



DEPARTMENT OF PATIENT SAFETY AND QUALITY

ANNUAL REPORT

2010

2010 Annual Report

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I. INTRODUCTION TO DEPARTMENT OF PATIENT SAFETY AND QUALITY ANNUAL REPORT

The 2010 Annual Report is organized according to the structure of the Department of Patient Safety and Quality. We hope this report provides a meaningful overview of the activities and accomplishments of our various sections in 2010.

As a result of quality improvement efforts across many disciplines, Denver Health was ranked #15 out of 98 academic health centers and was the highest performing Public Safety Net Hospital in the UHC data base on their aggregate quality and accountability score in 2010. Even more impressive, Denver Health is ranked #1 out of 111 academic health centers with respect to observed to expected mortality.

In addition, in recognition of the outstanding work to develop a novel electronic quality scorecard, Denver Health was awarded the NAPH President's Award for Health Reform Readiness and Leadership in June, 2010.

II. DEPARTMENT OF PATIENT SAFETY AND QUALITY 2010 ORGANIZATION, STAFF, AND BUDGET

A. ORGANIZATION

As of December 31, 2010, the Department of Patient Safety and Quality was comprised of nine units under the supervision of Philip Mehler, M.D, Chief Medical Officer. The units were:

1. Patient Safety and Quality Oversight: Thomas MacKenzie, MD, MSPH, Chief Quality Officer
2. Regulatory Compliance: Kendra Moldenhauer, RN, Director
3. Ambulatory Quality Improvement: Ray Estacio, MD, Associate Director of CHS for Quality and Research, and Rachel Everhart, MS, Data Team Administrator
4. Division of Education: Chris Carey, MD, Director
5. Medical Biostatistics: Allison Sabel, MD, PhD, MPH, Director
6. Infection Prevention: Connie Price, MD, Director
7. Medical Staff Office: Sandra Taylor, CPCS, Manager
8. Health Services Research: Ed Havranek, MD, Director
9. Utilization Management: Teresa Kukolja, RN, Director

The Department of Patient Safety and Quality is responsible for clinical quality monitoring, performance improvement, utilization management, regulatory preparedness.

The Medical Staff Office (MSO) is responsible the credentialing and privileging of the Denver Health Medical Staff and Allied Health Professionals.

The Director of Education is responsible for bringing oversight and organization to the professional education occurring within Denver Health and Hospital Authority.

The Director of Regulatory Compliance and Care Process provides coordination of regulatory reviews, surveys, or inquiries to Denver Health. This includes activities related to Joint Commission, CMS, Office of Civil Rights, and The Colorado Department of Public Health and Environment. In addition, the Director also reviews care processes, systems, and tools to assist in improving the quality and efficiency of care provided and assures that these changes meet or exceed regulatory expectations. The Director of Regulatory Compliance also supports the many different quality initiatives of Denver Health and from the Department of Patient Safety and Quality.

The Director of Infection Control is responsible for provision of safe, high quality health care in the setting of minimizing the risk of acquiring and transmitting infections. This is accomplished through utilization of healthcare epidemiology, surveillance, and prevention strategies against healthcare associated infection, through the efforts of the infection control nurses.

Administration refers to the organizational support function for the MSO, Regulatory Compliance, Patient Representatives, and the Division of Education. All administrative functions (budget, space, equipment, etc.) are also subsumed in the Administration Section.

II. DEPARTMENT OF PATIENT SAFETY AND QUALITY 2010 ORGANIZATION, STAFF, AND BUDGET

B. DEPARTMENT STAFF

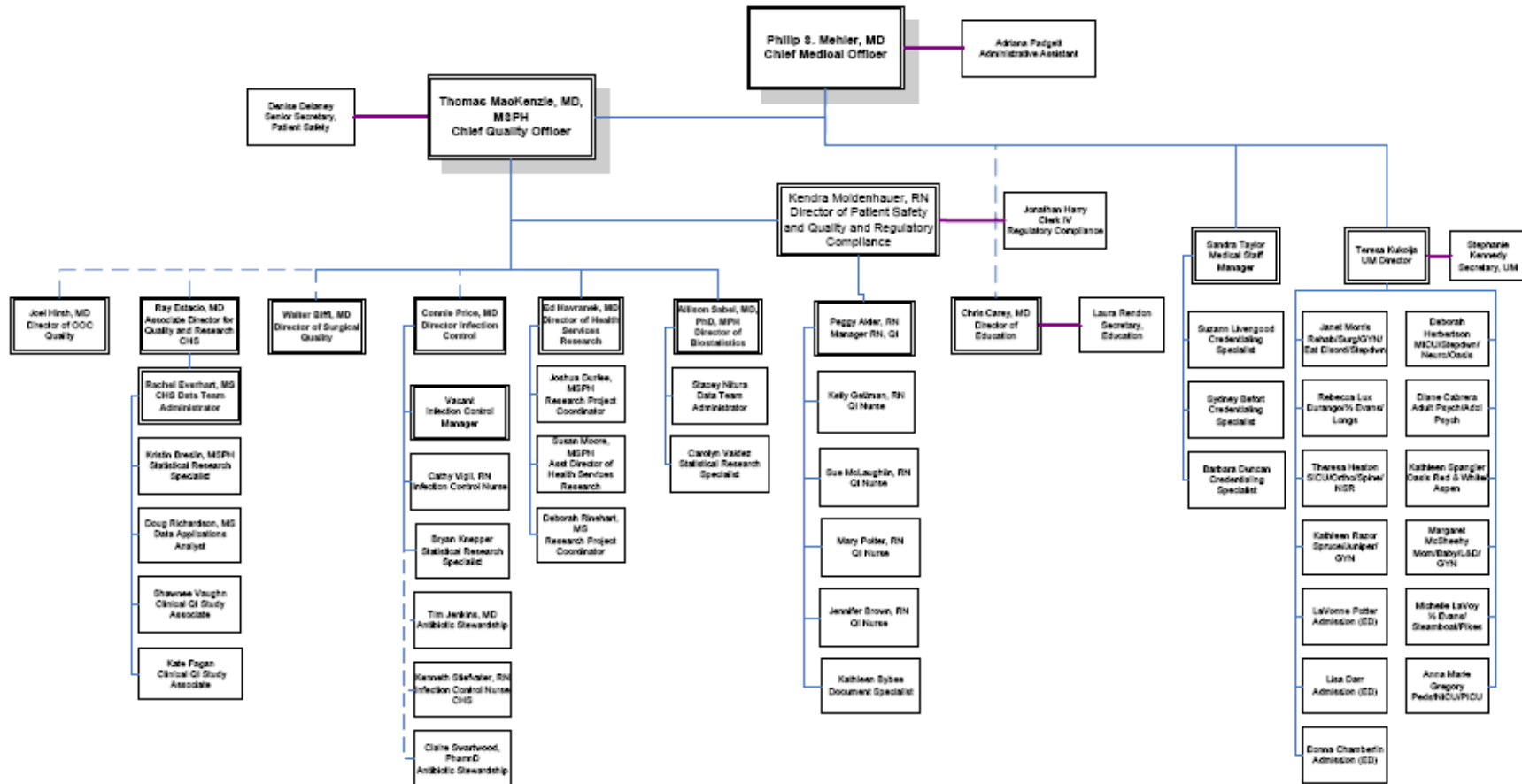
As of December 31, 2010, the Department of Patient Safety and Quality positions and staff consisted of the following:

- Chief Medical Officer, Denver Health – Philip Mehler, M.D.
 - Administrative Assistant, Chief Medical Officer – Adriana Padgett
- Chief Quality Officer – Thomas MacKenzie, MD, MSPH
 - Department of PS&Q Senior Secretary – Denise Delaney
- Director of Regulatory Compliance and Care Process – Kendra Moldenhauer, RN
 - Continual Readiness administrative support: Jonathan Harry
 - Document Control Specialist: Kathleen Bybee
- Manager of Clinical Performance Improvement –Peggy Alder, RN
 - Quality Improvement Nurse – Pam Sue McLaughlin, RN
 - Quality Improvement Nurse – Kelly Gettman, RN
 - Quality Improvement Nurse – Mary Potter, RN
 - Quality Improvement Nurse, BHS Regulation – Jennifer Brown, RN
- Director of Education – Chris Carey, MD
 - Education Secretary – Laura Rendon
- Director of Medical Biostatistics – Allison Sabel, PhD MPH
 - Data Team Administrator – Stacy Nitura
 - Statistical Research Specialist - Carolyn Valdez
- Director of Infection Control – Connie Price, MD
 - Manager of Infection Control – Vacant
 - Infection Control Nurse – Cathy Vigil, RN
 - Infection Control Nurse – Amy Irwin, RN
 - CHS Infection Control Nurse – Kenneth Stiefvater, RN
 - Statistical Research Specialist – Brian Knepper
 - Antibiotic Stewardship director – Tim Jenkins, MD
 - Antibiotic Stewardship Pharm D – Claire Swartwood, PharmD
- Manager of Medical Staff Office – Sandra Taylor, CPCS
 - MSO Credentialing Coordinator – Suzan Livengood
 - MSO Credentialing Coordinator – Sydney Befort
 - MSO Credentialing Coordinator – Barbara Duncan
- Director of Health Services Research – Ed Havranek, MD
 - Assistant Director, HSR – Susan Moore, MSPH
 - Research Projects Coordinator – Michael (Joshua) Durfee, MSPH
 - Research Project Coordinator – Deborah Rinehart, MSPH
- Director, Utilization Management – Teresa Kukulja, RN
- Director, Clinical Social Work – Vacant
- Director, Surgery Quality Improvement – Walter Biffi, MD

Attachment 1

Department of Patient Safety and Quality

January, 2011



II. DEPARTMENT OF PATIENT SAFETY AND QUALITY 2010 ORGANIZATION, STAFF, AND BUDGET

C. DEPARTMENT BUDGET

Please refer to Attachment 2 for the Department of Patient Safety and Quality's 2010 actual expenditures versus budget as of December 31, 2010.

The department ended the year under budget by \$55,589.00.

Attachment 2

Denver Health and Hospital Authority
 Budget Comparison Report for DENVER HEALTH
 Date Ending December 31, 2010

815000 Patient Safety and Quality

Run Date 01/21/11
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	December Actual	December Budget	December Variance	December Var Pct	YTD Actual	YTD Budget	YTD Variance	YTD Var Pct
* CHARGES:								
REVENUE ADDITIONS/DEDUCTIONS								
3890 MISC REVENUE	0.00	0	0	0	800.00	0	800	0
TOTAL REVENUE ADDS/DEDUCTS	0.00	0	0	0	800.00	0	800	0
TOTAL REVENUE	0.00	0	0	0	800.00	0	800	0
EXPENSE								
PERSONNEL:								
5001/5002 ADMIN/MGRl SAL	62,683.54	121,405	58,721	48	672,699.14	1,417,411	744,712	53
5011/5012 ADMIN/MGRl PHYS	32,168.17	0	(32,168)	0	374,322.55	0	(374,323)	0
5021/5022 ADMIN/MGRl RN SAL	0.00	0	0	0	57,555.10	0	(57,555)	0
5061/5062 CLNCL PROF/TECH S	0.00	1,811	1,811	100	1,578.24	21,321	19,743	93
5071/5072 NONCLNCL PROF/TCH	25,759.17	24,143	(1,616)	(7)	267,085.61	281,843	14,757	5
5081/5082 CLERICAL SALARIES	14,049.14	11,935	(2,114)	(18)	161,009.84	139,282	(21,728)	(16)
5101/5102 RN SALARIES	29,572.99	28,667	(906)	(3)	338,878.99	334,008	(4,871)	(1)
5121/5122 PHYSICIAN SAL	10,424.71	0	(10,425)	0	57,742.84	0	(57,743)	0
5221/5222 OVERTIME	369.06	0	(369)	0	5,913.54	0	(5,914)	0
5231/5232 SHIFT DIFFERENTL	19.89	0	(20)	0	2,538.58	0	(2,539)	0
5251/5252 PROFESSIONAL DIFF	292.00	0	(292)	0	1,066.00	0	(1,066)	0
5032 ON-CALL SALARIES	0.00	704	704	100	0.00	8,288	8,288	100
5310 VACANCY SAVINGS	0.00	(13,207)	(13,207)	100	0.00	(154,150)	(154,150)	100
5380/5390 MISC PAYROLL-DRA	0.00	(33,815)	(33,815)	100	0.00	(67,988)	(67,988)	100
TOTAL SALARIES	175,338.67	141,643	(33,696)	(24)	1,940,390.43	1,980,015	39,625	2
BENEFITS:								
5565 FRINGE BENEFITS	44,010.01	44,093	83	0	487,038.00	514,662	27,624	5
TOTAL BENEFITS	44,010.01	44,093	83	0	487,038.00	514,662	27,624	5
TOTAL PERSONNEL	219,348.68	185,736	(33,613)	(18)	2,427,428.43	2,494,677	67,249	3
NON-PERSONNEL:								
PROFESSIONAL SERVICES:								
5710 PHYSICIAN SERVICES	0.00	0	0	0	1.36	0	(1)	0
5750 OTHER PROFESSIONL SVCS	6,447.00	2,917	(3,530)	(121)	37,662.80	35,000	(2,663)	(8)
TOTAL PROFESSIONAL SERVICES	6,447.00	2,917	(3,530)	(121)	37,664.16	35,000	(2,664)	(8)
SUPPLIES:								
7000 SUPPLIES-OFFICE ADMIN	1,226.27	1,167	(59)	(5)	9,842.50	14,000	4,158	30
7001 EDUCATIONAL MATERIALS	0.00	0	0	0	690.40	0	(690)	0
7010 SUPPLIES - MEDICAL	0.00	0	0	0	0.58	0	(1)	0
7050 SUPPLIES - FOOD	6.50	0	(7)	0	233.66	0	(234)	0
7060 SUPP-CLOTHING & SAFETY	0.00	0	0	0	32.02	0	(32)	0
7080 MNR FURN/EQUIP-NON-MED	1,190.77	167	(1,024)	(613)	3,288.32	2,000	(1,288)	(64)
7085 SUPPLIES - REBATES	422.25	0	(422)	0	422.25	0	(422)	0
7090 SUPPLIES - OTHER	1,058.96	17	(1,042)	(6,129)	1,935.93	200	(1,736)	(868)
7095 FREIGHT - INVENTORY	0.00	0	0	0	94.52	0	(95)	0
TOTAL SUPPLIES	3,904.75	1,351	(2,554)	(189)	16,540.18	16,200	(340)	(2)
REPAIR AND MAINTENANCE:								

	December Actual	December Budget	December Variance	December Var Pct	YTD Actual	YTD Budget	YTD Variance	YTD Var Pct
*								
7220 R&M MEDCL/DENTL/BIOMED	0.00	0	0	0	2,800.00	0	(2,800)	0
TOTAL REPAIR & MAINTENANCE	0.00	0	0	0	2,800.00	0	(2,800)	0
TECHNICAL & OTHR SUPPRT SVC:								
5790 OTHER SUPPORT SERVICES	220.25	167	(53)	(32)	2,173.82	2,000	(174)	(9)
6280 PRINTING/COFYNG/PROCG	0.00	167	167	100	0.00	2,000	2,000	100
7300 COPIER RENTAL	0.00	642	642	100	9,473.94	7,700	(1,774)	(23)
TOTAL TECH & OTHR SPRT SVCS	220.25	976	756	77	11,647.76	11,700	52	0
MANAGED CARE:								
UTILITIES & COMMUNICATN SVC:								
7350 COMMUNICATION	240.00	142	(98)	(69)	2,880.00	1,708	(1,172)	(69)
8020 POSTAGE/SHIPPING	0.00	7	7	100	165.00	89	(76)	(85)
TOTAL UTIL. & COMMUNICATION	240.00	149	(91)	(61)	3,045.00	1,797	(1,248)	(69)
INSURANCE & CLAIMS:								
TRAVEL/CONFERENCES:								
6000 TICKET FARES	0.00	250	250	100	4,238.80	3,000	(1,239)	(41)
6010 LODGING	501.52	333	(169)	(51)	8,048.37	4,000	(4,048)	(101)
6020 MEALS	237.62	125	(113)	(90)	1,702.37	1,500	(202)	(13)
6040 MILEAGE/PARKING	0.00	58	58	100	307.36	700	393	56
6045 TRAVEL - OTHER	94.00	125	31	25	1,411.53	1,500	88	6
6050 CONFERENCE/MEETING COSTS	1,824.00	500	(1,324)	(265)	7,241.14	6,000	(1,241)	(21)
TOTAL TRAVEL/CONFERENCES	2,657.14	1,391	(1,266)	(91)	22,949.57	16,700	(6,250)	(37)
DUES/AWARDS/EDUCATION:								
8000 DUES/MEMBERSHIP FEES	205.00	83	(122)	(147)	245.00	1,000	755	76
8010 SUBSCRIPTIONS & BOOKS	3,343.00	275	(3,068)	(1,116)	5,073.00	3,300	(1,773)	(54)
8015 JOURNALS	0.00	100	100	100	0.00	1,200	1,200	100
TOTAL DUES/AWARDS/EDUCATION	3,548.00	458	(3,090)	(675)	5,318.00	5,500	182	3
EMPLOYEE RECRUITMENT:								
LEASE/DEBT PAYMENTS:								
OTHER OPERATING EXPENSES:								
8030 PARTICPNT STIPNDS/INCN	0.00	100	100	100	640.00	1,200	560	47
8320 OTHER EXPENSES	179.10	0	(179)	0	(47.86)	0	48	0
TOTAL OTHER OPERATING EXP	179.10	100	(79)	(79)	592.14	1,200	608	51
CHARGEBACK/REDUCTION OF EXP:								
TOTAL NON-PERSONNEL EXPENSE	17,196.24	7,342	(9,854)	(134)	100,556.81	88,097	(12,460)	(14)
TOTAL OPERATING EXPENSE	236,544.92	193,078	(43,467)	(23)	2,527,985.24	2,582,774	54,789	2
NON-OPERATING EXPENSE:								
DEPRECIATION/AMORTIZATION:								
INTEREST EXPENSE:								
CAPITAL:								
NET INCOME	(236,544.92)	(193,077)	(43,468)	23	(2,527,185.24)	(2,582,774)	55,589	(2)

III. 2010 DEPARTMENT OF PATIENT SAFETY AND QUALITY MISSION STATEMENT

Vision: To support high quality clinical care and eliminate patient harm.

Mission: To optimize the quality of care and safety of patients, by

- creating an environment that encourages a culture of safety
- focusing on patient-centered, evidence-based care
- complying with core measures and national patient safety goals
- monitoring our outcomes and addressing deficiencies

IV. PATIENT SAFETY, QUALITY AND REGULATORY COMPLIANCE 2010 ANNUAL REPORT

2010 Department of Patient Safety and Quality Strategic Initiatives:

1. Reducing Avoidable Readmissions
 - a. Inpatient lean focus for 2010 (GMD service only)
 - b. Includes discharge planning throughout the length of stay, safer transitions to outpatient care, interventions in ED to prevent admission
 - c. Includes medication reconciliation
 - d. Includes emphasis on palliative care services when appropriate
 - e. Likely focus of State provider fee incentive plan in 2010
2. Electronic Health Record Development (LifeLink Clinicals, Outpatient)
 - a. This represents a huge opportunity for improved patient safety and quality while also posing some significant risk if poorly designed or implemented.
 - b. The department needs to be intimately involved in development and implementation decisions to ensure safe, evidence-based, and regulatory compliant systems
 - c. Scope of work to include clinician interface, CPOE, provider documentation, clinical decision support, data warehouse extraction, workflow engine, medication reconciliation, e-prescribing
3. Abnormal Result Tracking
 - a. Includes all ancillary test results (inpatient and outpatient)
 - b. Scope of oversight
4. Guideline Development/Approval/Dissemination
5. Department/Service Engagement in Quality and Safety
 - a. Represents the need to identify departmental leaders/liaisons to DPSQ
 - b. Involve caregivers in discussions about implementation of quality measures

- c. Give feedback on performance and outcomes related to quality, and engage caregivers in determining solutions including an emphasis on CMS Core Measures and departmental ongoing professional practice evaluations (OPPE)
 - d. Institution needs to support protected time for quality and safety issues
 - e. Departments need to be held accountable by the enterprise for quality and safety activities
6. Hospital Acquired Condition (HAC) and other Adverse Event (AE) Prevention
- a. Implementation and rollout of new electronic score card throughout the enterprise
 - b. Development of an automated Global Harm Score
 - c. Development of unit-specific, department-specific, and provider-specific reports on harm
 - d. Engagement of the enterprise in coordinated effort to reduce harm
 - e. Continued high level focus on interventions to improve identification and rescue of deteriorating patients (clinical triggers program)
 - f. Enhanced use and dissemination of data from the PSN voluntary reporting system.

Projects to support strategic initiatives and improve patient safety

1. LifeLink Clinicals Optimization Goal: Improve the quality, content and efficiency of nursing (and ancillary) documentation.
 - a. Collaborative project between EHS, the Department of Nursing, Respiratory Therapy, PMR and the Department of Patient Safety and Quality to optimize the electronic health record in order to “tell the patient story”
 - b. Identify opportunities for documentation improvement.
 - c. Develop and implement a “Plan of Care” chapter.
 - d. Revise the “Body System” chapter to eliminate “Within Defined Limits” and reduce redundant and confusing documentation fields.
2. Clinical Practice Committee Goal: Obtain a resource to manage the clinical guideline process
 - a. Received personnel expansion of a Document Control Specialist (1.0 FTE) to manage the policy and procedure process
3. Policy and Procedure Improvement Project. Goal: Redefine policy and procedure definitions, create standard work for the development, review and submission of hospital policy and procedures and obtain a resource to manage policies and procedure.
 - a. Received personnel expansion of a Document Control Specialist (1.0 FTE) to manage the policy and procedure process
4. Department engagement in quality and safety initiatives
 - a. Created the expectation that each major clinical department will present quality and safety initiatives to the Executive Patient Safety and Quality Committee.
 - b. Implemented the Quality Integration Meeting to assimilate the work of the Departments of Patient Safety and Quality and Nursing
 - c. Implemented the “mini tracer” project to include more leadership and frontline staff in patient safety
5. Rapid Response Program (clinical triggers). Goals: Timely and appropriate response to episodes of clinical deterioration; ↓Acute Care COR zeros; and ↓ICU Bouncebacks.
 - a. Supplemented clinical triggers education with “Vitals are Vital” training that includes review of the clinical triggers criteria and application to patient scenarios.
 - b. Increased use of the clinical triggers program: 46 calls/month (4th qtr – 68 calls/month) ↑from 28 calls/month in 2009
 - c. Maintain the Acute Care COR Zero rate: 0.51 acute care Cor Zeros/1000 acute care days. 0.42 acute care COR Zeros/1000 acute care days in 2009 (0.80 in 2006 at the start of the program)

- d. Decreased ICU Bouncebacks within 48 hours: 2.12 ICU Bouncebacks/100 ICU transfers.
↓ from 3.34 ICU Bouncebacks/100 ICU transfers – 2009
 - e. The clinical triggers were integrated into the Emergency Department. Prior to transfer to acute care, Rapid Response criteria are considered, reviewed and acted upon in the Emergency Department in order to ensure patient safety and decrease transfers from acute care to the ICU within 24 hours of admission.
6. Acute Care COR Zeros Evaluation. Goal: No preventable COR Zeros on the acute care units.
- a. Reviewed and analyzed all acute care COR Zeros and determined performance improvement opportunities related to patient management, response to clinical deterioration and communication.
 - b. Identified system failures that contribute to delays in response
 - c. Facilitated performance improvement projects
 - d. Provided feedback to providers, nursing and ancillary services regarding opportunities for improvement.
 - e. Provided data and case review information to the COR Zero Committee to consider for process improvement
7. ICU Bounceback (within 48 hours) Evaluation Goal: No unplanned transfers back to the ICU within 48
- a. Reviewed and analyze all ICU Bouncebacks that occur within 48 hours and determine performance improvement opportunities related to patient management, coordination of care, response and communication.
 - b. Attended M & M and Outcomes conferences to provide feedback to residents and supervising attending physicians regarding trends and opportunities for improvement.
 - c. Presented ICU Bounceback data and case review information during Critical Care competency, to facilitate discussion regarding evaluation of patients prior to transfer.
 - d. Involved Respiratory Therapy in initiatives to decrease ICU Bouncebacks; including evaluation of patients prior to transfer out of the ICU and evaluation and treatment of acute care patients post-operatively and post ICU transfer.
 - e. 2010 – 2.12 ICU Bouncebacks/100 ICU transfers ↓ from 2009 – 2.89 ICU Bouncebacks/100 ICU transfers; 2008 – 3.34 ICU Bouncebacks/100 ICU transfers.
8. Evaluation of Transfers from Emergency Department → Acute Care → ICU within 24 hours. Goal: No ICU transfers within 24 hours of admission to acute care from the ED.
- a. Reviewed data and identify opportunities for improvement with the medical and nursing staff in the Emergency Department.
 - b. Provided data and case-specific information to ED physician and nursing leadership.
 - c. Implemented a hybrid Rapid Response (clinical triggers) process in the Emergency Department
 - d. 2010 – 9.75 transfers (ED to Acute Care to ICU) within 24 hours ↓ from 15 transfers in 2009.
9. Hospital Acquired Conditions(HAC) and Patient Safety Indicators (PSI) Project Goal: Evaluate and improve coding of HACs and PSIs, correct coding as appropriate, and identify opportunities to improve patient safety
10. Conscious and Deep Sedation Improvement Project Goal: Improve the safety and quality of care during procedures that require sedation, improve the content and quality of documentation and respond to adverse events related to sedation in a timely and effective manner..
- a. Rewrite the Sedation and Analgesia for Non-Anesthesiologist Clinical Care Standard
 - b. Revised the Sedation and Analgesia Physician Training Module
 - c. Design the conscious sedation documentation to meet all regulatory requirements, promote safe practice and improve communication
 - d. Forms developed and implemented

- e. Education of all procedural staff
 - f. Monitor compliance (2010 – 57% of cases reviewed contained all required elements of documentation compared to 19% in 2009).
11. Extreme Falls Program (Critical Care) Goal: Zero falls with injury in critical care
 - a. Completed a Failure Mode Effects Analysis (FMEA) on critical care falls
 - b. Presented Extreme Falls Program (poster presentation) at national and local conferences.
 - c. Implemented the Extreme Falls program in critical care
 - d. 2010 Critical Care Falls with injury: MICU- four, SICU–two, PCU- one.
 12. Mislabeled Transfusion Labs Goal: Zero mislabeled transfusion-related specimens
 - a. Increase in mislabeled specimens in 2010 (25/month) identified via Patient Safety Net. 2009 – 18.5/month 2008 – 22.5/month
 - b. Evaluation of mislabeling errors
 - c. Reviewed and revised (clarify) related policies
 - d. Provided data to specific nursing department.
 - e. Collaborated with laboratory to identify opportunities for improvement
 - f. Identified need to replace the current transfusion armbands which contribute to labeling errors
 13. Pre-operative History and Physicals Availability – improve provider access to patient history and physical information prior to surgery.
 - a. Initial State: pre-operative paperwork was stored in a locked file cabinet in the OR until the day of surgery. The information was not available to care providers if needed.
 - b. Current State: pre-operative paperwork is scanned into EDM the day after the preoperative work-up is complete. That information is available to providers in the time period prior to the actual surgery date.

