 2 Sept '17 - Aug '18	2 Year Total
Management			
Network Director	\$ 70,000	\$ 70,000	\$ 140,000
Professional Service Contracts			
UVM MC Faculty and Subject Matter Experts	\$ 85,000	\$ 85,000	\$ 170,000
Tupelo Group	\$ 60,000	\$ 60,000	\$ 120,000
Policy Integrity, LLC	\$ 30,000	\$ 30,000	\$ 60,000
Participating Hospital Teams			
10 teams	\$ 137,500	\$ 137,500	\$ 275,000
Information Technology - Secure Database			
Data Warehouse	\$ 15,000	\$ 15,000	\$ 30,000
Legal fees	\$ 2,500	\$ 2,500	\$ 5,000
Communication and Supplies			
Learning Sessions	\$ 2,000	\$ 2,000	\$ 4,000
Conference calls; webinars	\$ 750	\$ 750	\$ 1,500
Website	\$ 1,000	\$ 1,000	\$ 2,000
Oversight Committee	\$ 600	\$ 600	\$ 1,200
Travel			
	\$ 2,300	\$ 2,300	\$ 4,600
Fringe benefits			
	\$ 17,500	\$ 17,500	\$ 35,000
VMS Indirect			
Indirect subtotal	\$ 9,185	\$ 9,185	\$ 18,370
Totals			
Existing hospital expenditures	\$ 222,500	\$ 222,500	\$ 445,000
New hospital expenditures	\$ 208,535	\$ 208,535	\$ 417,070
Total hospital expenditures	\$ 431,035	\$ 431,035	\$ 862,070

Budget Narrative

The budget lines are estimates based on expenses incurred during the 2 years of support from the VHCIP grant. A 2 year budget is being proposed because of our experience during the VHCIP grant cycle of the time needed to actualize change. Blue highlighted budget amounts represent existing hospital expenditures supporting 10 hospital improvement teams and UVM MC UVM COM faculty expenses. Highlighted hospital expenditures represent 52% of the annual Network budget.

Management - \$140,000

The Network Director will be responsible for overall management of the Network. The Director will be a full-time VMS staff person with an annual salary of \$70,000. The Network Director will be responsible for working with VAHHS staff to manage files transfers, data base maintenance, data validation, and

routine monthly reports to hospitals; their duties will also include supporting the project analyst with analytic tasks. The budget also supports Director in his/her outreach and strategic planning efforts directed at the development of future Network initiatives.

Professional Service Contracts - \$350,000

UVM MC Faculty and Subject Matter Experts - \$170,000 in total (20% of total project budget)

Dr. Allen Repp will be the physician lead for the effort contributing 15% of his time (\$42,188 per year; \$84,376 total). Drs. Mark Fung and Justin Stinnett-Donnelly will both be contributing 5% of their time as subject matter experts (\$15,000 per year and \$30,000 total for each). Dr. Fung in the areas of Laboratory Medicine and Pathology; Dr. Stinnett-Donnelly in the area of high value care. Combined UVM indirect for the three physicians equals \$10,828 per year and \$21,656 total.

Vermont High Value Care Network - UVM Faculty			
UVM Faculty Lead and Subject Matter Experts	Year 1	Year 2	Total
	Sept '16-Aug '17	Sept '17-Aug '18	
Physician Lead (Repp @15%)	\$ 42,188	\$ 42,188	\$ 84,376
Lab & Pathology (Fung@5%)	\$ 15,000	\$ 15,000	\$ 30,000
High Value Care (Stinnett-Donnelly@5%)	\$ 15,000	\$ 15,000	\$ 30,000
Subtotal	\$ 72,188	\$ 72,188	\$ 144,376
UVM Indirect @ 15%	\$ 10,828	\$ 10,828	\$ 21,656
Total	\$ 83,016	\$ 83,016	\$ 166,032

Tupelo Group – \$127,000 (14% of budget)

Tupelo Group will be contracted for quality improvement training, design support and facilitation.

Policy integrity LLC – \$60,000 (7% of budget)

Policy Integrity will be responsible for database design in collaboration with NORC, VAHHS and the project manager.

Participating Hospital Teams - \$275,000

The budgeted amount represents the expense for improvement teams from 10 hospitals at \$13,750 per year per team; \$27,500 per team total. Team members will include: an IT specialist (@50 hours per year; \$2,500 per year; \$5,000 total); a physician lead (@2.5% FTE; \$6,250 per year; \$12,500 total); and, a QI / Project Management professional (@100 hours per year; \$5,000 per year; \$10,000 total).

Vermont High Value Care Network - Hospital Teams			
Participating Hospital Teams	Year 1	Year 2	Total
	Sept '16-Aug '17	Sept '17-Aug '18	
IT specialist (@50 hours per year)	\$ 2,500	\$ 2,500	\$ 5,000
Physician Lead (@2.5%)	\$ 6,250	\$ 6,250	\$ 12,500
QI / Project Management (@100 hours per year)	\$ 5,000	\$ 5,000	\$ 10,000
Total	\$ 13,750	\$ 13,750	\$ 27,500

Information Technology - Secure Database - \$35,000

We are seeking to transition our current database from a secure data enclave at University of Chicago (NORC) to the Vermont Association of Hospitals and Health Systems (VAHHS) secure database. This section of the budget includes the cost of hosting the database at VAHHS. Shepherding the monthly file uploads from hospitals and validating data in the central database and contributing institutions will be the responsibility of the Project management staff. The budget includes an annual amount to cover legal expenses pertaining the HIPPA requirements.