Projects to support patient safety

1. Electronic Quality Scorecard
 - a. Electronic tool to report and track progress of patient safety efforts
 - b. Measure and monitor core measures compliance, high acuity care, infection prevention efforts, patient flow, patient safety occurrences, and Ambulatory Care quality
2. Global Safety Score Development
 - a. Worked closely with eHS developers on automated report of safety events. To be validated in 2nd quarter 2011 and rolled out in 3rd quarter, 2011.
3. Employee Engagement in Continual Readiness
 - a. Mini Tracers
 - b. Patient Safety Rounds
4. Partners in Safety – patient and family involvement.
 - a. The program focuses on patient and family involvement in the safe provision of care: patient identification, preventing the spread of infection, medication safety, honoring patient wishes, learning about current illness, and preventing falls.
 - b. Policy and Procedures Goal: Redefine policy and procedure definitions and develop a process for clinical guideline submission.
 - i. Definitions for: policy, administrative procedure, clinical procedure, clinical practice guideline and clinical resource
 - ii. Develop on-line clinical guideline submission portal
5. Continual Readiness Sharepoint Site.

- a. Continual Readiness Tools
 - b. Data
 - c. Regulatory resources
6. Collaboration with local and national quality organizations
- a. CHA – Colorado Quality Report Card Steering Committee
 - b. CHA – Colorado Quality Professionals Meeting
 - c. NAPH – Quality Professional’s Group
 - d. University Healthsystem Consortium – Quality Council
 - e. CACHIE Advisory Work Group establishing ambulatory reporting standards
 - f. NHLBI – JNC 8 Hypertension guideline panel and integration work group
 - g. NQF – Patient Safety Advisory committee
 - h. State of Colorado – HQIP (Hospital Quality Incentive Payment) Advisory committee
 - i. High Value Health System Collaborative – one of 6 institutions (Dartmouth, Geisinger, Intermountain, Cleveland Clinic, Mayo, Denver Health)

Core Measures

Goal: Improve the quality of care and the Denver Health UHC ranking by improving the overall DH core measure bundle score.

- 1. Overall bundle score – 82%
- 2. Heart Failure bundle – 82%
 - a. 231/282 cases passed the heart failure bundle.
 - b. Improved abstraction/feedback process beginning Q2 2010 due to implementation of Siemens' Soarian Quality Measures (SQM) tool. SQM has nearly eliminated failed cases for three of the four heart failure measures – No failed cases for the three measures since Q2 2010.
 - c. Performance challenges for the fourth measure are related to our combined electronic and manual process for discharge medication reconciliation.
- 3. Acute MI bundle – 97%
 - a. 95/98 cases passed the acute MI bundle.
 - b. No failed cases since Q1 2010.
- 4. Pneumonia bundle – 83%
 - a. 177/214 cases passed the pneumonia bundle.
 - b. Performance challenges associated with our combined electronic and manual activities required for our immunization process, and ED antibiotic documentation.
- 5. SCIP bundle – 78%
 - a. 279/360 cases passed the SCIP bundle.
 - b. Performance decrease associated with inadvertent omission of field label during form revision of anesthesia record. Issue resolved by Q3 2010.
- 6. Online Core Measure Site supports core measures performance improvement activity.
- 7. Partnership with Siemens: Implemented Soarian Quality Measures tool Q2 2010.
 - a. Decreased the interval for number of days between coding/billing activity and case availability for abstraction from 50 days to 7days.
 - b. Decreased number of between case availability and performance improvement feedback to teams which allows feedback to teams within the 30-day post discharge window. This decrease provides opportunity to add clarifying addendums that change measure status from "Fail" to "Pass" or to "Exclusion," for some measures.
 - c. Decreased FTEs required to abstract core measures from 1.2 to 1.0.

Compliance with regulatory standards is essential to maintain accreditation and to preserve our financial viability. Our goal is to meet regulatory requirements by focusing on patient safety.

Accomplishments in 2010

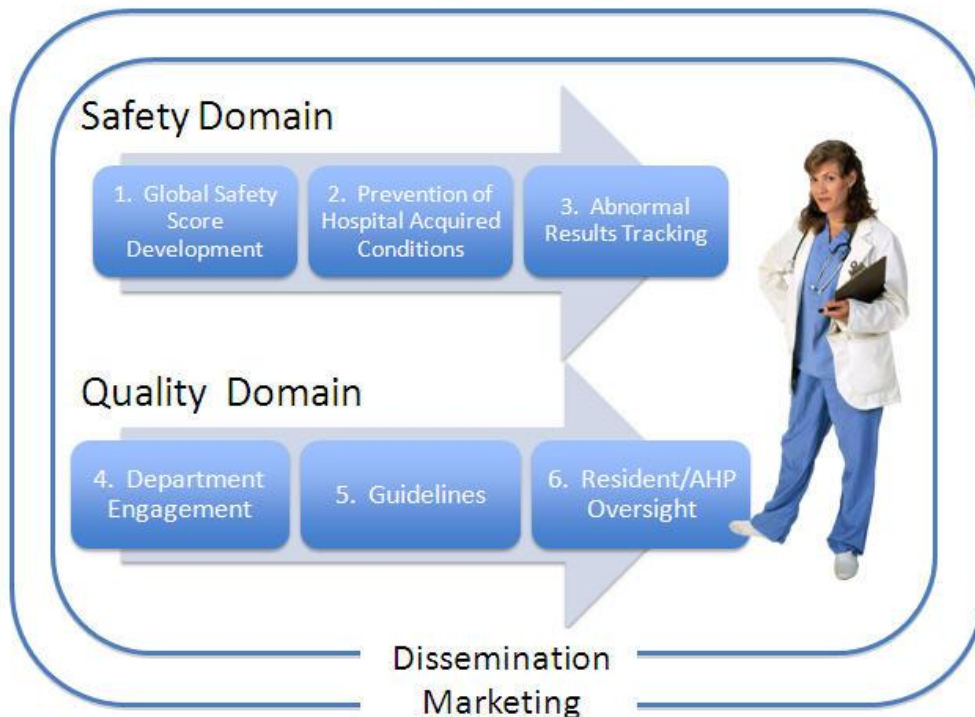
1. Successful response to an on-site CDPHE/CMS survey – no findings.
2. Successful completion of the annual Division of Behavioral Health 27-65 Survey
3. Successful response to four Joint Commission complaints – no findings.
4. Completion of CHS, BHS and Hospital Periodic Performance Reviews (PPR)
5. Developed a Continual Readiness Sharepoint site to support all regulatory activities
6. Developed and expanded the Continual Readiness Tracer process to include “mini tracers”. Mini tracers are topic- specific tracers that can be completed with staff in 15 – 20 minutes. The tracers consist of five to fifteen questions that include the expected answer. This continual readiness methodology increased leadership and staff involvement in the tracer process; focused on challenging standards; and provided valuable information to support decision making for ongoing regulatory activities. Mini-tracer completion – 50/month.
7. Collaborated with the Department of Nursing to develop Patient Safety Rounds. This program targeted problems that were identified during the 2010 PPR. Nurse managers, clinical nurse educators, charge nurses and Patient Safety and Quality nurses were asked to round on the units to observe for compliance with two patient identifiers, hand hygiene, medication safety etc. If noncompliance was observed, the evaluator was asked to provide one-on-one teaching with the staff involved. Over 1000 patient safety rounds were conducted in the last four months of 2010.

Regulatory Goals for 2011

1. Achieve Joint Commission accreditation.
2. Maintain Division of Behavioral Health 27-65 license

Department of Patient Safety and Quality Strategic Plan 2011

Patient Safety and Quality Strategic Plan 2011



REGULATORY ACTIVITY
JANUARY 1, 2010 – DECEMBER 31, 2010

DATE	SURVEYORS	DH STAFF	ISSUES	ORG	DEFICIENCIES	COMMENTS
February 2010	None	Kendra Moldenhauer	Patient complaint regarding provider negligence and inadequate discharge instructions from the Emergency Department	JC		Care was appropriate and discharge instructions were legible and meaningful
March 2010	None	Kendra Moldenhauer, Jon Clark and John Thompson	Staff complaint to the JC regarding inadequate training. JC requested information regarding staff competency, process for training, content of training, and the documentation of training in employee and department files.	JC	None	Although the Joint Commission was satisfied with our investigation, we did identify opportunities to improve the documentation of training in the Department of Engineering . Staff were allowed to maintain their own training files. Leadership was informed of the need to change the process for documentation. HR has conducted periodic competency file reviews to verify ongoing compliance with department-specific employee file requirements.
May 2010	None	Kendra Moldenhauer	Staff complaint to the JC regarding inadequate training in the ED, staff without required certifications, lack of clarity regarding roles and responsibilities for ED technicians and lack of clarity regarding the ED reporting structure	JC	None	Nursing Education developed a new process for tracking requirements and nursing certifications. Job descriptions were updated and signed but affected employees. Reporting structures were clarified.

DATE	SURVEYORS	DH STAFF	ISSUES	ORG	DEFICIENCIES	COMMENTS
June 2010	One	Jen Brown	Annual 27-65 Survey	CO Division of Behavioral Health	1. Staff training requirements – documentation that supports annual training for physicians was not available 2. The Emergency medication process was not found to be clearly and consistently documented	1. Physician education was developed in a web-based application and assigned to all physician staff in BHS on an annual basis. 2. Standard work developed and applied to practice. New report tool was developed to improve communication between providers
July 2010	None	Kendra Moldenhauer	Staff complaint regarding anesthesia machines – old equipment requiring frequent servicing	JC	None	New anesthesia machines had already been purchased. Biomed was waiting for all components of the machines to be delivered to DH prior to deployment in the OR.
September 2010	Two days	Kendra Moldenhauer	Unannounced State investigation based on DH report of a hospital death due to staff neglect Telemetry patient died while the telemetry technician left her post unattended	CDPHE Potential CMS investigation if the CoP for Nursing related to Plan of Care is not validated	None	New process for communication and hand-off of telemetry patients. Re-education of all telemetry technicians. Developed new standard work for covering telemetry technician breaks or illness.
December 2010	None	Kendra Moldenhauer Tom MacKenzie	Complaint to the JC regarding International Orthopedic Fellows. The complaint alleged that the Fellows were being allowed	JC	None	Review of all documents related to the International Orthopedic Fellows program. Review of process related to “onboarding” of the fellows.

DATE	SURVEYORS	DH STAFF	ISSUES	ORG	DEFICIENCIES	COMMENTS
		Sarah Radunsky	to participate in surgical procedures, and that the program did not follow guidelines set by the organization and that monitoring of the program was "loose"			Reviewed Volunteer Position Description signed by the fellows. Five OR employees who had frequent exposure to Orthopedic cases were interviewed to determine whether the complaint could be substantiated by members of the OR team. All staff.

V. DENVER HEALTH MEDICAL STAFF OFFICE 2010 ANNUAL REPORT

The Medical Staff Office (MSO) is an operating section within the Denver Health Department of Patient Safety and Quality. The MSO supports the Medical Staff, Allied Health Professionals, and Administration for credentialing, privileging, Joint Commission, CMS and NCQA preparedness and standards interpretation.

A. DENVER HEALTH MEDICAL STAFF 2010

The MSO consists of four (4) FTE's. The Manager, and three (3) FTE's Credentialing Coordinators who maintain the credentialing and privileging for the Denver Health Medical Staff and the Allied Health Professional Staff.

Comparative Data

2008 to 2010

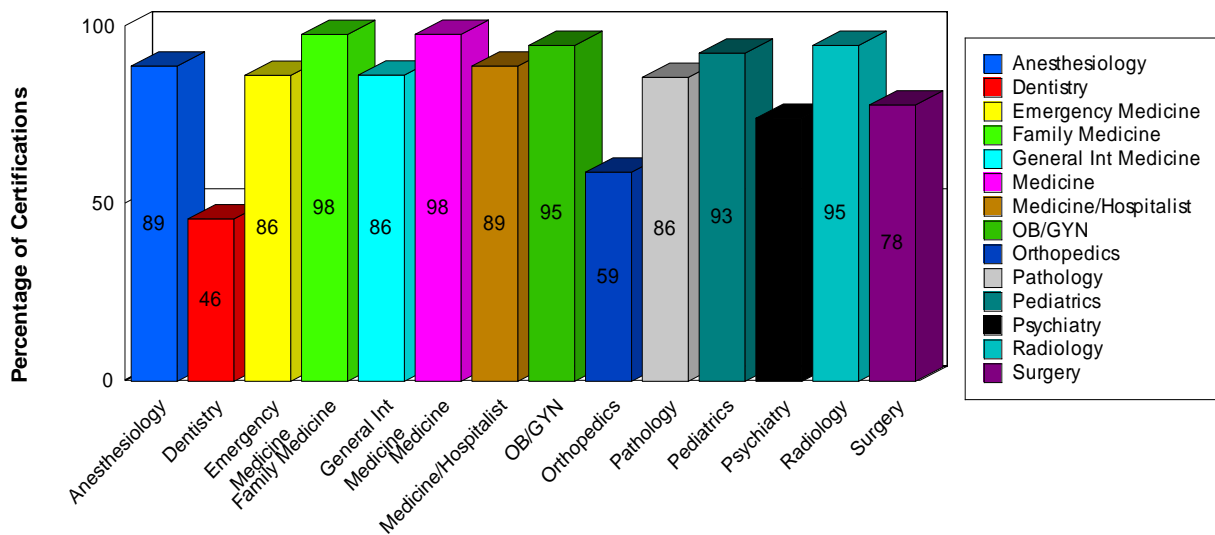
Denver Health Medical Staff

Comparative Activity	2008	2009	2010
Active Medical Staff Files Maintained	720	720	756
Medical Staff Initial Applications Processed	118	91	109
Medical Staff Reappointment Applications Processed	266	325	291
Active Allied Health Professional Files Maintained	218	235	244
Allied Health Initial Applications Processed	44	31	33
Allied Health Reappointments Applications Processed	94	89	120

V. DENVER HEALTH MEDICAL STAFF OFFICE 2010 ANNUAL REPORT

A. DENVER HEALTH MEDICAL STAFF 2010

Board Certification by Department: Active Medical Staff 563



Anesthesiology

Practitioners In Department: 18
Board Certified: 16 89%

Dentistry

Practitioners In Department: 25
Board Certified: 11 46%

Emergency Medicine

Practitioners In Department: 51
Board Certified: 44 86%

Family Medicine

Practitioners In Department: 46
Board Certified: 45 98%

General Int Medicine

Practitioners In Department: 44
Board Certified: 38 86%

Medicine

Practitioners In Department: 94
Board Certified: 92 98%

Medicine/Hospitalist

Practitioners In Department: 27
Board Certified: 24 89%

OB/GYN

Practitioners In Department: 19
Board Certified: 18 95%

Orthopedics

Practitioners In Department: 39
Board Certified: 23 59%

Pathology

Practitioners In Department: 7
Board Certified: 6 86%

Pediatrics

Practitioners In Department: 67
Board Certified: 62 93%

Psychiatry

Practitioners In Department: 31
Board Certified: 23 74%

Radiology

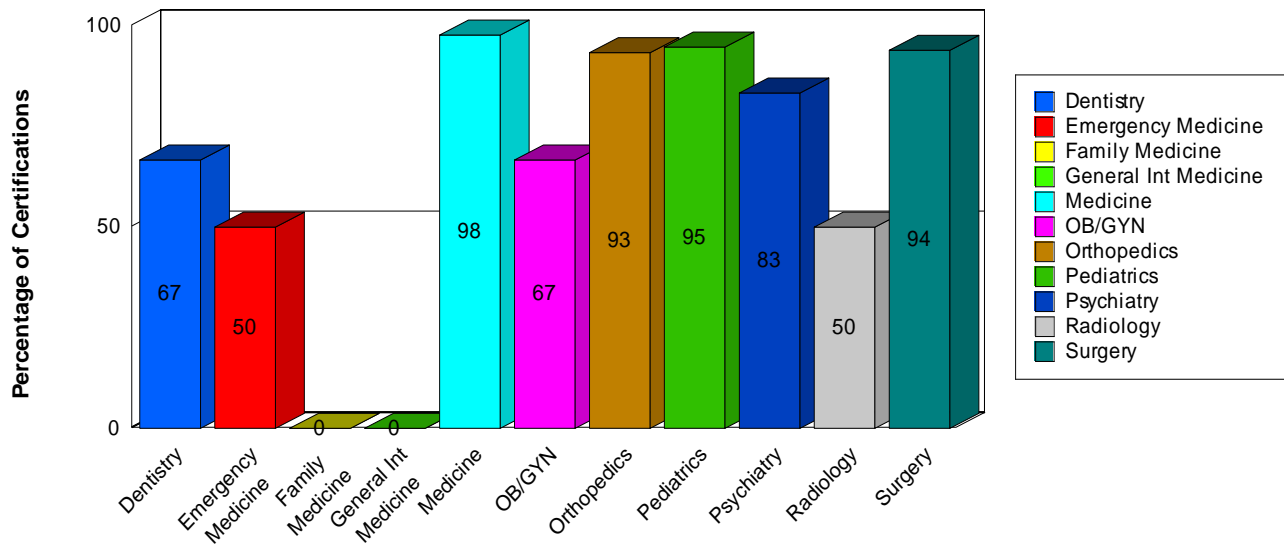
Practitioners In Department: 19
Board Certified: 18 95%

Surgery

Practitioners In Department: 78
Board Certified: 60 78%

V. DENVER HEALTH MEDICAL STAFF OFFICE 2010 ANNUAL REPORT

Board Certification by Department: Consulting Medical Staff 173



Dentistry

Practitioners In Department: 3
Board Certified: 2 67%

Emergency Medicine

Practitioners In Department: 2
Board Certified: 1 50%

Family Medicine

Practitioners In Department: 1
Board Certified: 0 0

General Int Medicine

Practitioners In Department: 1
Board Certified: 0 0

Medicine

Practitioners In Department: 88
Board Certified: 86 98%

OB/GYN

Practitioners In Department: 3
Board Certified: 2 67%

Orthopedics

Practitioners In Department: 15
Board Certified: 14 93%

Pediatrics

Practitioners In Department: 19
Board Certified: 18 95%

Psychiatry

Practitioners In Department: 6
Board Certified: 5 83%

Radiology

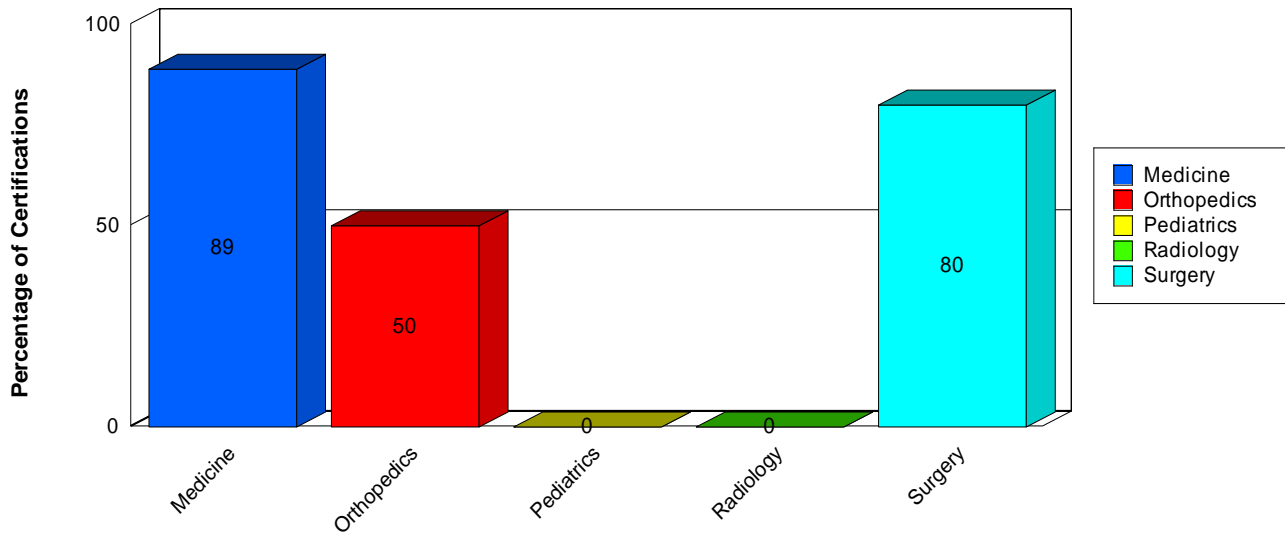
Practitioners In Department: 2
Board Certified: 1 50%

Surgery

Practitioners In Department: 33
Board Certified: 31 94%

V. DENVER HEALTH MEDICAL STAFF OFFICE 2010 ANNUAL REPORT

Board Certification by Department: Visiting Medical Staff 18



Medicine

Practitioners In Department: 9
Board Certified: 8 89%

Orthopedics

Practitioners In Department: 2
Board Certified: 1 50%

Pediatrics

Practitioners In Department: 1
Board Certified: 0 0

Radiology

Practitioners In Department: 1
Board Certified: 0 0

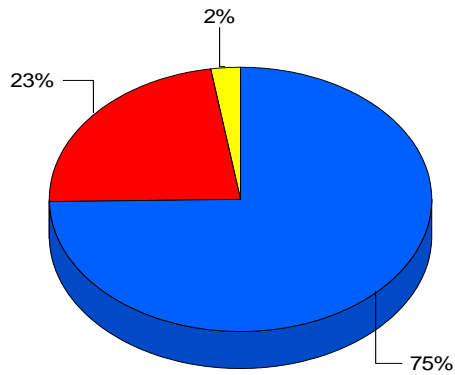
Surgery

Practitioners In Department: 5
Board Certified: 4 80%

V. DENVER HEALTH MEDICAL STAFF OFFICE 2010 ANNUAL REPORT

Denver Health Medical Staff Percentage of Physicians of Staff by Status

Active	565
Consulting	173
Visiting	18
Total Physicians On Staff:	756



Active	74.7%
Consulting	22.9%
Visiting	2.4%
Total:	100.0%

V. DENVER HEALTH MEDICAL STAFF OFFICE 2010 ANNUAL REPORT

B. MSO ACCOMPLISHMENTS 2010

- In 2010 the Medical Staff Office (MSO) was audited by CO Access, Anthem BCBS of Colorado, Denver Health Medical Plan, Inc. for DHHA, CIGNA, Aetna, United Healthcare, Coventry Insurance, and MultiPlan. They achieved compliance on every audit and full delegation was awarded.
- The Manager of the Medical Staff Office participated in a Value Stream Analysis on Continual Readiness in November 2010.
- The Medical Staff By-Laws were revised in 2010. New Joint Commission compliance standards were included in the revisions.
- The MSO worked with the Allied Health Credentialing Committee to complete the AHP supervision policy including the Ongoing Professional Practice Evaluation and Focused Professional Practice Evaluation process for the Allied Health Professionals.
- The MSO continued working with each individual department to create forms, enhance policies, and structure a tracking system for Ongoing and Focused Evaluations for the Medical Staff.
- The MSO staff attended 2 state professional educational conferences. Two members of the MSO attended the National Association of Medical Staff Services national education conference in October 2010.
- The MSO participated in numerous Web Conferences focused on Joint Commission standards and regulatory compliance.
- The MSO was actively involved in several Emergency Disaster exercises. The disaster credentialing policy and application was revised.
- The MSO provided support to the Department of Patient Safety and Quality to help monitor and track training on Pain Management and Assessment, Restraint for the Non-Violent Patient, and Fluoroscopy Radiation Safety.

V. DENVER HEALTH MEDICAL STAFF OFFICE 2010 ANNUAL REPORT

C. MSO INITIATIVES FOR 2011

1. Purchase and implement a new credentialing software system. The proposal is currently in the discovery stage with the Denver Health IT department.
2. Continue to improve on the Ongoing Professional Practice Evaluation process and tracking for each department. Revise the OPPE policy to incorporate all departments into one policy.
3. Provide support and a tracking mechanism to the AHP's for their OPPE policy and process.
4. Maintain quality staff and continue to provide educational developmental opportunities.

VI. DIVISION OF HOUSESTAFF AND STUDENT EDUCATION 2010 ANNUAL REPORT

Sponsored Programs

Emergency Medicine

The Emergency Medicine Residency Program successfully filled all first year positions in the match. The program continues to be one of the most desirable programs for medical students and we attract highly competitive applicants from across the United States. The program received continued full accreditation for 4 years from the Residency Review Committee in our annual evaluation.

The Emergency Medicine Residency Program applied for and was granted an expansion in residency complement by the RRC. We offered the additional programs in the 2011 match.

Medical Toxicology

The Medical Toxicology program received a site visit from the ACGME in July 2010. The program was granted continued full accreditation for 2 years. The program applied for and was granted an expansion of one fellow to accommodate a candidate from the US Air Force. This fellow will begin in July 2011.

Oral and Maxillofacial Surgery

The program is fully accredited by the Commission on Dental Accreditation. The program has one resident per year.

General Dentistry

The program is fully accredited by the Commission on Dental Accreditation.

Other Residency Issues

Nearly 1000 residents rotated at Denver Health in 2010. The Graduate Medical Education Committee met approximately every other month and discussed residency issues.

This year we faced significant challenges related to new Common Program Requirements from the ACGME. This new requirements further restricted the hours that first year residents could work and increased the supervision requirements for faculty. It has been estimated by the ACGME that the new requirements will cost teaching hospitals between \$380 million to over \$1 billion per year. In response to the anticipated increased costs we implemented a Lean Planning Event in Sept 2010 to plan for the new requirements. This event had representatives from University Hospital, Children's Hospital, various residencies, and the Graduate Medical Education Office. A report of the event is detailed below.

Medical Students

Approximately one third of medical students from the University of Colorado rotated at Denver Health for core rotations.

This year we made significant changes in the evaluation of faculty teaching by medical students. We worked with the University of Colorado School of Medicine to improve the reporting and documentation of faculty teaching by medical students. As a result, we implemented a pilot program in Obstetrics and Gynecology that ties student evaluations of faculty to faculty evaluation of students, and worked to improve documentation across all residencies. Many faculty members received medical student teaching evaluations for the first time in their careers.

VI. DIVISION OF HOUSESTAFF AND STUDENT EDUCATION 2010 ANNUAL REPORT

Other Students

Approximately 1,500 individual students of various types came to Denver Health for educational experiences in 2010. These include Army Medics, Audiology, Chaplin, CRNA, Dental, Dieticians, Foundations in Doctoring, HIM, Medical Assistant, Midwives, Occupational Therapy, Ophthalmology, Otolaryngology/ENT, Paralegal, Pathology/Blood Bank, Pharmacy, Physical Therapy, Physician Assistant, Psychology, Radiology Techs, Research/Observation, Respiratory Therapy, Shadowing, Social Work, Speech/Language Pathology, Surgery Techs, Toxicology, and Ultrasound/Sonographers. We do not have a good grasp of the costs of these students to Denver Health. It is likely that these students provide some labor to Denver Health.

Lean Efforts

Badging

We recognized that it was a significant expense to provide badges to all of the students listed above. We had an RIE around the badging and access issues for students. As a result of that RIE, we determined that we could make reusable badges that were specific to a type of student and require students to wear the picture ID badges provided by their home institution. Implementation of this policy saves Denver Health an estimated \$60,000 per year.

Resident Work Hours

The report from the 2P on Work Hours is attached. Prior to the retreat, the residency program directors had requested 63 additional FTEs to meet the work hour requirements. As a result of this event, we reduced the number of requested residency expansions at Denver Health to 5 FTEs.

VII. MEDICAL BIOSTATISTICS 2010 ANNUAL REPORT

This annual report summarizes the 2010 activities and accomplishments of the department of Medical Biostatistics, including the degree to which 2010 goals as outlined in the 2009 annual report were met, and is presented in sections as follows:

- A. Overview of Biostatistics and Clinical Data Warehousing at Denver Health
- B. Goals and Achievements in 2010
- C. Research Support in 2010
- D. 2011 Goals

A. OVERVIEW OF BIOSTATISTICS AND CLINICAL DATA WAREHOUSING (BCDW)

Biostatistics is the science of statistics applied to the analysis of biological or medical data. The department of Medical Biostatistics is a department within the Denver Health Department of Patient Safety and Quality.

This department is currently comprised of 2.9 FTEs as follows:

Allison Sabel, MD, PhD, MPH, CMQ serves as the Director of Biostatistics and Clinical Data Warehousing since November 2005. She is board-certified in Public Health and General Preventive Medicine with her Masters of Public Health in Epidemiology. Her doctorate is in Biostatistics and she is Certified in Medical Quality.

Carolyn Valdez serves as the Statistical Research Specialist with a 0.9 FTE effort. She joined our department in March 2010 after two years in quality improvement within Community Health Services. She is currently pursuing her Masters of Science in Biostatistics.

Stacy Nitura serves as the Data Team Administrator since September 2010. She joined our department after 7.5 years in eHS as an application analyst and senior application analyst for EDM. She is currently pursuing her Registered Health Information Technology Credentials.

Other key personnel in 2010 include:

Amy Trantanella, RN served as the Data Team Administrator for BCSD from June 2007 to February 2010. After completing her nursing degree in 2009, she continued to assist our department at 0.15 FTE effort. Her expertise in clinical data warehousing was essential for a successful transition of to our new employees.

Kate Fagan joined our department as a student worker to complete her Masters of Public Health practicum. After receiving her MPH, she was employed by the CHS division of our department as a Statistical Researcher.

VII. MEDICAL BIostatISTICS 2010 ANNUAL REPORT

B. GOALS AND ACHIEVEMENTS IN 2010

In its 2009 annual review and report, Medical Biostatistics identified seven goals to achieve in 2010. This section describes these goals and how they were achieved.

Goal #1. Coordinate the planning, analyzing, reviewing, interpreting, and summarizing of statistical data for Denver Health, with a specific emphasis on the needs of the Department of Patient Safety and Quality while expanding the scope of the department's QI efforts.

- Department of Patient Safety and Quality Initiatives for 2010
 - A. Reduce Avoidable Readmissions
 - Provided the methodological support, data retrieval, and analytic skills for the Inpatient Lean events and First Floor Value Stream events throughout the year.
 - Discharge planning and safer transitions to outpatient care through the services of the Anticoagulation Clinic were analyzed.
 - Medication reconciliation data was summarized each month and disseminated internally.
 - B. Electronic Health Record Optimization and Development
 - Led the Denver Health deployment of Enterprise Identity Management (EIM), which creates an efficient security model for our electronic systems.
 - Created an electronic interface to medication reconciliation, thereby eliminating the need for manual scanning and provides more readily available documents to the physicians
 - Collaborated with eHS Work Flow team to optimize their workflow engines via data from the data warehouse
 - C. Guideline Development/Approval/Dissemination
 - Provided the preparatory information needed for Lean events on order set usage and guideline development
 - D. Department/Service-line Engagement in Quality and Patient Safety
 - Created an automated email system for the Orthopedic and Trauma departments which identified patients whom were readmitted within 30 days.
 - Developed metrics for provider-based evaluations.
 - Provided monthly reports to nurse stations and CHS clinics on adult immunization status for their patients
 - E. Hospital Acquired Condition and Adverse Event Prevention
 - Led the development of the electronic Quality Scorecard during 2009, which was demonstrated at the executive/board level in January 2010 and disseminated enterprise-wide in February 2010.
 - Led the development of the automated global safety score during the fall of 2010 with implementation planned for spring of 2011.
 - Collaborated with the eHS Work Flow team to identify patients whom are deteriorating and may require a Rapid Response call.
 - Collaborated with the eHS Work Flow team to identify patients with a hospital acquired condition so that appropriate work flows could be developed.

VII. MEDICAL BIostatISTICS 2010 ANNUAL REPORT

- Determined how often abnormal vital signs were occurring on acute care patients which will provide further insight into the criteria for our Rapid Response Program.
 - Automated the Agency for Healthcare Research and Quality Patient Safety Indicators (PSI) software which allowed Denver Health to identify patients with PSIs in a timely manner, thereby providing the opportunity to improve physician documentation and address the PSI if applicable.
 - Created automated reports in Web Publishing for CMS Never Events and AHRQ PSIs.
- Infection Prevention
- Developed automated reports from the data warehouse to monitor impact of antibiotic stewardship program (ASP), helped design study to determine effect of ASP, and provided analytical support to establish if ASP continued to improve care at Denver Health.
 - Analyzed data from the Skin and Soft Tissue Infections program
 - Analyzed data for study on echocardiography use in Staphylococcal Bacteremia
 - Provided data for investigation on potential process issue
- Patient Safety and Quality Oversight
- Created a department specific report to summarize events from the Patient Safety Net (PSN)
 - Analyzed the effectiveness of our Adult Rapid Response project through the use of clinical triggers
- Regulatory Compliance
- Summarized data for the Joint Commission standard related to providing the same standard of care, treatment, and services throughout the hospital
 - Collaborated with the Core Measures nurses on improving their reports
- Medical Staff Office
- Developed evidence-based physician competencies that meet Joint Commission compliance for Ongoing and Focused Professional Practice Evaluation (OPPE/FPPE) Standards for the Departments of Urology.
 - Improved the OPPE reports for the Departments of: Surgery, Neurosurgery, Emergency Medicine, and Ophthalmology.

Goal #2. Provide the clinical, technical, and statistical expertise needed for the successful development, validation, and implementation of Denver Health's data warehouse.

- Completed 54 clinical data requests submitted through the data request portal
- Validated the Patient Status Report in LCR, which is the pass-through page to the Clinical Registries
- Validated the colorectal cancer screening registry to allow for deployment in June 2010.
- Validated and deployed patient reminder letters that summarize the patient's cancer screening status.
- Continued development and validation of the OB registry
- Collaborated with every clinical department at Denver Health with data requests and biostatistical analysis.

VII. MEDICAL BIostatISTICS 2010 ANNUAL REPORT

- Provided clinical guidance for the new extraction, translate, and load processes for data from: Lifelink Nursing Documentation, Lifelink Vital Signs, and Lifelink Workflow Engine
- Provided data and review of applications for award nominations or external reporting, such as: Eisenberg Award, Report to the City, HEDIS, GAO Survey, Leapfrog

Goal #3. Support the Performance Improvement nurses on data concerns in regards to the core measures and serve in an advisory role during the implementation of Soarian Quality Measures (SQM).

- Provided clinical guidance and data support for the implementation of SQM and four upgrades during 2010
- Improved the reporting capabilities of core measures data by creating customized reports from the data warehouse.

Goal #4. Provide mentorship to medical trainees and statistical research specialists, especially those who focus on quality and safety.

- Allison Sabel provided mentorship to the following individuals in study methodology, survey design, data collection, data cleaning, and statistical techniques:
 - Carolyn Valdez, Statistical Research Specialist in Department of Patient Safety and Quality, Division of Biostatistics and Clinical Data Warehousing
 - Rachel Everhart, Data Team Administrator in Department of Patient Safety and Quality, Division of Ambulatory Quality Improvement
 - Stacy Nitura, Data Team Administrator in Department of Patient Safety and Quality, Division of Biostatistics and Clinical Data Warehousing
 - Josh Durfee, Statistical Research Specialist in Department of Patient Safety and Quality, Division of Health Services Research
 - Kate Fagan, Masters of Public Health Student Worker in Department of Patient Safety and Quality, Division of Biostatistics and Clinical Data Warehousing
 - Dina Marroquin, Application Analyst for eHS Decision Support Solutions
 - Dr. Tim Jenkins, Director of Antibiotic Stewardship
 - Dr. Michael Liao, Emergency Medicine fellow
 - Dr. Frederic Pieracci, General Surgery resident
 - Dr. Utpal Sagar, Cardiology fellow
- Carolyn Valdez provided mentorship in data extraction, data cleaning, and statistical techniques to:
 - Kate Fagan, Masters of Public Health Student Worker in Department of Patient Safety and Quality, Division of Biostatistics and Clinical Data Warehousing
 - Diana Kurniawan, Quality Improvement Associate in Department of Patient Safety and Quality, Division of Ambulatory Quality Improvement

VII. MEDICAL BIostatISTICS 2010 ANNUAL REPORT

Goal #5. Demonstrate the successes of Denver Health's quality improvement projects and the data warehouse through lectures on the national level and through peer-reviewed publications.

- BCDW was significantly involved in two projects which received national recognition in 2010
 - A study on wrong-site and wrong-patient procedures done by Denver Health and COPIC was awarded the Colorado Patient Safety Coalition 2010 Patient Safety Award. This study received national attention in all major newspapers and medical journals.
 - The electronic Quality Scorecard was awarded the National Association of Public Hospitals and Health Systems President's Award in 2010 for its ability to enhance feedback and transparency.

- 5 manuscripts related to patient safety, quality improvement, or clinical data warehousing were published or accepted for publication in peer-reviewed journals in 2010.
 - Jenkins TC, **Sabel AL**, Sarcone EE, Price CS, Mehler PS, and Burman WJ. Skin and Soft Tissue Infections Requiring Hospitalization at an Academic Medical Center: Opportunities for Antimicrobial Stewardship. *Clinical Infectious Diseases*. 2010 Oct; 51(8): 895-903.
 - Stahel PF, Flierl MA, Smith WR, Morgan SJ, Victoroff MS, Clarke TJ, **Sabel AL**, Mehler PS. Commentary: Disclosure and Reporting of Surgical Complications: A Double-Edged Sword? *American J of Medical Quality*. 2010 Sept/Oct; 25(5)298-401.
 - Stahel PF, **Sabel AL**, Victoroff MS, Varnell J, Lembitz A, Boyle DJ, Clarke TJ, Smith WR, Mehler PS. Wrong Site and Wrong Patient Procedures in the Era of the Universal Protocol – Analysis of a Prospective Database of Physician Self-Reported Occurrences. *Archives of Surgery*. 2010 Oct; 145(10):978-984.
 - O'Connor ME, Spinks C, Mestas TA, **Sabel AL**, Melinkovich P. "Dyading" in the Pediatric Clinic Improves Access to Care. *Clinical Pediatrics*. 2010 Jul; 49(7): 664-70.
 - Jenkins TC, Knepper B, **Sabel AL**, Sarcone EE, Long J, Haukoos JS, Morgan S, Biffi W, Steele A, Price CS, Mehler PS, and Burman WJ. Decreased Antibiotic Utilization after Implementation of a Guideline for Inpatient Cellulitis and Cutaneous Abscess. *Archives of Internal Medicine*. In press, 2010.

- 6 peer-reviewed abstracts were presented or accepted in 2010.
 - Jenkins TC, Cervantes L, Stella S, **Sabel AL**, Keniston A, Price CS, Burman WJ, and Mehler PS. Targets for Antibiotic and Institutional Resource Stewardship in Inpatient Community-Acquired Pneumonia. 5th Decennial CDC/SHEA International Conference on Healthcare-Associated Infections, Atlanta, GA, March 18-21, 2010.
 - Price CS, Trantanella A, **Sabel AL**, Jenkins TC, Ogle J, and Douglas I. Outcomes of Patients Hospitalized in Denver with 2009 Influenza A (H1N1): An Inner City Experience. 5th Decennial CDC/SHEA International Conference on Healthcare-Associated Infections, Atlanta, GA, March 18-21, 2010.
 - Kajjoka E, Bessesen M, **Sabel AL**, Jenkins TC, and Price CS. Risk Factors and Molecular Analysis of *Clostridium difficile* infection (CDI) in Hospitalized Adults. 5th Decennial CDC/SHEA International Conference on Healthcare-Associated Infections, Atlanta, GA, March 18-21, 2010.

VII. MEDICAL BIostatISTICS 2010 ANNUAL REPORT

- **Valdez C.** Adolescent Body Mass Index is Associated with an Increase in Medical Encounters for Musculoskeletal Injuries. Academy Health Annual Research Meeting, Boston, MA, June 27-29, 2010.
 - **Valdez C.** Optimizing Outpatient Anticoagulation Patient Care. Academy Health Annual Research Meeting, Boston, MA, June 27-29, 2010.
 - Jenkins TC, Knepper BC, **Sabel AL**, Sarcone EE, Long JA, Haukoos JS, Morgan SJ, Biffi WL, Steele AW, Price CS, Mehler PS, Burman WJ. Decreased Antibiotic Utilization after Implementation of a Guideline for Inpatient Cellulitis and Cutaneous Abscess. Accepted for the 21st Annual Scientific Meeting of the Society for Healthcare Epidemiology of America, Dallas, TX, April 1-4, 2011.
- 7 invited national or regional lectureships were presented by Allison Sabel on the successes of Denver Health's quality improvement projects or the data warehouse.
- West Coast Soarian User's Group Meeting, "DSS, Innovations in Clinical Decision Support, and Soarian Quality Measures", Denver, CO, February 5, 2010
 - American College of Healthcare Executives, "Performance Management: You Don't Know What You Don't Measure", Chicago, IL, March 22-23, 2010
 - National Association of Public Hospitals and Health Systems Webinar, "Managing the Burden of Physician Competencies", March 19, 2010
 - Institute for Healthcare Improvement IMPACT Meeting, "Quality and Data Innovations in a Lean Environment", May 25, 2010
 - National Association of Public Hospitals and Health Systems Fellows Program, "Integrating Inpatient and Outpatient Care to Improve Patient Quality: Bridging the Hospital-Ambulatory Care Divide", Denver, CO, June 22, 2010
 - University HealthSystem Consortium Quality and Safety Fall Forum, CDB/RM/CM User Group Session, "Using UHC's Clinical Data Products, Your Own Hospital's Data Warehouse, and Business Intelligence Tools to Create an Electronic Dashboard for Quality and Safety", San Diego, CA, September 29, 2010.
 - Colorado Association of Healthcare Executives, "Performance Management: You Don't Know What You Don't Measure", Golden, CO, October 21, 2010

Goal #6. Provide biostatistical support on grant applications and publication of scientific manuscripts.

- Grants and Contracts
- Sudden Cardiac Grant in Severe Anorexia Nervosa, NIH/NHLBI. Placed on hold after discussions with NHLBI.
 - Application of Multiplexed Automated Digital Microscopy, MADM for Rapid Microbiological Diagnosis and Major Drug Resistance Phenotyping in Critical Infectious Disease, NIH. Rejected.
 - Systemic Inflammatory Response Syndrome in Emergency Departments, Michael Liao.
 - High Value Healthcare Collaborative
 - Medical Global Payment Demonstration Project
- 14 scientific manuscripts and research projects received biostatistical support
- Gaudiani JL, Sabel AL, Mascolo M, and Mehler PS.. Severe anorexia nervosa: Outcomes from a medical stabilization unit. *International Journal of Eating Disorders*, n/a. doi: 10.1002/eat.20889

VII. MEDICAL BIostatISTICS 2010 ANNUAL REPORT

- Chu ES, Gaudiani JL, Mascolo M, Cleary B, **Sabel A**, Carroll K, and Mehler PS. Acute Comprehensive Urgent Treatment for Eating Disorders (ACUTE). *Journal of Hospital Medicine*. Submitted for publication with favorable revision, 2010.
- Sagar UN, Krantz M, Long C, Barbey JT, White K, Gaudiani JL, **Sabel A**, and Mehler PS. Cardiac Repolarization and Resting Energy Expenditure in Patients Hospitalized with Severe Anorexia Nervosa. American Heart Association QCOR (Quality of Care and Outcomes Research in Cardiovascular Disease and Stroke), Washington, D.C., May 19-21, 2010.
- Sagar UN, Krantz MJ, Long CS, Barbey JT, White KV, Gaudiani JL, **Sabel A**, and Mehler PS. Cardiac Repolarization and Resting Energy Expenditure in Patients Hospitalized with Severe Anorexia Nervosa. Eating Disorders Research Society 16th Annual Meeting, Cambridge, MA, October 7-9, 2010.
- Krantz MJ, Sagar U, **Sabel AL**, Long CS, Barbey JT, White KV, Gaudiani JL, and Mehler PS. Is QT-prolongation a Characteristic Feature of Anorexia Nervosa? A pilot Study in Patients with Severe Disease. Rejected by the *American Journal of Cardiology*.
- Flierl MA, Gaudiani JL, **Sabel A**, Long CS, Stahel PF, Mehler PS. Complement Activation in Severe Anorexia Nervosa: A Prospective Cohort Study. Eating Disorders Research Society 16th Annual Meeting, Cambridge, MA, October 7-9, 2010.
- Flierl MA, Gaudiani JL, **Sabel AL**, Long CS, Stahel PF, and Mehler PS. Complement C3 Serum Levels in Anorexia Nervosa: A New Biomarker for the Severity of Disease? *International Journal of Eating Disorders*. Submitted for publication in 2010 and invited for edits.
- Gutierrez GP, **Jagunich (Valdez) CA**, Hambridge SJ. Association of BMI and Musculoskeletal Injury in Children. Invited lecture at North American Primary Care Research Group Annual Meeting, Nov 2010.
- Gutierrez GP, **Jagunich (Valdez) CA**, Hambridge SJ. Higher BMI is Associated with an Increase in Medical Encounters for Injuries. Pediatric Academic Society Annual Meeting, Vancouver, BC, Canada, May 2010.
- Gray K, **Sabel A**, Overdier K, Wolken R, Price C, Douglas I. Redefining ALPS (Alcoholism, Leukopenia, and Pneumococcal Sepsis). Rejected by *American Journal of Respiratory and Critical Care Medicine*.
- Gray K, **Sabel A**, Overdier K, Wolken R, Price C, Douglas I. Redefining ALPS (Alcoholism, Leukopenia, and Pneumococcal Sepsis). Rejected by *Chest*.
- **Sabel AL**, MacKenzie TD, Moldenhauer K, Potter MM, Biffi WL, and Mehler PS. Clinical Triggers: An Effective Alternative to a Rapid Response Team. *American Journal of Medical Quality*. Submitted for publication in 2010 and invited for edits.
- Biffi WL, Beno M, Goodman P, Bahia A, **Sabel A**, Snow K, Steele AQ, Swartwood C, Thienelt C, MacKenzie T, and Mehler PS. "Leaning" the Process of Venous Thromboembolism Prophylaxis. *The Joint Commission Journal on Quality and Patient Safety*. Submitted for publication in 2010 and accepted in 2011.
- Analysis of Trends in Discontinuation of Concurrent Use of Clopidogrel (Plavix) and Proton-Pump Inhibitors (PPIs)

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Goal #7. Work with UHC on refinement of the product lines, risk adjustment methodology, and quality and accountability study.

- Dr. Allison Sabel served as the Medical Director of Clinical Data and Informatics for University HealthSystem Consortium until September 2010. She led the clinical efforts in risk adjustment and analytics for UHC's clinical tools including the Clinical Data Base, Clinical Resource Manager, and Core Measures Data Base.
- Refined nine Product Lines which will be rolled out in Q1 2011
- Provided methodologic and statistical support for the publication of letters in response to manuscripts concerning UHC's product lines or risk adjustment methodology.
 - Keroack MA, Meurer SJ, **Sabel AL**. Neurosurgical Morality Rates. *J Neurosurg*. 2010 Feb; 112(2): 470.
- Patient Safety Net (PSN)
 - Served on the PSN Steering Committee to ensure that Denver Health's suggestions would be included in the revision of the product.
 - Created customized reports to assist Denver Health in understanding our error incidences in a logical manner so that we can avoid future occurrences.
- Advisory member representing Denver Health on all major UHC clinical committees:
 - Clinical Informatics Advisory Group Executive Committee
 - Quality and Accountability Steering Committee
 - Risk Adjustment Task Force

C. RESEARCH SUPPORT IN 2010

Improving the Measurement of Surgical Site Infection (SSI) Risk Stratification and Outcome Detection
AHRQ ACTION 290-2006-000-20 RFTO # 8
9/2009 – 9/2011

Total Funding: \$500,000

BCDW Funding: 2% Phase I, 1% Phase II of Allison Sabel's salary

Reducing Inappropriate Prescribing of Antibiotics by Primary Care Clinicians
AHRQ ACTION 290-2007-100-08 RFTO #16
8/2009 – 8/2011

Total Funding: \$500,000

BCDW Funding: 8% of Allison Sabel's salary

University HealthSystem Consortium
Medical Director for Clinical Data and Informatics
BCDW Funding: 15% of Allison Sabel's salary and benefits

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D. 2011 GOALS

1. Coordinate the planning, analyzing, reviewing, interpreting, and summarizing of statistical data for Denver Health, with a specific emphasis on the needs of the Department of Patient Safety and Quality while expanding the scope of the department's QI efforts.
2. Provide the clinical, technical, and statistical expertise needed for the successful development, validation, implementation, and data extraction from Denver Health's data warehouse.
3. Support the Performance Improvement nurses on data concerns in regards to the core measures and provide support for existing and future reports from Soarian Quality Measures data.
4. Provide mentorship to medical trainees and statistical research specialists, especially those who focus on quality and safety.
5. Demonstrate the successes of Denver Health's quality improvement projects and the data warehouse through lectures on the national level and through peer-reviewed publications.
6. Provide biostatistical support on grant applications, research projects, and publication of scientific manuscripts.
7. Promote continuing education for staff related to progress towards completion of degrees or certifications.

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This report serves to address the requirements for our:

- 2010 Annual Report of Denver Health's Infection Prevention (IP) program
- 2010 Infection Prevention Program Analysis/ 2011 Plan to comply with Joint Commission standards

This report will be presented as follows:

- A. Denver Health IP Program
- B. Analysis of the 2010 Infection Prevention Program at Denver Health
- C. Risk assessment for Infection Prevention at Denver Health.
- D. Goals for the 2011 Infection Prevention Program at Denver Health

A. THE DENVER HEALTH INFECTION PREVENTION PROGRAM

Mission of the program is to support Denver Health in providing the highest quality and safest health care by:

1. Reducing the risk of acquiring and transmitting infections in both the inpatient and outpatient settings
2. Engage in research and teaching of healthcare epidemiology that enhances our ability to prevent healthcare-associated infections in all our various patient settings.

Denver Health and Hospital Authority is located in a metropolitan area of Denver, Colorado. A major teaching facility, it is comprised of a 477 bed licensed hospital, multiple specialty clinics, community health centers, and school based clinics as well as the health department for the city and county of Denver. Denver Health serves to meet the special health care needs of the population with services ranging from level one trauma care to those needed by multiple correctional care facilities in the state of Colorado. It also addresses the needs of special populations especially those of the poor, underinsured, mentally ill, the homeless and victims of violence. A twenty-one bed correctional care facility is part of the hospital itself. Other facilities include the Rocky Mountain Poison and Drug Center, Denver Cares detoxification facility, a center for Occupational Health and Safety and the Denver Paramedics. Mental Health services are provided from children ages 8 through adults in both inpatient and outpatient settings. Physicians are salaried employees who retain academic appointments on the University of Colorado School of Medicine faculty. Training is provided in 28 medical specialties and 23 allied health fields.

Other pertinent facts for the Infection Prevention program at Denver Health:

- No transplant services
- No cardiac surgery
- Most of our immunocompromised patients are related to HIV infection.
- Denver Health receives few long-term care patients relative to most other metro area hospitals.
- Expanding pediatric services

The Infection Prevention Program now is comprised of the following core program members coming together from 3 departments at DH:

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Connie Savor Price, MD (Department of Medicine/Chief of Infectious Diseases) serves as the program's medical director/healthcare epidemiologist since July 2002, with a 0.5 FTE effort to devote to the program. She has specialty fellowship training and research interest in healthcare epidemiology. She is actively involved with and serves as a board member of the Society of Healthcare Epidemiology of America (SHEA). In addition, she is board certified in internal medicine (ABIM), infectious diseases (ABIM) and medical microbiology (ABP). She serves as the Physician Representative on Colorado's Healthcare Associated Infections Advisory Committee for public reporting; as lead faculty for the Statewide collaborative to reduce surgical site infections and *Clostridium difficile* infections; and as a contracted advisor to the CDPHE emerging infections network on healthcare associated infections.

Marie Fornof, RN, BSN, CIC (Department of Patient Safety and Quality) served as the Program Manager full-time from January – September 2010. She has 18 years of experience in infection prevention and certification in infection prevention (CIC). She has extensive experience with the CDC's National Healthcare Safety Network system (NHSN) since its inception. She is an active member of the Association for Professionals in Infection Control and Epidemiology (APIC) and a member of its local board.

Cathy Vigil, RN, BSN, CIC (Department of Patient Safety and Quality) has served as an infection control practitioner at DH since June 2005 in a full-time role after years of experience as a community health nurse. She completed her BSN in 2007 and received her certification in infection prevention (CIC) in 2008. She is an active member of the Association for Professionals in Infection Control and Epidemiology (APIC).

Kenneth Stiefvater RN, BSN (Department of Community Health Services) has served as an infection control practitioner at DH since mid- 2005 at a half-time effort. He serves as a liaison to our program for issues in infection prevention relevant to CHS and our Denver Public School clinics, with formal reporting through the CHS Director of Nursing Services (Vickie Lesnansky, RN)

Amy Irwin, RN, DNP (Department of Medicine) has served to fulfill interim part-time infection control needs from September 2010 to the present (18 hours/week). She completed her clinical doctorate in nursing in 2006, and has worked full-time at DH since December 2007 as a research nurse coordinator for infectious diseases and has led the Healthcare Infection Prevention Performance Improvement (HIPPI) Champion program since October 2008. She is working towards certification in infection prevention (CIC), and participated in the 2010 SHEA-CDC Healthcare Epidemiology and Infection Control training course as a Pugliese Scholarship recipient, and the Johns Hopkins Fellows Course in Hospital Epidemiology and Infection Control.

Heather Young, MD (Department of Medicine) is a second year Infectious Diseases fellow at the University of Colorado. After coming to us from the University of Massachusetts Medicine/Pediatrics combined program, she successfully completed all of her Infectious Diseases clinical requirements during her 1st year of fellowship training. Her 2nd and subsequent years of fellowship are devoted exclusively to research in healthcare associated infections, specifically on the topic of surgical site infections (SSI), in close collaboration with our Department of Surgery and the Colorado Hospital Association. She has been instrumental in designing efforts to reduce SSI in hysterectomy patients at Denver Health.

Bryan Knepper MSc, MPH (Department of Patient Safety and Quality) has served as our Statistical Research Specialist as of June 2010 in a full-time role after years of experience in a similar role at CDPHE. He is charged with maintaining Infection Prevention data, designing more efficient methods for surveillance that will allow us to expand our data capture and feedback, administering NHSN for public reporting, and generating reports for increasing legal and regulatory demands for infection prevention data.