Communication and Supplies - \$8,700

4 Learning sessions are planned each year. \$500 is budgeted for each Learning Session. Learning Sessions will occur at participating hospitals. There will be no venue expenses. The budgeted amount for the Learning Session is for food and learning session specific expenses. The Network will use distance communications, e.g. conference calls and webinars, as the principal methods for communication among teams and faculty between Learning Sessions. The **Network** will have a designated webpage on the VMS Foundation website. \$300 is budgeted for 2 dinner meetings per year for the Oversight Committee.

Travel and Equipment - \$4,600

\$2,300 is budgeted for mileage each year – 4000 miles per year at \$0.54 per mile. Mileage will principally be expended to cover the cost of faculty to travel to participating hospitals and Learning Sessions, and travel by Project management staff.

Fringe Benefits - \$35,000

25% fringe benefits are applied to the full time \$70,000 salary of the Project operations staff.

Indirect - \$20,850

Indirect expenses of \$10,425 per year represents 10% of the budgeted amounts for management, Information Technology - Secure Database and Communications and Supplies. The indirect budget line will be paid to the VMS to cover the expenses of office space, telephone, computing, and VMS Foundation legal and accounting fees.

Conclusion

Annual expenditures on waste in healthcare are estimated to represent 30% of total expenditures nationally, and there is no reason to believe that this is not the case in Vermont. The Collaborative has achieved 20% reductions in unnecessary lab testing quickly, and we have only begun to test changes that could reduce waste further in this area. The infrastructure has the potential to be directed toward a wide spectrum of other clinical areas where waste is suspected. However, implementation and dissemination of clinical practice changes to promote high value care has proven challenging. Busy clinicians and staff often lack resources, skills and time to drive change within organizations and self-protective institutional structures often impede effective collaboration and meaningful comparisons of performance across organizations.

We developed a collaborative, multi-institutional model to facilitate implementation of specific high-value care practices in hospitalized adults across a state. We began by clearly identifying underlying problems, followed by an organized plan to test change and sustain success. Our central asset was professional social capital marked by reciprocity, trust and cooperation. Our effort was change led from the inside, not change imposed from the outside.

Our results suggest significant decreases in lab tests ordered resulting in less needle sticks, less blood loss, less interrupted sleep and less cost. Our second target was to improve COPD care across the region. We have begun to introduce a standardized diagnostic and treatment pathway for adults admitted with acute exacerbation of chronic obstructive pulmonary disease (COPD) which will lead to standardized highest value care for all patients admitted with acute exacerbation of COPD.

This scalable model promoted collaborative, clinician-driven changes in care delivery to enhance the value of care across a region. The model was designed to obviate historical barriers to implementing clinical practice changes across non-affiliated hospitals. The first initiative resulted in decreased laboratory utilization in hospitalized adults and yielded an estimated annual blood savings equivalent to the average blood volume of 22 adults just for the several tests being monitored as common metrics across all hospitals – outcomes felt to be clinically important by participating teams.

The core elements of the model include:

6. A neutral convener – in this case, the state medical society education and research foundation
7. Voluntary participation from hospitals
8. Interdisciplinary teams from each participating hospital that included physician champions
9. Cooperative identification of a low value clinical practice as an improvement aim for all hospital teams – coupled with customized goals and implementation at individual hospitals
10. Standardized electronic data extracts that included administrative, charge, and laboratory data, regularly uploaded to a secure data enclave
11. Centralized resources for data analytics, quality consultation, project management and physician leadership
12. Shared comparative measures of performance

Participating hospitals uploaded 27 months of billing and laboratory data of all adult inpatients to a secure data enclave at University of Chicago. The baseline data base comprises more than 90% of hospital beds in the region. Analytic tools allow all-collaborative and hospital specific performance reports to be sent to multi-disciplinary hospital improvement teams to support their investigations of problems and tests of changes targeting reducing harm and conserving resources.

The robust data set is being maintained to support both health policy and clinical articles in the peer reviewed literature and with the hope that continued funding will be secured to continue the quality improvement interventions at participating hospitals. The data set now allows assessment of the effectiveness of individual interventions and performance comparison on clinically meaningful measures. We anticipate future evaluation of patient-centered outcomes such laboratory-free (“needle free”) days and the incidence of hospital-acquired anemia. Planned health economic analyses will help to determine cost-effectiveness. Moving forward, this model offers a novel tool in healthcare reform efforts.

We encountered a number of challenges, most notably: (a) team participation was often hampered by competing clinical and administrative duties, and (b) the data set required extensive refinement and validation, precluding regular measurement reports to the hospital teams.

We truly believe this kind of work (working with our colleagues to rationalize care delivery, improve quality, reduce variation and shift the focus to health improvement) is at the center of health system transformation in Vermont and in the country. Everything else should aim to support this work, or our efforts to control costs and improve quality will be fleeting.

It is our hope that this report will stimulate discussions among health policy decision makers that result in continued funding for the improvement infrastructure that the VHCIP grant funds built so that the infrastructure can mature and be redirected towards other areas offering promise for reduce waste and integrating care across the region.