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Other key supporting personnel include:

Tim Jenkins, MD- Antibiotic Stewardship (see Antibiotic Stewardship Annual Report)
Claire Swartwood, Pharm. D. - Antibiotic Stewardship
Julia Frey, M.T.—Microbiology

As well as our Members of the Infection Prevention Committee

Research Support 2010

Grants and Contracts

Title: Patient Safety Program RFP #LQ HFD1002

Description: *Reducing Healthcare Associated Infections through a Statewide Collaborative*

Granting organization: CDC, via CHA/CDPHE

Start date 3/10

End date 3/12

Annual and total funding: \$22,500 (\$15,000 year 1; \$7,500 year 2)

Title: Improving the Measurement of Surgical Site Infection (SSI) Risk Stratification and Outcome Detection

Description: *Implementing strategies to improve detection of and risk stratification for surgical site infections.*

Granting organization: AHRQ ACTION

Start date 9/09

End date 9/11

Annual and total funding: \$500,000

Title: Reducing Inappropriate Prescribing of Antibiotics by Primary Care Clinicians

Description: *Implementing strategies that will reduce antibiotic use for illnesses not requiring them and decreasing use of broad spectrum antibiotics in the primary care setting.*

Granting organization: AHRQ Primary Care Based Research Network (West)

Start date 8/09

End date 8/11

Annual and total funding: \$500,000

Title: Rapid bacterial identification and antibiotic resistance testing in critically ill adults at risk for ventilator acquired pneumonia

Description: *Using multiplex automated digital microscopy to diagnose infections and their susceptibilities direct from specimens in less than 1 day*

Granting organization: Denver CTSA

Start date: 2/09

End date: 2/11

Annual and total funding: \$100,000

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Title: Community Acquired Methicillin-Resistant Staphylococcus aureus (David West, Ph.D)
Description: *AHRQ task order to evaluate primary care approaches to dealing with methicillin-resistant S. aureus.*
Granting organization: AHRQ Primary Care Based Network (West)
Start date: 9/08
End date: 9/10
Annual and total funding: N/A

Title: The Role of Antibiotics in Open Fractures Revisited: Characteristics of Staphylococcus aureus and Susceptibility Profile
Description: Study to determine whether antibiotic prophylaxis directed toward MRSA is necessary in patients presenting with open fractures
Granting organization: Orthopaedic Trauma Association
Start date: 9/08
End date: 9/10
Annual and total funding: \$80,000 (\$40,000/year)

Title: Impact of Microbial Ecology on Human Staphylococcus aureus Carriage
Description: *Identify microbial determinants of SA colonization through an epidemiological study of SA-colonized and non-colonized individuals.*
Granting organization: CU Butcher Award (Pace)
Start date: 07/08
End date: 07/10
Total funding: \$10,000

Title: Healthcare Associated Infections in Colorado
Description: *Multi-state population based surveillance study designed to understand the changing epidemiology of Clostridium difficile; methicillin resistant Staphylococcus aureus*
Granting organization: CDC via CDPHE (Ken Gershman, MD, MPH)
Start date: 02/08
End date: 02/12
Annual funding: \$10,000

Pharmaceutical/Biotech projects

Title: DAP-4IE-06-03 A phase 4 multicenter, randomized, double blind study to describe the efficacy and safety of cubicin® (daptomycin for injection) with and without initial gentamicin combination therapy in the treatment of Staphylococcus aureus infective endocarditis
Company: Cubist Pharma
Start date: 08/08
Stop date: 12/10

Title: Development of Rapid Microbiology Techniques Using Leftover Human Specimens.
Company: Acclr8 Corp
Start date: 12/07
Stop date: ongoing

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Title: BCX1812-301: A Phase 3, multicenter, randomized, double-blind, controlled study to evaluate the efficacy and safety of peramivir administered intravenously in addition to standard of care compared to standard of care alone in adults and adolescents who are hospitalized due to serious influenza

Company: BioCryst Pharmaceuticals

Start date: 12/09

Stop date: 3/11

Title: MP-2009-B: Prospective Study into the Performance of the MicroPhage S aureus/MSSA/MRSA Test direct from Blood Culture

Company: MicroPhage Inc

Start date: 7/09

Stop date: 7/10

Title: H030-011: A Phase II, Randomized, Placebo-Controlled, Double-Blind, Dose Ranging Study to Assess the Immunogenicity and Safety of a Clostridium difficile Toxoid vaccine (ACAM-Cdiff) in Subjects with Clostridium difficile Infection (CDI).

Company: Sanofi-Pasteur, Inc.

Start Date: 3/10

End Date: 1/11

Title: DAP-RENS 08-05: A prospective, multicenter, randomized, evaluator-blinded, comparator-controlled study to describe the safety and efficacy of daptomycin for the treatment of complicated skin and skin structure (cSSI) and Staphylococcus aureus bacteremia among subjects with moderate or severe renal impairment.

Company: Cubist

Start Date: 6/10

End Date 1/11

Publications 2010

Peer-Reviewed Manuscripts 2010

1. Kashuk JL, Moore EE, Price CS, Zaw-Mon C, Nino T, Haenel J, Biffi WL, Cothren CC, Johnson JL. Patterns of Early and Late Ventilator Associated Pneumonia due to Methicillin Resistant Staphylococcus aureus in a Trauma Population. J Trauma. 2010 Sep;69(3):519-22.
2. Frank DN, Feazel LM, Bessesen MT, Price CS, Janoff EN, Pace NR. The human nasal microbiota and Staphylococcus aureus carriage. PLoS One. 2010 May17;5(5)
3. Jenkins TC, Sabel AL, Sarcone EE, Price CS, Mehler PS, Burman WJ. Skin and Soft-Tissue Infections Requiring Hospitalization at an Academic Medical Center: Opportunities for Antimicrobial Stewardship. Clin Infect Dis. 2010 Oct 15;51(8):895-903
4. Burden M, Cervantes L, Weed D, Keniston A, Price CS, Albert R. Newly Cleaned Physician Uniforms and Infrequently Washed White Coats Have Similar Rates of Bacterial Contamination After an Eight-Hour Workday: A Randomized Controlled Trial. J Hosp Med. 2011 Feb 10.
5. Saveli C, Belknap R, Morgan S, Price CS. The Role of Prophylactic Antibiotics in Open Fractures in an Era of Community Acquired Methicillin Resistant Staphylococcus aureus (MRSA). Orthopedics. Accepted June 29,2010. In Press.
6. Millett PJ, Yen YM, Price CS, Horan MP, van der Meijden OA, Elser F. Propionobacter acnes Infection as an Occult Cause of Postoperative Shoulder Pain: A Case Series. Clin Orthop Relat Res. 2011 Jan 15.

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7. Jenkins TC, Knepper BC, Sabel AL, Sarcone EE, Long JA, Haukoos JS, Morgan SJ, Biffl WL, Steele AW, Price CS, Mehler PS, Burman WJ. Decreased Antibiotic Utilization After Implementation of a Guideline for Inpatient Cellulitis and Cutaneous Abscess. *Arch Intern Med.* 2011 Feb 28.

Abstracts 2010

1. Preslaski C, Doody M, Price C, Jenkins T. Use of oseltamivir at an academic hospital: antimicrobial stewardship lessons from the H1N1 influenza pandemic. In: Final program of the 5th Decennial International Conference on Healthcare-Associated Infections 2010 (Atlanta). Arlington, VA: Society for Healthcare Epidemiology of America, 2010.
2. Jenkins T, Cervantes L, Stella S, Keniston A, Sabel A, Price C, Burman W, Mehler P. Targets for antibiotic and institutional resource stewardship in inpatient community-acquired pneumonia. In: Final program of the 5th Decennial International Conference on Healthcare-Associated Infections 2010 (Atlanta). Arlington, VA: Society for Healthcare Epidemiology of America, 2010.
3. Kajioka E, Bessesen M, Sabel A, Jenkins T, Price C. Risk factors and molecular analysis of *Clostridium difficile* infection in hospitalized adults. In: Final program of the 5th Decennial International Conference on Healthcare-Associated Infections 2010 (Atlanta). Arlington, VA: Society for Healthcare Epidemiology of America, 2010
4. Loretta Sullivan Chang, MD, MPH, Heather Gilmartin, RN, MSN , Elissa Meites, MD, MPH , Maho Imanishi, BA , Connie S. Price, MD , S. Arunmozhi Balajee, PhD , Benjamin J. Park, MD , Judith Noble-Wang, PhD , Carol Rao, PhD , Shelley Magill, MD, PhD , Tom Chiller, MD, MPH. Investigation of a cluster of Acremonium- and Lecanicillium-positive clinical cultures from orthopedic patients — Colorado, 2008-2009. In: Program and Abstracts for the Fifth Decennial International Conference on Healthcare-Associated Infections (Atlanta). March 18-22, 2010. Arlington, VA: Society for Healthcare Epidemiology of America
5. Abigail L. Carlson, Theresa Mickiewicz, MSPH, Alicia P. Budd, MPH, Connie S. Price, MD , Trish Perl, MD, MSc. Detection of Pandemic H1N1 Influenza at Johns Hopkins Hospital: Syndromic vs. Laboratory Surveillance. In: Program and Abstracts for the Fifth Decennial International Conference on Healthcare-Associated Infections (Atlanta). March 18-22, 2010. Arlington, VA: Society for Healthcare Epidemiology of America
6. Theresa Mickiewicz, MSPH, Abigail L. Carlson, Olivia D. Farrow, JD, RS, Gerald R. Huffman, BS, Trish Perl, MD, MSc, Connie S. Price, MD. Regional and National Influenza Surveillance: How do They Compare? In: Program and Abstracts for the Fifth Decennial International Conference on Healthcare-Associated Infections (Atlanta). March 18-22, 2010. Arlington, VA: Society for Healthcare Epidemiology of America
7. Price C, Trantanella A, Sabel A, Wolken B, Jenkins T, Ogle J, Douglas I. Outcomes of patients hospitalized in Denver with 2009 influenza A (H1N1): an inner city experience. In: Final program of the 5th Decennial International Conference on Healthcare-Associated Infections 2010 (Atlanta). Arlington, VA: Society for Healthcare Epidemiology of America, 2010
8. Irwin , A; Chu, E; Biffl, W; Douglas, I; Price, C. Effectiveness of a Web-Based Module to Improve Infection Prevention Knowledge for Hospitalists Performing Central Venous Catheter Insertion. In: Program and abstracts of the 5th Decennial International Conference on Healthcare-Associated Infections (Atlanta). Arlington, VA: Society for Healthcare Epidemiology of America, 2010. (Poster Presentation).
9. Irwin A ; Fornof M; Vigil C; Baker K; Bonansinga S; Dillon M; Howerzyl E; Smith J; Cooper S; Carerra E; Doucette T; Elliott T; Wilmer C; Case M; Cunningham C; Lindberg N; Pokrywka L; Nino T ; Ruzich S; Stafford N; Potter M; L. Biffl W; Douglas IS; Eisert S; Price, CS. Beyond Bundles: Enlisting Healthcare Infection Prevention Performance Improvement (HIPPI) Champions to Promote Patient Safety in Critical Care. In: Program and abstracts of the 5th Decennial International Conference on Healthcare-Associated Infections (Atlanta). Arlington, VA: Society for Healthcare Epidemiology of America, 2010. (Poster Presentation).

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10. Irwin, A; West, D; Price, C; Jenkins, T; Mackenzie, T; DeAlleaume, L; Eisert, S. Developing Interventions in Diverse Practices. AHRQ 2010 Practice-Based Research Network (PBRN) Annual Conference, Washington, D.C.: June 2010. (Podium Presentation).
11. S. Metzger, C. S. Price, W. M. Dunne, A. Shamsheyeva, K. Hance, J. Mascali, W. Kim, D. Jolly, I. Yushkevich, K. Havens, D. Howson. Rapid Quantitation and Identification of Pseudomonas aeruginosa, Staphylococcus aureus, and Acinetobacter baumannii In Bronchoalveolar Lavage Fluid. In: Program and Abstracts of the 110th General Meeting of the American Society of Microbiology, 2010 (poster presentation)
12. Abigail Carlson, Theresa Mickiewicz, MSPH , Alicia Budd, MPH , Richard Rothman, MD, PhD , Connie Price, MD , Trish Perl, MD, MSc, FIDSA , Performance of Google Flu Trends During 2009 Seasonal and Pandemic Influenza. In: Program And Abstracts Of The 47th Meeting Of The Infectious Disease Society Of America (Philadelphia). Alexandria, Va: Infectious Diseases Society Of America, 2010. (Poster Presentation)

B. ANALYSIS OF THE 2010 INFECTION PREVENTION PROGRAM AT DENVER HEALTH

The following summarizes the status of goals and strategies that were initiated as part of the 2010 program at Denver Health:

2010 Goal #1. Improve hand hygiene compliance.

From a baseline of <40% compliance when surveillance started in 2005, to 73% overall compliance in 2008 and 85% in 2009, we maintained our progress with an **overall compliance rate of 86% in 2010.**

These measurements were **taken from 1512 observations** of hand hygiene opportunities made throughout 2010 in our acute care areas, including general medicine wards, ICUs, ED, urgent care, and psychiatry settings. This was made possible again by Cathy Vigil's self-designed hand-held mobile surveillance system. The system, a software application prototype, is an excel spread sheet with drop down boxes for location, position, and "before" or "after" HH observation. IP carried the system on daily rounds to record HH observations. Once at a computer, the mobile device synced into a DH database. Use of the hand-held device increases the number of observations possible, maintains data integrity, allows IP staff to view accurate graphed compliance on a daily basis, which allows for more timely education in regards to HH and staying in compliance with the CDC guidelines on HH.

Numerous other strategies were employed to sustain our improvements in 2010:

- Ongoing observation in all clinical areas continued with reports prepared quarterly, presented at infection prevention committee, and sent to all stakeholders. We continued to promote data transparency to drive improvement by posting on the PULSE, nursing dashboards, and in clinical areas.
- We continued focused education in new employee orientation, new physician orientation, nursing orientation, and updated our hand hygiene education in our annual required competency training.
- Signs were made and posted in inpatient rooms as well as in exam rooms for CHS and specialty clinics encouraging visitors and patients to remind caregivers to perform hand hygiene prior to giving care. These signs were created in Spanish and English.
- In CHS, patient interviews after the appointment asked the patient how their provider did with hand hygiene.
- A CDC video in both English & Spanish is available on the patient education channel.
- The reporting icon on the Pulse allows for anonymous reporting of hand hygiene violations. Although it was rarely used in 2010, it is possible that its presence is maintaining sustained effect after the initial increase we saw in 2008 soon after its implementation.

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- Focused efforts in lower compliance areas, especially the Emergency Department, involved increased observations, identifying ED staff champions, and making waterless hand sanitizers more widely available.
- Pocket hand gel on Behavioral Health and Rehabilitation units

Continued barriers to our goal of 100% compliance relate to competing provider priorities, better compliance with “before” opportunities in the inpatient settings, and more personnel dedicated to promoting these efforts, especially in high volume/high turnover areas such as the Emergency Department.

2010 Goal #2. Decrease the rate of device related infections

Device related infection prevention continued to be the subject of our Healthcare Infection Prevention Performance Improvement (HIPPI) initiatives particularly in the areas of central-line associated bloodstream infections (CLABSI) and ventilator-associated pneumonia (VAP). The group is represented by healthcare providers focused in the adult ICUs with a special interest in infection prevention.

Benchmarking was performed against >1500 hospitals contributing data to the CDC’s National Healthcare Surveillance Network (NHSN). Denver Health rates were monitored and benchmarked against national mean rates for comparable units, e.g. MICU was benchmarked against other similar medical major teaching ICUs and SICU was benchmarked against other trauma ICUs. SDU, PICU, and NICU were all benchmarked against their comparable settings. Benchmarking data for general medical wards became available for the 1st time in 2009, and where applicable, these units also were benchmarked accordingly. Each rate is given an NHSN “percentile” according to where we rank vs our similar peer units: top 10%; 10-25%; 25-50%; 50-75%; 75-90%; and 90%.

Central-line associated bloodstream infections (CLABSI): Rates in the MICU, SICU, PICU, NICU and Progressive Care Unit (PCU) were monitored and benchmarked against national mean rates for comparable units. Continued “bundle” interventions resulted in sustained to improved rates. Quarter 3, 2010, marked the initiation of CLABSI surveillance in Acute Care. In adult and pediatric ICUs, **all 2010 rates again were below national pooled mean rates; adult ICUs and PICU accomplished lower than national pooled mean rates again for the 4th consecutive year.** The Progressive Care Unit had a lower frequency of central line utilization; thus the 2 CLABSI diagnosed in PCU patients in 2010 resulted in rates for that unit that were above pooled mean national rates, but improved vs their own rates from the previous 2 years.

Denver Health CLABSI rates over the last 4 years, and the corresponding National Healthcare Surveillance Network (NHSN) percentile, were as follows:

CLABSI per 1000 central line days

	2007	2008	2009	2010	NHSN percentile for 2010
MICU	1.4	1.7	1.8	1.0	10-25%
SICU	2.9	2.2	1.7	0.8	10-25%
PCU	---	3.7	3.9	2.7	75-90%
PICU	0.0	0.0	0.0	0.0	10%
NICU	0.0	5.7	0.0	0.0	10- 25%*
Acute Care	--	--	--	1.1	50-75%

* for birthweight > 2500g, NHSN percentile is 10- 50%

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All ICUs benchmarked in the top 10-25% of comparable units reporting to NHSN. Interventions championed by the Infection Prevention, Patient Safety and Quality, HIPPI champions, unit directors, and most importantly- front line staff-included:

- Emphasized no more than 3 attempts at insertion
- Enforced line care protocols
- Real time HIPPI audits for compliance with evidence based prevention measure were performed throughout 2010. By Nov and Dec 2010, the following compliance rates were achieved:
 - Central line insertion site choice (use of IJ or SC sites): 96% compliant
 - Central line clean and intact: 98% compliant
- HIPPIs provided “teachable moments” education to colleagues when opportunities for improvement were identified
- Provided web-based educational training to all units where central lines are placed or maintained
- Dedicated Hospital Medicine procedure service, all of whom were trained in infection prevention measures utilizing a comprehensive web-based training module through our recent AHRQ grant
- As housewide CLABSI reporting is mandatory in 2011 and monitoring for prevention best practices is a Joint Commission performance measure, the HIPPI Champions have responded by expanding the HIPPI Champion program into acute care to assist in monitoring and auditing of implementation of CLABSI prevention best-practices.
- A two-year impact analysis of the HIPPI Champion program on CLABSI prevention yielded the following results:
 - **A 47% reduction in CLABSI following program implementation was observed at the end of 2010**
 - **An estimated cost-avoidance of \$129,028.50 in direct medical costs associated with CLABSI**
 - **A 20% reduction in hospital deaths with an average length of stay in the ICU of 3.4 days**

Rates in MICU and NICU were also publicly reported to the State of CO per new reporting law. The SICU was exempt in 2010 from reporting given its trauma designation, but will be required to report in 2011.

It was also our goal to validate a more efficient surveillance system for CLABSI that would allow us to broaden our surveillance activities outside the ICU. Through the hiring of Bryan Knepper, this was accomplished in 2010 and we now monitor all CLABSI housewide. It is notable that **none of the Acute Care CLABSI events occurred in patients whose lines were placed by the Hospital Medicine procedure service.**

Avoiding unnecessary central lines was also a goal for 2010. Evaluation of our central line use **revealed lower utilization of central lines in our ICUs compared to comparable units (top 10-25%) reporting nationally through NHSN**, which may in part explain low rates of CLABSI in these units as well. Further opportunity for improvement to reduce unnecessary central lines are greatest in PCU and medicine/surgery general inpatient wards. Findings are described in table below.

Central Line Utilization Ratio*

	2008	2009	2010	2010 NHSN percentile
MICU	0.54	0.47	0.47	10%-25%
SICU	0.62	0.57	0.51	10%-25%
PCU	0.28	0.26	0.20	50%-75%
PICU	0.40	0.20	0.18	10%
MED/SURG	0.15	0.14	0.12	50%-75%

* line days/ patient days

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In 2010, an initiative began to utilize our Lifelink electronic documentation system to require daily alerts that would require documenting an appropriate indication for all central venous catheters. Those lines without an indication would be removed by a physician or qualified staff. This initiative that began in 2010 will continue into 2011 as we further refine it to incorporate into electronic workflow.

Ventilator-associated Pneumonia: Rates in the MICU, SICU, and PCU were monitored and benchmarked against national mean rates for comparable units. Note that benchmarking against national rates for VAP is problematic given lack of easily standardized definitions for VAP. As a more important indicator of quality, **benchmarking against our own historical data showed improved VAP rates for the 5th consecutive year, achieving our lowest VAP rates to date. All units benchmarked below mean rates of comparable units reporting to NHSN.**

Denver Health VAP rates over the last 4 years, and the corresponding National Healthcare Surveillance Network (NHSN) percentile, are shown below:

VAP per 1000 ventilator days

	2007	2008	2009	2010	NHSN percentile for 2010
MICU	2.0	2.5	2.1	1.34	25%- 50%
SICU	9.9	7.4	3.4	3.02	25%- 50%
PCU	---	---	2.1	0.0	25%- 50%

All units benchmarked better than pooled mean, and in the top 25th-50th percentile of NHSN. Interventions championed by the Infection Prevention, Patient Safety and Quality, HIPPI champions, unit directors, and most importantly-front line staff- included:

- Chlorhexidine addition to Intubation Trays: Working with Clinical Value Manager to add chlorhexidine to intubation trays (HIPPIs indicated that RT inconsistently performs initial oral care with chlorhexidine upon intubation due to chlorhexidine not included in tray kits).
- Real time HIPPI audits for compliance with evidence based prevention measure were performed throughout 2010. By Nov and Dec 2010, the following compliance rates were achieved:
 - **Ventilator weaning: 83% compliant**
 - **Sedation vacation: 95% compliant**
 - **Oral care: 100% compliant**
 - **Aspiration precautions: 97% compliant**
 - **Clean yankauer: 100% compliant**
- HIPPIs provided “teachable moments” education to colleagues when opportunities for improvement were identified
- Provided VAP Prevention web-based modules to nursing staff on units (MICU, SICU, and PCU)

Catheter-Related Urinary Tract Infections (CAUTI). Surveillance for CAUTI in the adult ICUs continued in 2010. Although this is a low morbidity/mortality infection, it is a priority for infection prevention because a) CAUTI tends to be caused by more antibiotic resistant pathogens and their control is impacted by efforts toward reducing CAUTI and b) non-reimbursement by CMS for CAUTI.

Rates of CAUTI increased in the MICU from 2009 to 2010 and decreased in the SICU. **Both critical care units were substantially lower than the national mean for CAUTI rates (top 25-50th percentile) in 2010.**

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Denver Health CAUTI rates over the last 3 years, and the corresponding National Healthcare Surveillance Network (NHSN) percentile, is shown below.

CAUTI per 1000 catheter days

	2007	2008	2009	2010	2010 NHSN percentile
MICU	--	3.5	1.7	2.7	25-50%
SICU	--	3.9	3.2	2.8	25-50%

In 2010, Cathy Vigil, with the front line staff from the Medicine and Nursing services, spearheaded a CAUTI Workflow initiative in conjunction with eHealth Services. The purpose of this workflow was to continue initiatives set forth in 2009 from the "Get the Catheters Out" campaign and define opportunities to decrease the risk of CAUTI through addressing unnecessary catheter use. Evaluation of our urinary catheter use practices revealed opportunity for improvement, particularly in surgical intensive and progressive care units, as described in table below.

Urinary Catheter Utilization Ratio*

	2008	2009	2010	2010 NHSN percentile
MICU	0.74	0.77	0.64	10%-25%
SICU	0.94	1.0	0.96	75%-90%
PCU	0.71	0.67	0.58	90%
PICU	0.36	0.21	0.20	25%-50%
MED/SURG	0.18	0.15	0.14	10% -25%

* catheter days/ patient days

After initial pilot data revealed decreased urinary catheter utilization on intervention wards, the nursing driven protocols to remove unnecessary catheters was programmed into Lifelink throughout the inpatient setting in early 2011.

2010 Goal #3. Decrease surgical site infection (SSI) rates.

Denver Health SSI rates over the last 3 years, and the comparison to NHSN pooled mean rates for a risk category of 2, is shown in the table below:

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SSI per 100 Operations

	2007	2008	2009	2010	2010 NHSN comparison
Knee Arthroplasty	2.9	0.0	1.3	2.1	50 th -75 th %ile of risk index 2,3 procedures
Hip Arthroplasty	4.0	4.1	1.3	1.2	25 th -50 th %ile of risk index 2,3 procedures
Abdominal Hysterectomies	10.0	10.3	8.8	3.8	50 th %ile of risk index 2,3 procedures
Vaginal Hysterectomies	--	--	0.0	1.8	75 th %ile of risk index 1,2,3 procedures
Craniotomies	5.6	6.5	3.2	3.1	Below pooled mean for risk index 2,3 procedures
Thoraco/Lumbar Spinal Fusions	--	7.6	4.5	5.3	50 th -75 th %ile of risk index 2,3 procedures
Bariatric Surgeries	13.6	13.9	13.3	4.5	25 th -50 th %ile gastric for risk index 2,3
Herniorraphies		2.3	2.2	1.0	50 th %ile of risk index 1 inpatient procedures

Because of our vertically integrated system, we have the advantage of doing thorough post-discharge infection surveillance that most hospitals are unable to do. The ability to do thorough surveillance may make rates appear higher than other hospitals reporting to NHSN.

Despite the better SSI capture, our institution fared at or better than pooled mean rates for medium to high-risk patient populations in 5 of 8 procedures. A better measure of progress may be comparison to our own historical rates. **With all monitored procedures taken together, our overall SSI rate improved in 2010 for 5 of our 8 measures, with dramatic improvements in hysterectomy, bariatric, and hernia surgeries.** Rates increased modestly in vaginal hysterectomies, knee arthroplasties, and thoraco/lumbar spinal fusions. These will remain priorities in 2011.

General interventions to decrease rates of infection included avoidance of hypothermia; perioperative glucose control; appropriate perioperative antibiotics; avoidance of shaving; cutaneous antisepsis; wound care education, outpatient followup, environmental services best practices, decreased OR traffic (especially between clean and contaminated cases). Perioperative antibiotic compliance continued to be monitored by CMS chart abstractors and reported quarterly to the infection prevention committee. Infection Prevention supplemented this monitoring on all SSI cases.

Based on literature published in 2010, the Infection Control committee endorsed the universal use of a chlorhexidine based skin preparation as first line for patient skin prep.

In addition, Infection Prevention developed and, through Patient Safety and Quality, implemented online educational materials for all surgery and OR staff in the prevention of Surgical Site Infection.

Other procedure-specific interventions:

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Prosthetic knee and hip replacements. These rates are publicly reported to the State of Colorado. Knee arthroplasties increased in 2010 while hip arthroplasties rates decreased. Use of chlorhexidine for cutaneous antisepsis, *Staphylococcus aureus* nasal decolonization, and pre-operative patient optimization was again emphasized in 2010. Pre-operative patient optimization involves working with the surgeons and primary care providers to make sure patients have their, e.g., diabetes, among other chronic conditions, well controlled prior to elective surgery. Patient education materials and preoperative “packets” were created to increase compliance with these protocols. Automating this process was a focus of a “mini-RIE” in 2010.

Abdominal hysterectomies. These rates are publicly reported to the State of Colorado. In 2010 multiple interventions were initiated that dramatically and significantly decreased rates of SSI in comparison to 2009. A case control study initiated by Marie Fornof and then completed in further detail by Heather Young, MD and Norma Stiglitch, MD revealed opportunities for improvement. Specifically, perioperative antibiotic choice of a 2nd generation cephalosporin, rather than 1st generation, was associated with lower rates of infection. Blood transfusion practices was also associated with infection. By universally implementing broader spectrum perioperative antibiotic and limiting blood transfusions, rates dropped to zero in 3rd and 4th quarters of 2010.

Vaginal hysterectomies. This is a low risk procedure of which rates are publicly reported to the State of Colorado. In 2010, we had one (1) SSI case related to this procedure.

Craniotomies. Aggressive interventions to prevent craniotomy infections continued in 2010, including enhanced wound cleaning on post operative patients; earlier patient follow-up after discharge; increased patient education re: wound care; and evaluation of OR environment and engineering controls. The craniotomy infection rate for 2010 did not significantly decrease in comparison to 2009. The rate for this procedure however, was lower than the NHSN Pooled Mean Rates for medium-high risk patients.

Bariatric Surgeries. There are no national benchmarks for bariatric surgery. Interventions based on findings from our case control study in 2009 continued in 2010, including weight based dosing of ampicillin-sulbactam for perioperative prophylaxis. Other procedure based interventions were made in surgery dept (e.g., type of approach). An impressive and significant 66% rate decrease was observed in 2010, which is below pooled mean for gastric surgeries overall.

Spinal fusions (lumbothoracic) A modest rate increase was observed in 2010 and remained slightly above pooled mean rates. Neurosurgical procedures will be a focus for intervention in 2011.

Herniorrhaphies. Because of new state reporting requirements, surveillance for herniorrhaphy surgical site infection (SSI) continued in 2010. SSI rates are below NHSN mean and decreased in 2010 in comparison to 2009.

2010 Goal #4. Education of patients, families, and staff.

The isolation and transmission based precautions policy (P-4.14) was revised and posted in December 2010. This policy was revised to incorporate enhanced information and clarification on multi-drug resistant organisms (MDROs) and outline the procedures for visitors to follow when visiting patients in isolation.

In addition, a new Inpatient Visitor Practice (PR-4.01) administrative procedure was developed in coordination with the Department of Nursing to extend transmission-based precautions to visitors. Visitors are now required to comply with the use of personal protective equipment specific to the type of isolation to prevent the transmission of organisms of epidemiological significance.

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Other specific educational efforts to assist staff and visitors' understanding of our policies is provided below:

- Revised Isolation signs in both English and Spanish with specific precaution steps applied to both staff and visitors visiting patients in isolation.
- Revised the Infection Prevention Annual Training Module to include updated CDC guidance on transmission-based precautions
- Extensive education of inpatient nursing staff and departments that care for patients especially in the area of multidrug resistant organisms and new visitor policy requiring visitors to wear personal protective equipment when visiting patients in isolation.
- Addition of new policy requirements in new employee, new nurse, and new physician orientation
- In-services in other ancillary departments tailored to their settings, primarily rehabilitation services and radiology.
- Patient and family educational materials were created for *Clostridium difficile*, MRSA, VRE, KPC, MDR-Aci, MDR-Pseudomonas, and ESBLs.
- Educational posters were developed for DH employees working in clinical areas summarizing the content outlined in the isolation and transmission-based precautions policy:
 - Transmission-based Precautions At-a-Glance Poster
 - MDRO Definitions Poster
 - MDRO Basics Poster
- Discussions at Nursing Council, Nurse Educator, and Charge Nurse Meetings
- Monthly presentations at Safety Representative Meetings.
- Rounds at least 3x/week on the nursing units and clinics with education of managers and staff as needed.
- Attend staff meetings as requested by managers and supervisors.
- Revised new employee and web based education materials to keep current with current evidence based recommendations.
- "Meet the Pathogens" tip sheet every-other month for 6 throughout the year.

Measurements of success have included evaluation of nursing understanding on infection prevention rounds; JCAHO tracers; and feedback from infectious diseases attendings.

An on call schedule available on the PULSE to advertise the availability of the IP nurses and/or Hospital Epidemiologist for 24/7 coverage to answer questions and address concerns related to Infection Prevention.

2010 Goal #5. Ensure compliance with Sterilization and Disinfection protocols.

In December 2009, a task force was assembled due to a warning from the FDA about the Steris System 1 sterilizers used in OR, Urology clinic, and Women's services. The reason for the warning was not due to any reported safety issues; rather, the device is no longer considered "approved" by the FDA due to multiple system modifications over the years. The warning outlined the need to transition to alternative systems for the Steris I within 18 months of the alert. By November 2010, Denver Health was able to transition away from the Steris System 1 and has received two new Evotech scope washers, one Amsco V-PRO 1 Plus Low Temperature Sterilization System, and one Sterrad sterilizer. Training on the new equipment is in process.

The SPD policies have been updated with Infection Prevention input to comply with standards by AORN and AAMI.

Infection Prevention actively participated in the search for a new manager of Sterile Processing (SPD) who was ultimately hired in December 2010.

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Rounds were performed in SPD by Infection Prevention at least quarterly. Deficiencies noted on these rounds were able to be addressed promptly, including better processes to identify and discard expired Steris and Cidex test strips, and testing strips with a fully potent and a “below” potency solution to validate the integrity of the strips.

We also addressed a deficiency brought to our attention by our Urology service involving decontamination processes after cystoscopy. A comprehensive review of electronic chart data by Dr. Allison Sabel identified no adverse outcomes as a result of the decontamination concerns. SPD took over the processing of these instruments and will continue to ensure compliance with appropriate protocols

PSN alert also notified us to a problem in processing of other luminal instruments in the OR. Systems were put in place to ensure immediate enzyming of luminal instruments after use; brushing of luminal instruments during decontamination; blowing air through the lumen before sterilization, and passing a sterile brush through the lumen of sterilized instrument immediately prior to use to ensure no retained bioburden.

2010 Goal #6. Prevent construction-related infection risk.

Several major projects were completed in 2010, including the ED/DECC remodeling; remodeling of the 5th floor Adolescent Psych and Med-Surg unit. . Infection Prevention was involved in all areas of projects from preplanning design meetings through project completion.

Rounds were made by the infection prevention nurses routinely. Frequency was based on the risk as determined by the Infection Control Risk Analysis (ICRA). Both planned and surprise visits were conducted. **Routine rounds, both announced and unannounced, showed good adherence to Infection Prevention requirements.**

Using the redesigned ICRA form and the methods of procedures document (MOP), in conjunction with both bond and CIP project directors in 2009, breeches in infection control standards were mitigated in construction projects during 2010. The IT department was extensively educated on the ICRA processes, and monitoring of these processes have shown good compliance. Contractors also were in-serviced to emphasize requirements by DH of complying with infection prevention policies, including continuous monitoring of negative airflow in construction areas; ensuring intact barriers; and frequently changing tacky mats.

Air monitoring studies of aspergillus spore counts were conducted by an outside contractor and reviewed each month by the Infection Prevention Committee (IPC). Rates of aspergillus isolated in clinical cultures also were reviewed each month by IPC. No breaches were noted from these surveillance data.

2010 Goal #7. Decrease healthcare transmission and/or emergence of multidrug resistant organisms (MDRO) and other organisms of significance in the hospital

Our goal was to minimize hospital-associated spread of MDROs and other organisms identified as significant at DH. These were tracked daily (Monday -Friday) and reported monthly at IP Committee. Denver Health rates over the last 4 years are shown in the table below:

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Rates of MDROs and other organisms of significance per 1000 patient days

	2007	2008	2009	2010
Aspergillus	0.11	0.14	0.05	0.08
<i>Acinetobacter baumannii</i>	0.43	0.47	0.23	0.13
Carbapenem Resistant <i>Pseudomonas aeruginosa</i>	--	0.2	0.15	0.10
Klebsiella producing carbapenemases (KPCs)	--	---	0.02	0.01
Extended spectrum beta lactamases (ESBLs)	--	--	0.33	0.41
Methicillin-resistant <i>Staphylococcus aureus</i> (MRSA)	--	1.07	0.80	0.10**
Vancomycin-resistant enterococci (VRE)	0.36	0.29	0.50	0.44
<i>Clostridium difficile</i>	0.91	0.81	1.00*	0.82
Influenza		0.13	1.40	0.13

*New, more sensitive C diff testing methods implemented in 2009

** Surveillance definitions revised to include only healthcare associated MRSA

Extensive educational efforts were made as well to increase staff's awareness and understanding of MDROs. This was facilitated through enhancing the IP Annual Training module to include additional education on MDROs and placement of new MDRO educational posters.

Aspergillus. Although not an MDRO, this organism is of interest due to frequent construction activities at DH. All isolates reported from clinical lab are recorded to alert infection control of potential breaches in construction early, as increase in isolation rates could be indicative of such a breach. **This monitor provides evidence of excellent containment in our construction activities.**

Acinetobacter. **In 2010, the resistant version of *Acinetobacter baumannii*, prevalent in past years and at many trauma centers, was essentially eliminated from our institution.** This is credited to antibiotic stewardship and heightened infection control efforts in our SICU and OR (limited pulsatile lavage on colonized patients, empiric isolation, decreased fluoroquinolone usage).

Methicillin-resistant *Staphylococcus aureus* (MRSA)- ASC continued in both the MICU and SICU on admission and weekly as in the past several years. Charts continue to be identified with an "XX" to allow identification of colonized patients on readmission or in the clinic setting. **Routine monitoring showed that the healthcare associated transmission is low relative to colonization/infection burden.** It is notable that most of the MRSA seen at DH comes into our institution from the community and outpatient rates now exceed what we see in the inpatient setting.

Vancomycin-resistant enterococci (VRE). Rates decreased in 2010 in comparison to 2009 data. The medical record continues to identify these patients with a "VV" to allow for appropriate precautions. **This, along with antibiotic stewardship and enhanced surveillance and prompt identification of potential clusters of cases (in near real-time) are credited for the low rate of VRE at our institution.**

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Clostridium difficile. Nationally, rates of *C. difficile* have tripled in US hospitals since 2000, and in 2007, DH began to see an increase associated with an increase in severity. Our rates remain lower however, than those reported in the literature from other acute care hospitals and compared to other facilities in Colorado (based on surveillance data from CDPHE). Despite concerning trends elsewhere, ***C. difficile* rates decreased at DH in 2010 compared to 2009**. This is especially remarkable in light of new testing procedures introduced in 2009 that is more sensitive in detecting *C. difficile*. Enhanced precautions--including isolation of a patient admitted with diarrhea unless an alternative cause is found; use of bleach and glo-germ monitoring to terminally clean all *C. difficile* inpatient rooms and equipment; hand hygiene with soap and water for *C. difficile* positive patients; and aggressive antimicrobial stewardship -- have led to a stabilization in the overall number of cases seen at DH.

Influenza. 2010 influenza data encompasses the end of the 2009-2010 influenza season and the beginning of the 2010-2011 influenza season. No incidence of hospital transmission of influenza was identified in 2010. During 2010, 14 patients were hospitalized with influenza, mostly on adult Medicine wards. This is lower than previous calendar years because of the early onset of the H1N1 pandemic during the 2009-10 season that was nearly resolved by 2010). The 2010-11 season has been more typical in its timing and has been a severe season in terms of hospitalizations versus previous years (excluding the H1N1 pandemic), and influenza hospitalization did not occur regularly until December 2010.

Antibiogram

In collaboration with our Antibiotic Stewardship Program and Microbiology, an institution-wide antibiogram for 2010 was created to assist providers in choosing appropriate empiric therapy. The Antibiogram is posted on the Antibiotic Stewardship subsite of the PULSE. Unit/Service specific antibiograms are being created for the MICU, SICU, and Pediatrics. See also the Antimicrobial Stewardship Program Annual Report.

Gram-positive organisms

When outpatient urine isolates are excluded, *Staphylococcus aureus* remained the most common cause of serious infection at Denver Health. In 2010, we observed a significant decrease in the proportion of *S. aureus* isolates resistant to methicillin compared with 2009 (40.5% vs. 45.1%, $p=0.02$). In addition, we observed a non-significant decrease in the proportion enterococcal isolates resistant to vancomycin (VRE) (20% vs. 25%, $p = 0.21$).

Gram-negative organisms

The results of the 2010 antibiogram reveal some encouraging trends in susceptibility of important gram-negative organisms. First, the susceptibility profile of *Pseudomonas aeruginosa* has improved over the last 5 years, likely a result of aggressive Infection Prevention efforts to prevent hospital transmission of these organisms and antibiotic stewardship efforts to decrease the selective pressure for the development of resistance. As examples, in 2010, 82% of *P. aeruginosa* isolates were susceptible to cefepime compared with a nadir of 72% in the previous 5 years; 85% of isolates were susceptible to imipenem compared with a nadir of 73%; and 76% of isolates were susceptible to levofloxacin compared with a nadir of 64%. Another encouraging trend was observed with *Escherichia coli*. Over the previous 5 years, *E.coli* susceptibility to levofloxacin had been stable, albeit suboptimal, at 76 – 77%. In 2010, 81% of isolates were now susceptible to levofloxacin.

2010 Goal #8. Collaboration with Center for Occupational Health & Safety to decrease occupational infection related hazards

Please see the COSH Annual Report (Department of Medicine).

Infection Prevention supported COSH efforts to decrease exposure incidents by providing a venue for reporting of exposure data at Infection Prevention Committee meetings. During these discussions, input from experts and front line staff was gathered on how to formalize interventions and better prevent these exposures.

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In 2010, Infection Preventionists continued to serve on the products committee for the evaluation of new devices that could enhance exposure prevention to employees.

Infection Prevention also provides education at new employee orientation and annual competency training on reporting of bloodborne pathogen exposures. We have begun working with COSH and the OUCH line to make policies and procedures for exposures more easily accessible via a specific Sharepoint site. The BBPE manual is also easily accessible via an icon on all DH desktops.

In addition, with a goal of increasing influenza vaccination compliance among our direct care providers, Infection Prevention worked with COSH and formed a task force of administration, COSH, IP, Education, and Nursing. They started meeting in June 2010 to plan the annual campaign. Mandatory vaccination was discussed at length for the 2010-11 season but, given the large presence of medical trainees at our institution, deferred until other academic centers joined efforts to ensure consistency across the organizations. In the design of this season's campaign, feedback from the 2009-10 influenza vaccination campaign were reviewed. Based on these results, more dates and times for employee influenza vaccination were added to help decrease the waiting that had been a complaint during the prior season. The campaign also increased accessibility to vaccination by providing vaccine on individual units and upon entry to the parking garage. Infection Prevention also provided staff support for vaccinations. As a result of these efforts, **2010 was a record year for employee influenza vaccination**, with an overall rate of vaccine compliance of 65% among direct care providers.

Percent of DHHA Direct Care Providers Receiving Flu Shots by Job Class

Advanced Care Professional	Clinical Professional Technician	Dentists and Dental Residents	Manager Physicians	Staff Physicians	Registered Nurses	Intermittent Registered Nurses	Emergency Medicine Residents
73%	61%	50%	92%	80%	65%	41%	49%

In addition, more accurate capture of employee vaccination was obtained through the efforts of Melinda Marcotte in COSH. A survey was sent to employees who did not have a record of vaccination through Denver Health to capture reasons for lack of a record of vaccine, including vaccination elsewhere. Those who did not get vaccinated at all were asked reasons for their declination to help inform future campaigns.

2010 Goal #9. Hire and orient of a database manager in 2010.

In response to the increase of both mandated reporting and of infection prevention database needs, Bryan Knepper was hired in June 2010 to accomplish a number of database needs. His progress in a short time is noteworthy for the following enhancements to our programs, allowing for our improved efficiency:

- Reformatting of the MRSA data base from several Excel databases into a single Access database. This has resulted in improved accuracy by direct input of data from laboratory systems and database expansion within a

single Access database. This has also provided more meaningful tracking of healthcare vs community associated MRSA

- Freeing the Infection Preventionists from data entry tasks. For example, by creating an automatic download of lab data for MDROs, there are now fewer data entry requirements by Infection Preventionists.
- State mandated NHSN data entry also is now taken on by the database manager, freeing the IP up to spend more time on interventions.
- Posting data for all stakeholders in a cleaner and clearer format on our Infection Prevention subite
- Expansion of data capture by semi automating CLABSI surveillance, allowing us to for the first time capture CLABSI data from the general wards.

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2010 Goal #10. Improve behavioral health services knowledge of and compliance with infection prevention measures

Behavioral health services are provided with in-service education both formally and on a consultative basis. A specific Behavioral Health risk assessment was also performed in 2010, and incorporated into our overall program goals

One of the priority areas noted in the risk assessment for Behavioral Health in 2010 was hand hygiene. Because of the unique mental health issues with this population, waterless hand sanitizers can not be of mounted in behavioral health areas. As a result, staff have been provided their own personal waterless hand sanitizer. They have also been trained to perform monitoring of hand hygiene compliance and submit reports to Infection Prevention each quarter. These data are compared to observational data obtained from Cathy Vigil's surveillance audits. Compliance data is fed back to the front line staff in efforts to drive further improvement. Most recent audit showed 100% compliance with hand hygiene.

Other vulnerabilities on this ward's risk assessment was transmission based precautions for diarrhea. Many patients in this population experience diarrhea due to substance abuse problems, but these settings are also prone to outbreaks of norovirus and other enteric pathogens. We have encouraged staff to utilize expertise of Infectious Diseases and Hospital Medicine consultative services to help distinguish between potentially infectious and non-infectious etiologies. In addition, focused education on transmission-based precautions, particularly use of contact isolation, has been emphasized in this patient care area. Unique issues for group therapy also have been specifically addressed.

C. RISK ASSESSMENT FOR INFECTION PREVENTION IN 2011

Input toward a formal risk assessment for acute care areas was solicited in January 2011 from members of the Infection Prevention Committee, Acute and Critical Care Unit managers, and nurse educators.

The risk assessment was completed by Dr. Connie Price with this input. The risk assessment includes all standard practices listed in the Joint Commission Compendium that was published in October of 2008, including: Prevention of Central-line Bloodstream Infections (CLAB), Prevention of Ventilator Associated Pneumonia (VAP), Prevention of Catheter – Related Urinary Tract Infections (CAUTI), Prevention of Surgical Site Infection (SSI), Prevention of *Clostridium difficile* Transmission (CDI) and Prevention of *Methicillin-Resistant Staph Aureus* (MRSA) Transmission.

Given past efforts and focus on previous risk assessments, most of the results showed prevention measures to be fully implemented. The summary of measures below showed the following being less than fully implemented:

1. Checklist for central line insertion is done as the procedure is started and occurs and is not filled out after procedure is completed- CLAB

2. Healthcare personnel involved in the insertion, care & maintenance of urinary catheters are educated about CAUTI prevention- CAUTI.
3. Urinary catheters are removed as soon as no longer needed- CAUTI
4. Urinary catheters are inserted only when necessary for patient care-CAUTI
5. Equipment is dedicated whenever possible- CDI
6. Surgeons and perioperative personnel are educated about SSI prevention.-SSI
7. Patients and their families are educated about SSI prevention-SSI

A specific Behavioral Health risk assessment was also performed in 2010, and incorporated into our overall program goals. Priority areas identified included transmission based precautions for diarrhea and unique issues for group therapy settings. Although hand hygiene improved dramatically, continued emphasis was noted as a priority to sustain gains.

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D. GOALS FOR THE 2011 INFECTION PREVENTION PROGRAM

Based on the review of both the assessment of the 2010 Infection Prevention Plan and the Risk Assessments outlined above, the following goals have been chosen for the 2011 Infection Prevention Plan:

1. Improve hand hygiene compliance.

The new model of hand hygiene prevention from the Joint Commission no longer requires a goal of 100% but speaks more to the plan of process improvement. Having achieved the organizational goal of 85% compliance, the hand hygiene goal for 2011 has been raised to 90%. To that end, the 2011 goals for continued improvement to meet and exceed that goal include the following strategies:

1. Continued focus education using new employee orientation, new physician education, nursing orientation and annual required competency training.
2. Implement a new Hand Hygiene Campaign using LEAN tools
3. Work with volunteer coordinator and other managers to get more individuals to perform observations.
4. Continued use of reporting icon on the Pulse to report violations.
5. Focus on areas with results under 90% and perform a walk through of all areas with goal non-compliance to identify the following:
 - i. Opportunities for better location of hand hygiene products
 - ii. Barriers identified by the manager, educator, and IP for increasing staff compliance
 - iii. The manager, educator and IP will design a methodology for the area that the manager and educator will implement with consultation from the IP as requested.

2. Decrease the rate of device related infections

Central venous catheters, endotracheal tubes, and urinary catheters pose increased risk for healthcare associated infections. The following interventions will be continued or implemented to decrease risk for infection from these devices in 2011:

- a) Continue the Healthcare Infection Prevention Performance Improvement (HIPPI) champion program to help accomplish change at a peer level in the SICU, MICU, & PCU.
- b) Expand the HIPPI program to acute care inpatient areas, including dialysis, to assist in auditing and monitoring of CLABSI-prevention best-practices.
- c) Implement strategies to ensure the checklist for central line insertion is done as the procedure is started and occurs in real time and is not filled out after procedure is completed. We will explore use of electronic technologies (e.g. use of an Ipad touch) similar to what is used for monitoring hand hygiene compliance to help monitor progress

- d) Continue online training with post test for all medical staff (including housestaff) who perform central line insertions, intubations, and ventilator care.
- e) Audit processes for CLABSI & VAP during each quarter by IP and/or HIPPI champions. Take action as needed based on the audits.
- f) Develop and implement a Central Line workflow in LifeLink to target provider evaluation of daily necessity for central line.
- g) Continue implementation in acute care, the CAUTI workflow in LifeLink to target removal of unnecessary urinary catheters on general medicine wards.
- h) Continue validation work aimed at more efficiently conduct CLABSI surveillance.
- i) Targeted education around CAUTI prevention to healthcare personnel involved in the insertion, care & maintenance of urinary catheters.

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- j) Implement strategies to ensure that urinary catheters are inserted only when necessary for patient care. This may be done by placing a list of indications on all urinary catheter kits.

3. Decrease surgical site infection (SSI) rates.

The following surgeries will be targeted for SSI surveillance in 2011:

- a) Prosthetic knee and hip replacements
- b) Abdominal and vaginal hysterectomies
- c) Craniotomies
- d) Thoraco/lumbar fusions
- e) Bariatric surgeries
- f) Herniorraphies
- g) Colon resection (new)

Arthroplasty, vaginal and abdominal hysterectomies, and herniorraphies are publicly reported through CDPHE.

It is also our goal to validate a more efficient surveillance system for SSI that will allow us to broaden our surveillance activities in this regard. As above surgeries are semi-automated, additional surgeries will be surveilled based on Infection Prevention Committee input.

Beginning in 2011, a formal surgical site infection report will be provided to individual surgeons to submit for their Ongoing Physician Performance Evaluations (OPPE). This will fulfill a JC requirement as well as provide important feedback to surgeons about their infection data. In addition to review of each SSI by the Infection Prevention Committee each quarter, each infected case will be reviewed by the attending surgeon for accuracy and for opportunities for improvement. The report will be comprised of two pieces: a line list of relevant surgical procedures attributed to the surgeon, and the Standardized Infection Ratio (SIR) report. The SIR is a metric generated within the National Healthcare Safety Network (NHSN). It uses important risk factors in historical data to calculate the expected number of surgical site infections given a surgeon's caseload, and subsequently compares this number statistically with the actual number of infections observed. Focused Physician Performance Evaluations (FPPE) will ensure when statistically significant outliers are identified or at Director's or CMO discretion. Surgeon OPPE reports will be generated biannually. Because data from multiple sources are required to create these reports (including SSI surveillance data, medical charts, microbiology data, and data warehouse data) it is anticipated that refinement and streamlining the processes for collecting, organizing and securing these data will be explored during 2011.

A clinical care guideline for the prevention of SSI, proposed by the Infection Prevention Committee in 2010, will be formally endorsed by the Patient Safety and Quality Committee and distributed

An annual SSI web-based training module , also developed in 2010, will be assigned in 2011 to direct care providers working in surgical services

Continued interventions to decrease rates of infection will include continued pre-operative optimization of elective surgery patients; avoidance of hypothermia; perioperative glucose control; appropriate perioperative antibiotics; avoidance of shaving; cutaneous antisepsis; wound care education, outpatient follow-up, environmental services best practices, decreased OR traffic (especially between clean and contaminated cases), among other interventions. We also hope to develop a more formal relationship with the OR to have a more continuous presence of IP personnel or designated staff to monitor compliance with infection prevention measures.

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Special focus will be on improving rates of SSI in neurosurgical procedures. Interventions under consideration include those implemented to improve arthroplasty SSI rates, including preoperative CHG baths and nasal decolonization with mupirocin. The OR environment will also be assessed and use of Stryker suits will be considered.

Perioperative antibiotic compliance will continue to be monitored by CMS chart abstractors and reported quarterly to the infection prevention committee. As needed, Infection Prevention will supplement this monitoring

Enhanced patient and family education on prevention of surgical site infections will be addressed in 2011

Routine rounds in Sterile Processing will be continued at least quarterly. Infection Prevention will provide consultation to assure the processes in place are both evidence-based and meet current regulatory requirements. Standing quarterly reports to the Infection Prevention Committee from SPD representatives on these process measures has been implemented in 2011.

4. Decrease healthcare transmission of multi-drug resistant organisms (MDRO)/ ensure containment of organisms of significance

Daily surveillance of the following MDROs/organisms of significance will continue in 2011:

- a. Aspergillus
- b. Multi-drug Resistant *Acinetobacter baumannii* and
- c. Multi-drug Resistant *Pseudomonas aeruginosa*
- d. Klebsiella producing carbapenemases (KPCs)
- e. Extended spectrum beta lactamases (ESBLs)
- f. Methicillin-resistant *Staphylococcus aureus* (MRSA)
- g. Continued active surveillance culturing both on admission and weekly in the MICU & SICU; as needed in other areas including NICU
- h. Vancomycin-resistant enterococci (VRE)
- i. *Clostridium difficile*

Daily monitoring of the labs of significance will be modified to reflect above organisms of concern. These reports will be generated electronically to minimize paper waste and improve efficiency for tracking. We will continue to identify clusters of infection for appropriate isolation and any clusters that may indicate an outbreak situation.

We also will continue efforts to increase compliance and understanding of transmission-based precautions through the following methods:

- Education of patient transporters, inpatient nursing staff and departments that care for patients especially in the area of contact precautions
- Education at nursing and at new physician orientation
- Consultation with other clinical departments to provide in-services to their employees and to aid them in establishing educational programs as part of the department education for new employees
- Quarterly audits and feedback of compliance with isolation precautions will be conducted by the Infection Prevention program.
- Education of patients regarding their MDROs using patient information sheets
- Education of visitors regarding standard and transmission-based precautions, especially when visiting patients in isolation.

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Infection prevention will continue to work with the inpatient dialysis unit on 7A to develop improved processes for contact isolation. Infection prevention will collaborate with Fresenius, engineering, construction, and environmental services to develop a modified contact isolation process for continuation of dialysis machine care separate from direct patient contact, in which current contact isolation processes will be applied and maintained.

5. Decrease risk of healthcare associated infections related to construction and ensure that design of new or remodeled facilities optimizes infection prevention

The infection prevention personnel will continue to attend meetings starting with predesign and preconstruction. One of them will attend a weekly meeting where all ongoing projects are discussed. Routine walk-throughs will be done in all construction areas. Infection Control Risk Assessments (ICRAs) will be done prior to the start of any construction and the contractors are in-serviced about the infection prevention concerns related to hospital construction. The project superintendent or their designees will be responsible for seeing that all workers are in-serviced in appropriate infection prevention techniques prior to the start of their work at DH.

Special attention will be given to the largest project of 2011-- Pavilion M.. The new facility will include 4 ambulatory surgery operating suites, 2 gastroenterology suites, and adolescent psychiatry (inpatient and outpatient). An outpatient dialysis unit that will be leased to a commercial dialysis company will also be located in Pavilion M.

6. Collaboration with Center for Occupational Safety & Health (COSH) to decrease occupational infection related hazards.

Infection Prevention will continue to work closely with COSH in 2011 to decrease occupational infection related hazards through the following processes:

- a) Review bloodborne pathogen data at IPC at least annually taking action as indicated
- b) Formalize an intervention to reduce exposures in 2011
- c) Review 2010 employee influenza vaccination data and help with 2011 plan to increase percentage of employees receiving the vaccine. Reconsider implementing a mandatory influenza vaccination policy
- d) Education at new employee orientation and annual competency training about reporting of bloodborne pathogen exposures
- e) Collaboration following potential exposure of employees to an infectious illness

- f) Make policies and procedures for non-bloodborne exposures more easily accessible; educate staff on appropriate processes for exposures

In addition, Infection Prevention and COSH will work with legal and administration to better define processes for evaluating ill, potentially communicable, employees who acquire their illness outside of the work environment.

7. Increase employee Influenza vaccination rates.

In preparation for the 2011-2012 influenza season, we again will pursue a mandatory “vax or mask” strategy . This strategy would require direct care providers (physicians, nurses, technicians, allied health, dentists) to receive influenza vaccination by Dec 1 of each year or wear a mask for all patient care activities for the duration of the influenza season. This strategy was endorsed by combined votes from the Infection Prevention, Medical Immunization, and Patient Safety Committees. The proposal received Executive Staff support with the stipulation that the other academic facilities employ a consistent strategy, given the large presence of trainees rotating through our institution. At the time of this

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report, a preliminary survey of other academic centers in Denver has revealed interest in exploring. Meetings with TCH, UCH/CU, NJ, and the VA will be held in March 2011 to define a system that will be consistent across centers and will allow for tracking of housestaff who have been vaccinated between institutions. (The VA will be bound by Federal requirements but will still be included to assist in enforcing housestaff compliance.)

Additional nasal vaccine will be purchased for 2011-12 to respond to the 7% of employees who claimed fear of needles as reason for declining flu vaccination.

Our goal will be to achieve >90% vaccination rate of all direct care providers.

8. Hiring and orientation of an infection control and prevention manager in 2011.

At the time of this report, we are pleased to announce that Amber Miller, RN, MSN, CIC, has accepted our offer to become our new Manger of Infection Prevention at Denver Health. Ms Miller has been in the combined role(s) of Patient Safety and Infection Prevention Manager for Exempla since 2003. Currently at Exempla’s Lutheran Medical Center site, Ms Miller has been responsible for the development, coordination, implementation and evaluation of all activities and outcomes in the Patient Safety Program and Infection Prevention Program over the past 8 years. She has led several infection prevention collaboratives such as Transformation of the ICU, Surviving Sepsis, and more recently led the pilot project for the Joint Commission’s Center for Transforming Healthcare Hand Hygiene Collaborative utilizing Lean Six Sigma. The latter has gained her national recognition for use of LEAN in Infection Prevention. Amber is a registered nurse in the state of Colorado and certified in infection control by the Certification Board of Infection Control. She is active in the national and local chapter of the Association for Professionals in Infection Control (APIC) and serves on the Colorado Healthcare Associated Infections Advisory Committee. She also serves as lead faculty for the American Reinvestment and Recovery Act (ARRA) funded Infection Prevention training course for Colorado. Her anticipated start date will be April 11, 2011

9. Improve behavioral health services knowledge of and compliance with infection prevention measures

Behavioral health services will be provided with in-service education both formally and on a consultative basis.

Hand hygiene compliance will continue to be a focus in this setting. Staff will continue to perform monitoring of hand hygiene compliance and submit reports to Infection Prevention each quarter. These data will be periodically audited by Infection Prevention staff to ensure accuracy and consistency of surveillance.

Behavioral Health staff will again be encouraged to utilize expertise of Infectious Diseases and Hospital Medicine consultative services to help distinguish between potentially infectious and non-infectious etiologies of diarrheal illness frequently encountered in this setting. As such, focused education on transmission-based precautions, particularly use of contact isolation, will be emphasized in this patient care area. Unique issues for group therapy will again be specifically addressed and reinforced.

REPORTING OF INFECTION PREVENTION DATA

The following table displays the infection prevention reporting calendar for the 2011 year. Data will be posted on the Infection Prevention Subsite according to the schedule below:

Date		Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	
		Data and Time Period Reported	Device-Related Infections	CLAB	4thQ10		1stQ11		2ndQ11		3rdQ11			
VAP	4thQ10			1stQ11		2ndQ11		3rdQ11						
CAUTI	4thQ10			1stQ11		2ndQ11		3rdQ11						
Surgical Site Infections	AHYST		4thQ10			1stQ11		2ndQ11		3rdQ11				
	VHYST		4thQ10			1stQ11		2ndQ11		3rdQ11				
	KPRO		4thQ10			1stQ11		2ndQ11		3rdQ11				
	HPRO		4thQ10			1stQ11		2ndQ11		3rdQ11				
	CRANI		4thQ10			1stQ11		2ndQ11		3rdQ11				
	FUSION		4thQ10			1stQ11		2ndQ11		3rdQ11				
	HERNIA		4thQ10			1stQ11		2ndQ11		3rdQ11				
BARIATRICS	4thQ10			1stQ11		2ndQ11		3rdQ11						
Healthcare Associated Organism Monitors	MRSA		Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11
	VRE		Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11
	C-Diff	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	
	ACINETOBACTER	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	
	ASPERGILLUS	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	
	MDR P	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	
	AERUGINOSA	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	
	ESBL	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	
	KPC	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	
Process Indicators	HAND HYGIENE and TBP	1stQ11			2ndQ11			3rdQ11			4thQ11			
	PERIOPERATIVE ANTIBIOTICS	4thQ10		1stQ11			2ndQ11			3rdQ11				

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The Antibiotic Stewardship Program Annual Report for 2010 will be presented as follows:

- A. Description of the Denver Health Antibiotic Stewardship Program
- B. Analysis of the 2010 Antibiotic Stewardship Program at Denver Health
- C. Goals for the 2011 Antibiotic Stewardship Program at Denver Health

A. THE DENVER HEALTH ANTIBIOTIC STEWARDSHIP PROGRAM

The mission of the program is to support Denver Health in providing the highest quality and safest health care:

- a) Primary program goal: To ensure the optimal antibiotic choice, dose, and duration of therapy for each individual patient to maximize the opportunity for a favorable outcome
- b) Secondary goals:
 - i) Decrease unnecessary antibiotic use in the hospital and ambulatory care settings
 - ii) Decrease selective pressure for the development of antibiotic-resistant pathogens
 - iii) Decrease the risk of *Clostridium difficile* infection
 - iv) Decrease the risk of catheter-related bloodstream infections
 - v) Decrease the risk of adverse drug events related to antibiotics
 - vi) Decrease infection-related costs for patients and the institution
 - vii) Educate providers regarding appropriate antimicrobial prescribing

The Antibiotic Stewardship Program is comprised of the following two individuals with support from the Department of Patient Safety and Quality, the Division of Infectious Diseases, the Department of Pharmacy, and the Department of Medicine:

Timothy Jenkins, MD (Department of Medicine/Infectious Diseases) serves as the program's director since its inception in July 2008, with a 0.5 FTE effort devoted to the program. His research interests include strategies to improve overall antimicrobial utilization in the hospital and ambulatory care setting, strategies to improve antibiotic prescribing for common infections treated in the hospital, and the epidemiology, evaluation, and treatment of *Staphylococcus aureus* bloodstream infections. He is board certified by the ABIM in Internal Medicine and Infectious Diseases and is a member of the Infectious Diseases Society of America (IDSA) and the Society of Healthcare Epidemiology of America (SHEA).

Claire Swartwood, PharmD (Department of Pharmacy) serves as the program's infectious diseases-trained clinical pharmacy specialist, with a 0.8 FTE effort devoted to the program. She has worked as a pharmacist at Denver Health since 2004, initially as the Medication Use Coordinator, and more recently, the Emergency Department Pharmacist. She transitioned to her infectious diseases pharmacist position and joined the Antibiotic Stewardship Program in December 2009. She is board certified by the Board of Pharmaceutical Specialties in pharmacotherapy and is a member of Infectious Diseases Society of America (IDSA), American Society of Microbiology (ASM), Society of Critical Care Medicine (SCCM), and several other pharmacy-related organizations focusing on their sub-groups of infectious disease and critical care.

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Additional members of the committee supporting the Antibiotic Stewardship Program include:

Philip Mehler, MD
Connie Price, MD
William Burman, MD
Mike Benedict, RPH, MBA
Allison Sabel, MD, PhD, MPH
Andy Steele, MD

Research Support 2010

Grants

Title: Reducing Inappropriate Prescribing of Antibiotics by Primary Care Clinicians

Description: *Implementing strategies that will reduce antibiotic use for illnesses not requiring them and decreasing use of broad spectrum antibiotics in the primary care setting.*

Granting organization: AHRQ Primary Care Based Research Network (West)

Start date: 8/09

End date: 8/11

Total funding: \$500,000

Publications 2010

Peer-Reviewed Manuscripts

- 1) Jenkins TC, Sabel AL, Sarcone EE, Price CS, Mehler PS, Burman WJ. Skin and soft-tissue infections requiring hospitalization at an academic medical center: opportunities for antimicrobial stewardship. *Clin Infect Dis* 2010; 51(8):895-903

Competitive Abstracts

- 1) Preslaski C, Doody M, Price C, Jenkins T. Use of oseltamivir at an academic hospital: antimicrobial stewardship lessons from the H1N1 influenza pandemic. In: Final program of the 5th Decennial International Conference on Healthcare-Associated Infections 2010 (Atlanta). Arlington, VA: Society for Healthcare Epidemiology of America, 2010
- 2) Jenkins T, Cervantes L, Stella S, Keniston A, Sabel A, Price C, Burman W, Mehler P. Targets for antibiotic and institutional resource stewardship in inpatient community-acquired pneumonia. In: Final program of the 5th Decennial International Conference on Healthcare-Associated Infections 2010 (Atlanta). Arlington, VA: Society for Healthcare Epidemiology of America, 2010
- 3) Kajioka E, Bessesen M, Sabel A, Jenkins T, Price C. Risk factors and molecular analysis of *Clostridium difficile* infection in hospitalized adults. In: Final program of the 5th Decennial International Conference on Healthcare-Associated Infections 2010 (Atlanta). Arlington, VA: Society for Healthcare Epidemiology of America, 2010
- 4) Price C, Trantanella A, Sabel A, Wolken B, Jenkins T, Ogle J, Douglas I. Outcomes of patients hospitalized in Denver with 2009 influenza A (H1N1): an inner city experience. In: Final program of the 5th Decennial International Conference on Healthcare-Associated Infections 2010 (Atlanta). Arlington, VA: Society for Healthcare Epidemiology of America, 2010

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B. ANALYSIS OF THE 2010 ANTIMICROBIAL STEWARDSHIP PROGRAM AT DENVER HEALTH

Summary of 2010 Antibiotic Utilization and Cost Data

The following changes in antimicrobial utilization and costs were observed in 2010 compared with 2009 (all figures adjusted for census days):

- 7.0% reduction in overall hospital-wide antibiotic utilization
- 6.2% reduction in broad-spectrum antibiotic use (anti-pseudomonal agents)
- a \$232,774 decrease in patient-level antibiotic expenditures (acquisition costs to DH) representing a 20.9% reduction (\$290,776 before adjusting for census days)

Of importance, aggregate data from University HealthSystem Consortium (UHC) hospitals reveal that from 2002 through 2009 (2010 data not yet available), overall antimicrobial utilization has *increased*. A comparison between Denver Health and aggregate data from UHC hospitals regarding use of commonly-used antibiotics is provided below (all figures are adjusted for census days).

Carbapenems:

- Carbapenem use has consistently increased among UHC hospitals but has decreased at Denver Health.
- In 2009, Denver Health used 25% of the amount of carbapenems used at UHC hospitals

Fluroquinolones:

- Although fluoroquinolone use has been decreasing among UHC hospitals, the rate of decline has been substantially greater at Denver Health
- In 2009, Denver Health used 48% of the amount of fluoroquinolones used at UHC hospitals

Piperacillin-tazobactam:

- In 2009, Denver Health used 89% of the amount of piperacillin-tazobactam used at UHC hospitals

Vancomycin

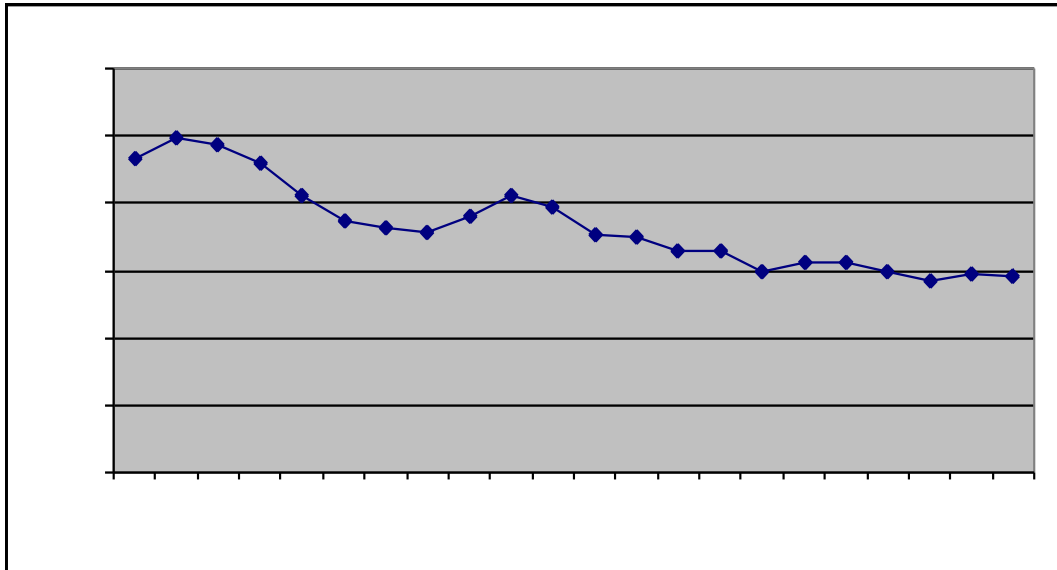
- In 2009, Denver Health used 79% of the amount of vancomycin used at UHC hospitals

Use of Broad-Spectrum Antibiotics and Antimicrobial Resistance at Denver Health

The progressive development of antimicrobial resistance is one of the major threats facing hospitals in the United States. Infection Prevention efforts to stop the spread of resistant organisms within the hospital and antibiotic stewardship efforts to decrease unnecessary antibiotic use are critical to slow or reverse trends of antimicrobial resistance. Antibiotics with a broad spectrum of antimicrobial activity are more likely to promote resistance than narrower-spectrum antibiotics. Given this, one of the major goals of the Antibiotic Stewardship Program has been to decrease unnecessary use of agents with activity against *Pseudomonas aeruginosa*. Anti-pseudomonal antibiotics are universally broad in spectrum and represent the last line of defense against multi-drug resistant gram-negative pathogens. Figure 1 displays the trend in anti-pseudomonal antibiotic utilization at Denver Health over time. Overall, use of these agents has decreased by 40% since 2005, including a 14% decline since the inception of the Antibiotic Stewardship Program in July 2008. Use of anti-pseudomonal agents was maintained in 2010 at its lowest level since we have been able to track antibiotic utilization data at Denver Health

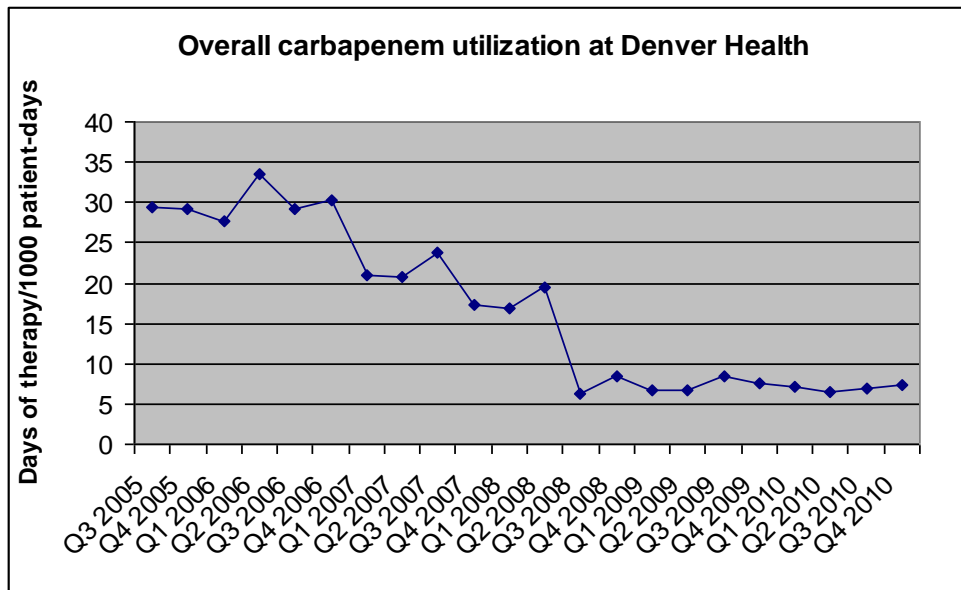
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Figure 1.



Carbapenems, a specific anti-pseudomonal drug class with particularly broad-spectrum activity, have been targeted for reduction by the Antibiotic Stewardship Program. As seen in Figure 2, carbapenem use dramatically decreased after the 2nd quarter of 2008, coinciding with the inception of the stewardship program. Low carbapenem use was maintained during 2010.

Figure 2.

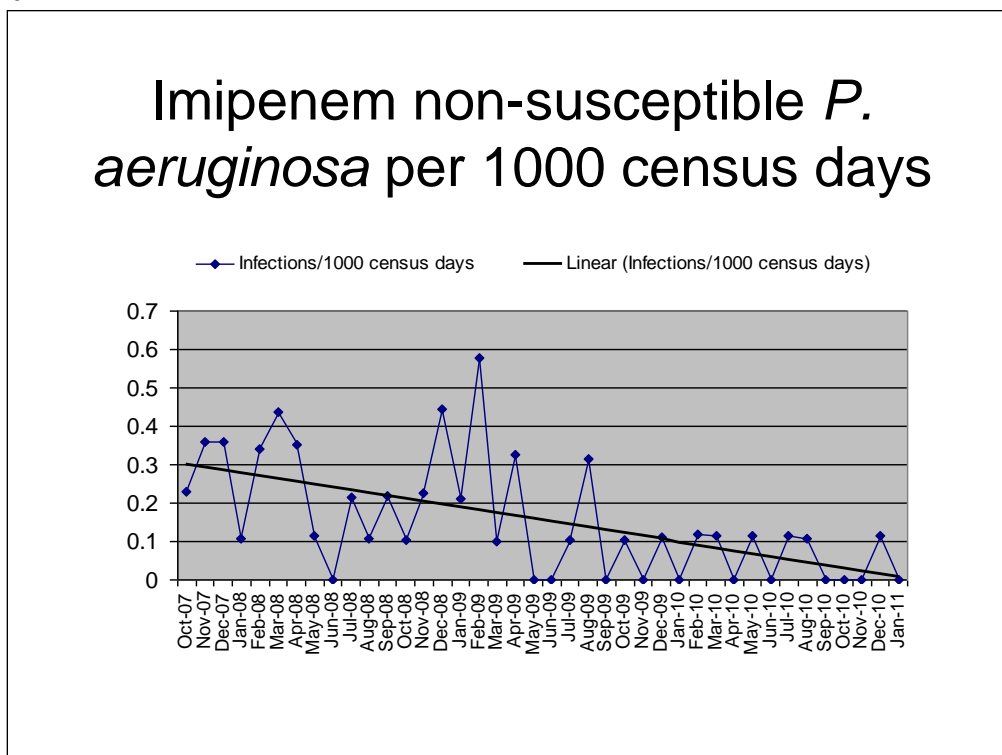


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Judicious use of broad-spectrum antibiotics appears to be paying dividends as evidenced by trends in antimicrobial resistance. The results of the 2010 antibiogram reveal that the susceptibility of *Pseudomonas aeruginosa* isolates to specific anti-pseudomonal agents has improved substantially compared with previous years. For example, 82% of isolates were susceptible to cefepime in 2010 compared with a nadir of 72% previously; 85% of isolates were susceptible to imipenem compared with a nadir of 73% previously; and 76% of isolates were susceptible to levofloxacin compared with a nadir of 64% previously.

Corroborating these data, rates of imipenem non-susceptible *Pseudomonas aeruginosa* infections, standardized for census days, have progressively declined at Denver Health over time (Figure 3.)

Figure 3.



The improvements in *Pseudomonas aeruginosa* susceptibility at Denver Health have come at a time when many institutions are seeing alarming increases in antimicrobial resistance in this important pathogen. It is likely that reductions in the use of anti-pseudomonal agents in concert with an aggressive Infection Prevention policy to prevent transmission of these organisms have contributed to the observed improvements in susceptibility.

Another encouraging trend in antimicrobial resistance during 2010 was that of fluoroquinolone-resistant *Escherichia coli*. Over the last 5 years, *E. coli* susceptibility to levofloxacin has been stable (and suboptimal) at 76 – 77%. In 2010, 81% of isolates are now susceptible to levofloxacin. It is likely that fluoroquinolone-sparing treatment

strategies in both the inpatient and outpatient setting have contributed to the increased susceptibility in this important pathogen.

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Results of 2010 Antibiotic Stewardship Program Goals and Strategies

Overarching Goal 1. Expand current efforts to improve the appropriateness of antibiotic utilization in the hospital via prospective reviews of patients receiving antibiotics with provider feedback and prescribing recommendations

Goal 1a. Work with IS on the development of a patient-level daily report including medications, vital signs, laboratory values, and microbiology data to improve the efficiency of prospective case reviews and provider feedback

An effective, evidence-based antibiotic stewardship intervention involves prospective identification of patients receiving antibiotics, case review to determine appropriateness of therapy, and real-time feedback to providers with prescribing recommendations. Assimilation of the relevant data during case reviews (e.g., current medications, allergies, vital signs, laboratory values, and microbiology data) is a time- and labor-intensive process. We utilize the Siemens pharmacy system to identify patients receiving antibiotics but lack the ability to pull in all of the necessary data elements into a comprehensive report. Table 1 summarizes the number of cases reviewed and the proportion where an intervention (i.e., a prescribing recommendation) was performed. These data demonstrate that a large number of case reviews are performed each quarter, and in a substantial proportion, no intervention is required. This highlights the need for an electronic, comprehensive, patient-level report consisting of data elements that would allow for quick review of the appropriateness of the antibiotic regimen, thus increasing the efficiency of this process.

Table 1. Summary of documented prospective case reviews and interventions, 2010

	Total number of cases reviewed	Cases reviewed, no intervention required n (%)	Cases reviewed, intervention performed n (%)
Qtr1*	372*	112 (30)	260 (70)
Qtr2	563	250 (44)	313 (56)
Qtr3	621	328 (53)	293 (47)
Qtr4	881	493 (56)	388 (44)

*Qtr 1 data not all inclusive due to an update to the Siemens pharmacy system in 3/2010

In 2010, we continued to work with eHealth Services and the Department of Patient Safety and Quality on the development of such a tool. We used examples from other institutions to develop a template of the report and necessary data elements. With the transition to LifeLink, the development of this report continues to be a work in progress but must remain a priority in 2011. In the interim, we have reviewed and modified the reports currently available through the Siemens pharmacy system in order to facilitate the case-review process.

Goal 1b. Involve the floor pharmacists in daily antimicrobial stewardship activities through education and competency training

In 2010, several educational lectures regarding antibiotic stewardship were presented to the pharmacists in order to improve knowledge surrounding antibiotic utilization issues at Denver Health and empower the pharmacists to advocate for the judicious use of antibiotics.

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- Tim Jenkins provided a lecture to the pharmacy staff on strategies to improve antibiotic use, an overview of antimicrobial stewardship efforts at Denver Health, and antimicrobial resistance.
- Claire Swartwood provided four separate pharmacy competency lectures on antimicrobials, monitoring, and dosing with concentration of the education surrounding a new vancomycin guideline for Denver Health.

Continued efforts will focus on involvement of the floor pharmacists in daily antimicrobial stewardship activities through education and competency training

Goal 1c. Increase attention to reducing unnecessary use of vancomycin

In order to improve the appropriateness of vancomycin use at Denver Health, this antibiotic has been a continued focus during daily case reviews. In addition, we developed a Clinical Care Guideline for the use of vancomycin. This provides guidance regarding appropriate indications for the antibiotic as well as dosing and monitoring recommendations. Two of the goals of this guideline are to prevent the common error of initial under-dosing of vancomycin as well as decrease the overuse of serum vancomycin levels when not indicated. In order to measure its effectiveness, we plan to track the use of serum vancomycin levels before and after implementation of the guideline. These data are not yet available.

As another strategy to curb unnecessary vancomycin use, improve dosing, and promote more appropriate use of serum levels, we have engaged floor pharmacists in the daily monitoring of this drug. In 2010, the duties of the floor pharmacists were expanded to include prospective monitoring of patients receiving vancomycin 7 days per week.

In aggregate, efforts targeted to vancomycin utilization this year have reduced use by 4.7% compared with 2009. We will continue to assess the impact of these interventions in 2011.

Goal 1d. Continue to focus on reducing the unnecessary use of anti-pseudomonal agents

As discussed above, anti-pseudomonal agents are critical antibiotics given their broad spectrum of activity. Despite increasing bacterial resistance to these agents, new antibiotic development with gram-negative activity has dramatically fallen off over the last 15 years. At present, there are no antibiotics in the pipeline with a novel mechanism of gram-negative activity. Therefore, conservation of existing agents is of the utmost importance. We have therefore continued to focus on reducing unnecessary use of anti-pseudomonal agents; pharmacy reports of patients receiving these antibiotics are run daily. When appropriate, suggestions are made to providers to use alternative agents. These efforts have been focused to carbapenems, piperacillin-tazobactam, levofloxacin, and aminoglycosides.

In addition to daily case-reviews with feedback to providers, we have implemented several Clinical Care Guidelines to help decrease unnecessary use of anti-pseudomonal agents. The complicated intra-abdominal guideline was revised to reflect updated recommendations in 2010 and encourages use of ceftriaxone plus

metronidazole (over piperacillin-tazobactam, the most common treatment) for a subset of these infections. The Clinical Care Guideline for the management of skin and soft tissue infections has been an effective tool to decrease unnecessary use of gram-negative agents. Since implementation of the guideline through a multi-faceted intervention to promote its use, we have observed 45%, 36%, and 36% relative declines in the use of broad gram-negative antibiotics, anti-pseudomonal agents, and antibiotics with anaerobic activity, respectively.

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The following is a summary of changes in the use of anti-pseudomonal agents in 2010 compared with 2009 (standardized for census days):

- 6.2% overall reduction in overall use of anti-pseudomonal agents
 - 28.3% reduction in use of imipenem
 - 6.5% reduction in use of levofloxacin
 - 8.0% reduction in use of piperacillin-tazobactam
 - 26.4% reduction in use of aminoglycosides
 - 52.1% increase in use of cefepime

Overarching Goal 2. Expand Antimicrobial Stewardship Program services for hospital providers

Goal 2a. Increase provider access to the Antibiotic Stewardship Program by publishing contact information on the “on-call” list on the Pulse for antibiotic-related questions and approval of restricted antimicrobials. This resource may also generate formal ID consults.

One of the major interventions to increase access to antibiotic utilization expertise in 2010 was the development of the “Antibiotic Stewardship Pager.” The pager is carried by a member of the Antibiotic Stewardship Program, and the contact number is listed under the “On Call” section of the Pulse from Mondays – Fridays, 8am – 5pm. The purpose of the pager is two-fold: 1) to provide a service to providers who have questions regarding antibiotic prescribing that do not warrant a formal ID consultation, and 2) to provide a single contact number through which the prescribing of restricted antibiotics can be discussed and approved (outside of the pager hours, requests for restricted antimicrobials are directed to the Infectious Diseases attending on call). When appropriate, formal ID consultations are suggested. Tracking data reveal an average of 15 – 30 calls to the pager per month.

Goal 2b. Review the antimicrobial formulary and establish a formal, standardized procedure for the prescribing of restricted antimicrobial agents

The antimicrobial formulary was comprehensively reviewed in 2010, and changes were brought to, and approved by, the P&T Committee. In addition, we established a formal, standardized procedure for the prescribing and approval of restricted antimicrobial agents. Appropriate scripting was built into CPOE to direct providers to call the Antibiotic Stewardship pager (or ID attending after hours) when restricted agents are ordered. In addition, we developed a set of standardized indications for selected restricted antimicrobial agents to facilitate the approval process. In general, we believe that implementation of this standardized process has improved consistency, eliminated previous confusion, and streamlined the process of prescribing restricted antibiotics.

Goal 2c. Creation of an “Antibiotic Prescribing Table” to provide recommendations for empiric therapy, step-down oral options, and recommended duration of therapy for common infections in the hospital

An “Antibiotic Prescribing Table” is in the process of development. The purpose of such a table is to provide a single, quick reference for providers to determine the appropriate choice of antibiotics, dose, and duration of

therapy for common infections treated in the hospital setting. We will work to further develop and finalize this resource during 2011.

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Goal 2d. Continue to update and develop Clinical Care Guidelines to standardize and streamline the management of infections

Clinical Care Guidelines continue to be an important intervention to improve the use of antibiotics at Denver Health. Guidelines for the following infections were developed or maintained in 2010:

- 1) Inpatient skin and soft tissue Infections (reviewed, updates in process)
- 2) *Clostridium difficile* infection (reviewed, updates in process)
- 3) Complicated intra-abdominal infections (reviewed, maintained)
- 4) Invasive Candidal infections (reviewed)
- 5) Urinary tract infection in outpatients (reviewed and updated)
- 6) Inpatient and outpatient community acquired pneumonia (developed and submitted, approval pending)

We have demonstrated particular success in the development and implementation of the Clinical Care Guideline for inpatient skin and soft tissue infections. Cellulitis and cutaneous abscess are one of the most common causes of hospitalization for infection at Denver Health. As described above, we have demonstrated substantial decreases in use of broad-spectrum gram-negative therapy, anti-pseudomonal agents, and anaerobic therapy after implementation of the guideline. In addition, the median duration of therapy for these common infections has decreased by nearly 25%, and significantly more patients are appropriately receiving short courses of therapy. Implementation of the guideline also led to decreased use of certain health care resources including blood cultures, advanced imaging studies (CT and MRI), and inpatient consultations. The results of this successful intervention were recently published in *Archives of Internal Medicine*.

In addition, as part of an AHRQ-sponsored project to reduce unnecessary antibiotic utilization in primary care practices, Dr. Jenkins led the development of management algorithms for 8 of the most common infections treated in the outpatient setting, including:

- 1) Acute bronchitis
- 2) Non-specific upper respiratory infection
- 3) Acute sinusitis
- 4) Acute pharyngitis
- 5) Acute otitis media
- 6) Urinary tract infection
- 7) Skin and soft tissue infection
- 8) Community-acquired pneumonia

Antibiotic utilization at clinics randomized to use of these decision support tools (Westside and Lowry) will be compared with utilization at control sites (Westwood and Denver Health Medical Plan Clinic). Upon completion of the study period in May 2011, these guidelines will be submitted as Clinical Care Guidelines and disseminated to all Denver Health clinics.

Overarching Goal 3. Utilize data warehouse and Information Systems (IS) expertise to improve antimicrobial prescribing and monitoring

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Goal 3a. Create patient-specific reports for use in daily case reviews as described above under Goal 1

Efforts toward creating an automated, electronic, patient-specific report including data necessary for daily case reviews with prescribing feedback are described above (Goal 1a).

Goal 3b. Implement automatic stop dates for antimicrobial agents in the Siemens/ CPOE interface to prevent unnecessary prolongation of therapy

We assessed whether the interface between the Siemens pharmacy and CPOE systems could be utilized to prevent unintended prolongations of antibiotic therapy. The evaluation revealed that at present, antibiotic stop dates ordered in CPOE automatically default to 7 days from the time of the order. At that time, an automatic renewal prompts providers to renew or to discontinue the antibiotic. When the planned duration of antibiotic therapy is known, pharmacists are now being encouraged to manually enter the stop date, without an automatic renewal request, to prevent unintended prolongation of therapy.

Goal 3c. Automate information from the microbiology laboratory to assist in targeting appropriate therapy (bug-drug optimization)

We worked with IT support from the Denver Health microbiology laboratory to generate an automated, daily report of patients with positive blood cultures. This report automatically updates each hour, thus provided relatively real-time data regarding patients with positive cultures, the infecting pathogen, and antibiotic susceptibilities. Daily review of the report allows us to identify patients with bloodstream infections and quickly assess the appropriateness of empiric therapy and opportunities to de-escalate to narrower therapy. This report was also made available to all Infectious Diseases faculty and fellows, allowing rapid identification of patients with *Staphylococcus aureus* bloodstream infection, where ID consultation is required. Given the successful creation of this report for bloodstream infections, we will consider expansion of its use for other sites of infection in the future.

Goal 3b. Develop a system to track Antibiotic Stewardship Program interventions electronically

Codes for antibiotic stewardship-specific pharmacy interventions were built into the pharmacy system in order to track the number and type of pharmacist stewardship interventions over time. Interventions can be input by any pharmacist making a stewardship-related recommendation along with whether the recommendation was accepted by the provider. Data are summarized in Table 2.

Table 2. Antibiotic stewardship interventions by pharmacists and proportion accepted by providers, 2010

	QTR2 (N=290) n (% accepted)	QTR3 (N=247) n (% accepted)	QTR4 (N=333) n (% accepted)
Streamline antibiotics	88 (73)	77 (75)	91 (70)
Kinetics	51 (59)	57 (81)	168 (71)**
Discontinue antibiotics	58 (29)	46 (33)	25 (50)
Drug-drug interaction	4 (100)	6 (83)	6 (83)

(significant) detected			
Drug info provided	3 (100)	5 (100)	4 (100)
Dosing change	58 (91)	68 (85)	87 (81)
Allergy detected	----	4 (100)	---
Alternative antibiotic	14 (79)	---	17 (41)
Approval of restricted antibiotic	9 (67)	18 (83)	11 (73)

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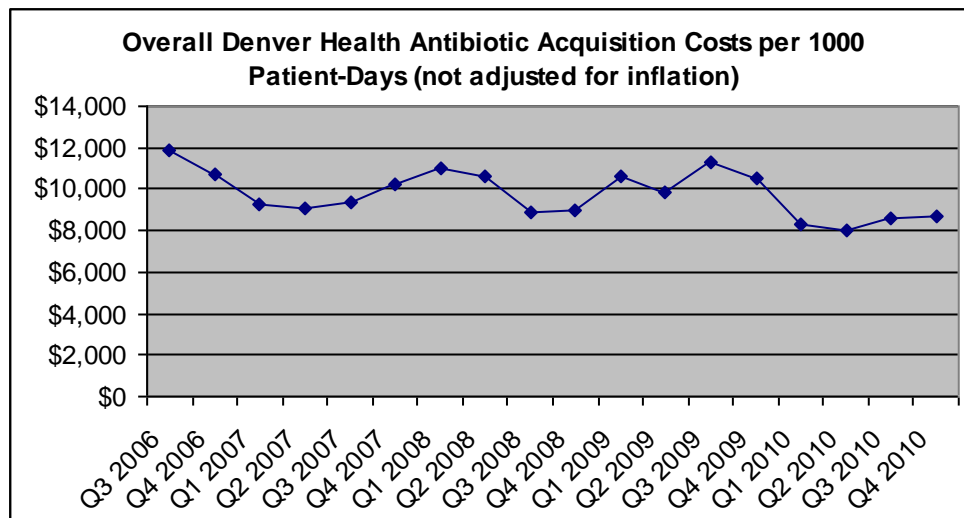
*Qtr 1 data not included due to an update to the Siemens pharmacy system in 3/2010 **Vancomycin Clinical Care Resource was approved and pharmacists' responsibilities for vancomycin monitoring on the floors was initiated

Overarching Goal 4. Implement cost containment strategies for high-impact antimicrobials

Goal 4a. Monitor antimicrobial expenditures quarterly and use the data to identify areas to intervene to limit unnecessary costs

Through use of a data warehouse report of patient-level data regarding antibiotic expenditures and census data, we successfully tracked antibiotic cost data (standardized for census) quarterly during 2010. Antibiotic expenditures per 1000 patient-days remained at their lowest levels since tracking data are available.

Figure 4.



Goal 4b. Implement a surveillance and substitution program to replace nafcillin and penicillin G (high-cost drugs) with cefazolin in select cases of *S. aureus* and streptococcal infections

We implemented a surveillance and substitution program to replace nafcillin and penicillin G (high-cost drugs) with cefazolin, a low-cost but efficacious antibiotic, in selected cases of methicillin-sensitive *S. aureus* infection and beta-hemolytic streptococcal infection. Results of this successful program are summarized in Table 3.

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Table 3. Comparison of nafcillin, penicillin G, and cefazolin utilization and costs (adjusted for census)

	Antibiotic Utilization*	Antibiotic acquisition costs
Nafcillin		
2009	8.3	\$62,445
2010	2.3	\$18,079
Change	-72.2%	-\$44,366
Penicillin G		
2009	13.9	\$95,319
2010	10.8	\$37,642
Change	-22.3%	-\$57,677
Cefazolin		
2009	46.5	\$9,919
2010	49.7	\$11,100
Change	+6.8%	\$1,181
Net cost savings		\$-100,862

*days of therapy administered per 1000 patient-days

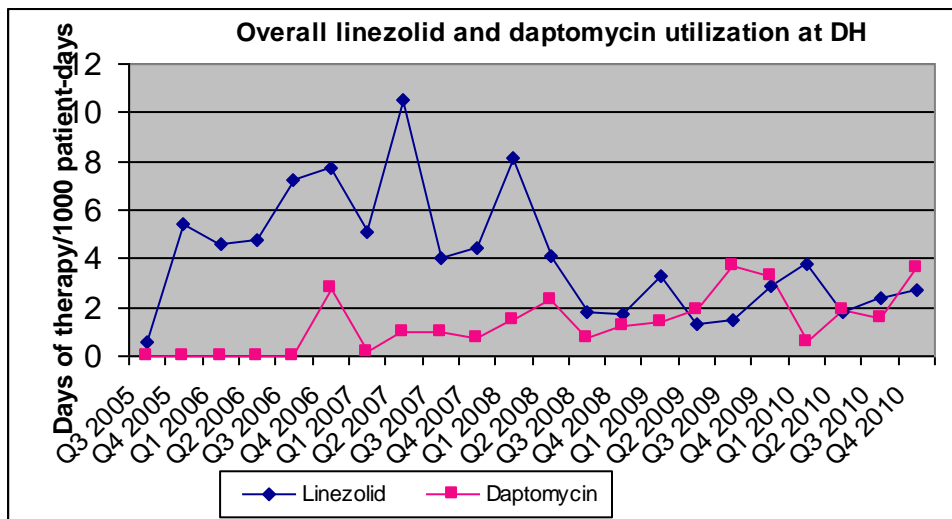
Of note, some of the cost savings for penicillin G resulted from our ability to secure this antibiotic at a lower price compared with 2009; however, the intervention decreased utilization by 22.3%.

Goal 4c. Develop criteria for the appropriate use of daptomycin and linezolid for resistant gram-positive infections; increase surveillance regarding the use of these expensive drugs

Given the high cost of daptomycin and linezolid, in 2010, we developed criteria for the appropriate empirical use of these agents for known or suspected resistant gram-positive infections. In addition, approval via the Antibiotic Stewardship pager was required for their use, and we performed daily monitoring of patients receiving these antibiotics to ensure appropriate utilization. Daptomycin and linezolid utilization over time are shown in Figure 5. In 2010, overall use of these agents decreased by 4.2% compared with the prior year.

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Figure 5.



Goal 4d. Evaluate the Group B streptococcal prophylaxis strategy in pregnant women and whether the substitution of PCN G with ampicillin is indicated

In collaboration with the Obstetrics and Gynecology service, we evaluated the protocol for Group B streptococcal prophylaxis in pregnant women and whether the substitution of penicillin G with ampicillin, a less expensive antibiotic, was indicated. Upon review of the data, it was determined that penicillin G remained the drug of choice based on safety considerations despite its higher cost.

Goal 4e. Increase surveillance of the use of anti-fungal agents; evaluate rates of infections with fluconazole-resistant *Candida* species over time.

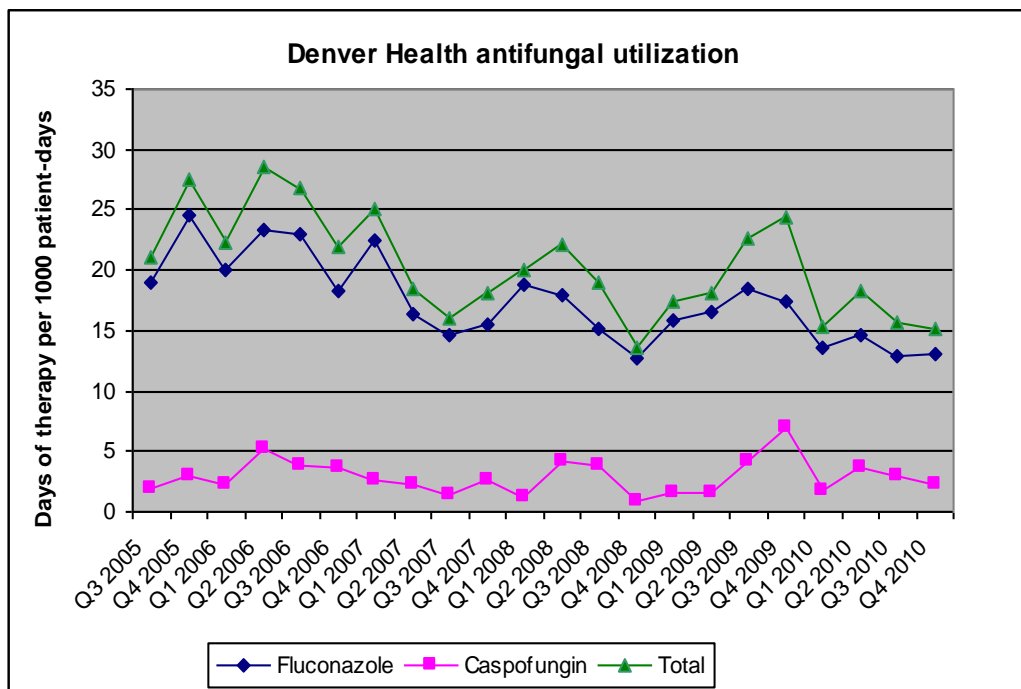
In response to a rise in caspofungin (an expensive antifungal agent) use in late 2009, we implemented daily antifungal utilization surveillance with prescribing recommendations to providers when appropriate. In addition, we evaluated the change in the proportion of azole-resistant *Candida* species over time at Denver Health. Table 4 shows that since 2006, we have had an increase in the proportion of *Candida* isolates (*C. glabrata* and *C. krusei*) that tend to be resistant to fluconazole (thus warranting caspofungin). Despite this increase in resistant isolates, efforts to ensure appropriate use of caspofungin resulted in a 38.4% decrease in use of this antifungal agent during 2010. Overall antifungal use declined by 22.2% in 2010 compared with 2009 (Figure 6).

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Table 4. Azole-resistant *Candida* species over time

Year	Total isolates from sterile sites	Azole-resistant isolates (<i>C. glabrata</i> or <i>C. krusei</i>) n (% of total)
2005	38	7 (18.4)
2006	55	3 (5.5)
2007	61	6 (9.8)
2008	58	7 (12.1)
2009	68	11 (16.2)

Figure 6.



Goal 4f. Monitor the fluctuating prices of antimicrobial agents to identify areas to reduce costs

As in previous years, a summary document was compiled with relative costs of antimicrobial agents. It was through review of this document that nafcillin and penicillin G were identified as opportunities to shift to a more cost-effective antibiotic, as described above. This document was posted on the Antimicrobial Stewardship subsite on the Pulse as a resource for providers.

Overarching Goal 5. Improve the Antimicrobial Stewardship subsite on the Pulse and increase its utilization

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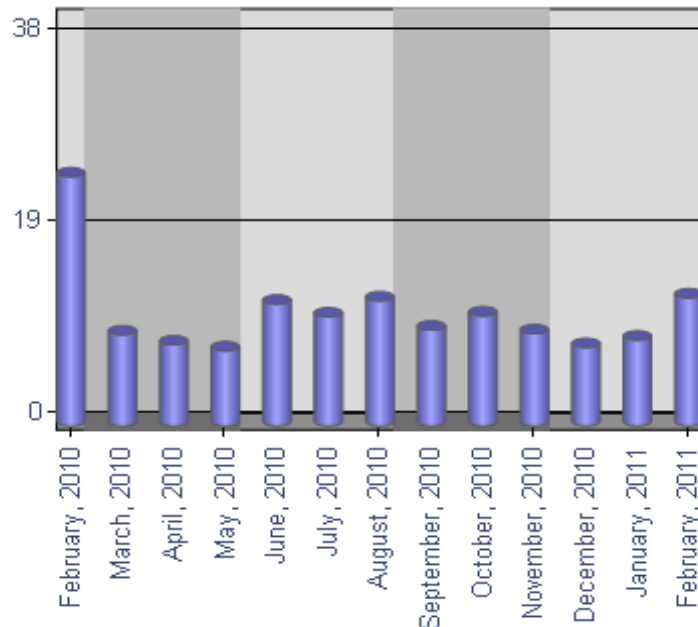
Goal 5a. Educate providers regarding the availability and resources of this site

The Antibiotic Stewardship sharepoint site on the Pulse was expanded to provide additional resources to clinicians and pharmacists to promote improved antibiotic prescribing. Documents included on the subsite include: the current Denver Health antibiogram, dosing card for antimicrobial agents, approved Clinical Care Guidelines or Resources relevant to antibiotic prescribing, antibiotic utilization data, and evidence-based data regarding antibiotic utilization concepts (e.g., efficacy of short-course therapy for community-acquired pneumonia). The availability of the sharepoint site and its associated resources were reinforced with clinicians and pharmacists each time an e-mail communication was sent to these providers (e.g., new antibiogram or Clinical Care Guideline).

Goal 5b. Track the utilization of this site over time by IS surveillance

The Antibiotic Stewardship subsite was reformatted in February 2010, and we began tracking provider utilization of the site over time (Figure 7). There were no substantial changes in use during 2010. Our goal is to see visits to this site increase over time as more resources are made available and providers begin to incorporate these resources into their everyday hospital care.

Figure 7. Visits per month for the Antibiotic Stewardship Sharepoint Site



Goal 5c. Improve the resources available on the site to include (but not limited to) approved clinical care guidelines, antimicrobial utilization trends at Denver Health, antibiograms, and other prescribing resources

We will continue to update the Antibiotic Stewardship subsite with the 2011 antibiogram and dosing recommendation card, Clinical Care Guidelines, antibiotic utilization data, and evidence-based literature as

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appropriate. We plan to redesign the site this year to make the Clinical Care Guidelines immediately visible on navigating to the Antibiotic Stewardship subsite.

Overarching Goal 6. Develop clinical care guidelines for the management of important infections from an antimicrobial stewardship perspective

Goal 6a. A clinical care guideline for community-acquired pneumonia will be developed in 2010

Clinical Care Guidelines for the management of both inpatient and outpatient community-acquired pneumonia (CAP) were developed in 2010. The goals of the guidelines are to: 1) decrease low-risk hospital admissions 2) decrease early use of chest CT in patients with a diagnosis of CAP and no clinical evidence of complications 3) decrease use of vancomycin 4) decrease use of a new drug class on discharge, and 5) decrease the duration of antimicrobial therapy. They have been submitted to the Clinical Care Guidelines committee, and once approved, will be implemented using a multi-faceted strategy to improve uptake. We will track the 5 metrics described above over time to evaluate the impact of the guideline.

Goal 6b. Healthcare-associated pneumonia/ventilator-associated pneumonia will subsequently be addressed, followed by urinary tract infection

The development of a Clinical Care Guideline for the management of healthcare-associated pneumonia and hospital-acquired pneumonia remains a priority, although this was not accomplished during 2010. We are currently collaborating with one of the Hospitalists, Dr. Nick Scaletta, to collect baseline data regarding resource utilization and antibiotic-prescribing practices. These data will be used to guide the focus of a Clinical Care Guideline to standardize and streamline the management of these infections with goals of decreasing unnecessary use of health care resources and broad-spectrum antibiotics.

The outpatient urinary tract infection (UTI) Clinical Care Guideline was updated and approved in 2010 to address the issues of making an oral option available to patients with fluoroquinolone-resistant *E.coli* infection. Cefixime was approved by P&T to be added to the formulary for this indication and was incorporated into the guideline. An inpatient UTI Clinical Care Guideline is planned for development in 2011.

Goal 6c. The clinical care guideline for febrile neutropenia will be updated

The Infectious Diseases Society of America recently published a national guideline regarding the management of febrile neutropenia. This guideline will be reviewed, and we will make appropriate changes to our institutional guideline in 2011.

Overarching Goal 7. Maintain an active P&T Antimicrobial Subcommittee

Goal 7a. Continue to hold monthly meetings with distribution of a pre-meeting agenda and post-meeting minutes

The antimicrobial subcommittee of P&T held monthly meetings throughout 2010 with distribution of a pre-meeting agenda and post-meeting minutes.

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Goal 7b. Discussion topics include (but not limited to) clinical care guideline development, review of other clinical guidelines that involve antimicrobial therapy, antibiotic utilization strategies, and review of new antimicrobial agents

Discussion topics at Antimicrobial Subcommittee meetings during 2010 included Clinical Care Guideline development, general antibiotic utilization strategies for Denver Health, antimicrobial drug shortages and alternative recommendations during shortages, antimicrobial formulary review and modification, appropriate indications for high-cost antimicrobials, drug safety warnings, role of newly FDA-approved antimicrobial agents, review of ID-related safety issues, perioperative prophylaxis for C-sections, continuous infusion of antibiotics, fluoroquinolone formulary, antimicrobial laden cement and beads, and antifungal susceptibility testing for sterile-site *Candida* isolates.

Goal 7c. Continue to report business items to P&T, as appropriate

Topics reported by the Antimicrobial Subcommittee to P&T during 2010 included revisions to the antimicrobial formulary, temporary replacement of acyclovir with valacyclovir during the acyclovir shortage, evaluation of vancomycin oral tablet use for *C. difficile*, approval of the update to the outpatient UTI treatment guideline for non-pregnant adults, addition of daptomycin to the inpatient formulary (restricted to ID consult), approval of the Clinical

Care Guidelines for inpatient and outpatient community-acquired pneumonia, and approval of the vancomycin Clinical Care Resource.

Activities and accomplishments not related to specific goals set forth for 2010

Continue monitoring antimicrobial prescribing for HIV patients admitted to the hospital

An electronic, daily surveillance report of HIV-infected patients admitted to the hospital was developed in the fall of 2008. Using this report, the Antimicrobial Stewardship Program and Infectious Diseases consult service are able to rapidly identify these patients to ensure appropriate antiretroviral therapy and opportunistic illness prophylaxis. These efforts were continued in 2010. Pharmacist reviews were documented when possible (Table 5), however, the data do not reflect all monitoring activities. In general, this intervention identified prescribing errors (including errors of omission) requiring intervention in 15% to 29% of cases.

Table 5. Pharmacist case reviews of HIV-infected patients for appropriate antiretroviral therapy and opportunistic infection prophylaxis, 2010

	HIV medication profiles reviewed	Intervention required n (%)
Qtr1*	14	6 (43)
Qtr2	23	6 (26)
Qtr3	46	7 (15)
Qtr4	55	16 (29)

*Qtr 1 data not all inclusive due to an update to the Siemens pharmacy system in 3/2010

Management of Antimicrobial Drug Shortages

In 2010, a number of severe drug shortages led to potential patient safety issues due to lack of drug availability. The Antimicrobial Subcommittee and Antibiotic Stewardship Program identified these shortages as they arose, monitored their status prospectively, determined a plan of action based on severity and timing of expected

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resolution, and communicated with providers as appropriate. Examples of such shortages included oral acyclovir, intravenous (IV) acyclovir, aztreonam, IV trimethoprim-sulfamethoxazole, amikacin, and IV clindamycin. This will continue to be an area of ongoing surveillance and action in 2011.

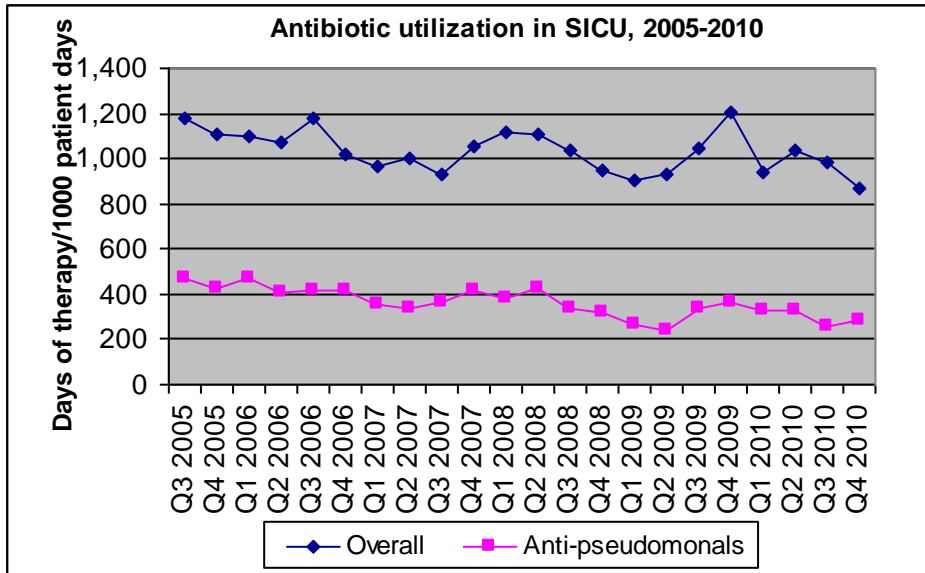
Collaborative efforts with Infection Prevention

In 2010, we continued to work closely with Infection Prevention by participation in weekly meetings as well as monthly Infection Prevention Committee meetings. Issues common to both Infection Prevention and Antibiotic Stewardship include catheter-associated bloodstream infections, catheter-associated urinary tract infections, ventilator-associated pneumonia, surgical site infections, *C. difficile* infection, influenza, and multi-drug resistant organisms such as VRE, imipenem-resistant *Pseudomonas aeruginosa*, extended spectrum beta-lactamase (ESBL)-producing organisms, and *Klebsiella pneumoniae* carbapenemase (KPC)-producing organisms. We will continue to collaborate with Infection Prevention to address these important challenges.

Continue collaborative efforts in the SICU and MICU to optimize antibiotic use for critically ill patients

The Infectious Diseases Division has actively participated in weekly surgical ICU (SICU) rounds to serve as a resource for appropriate antimicrobial utilization since 2005. This collaboration was maintained during 2010 in addition to more regular case review and provider feedback by Claire Swartwood, PharmD. Overall antibiotic use and use of anti-pseudomonal agents have declined over the 5-year period of this collaboration (Figure 8).

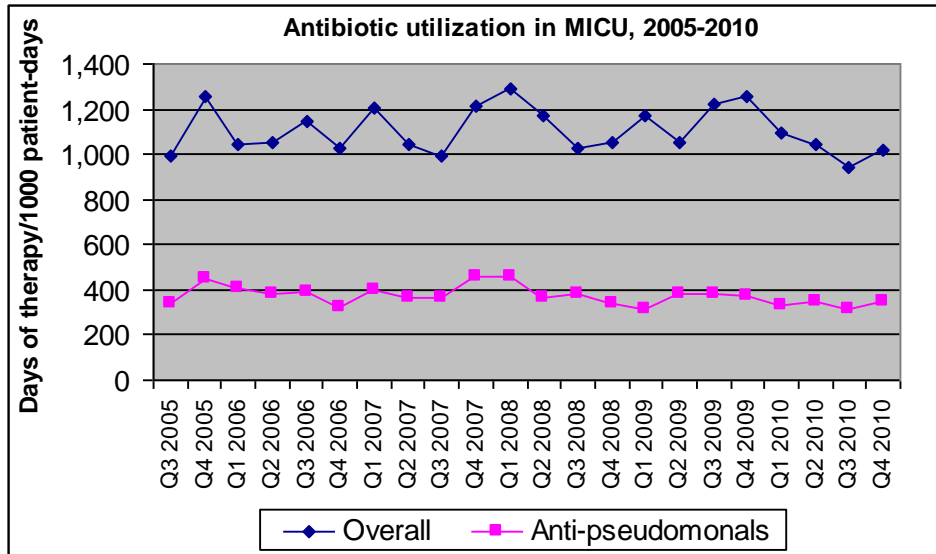
Figure 8.



In addition, we continued to collaborate with the attending physicians and pharmacists staffing the medical ICU (MICU) in efforts to optimize antibiotic use for this critically ill patient population. In 2010, overall and anti-pseudomonal antibiotic use remained at the lowest levels since these data were available (Figure 9).

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Figure 9.



C. GOALS FOR THE 2011 ANTIMICROBIAL STEWARDSHIP PROGRAM

Goal 1. Perform a comprehensive review of antimicrobial resistance at Denver Health; review and update antibiotic utilization strategies accordingly

- Develop the 2010 Denver Health hospital-wide antibiogram, MICU, SICU, and Pediatric antibiograms, identify important trends in antimicrobial resistance, and disseminate results to clinicians and pharmacists.
- Discuss overall antibiotic utilization strategies in the Antibiotic Subcommittee with input from appropriate stakeholders (e.g., critical care physicians, pediatricians, hospitalists) and disseminate results to clinicians and pharmacists.
- Re-evaluate the role of carbapenems given the new breakpoint recommendations of enterbacteraicea and potential for earlier detection of ESBL-producing organisms.

Goal 2. Continue quarterly antimicrobial utilization surveillance; develop and maintain strategies to optimize antibiotic use accordingly

- Perform quarterly hospital-wide and ICU-specific surveillance for overall antibiotic use and commonly-used agents/classes.
- Develop and maintain strategies to prevent unnecessary use of anti-pseudomonal agents.
- Develop and maintain strategies to prevent unnecessary use of vancomycin.

Goal 3. Expand the ability to perform prospective case reviews with provider feedback and prescribing recommendations

- Develop a patient-specific daily report including medications, allergies, vital signs, laboratory values, and microbiology data to improve the efficiency of prospective case reviews and provider feedback.

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- Increase involvement of the floor pharmacists in daily antibiotic stewardship activities through education and competency training with electronic documentation of interventions.
- Expand the use of automated, daily microbiology reports to facilitate timely bug-drug optimization.

Goal 4. Expand Antimicrobial Stewardship Program services for hospital providers

- Maintain the Antibiotic Stewardship pager as a resource for providers to promote appropriate antibiotic prescribing.
- Further develop and finalize an “Antibiotic Prescribing Table” to provide recommendations for empiric therapy, step-down oral options, and recommended duration of therapy for common infections in the hospital.
- Develop Clinical Care Guidelines and Resources for important infections and antibiotics (see Goal 6).

Goal 5. Collaborate with eHealth Services and data warehouse personnel to improve the appropriateness of antibiotic prescribing and the efficiency of daily case reviews and intervention documentation

- Develop an electronic, comprehensive, patient-specific daily report to improve the efficiency of case reviews (as discussed under Goal 1).
- With the transition to LifeLink, evaluate for new IT-related opportunities to improve antibiotic prescribing.
- Create additional automated microbiology laboratory reports as appropriate (e.g., non-blood sterile site cultures, urine cultures) to facilitate appropriate targeting of antibiotic therapy (bug-drug optimization).
- Maintain and improve the system to electronically record and track Antimicrobial Stewardship Program interventions.

Goal 6. Implement or maintain cost containment strategies for high-impact antimicrobials

- Maintain the cefazolin substitution intervention to minimize use of nafcillin and penicillin G when cefazolin is an appropriate alternative.
- Ensure appropriate indications for use of daptomycin and linezolid for known or suspected resistant gram-positive infections and continue daily surveillance of patients receiving these agents.
- Ensure appropriate indications for use of caspofungin and fluconazole; utilize Candidal susceptibility testing to decrease use of caspofungin for azole-susceptible infections.
- Update and review the relative costs of antimicrobial agents twice yearly and re-evaluate antibiotic utilization strategies based on current costs.

Goal 7. Improve the Antibiotic Stewardship subsite on the Pulse and increase its utilization

- Reformat the Antibiotic Stewardship subsite so that Clinical Care Guidelines and the antibiogram are immediately visible upon navigation to the site.
- Utilize opportunities to reeducate providers regarding the availability and resources of this site.
- Track quarterly visits to the Antibiotic Stewardship subsite; formulate and carry out an action plan to further promote its use if indicated.

Goal 8. Develop, implement, and measure uptake of Clinical Care Guidelines for the management of important infections to improve antibiotic and health care resource utilization and update existing Clinical Care Guidelines as appropriate

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- Implement the Clinical Care Guidelines for inpatient and outpatient community-acquired pneumonia and begin tracking metrics to assess uptake and effect.
- Collect data regarding present management of healthcare-associated/hospital-acquired pneumonia and use these data to develop a Clinical Care Guideline with goals of decreasing unnecessary broad-spectrum and prolonged therapy and use of health care resources.
- Develop a Clinical Care Guideline for inpatient management of complicated urinary tract infection with goals of preventing treatment of asymptomatic bacteriuria and promoting short-course therapy (will extend into 2012)
- Develop a Clinical Care Guideline for febrile neutropenia (will extend into 2012)
- Obtain institutional approval for and implement Clinical Care Guidelines for common outpatient infections (acute bronchitis, acute sinusitis, non-specific URI, acute pharyngitis, acute otitis media, and skin and soft tissue infections)
- Update existing Clinical Care Guidelines as appropriate

Goal 9. Maintain an active P&T Antimicrobial Subcommittee

- Continue to hold monthly meetings with distribution of a pre-meeting agenda and post-meeting minutes
- Discussion topics include (but not limited to) clinical care guideline development, review of other clinical guidelines that involve antimicrobial therapy, antibiotic utilization strategies, and review of new antimicrobial agents
- Continue to report business items to P&T, as appropriate

Goal 10. Expand efforts to benchmark Denver Health antibiotic utilization and costs over time

- Review the antibiotic utilization and cost data available through UHC and determine whether they are appropriate for benchmarking for the Denver Health Antibiotic Stewardship Program
- If determined to be appropriate, develop and carry out a plan for periodic benchmarking of Denver Health performance

X. DIVISION OF HEALTH SERVICES RESEARCH 2010 ANNUAL REPORT

This annual report summarizes the 2010 activities and accomplishments of the department of Health Services Research, including the degree to which 2010 goals as outlined in the 2009 annual report were met, and is presented in sections as follows:

- Overview of Health Services Research at Denver Health
- HSR 2010 Goals and Initiatives
- HSR 2010 Research Projects, Networks and Collaboration, News and Events
- HSR 2011 Goals

In addition, this report addresses alignment with the strategic imperatives of *maintaining financial viability, recruiting and retaining a highly trained workforce, and building critical partnerships.*

A. OVERVIEW OF HEALTH SERVICES RESEARCH

The Agency for Healthcare Research and Quality defines health services research as:

"[an examination of] how people get access to health care, how much care costs, and what happens to patients as a result of this care. The main goals of health services research are to identify the most effective ways to organize, manage, finance, and deliver high quality care; reduce medical errors; and improve patient safety."

The department of Health Services Research (HSR) is a division within the Denver Health (DH) Department of Patient Safety and Quality. HSR actively seeks to promote research collaboration both internally between DH personnel and departments and externally between DH and other healthcare systems and organizations, and seeks funding to support DH's mission and broad-based initiatives including patient safety, health information technology, and hospital redesign. HSR implements and supports research studies and programs, publishes papers in peer-reviewed academic journals, and presents research findings in national and local forums. HSR also assists DH physicians in enhancing the research component of their clinical practice.

External research partners in 2010 included Intermountain Healthcare, the Salt Lake City Veterans' Administration Medical Center, Vail Valley Medical Center, the University of Maryland, Abt Associates Inc., EMC Consulting, Microsoft Corporation, and the University of Colorado, as well as the members of the High Value Health Collaborative (Mayo Clinic, Cleveland Clinic, Geisinger Health System, and the Dartmouth Institute/Dartmouth-Hitchcock Medical Center).

Research projects involving HSR personnel are supported primarily through grant and contract awards received from government agencies and private foundations. Present funding sources include the Agency for Healthcare Research and Quality (AHRQ), the Centers for Disease Control and Prevention (CDC), and the Office of Population Affairs (OPA).

HSR is currently comprised of 3.0 FTEs:

Edward Havranek, MD	Director (0.2 FTE)
Susan L. Moore, MSPH	Assistant Director
M. Josh Durfee, MSPH	Research Project Coordinator (0.8 FTE)
Debbie Rinehart, MA	Research Project Coordinator

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B. GOALS AND ACHIEVEMENTS IN 2010

In its 2009 annual review and report, HSR identified six goals to achieve in 2010. This section describes these goals and the extent to which they were achieved.

1. Goal:	Write and submit a minimum of 3 full research proposals to a combination of federal, state, and local agencies, in pursuit of multiple mechanisms for research funding (e.g. grant v. contract funding).
Status:	Achieved.
Description:	<p>5 full proposals were submitted through HSR to a variety of federal and private funding agencies, as follows:</p> <ul style="list-style-type: none"> • 1 proposal in response to AHRQ ARRA RFA-HS-10-001 (R24), "CER Infrastructure for Complex Patient Studies" (grant award received) • 1 proposal in response to AHRQ ACTION RFTOs 20 & 21, "Utility of Algorithm-based Prescribing for Ventilator-associated Pneumonia (VAP) to Reduce Unnecessary Antimicrobial Use in ICUs" and "Optimizing Oral Decontamination Strategies for the Prevention of VAP." • 1 proposal in response to AHRQ ACTION RFTO 23, "Using Nursing Home Antibiograms to Improve Antibiotic Prescribing and Delivery" (contract award received) • 1 proposal in response to AHRQ ACTION RFTO 28, "ARRA ACTION: Comparative Effectiveness of Health Care Delivery Systems for American Indian and Alaska Natives Using Enhanced Data Infrastructure" (contract award received) • 1 proposal in response to AHRQ ACTION SS RFTO, "A Model for Enhancing Throughput at Division of the Strategic National Stockpile (DSNS) Points of Dispensing (POD) Sites via use of Tele-health Technologies" (sole source; contract award received) <p>In addition, HSR personnel contributed to and/or committed to participate in 5 proposals submitted through other departments and organizations:</p> <ul style="list-style-type: none"> • 1 proposal through Intermountain Healthcare in response to AHRQ RFP No. AHRQ-10-10005, "Accelerating Change and Transformation in Organizations and Networks (ACTION II)." (master contract award received) • 1 proposal through Abt Associates Inc. in response to AHRQ SS ACTION RFTO, "Health IT Hazard Manager" (contract award received) • 1 proposal through Denver Health Managed Care to the Colorado Health Foundation, titled "Cost-effective Integration of Behavioral and Medical Care in a Safety Net Health Care System: The Denver Health Model." (grant award received) • 2 proposals through Denver Public Health to CDC, extending current projects "Evaluating School-Based Influenza Vaccination Programs

	that Bill Health Insurance” and “Examination of the Feasibility of Obtaining 3rd Party Payer Reimbursements for Adolescent Vaccination in the School Setting” by one year each (grant extensions received)
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2. Goal:	Secure a minimum of 1 new funding award.
Status:	Achieved.
Description:	<p>A total of 1 new grant and 3 new contract awards resulted from proposals submitted through HSR, as follows:</p> <ul style="list-style-type: none"> • AHRQ ARRA grant award 1R24HS019453-01, “Expanding CER Capability through Complex Patient Relationship Management;” award amount \$920,585, project period 08/01/2010 – 07/31/2012 • AHRQ ACTION contract award HHS290200600020-9, “Using Nursing Home Antibiograms to Improve Antibiotic Prescribing and Delivery;” award amount \$621,298, project period 07/26/2010 – 07/25/2012 • AHRQ ACTION contract award HHS290200600020-10, “A Model for Enhancing Throughput at Division of the Strategic National Stockpile (DSNS) Points of Disposition (POD) Sites via use of Telehealth Strategies;” award amount \$199,700, project period 09/15/2010 – 03/14/2012 • AHRQ ACTION contract award HHS290200600020-11, “Comparative Effectiveness of Health Care Delivery Systems for American Indian and Alaska Natives Using Enhanced Data Infrastructure;” award amount \$3,070,882, project period 09/27/2010 – 09/26/2012 <p>In addition, a total of 1 new master contract, 1 new contract, 1 new grant, and 2 grant extension awards resulted from proposals to which HSR contributed or committed, as follows:</p> <ul style="list-style-type: none"> • AHRQ ACTION II master contract award to Intermountain Healthcare; indefinite quantity, indefinite delivery (IDIQ) award, contract period 10/01/2010 – 09/30/2013, with option to extend from 10/01/2013 – 09/30/2015 • AHRQ ACTION contract award HHS290200600011-14 to Abt Associates Inc.; \$7,000 subcontract award to DH, project period 09/01/2010 – 02/29/2012 • Colorado Health Foundation grant award to Denver Health Managed Care; proposed amount \$1,316,774 for a 3 year timeframe. • 2 CDC grant extension awards to Denver Public Health; \$440,000 for the adolescent vaccination project and \$380,000 for the flu vaccination project to extend the project through August 2011. <p>Finally, two travel awards were secured to support HSR personnel in conducting presentation and professional development activities:</p> <ul style="list-style-type: none"> • National Institute on Drug Abuse (NIDA) Women & Gender Junior Investigator Travel Award for the College on Problems of Drug Dependence (CPDD) 2010 annual meeting; award amount \$750 • Inter-University Consortium for Political and Social Research Travel Stipend for Dyadic Data Analysis: Models and methods for the Study of Couples 2010 Summer Program; award amount \$750

3. Goal:	Present research findings at a minimum of 2 national conferences and 1 local conference
Status:	Achieved.
Description:	<p>Research findings from HSR projects were presented at 5 national and 1 local conferences, as follows:</p> <ul style="list-style-type: none"> • Daley MF, Kempe A, Pyzanowski J, Vogt T, Morgan N, Busch CK, Rinehart D, Hambidge S & Shlay JC (2010). "Billing for vaccination in schools: Experience from a school-based Tdap vaccination clinic." 44th National Immunization Conference, April 19-22, 2010, Atlanta, GA. • Fang H, Rinehart D, Bell D, McEwen D, Devine S, Dreisbach S, Mickiewicz T, Maravi M & Shaly J (2010). "A Cost Study of Integrating Family Planning Services into an STD Clinic." Presentation at the 138th APHA Annual Meeting, November 6-10, 2010, Denver, CO. • Rinehart D, Corsi KF, Mead K, Wechsberg W & Booth RE (2010). "False Power: qualitative research with women who use methamphetamine." College on Problems of Drug Dependence, June 12-17, 2010, Phoenix, AZ. • Rinehart D, Fang H, McEwen D, Mickiewicz T, Moises M, Bell D, Dreisbach S, Devine S & Shlay J (2010). "A time study of integrated family planning and STD services." AcademyHealth Annual Research Meeting, June 27-29, 2010, Boston, MA. • Shlay JC, McEwen D, Devine S, Bell D, Rinehart D, Mickiewicz T, Maravi M, Fang H & Dreisbach S. (2010). "Integration of family planning services into an STD clinic setting." 2010 National STD Prevention Conference, March 8-11, 2010, Atlanta, GA. • Shlay JC, Busch CK, Hammer A, Riis M, Parker-long L, Pyzanowski J, Daley M, Hambidge SJ, Rinehart DJ, Vogt T, Fang H & Kempe, A. (2010). "Implementation of an elementary school-located influenza vaccination program with billing of third-party payers." 44th National Immunization Conference, April 19-22, 2010, Atlanta, GA. • Shlay J, McEwen D, Devine S, Bell D, Rinehart D, Maravi M, Mickiewicz, Fang H & Dreisbach S (2010). "Integrating of Family Planning Services into an STD Clinic Setting." 138th APHA Annual Meeting, November 6-10, 2010, Denver CO. • Steele AW, Fischer HH, Moore SL, Ginosar D, Durfee MJ, Estacio RO. (2010) "Promoting chronic care management through mobile technology." Presentation at 138th APHA Annual Meeting, November 6-10, 2010, Denver, CO. • Steele AW. (2010) "Clinical Registries: Using Business Intelligence and Point-of-Care Solutions to Drive Chronic Care Management." Panel presentation at AMIA 2010 Annual Symposium, November 13-17, 2010, Washington, DC.

4. Goal:	Complete and submit a minimum of 1 new original manuscript to a peer-reviewed journal; in addition, revise as necessary and resubmit all current/existing manuscripts.
Status:	Partially achieved
Description:	<p>A nurse-run, telephone-based intervention to improve lipids in diabetics.</p> <ul style="list-style-type: none"> Submitted to <i>Journal of General Internal Medicine</i>; revise-and-resubmit request received. <p>The impact of tailored diabetes registry report cards on measures of disease control: a nested randomized controlled trial</p> <ul style="list-style-type: none"> Submitted to <i>BMC Medical Informatics and Decision Making</i>; accepted for 2011 publication <p>Patient and provider perspectives on the use of tailored report cards for diabetes care in a safety net system</p> <ul style="list-style-type: none"> Manuscript in draft; revision/submission pending publication of associated outcomes paper
5. Goal:	Pursue 1 professional development/training opportunity apiece for all HSR personnel in order to improve departmental expertise and familiarity with both current and new methods of analysis.
Status:	Achieved.
Description:	<p>HSR personnel engaged in two training opportunities, as follows:</p> <ul style="list-style-type: none"> <i>Dyadic Data Analysis: Models and Methods for the Study of Couples</i>, Inter-university Consortium for Political and Social Research, University of Michigan, June 2010. <i>Mixed Model Analyses Using SAS</i>, SAS Institute online course, October 27 – November 2, 2010 (group session)
6. Goal:	Complete review of candidates and selection process to hire a new director
Status:	Achieved
Description:	Dr. Havranek became part-time director in September 2010.

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C. Research Projects, Networks and Collaboration, and Events in 2010

New Research Awards/Initiatives

Using Nursing Home Antibigrams to Improve Antibiotic Prescribing and Delivery

DH PI: Thomas D. MacKenzie, MD
Partners: Denver Health, University of Maryland School of Medicine
Period: July 26, 2010 – July 25, 2012
Sponsor: ACTION Contract No. HHS290200600020, Task Order No. 9
HSR Personnel: Susan Moore (10% FTE)

The overall objectives of this project are: (1) to determine antibiotic susceptibility patterns for bacteria isolated in clinical cultures from nursing home (NH) residents and generate NH-specific antibiograms; and (2) to develop a toolkit that will aid NHs and affiliated laboratories in creating and maintaining NH-specific antibiograms. (3) to assess whether NH-specific antibiograms can be implemented for use both within the facility and transmitted to local EDs to impact the empiric management of presumed bacterial infections in NH residents.

Expanding CER Capability through Complex Patient Relationship Management

DH PI: Henry H. Fischer, MD
Period: August 1, 2010 – July 31, 2012
Sponsor: AHRQ ARRA grant 1R24HS019453-01
HSR Personnel: Susan Moore (40% FTE); Josh Durfee (15% FTE)

This project proposes to build data capacity for research by integrating the PRM solution into Denver Health's administrative and clinical data warehouse. This will not only better support targeted and personalized outreach to complex patients with comorbid chronic diseases such as mental health disorders, HIV, and cardiovascular disorders, but will also facilitate comparative effectiveness research in a healthcare system serving a large, diverse metropolitan population. A pilot research study will be conducted to demonstrate the feasibility and usefulness of the expanded PRM infrastructure by: 1) utilizing linked pharmacy and laboratory data to assist provider outreach to diabetic patients; 2) offering frequent personalized self-management support to diabetic patients through text messaging and collecting patient-reported data such as home weights and step counts; 3) supporting the collection of PHQ-9 depression screen data from at-risk, non-adherent diabetic patients.

A Model for Enhancing Throughput at Division of the Strategic National Stockpile (DSNS) Points of Dispensing (POD) Sites via use of Telehealth Technologies

DH PI: Gregory M Bogdan, PhD
Period: September 15, 2010 – March 14, 2012
Sponsor: ACTION Contract No. HHS290200600020, Task Order No. 10
HSR Personnel: Susan Moore (40% FTE)

The intent of this project is to develop, implement and test a model to apply tele-health technologies as a tool to enhance the medical screening process at Points of Dispensing (PODs) in response to an anthrax attack. Using protocols and algorithms developed for an anthrax scenario, and taking appropriate social and cultural factors into account, the model shall provide an example to health departments of how to establish linkages to telehealth providers, to identify symptoms and provide medical advice for the population in the affected area that requires

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prophylaxis. The model should build upon and augment materials currently available from AHRQ and other trusted sources to support the efforts of medical countermeasure dispensing.

Comparative Effectiveness of Health Care Delivery Systems for American Indian and Alaska Natives Using Enhanced Data Infrastructure

DH PI: Edward P. Havranek, MD
Partners: Denver Health, University of Colorado Denver (CAIANH)
Period: September 27, 2010 – September 26, 2012
Sponsor: ACTION Contract No. HHS290200600020, Task Order No. 11
HSR Personnel: Edward Havranek (2.5% FTE); Josh Durfee (10% FTE)

The purpose of this task order is to support the development of data infrastructure that will accelerate comparative effectiveness research (CER) for the American Indian/Alaska Native (AI/AN) population and to support efforts to prioritize health system delivery strategies through comparative effectiveness research for chronic disease management. The goals of this task order are to use electronic clinical data from the IHS national health information system (RPMS - Resource and Patient Management System) to enhance the capacity to electronically measure quality of care consistent with national HIT standards and to conduct comparative analysis that will identify health care delivery approaches within the Indian Health System that result in improved health outcomes. The organizational data store created in this project should serve as a long term source of data capable of supporting future comparative effectiveness and other longitudinal studies.

Completed Research Projects

Preventing Pressure Ulcers in Hospitals

DH PI: Catherine Dingley, RN PhD FNP
Partners: Boston University, Denver Health
Period: September 15, 2008 – October 31, 2010
Sponsor: ACTION Contract No. HHS290200600012, Task Order No. 5

The main tasks to be accomplished during the course of this project are to review successful approaches to preventing pressure ulcers (PrUs) in hospitals, including both clinical and managerial factors; to participate as part of a workgroup to develop and test tools to improve PrU prevention practices in hospitals; to develop a quality improvement manual for hospitals that provides a step-by-step approach for hospitals using these new tools to prevent pressure ulcers, and to participate as part of a multidisciplinary team in piloting a quality improvement (QI) project that uses the newly-developed tools to help refine the quality improvement manual.

Developing and Evaluating a Feasible, Sustainable National Safety Net to Complement Expansions of Public and Private Insurance

DH PI: Josh Durfee, MSPH
Partners: Wake Forest University
Period: November 1, 2009 – April 30, 2010
Sponsor: Robert Wood Johnson Foundation, through Wake Forest University

This project will develop, describe, and disseminate policy options for covering the uninsured through an adequate safety net of direct-access providers, to complement expansions of public

and private insurance. Economic analyses will provide a range of credible estimates of aggregate

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and per person costs for different versions of a comprehensive, integrated safety net for the uninsured. Analyses will cover several scenarios aimed at assisting policy makers under different reform assumptions, including: no substantial reduction (and likely increase) in the uninsured; nearly-universal coverage; or only partial coverage expansions.

National HIV Behavior Surveillance System: Heterosexuals at Increased Risk of HIV Infection (NHBS-HET2)

DH PI: Alia Al-Tayyib PhD
Period: April, 2010 – December 31, 2010
Sponsor: Centers for Disease Control and Prevention

The NHBS system was initiated by CDC to help state and local health departments establish and maintain a surveillance system to monitor selected behaviors and access to prevention services among groups at highest risk for HIV infection. The NHBS-HET2 wave is implementing Respondent Driven Sampling to recruit and interview heterosexuals at increased risk for HIV infection. Findings will be used to enhance the understanding of HIV risk and testing behaviors, and to develop and evaluate HIV prevention programs that provide services to these groups. HSR staff provided support with the formative qualitative evaluation for this project.

Continuing Research Projects

Chronic Care Management / Patient Relationship Management Proof of Concept

DH PI: Andrew W. Steele, MD, MPH, MSc.
Co-PI: Henry H. Fischer, MD
Partners: Denver Health, Microsoft Corporation, EMC Consulting
Period: November 30, 2009 – March 31, 2011
Sponsor: Microsoft Corporation, EMC Consulting, DH eHealth Services

This study is a collaborative effort between Denver Health, EMC Consulting, and Microsoft to improve management for chronic conditions by creating a technology platform to facilitate closed-loop bidirectional communications between patients and providers outside the traditional clinic visit setting. The proof of concept proposes to demonstrate how appointment attendance rates, medication adherence, and self-efficacy can be improved among adult diabetic patients in an urban safety net population by providing between-visit reminders and chronic disease management support through low-cost mobile communications technology.

Evaluating School-Based Influenza Vaccination Programs that Bill Health Insurance

DH PI: Judith Shlay, MD
Partners: Denver Health, Denver Public Schools, University of Colorado (Children's Outcomes Research Program and Colorado Health Outcomes Program)
Period: September 1, 2008 – August 31, 2011
Sponsor: Centers for Disease Control and Prevention #1 U01 IP000199-01

The purpose of this study is to: (1) implement a school-based influenza vaccination program in collaboration with a partner who bills third parties; (2) evaluate the feasibility of providing influenza vaccination services in the school setting; (3) evaluate the feasibility of billing health insurance plans for reimbursement of school-based influenza vaccination services for insured students; (4) determine the cost of conducting school-based influenza vaccination activities; (5)

evaluate the acceptability of school-based influenza activities from the perspectives of parents and examine factors associated with actually receiving influenza vaccinations at school; and (6)

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compare influenza vaccination rates in intervention schools with control schools that are not involved in the intervention.

Examination of the Feasibility of Obtaining 3rd Party Payer Reimbursements for Adolescent Vaccination in the School Setting

DH PI: Judith Shlay, MD

Partners: Denver Health, Denver Public Schools, University of Colorado (Children's Outcomes Research Program and Colorado Health Outcomes Program)

Period: September 1, 2008 – August 31, 2011

Sponsor: Centers for Disease Control and Prevention #1 U01 IP000196-01

The purpose of this project is to: (1) implement a school-based vaccination program in collaboration with a partner who bills third parties; (2) evaluate the feasibility of providing adolescent vaccination services in the school setting; (3) evaluate the feasibility of billing health insurance plans for reimbursement of school-based vaccination services for insured students; (4) determine the cost of conducting school-based adolescent vaccination activities; (5) evaluate the acceptability of school-based vaccination activities from the perspectives of parents and examine factors associated with actually receiving adolescent vaccinations at school; and (6) compare adolescent vaccination rates in intervention schools with control schools that are not involved in the intervention.

Integration of Family Planning Services into a STD Clinic Setting

DH PI: Judith Shlay, MD

Partners: N/A

Period: September 1, 2008 – August 31, 2011

Sponsor: Office of Population Affairs

This study will investigate how providing integrated family planning with sexually transmitted disease (STD) clinical services in the Denver STD clinic affects quality of care, cost of services, staff duties, clinic flow, clients' family planning needs, satisfaction with services, and incidence rates of STDs and pregnancies. In addition, the findings will address the feasibility of replicating such integration approaches more broadly in STD clinics. The project addresses the following specific aims:

Power in Drug Use and HIV Risk Behavior Among Non-Injection Methamphetamine Using Women

DH PI: Deborah Rinehart, MA

Partners: University of Colorado

Period: May 15, 2009 – April 30, 2011

Sponsor: NIDA (R21 award)

With the increase of HIV infection among women and the prevalence of high risk sex behaviors among methamphetamine (MA) using women, researchers must strive to better understand contextual issues that impact risk behaviors among this population. Through using mixed methods, this study proposes to operationalize and develop a scale to assess power issues for this population on four levels: structural, cultural, interpersonal and individual. Future research would include validating this scale among other subpopulations and using information from the study to

develop an HIV prevention intervention founded on multi-level theory of power that could be tested in a larger clinical control trial.

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Improving the Measurement of Surgical Site Infection (SSI) Risk Stratification and Outcome Detection

DH PI: Connie Savor Price, MD
Co-PI: Walter L. Biffi, MD, FACS
Partners: Denver Health, Intermountain Healthcare, Salt Lake City VAMC, Vail Valley Medical Center
Period: September 14, 2009 – March 13, 2011
Sponsor: ACTION Contract No. HHS290200600020, Task Order No. 8

The purpose of this project is to improve the ability to detect surgical site infection (SSI) and improve risk-adjustment for SSI. The overarching goal of the SSI Initiative is to provide better information to assist surgeons, hospitals and healthcare organizations to identify and reduce the risk of SSIs by improving the process by which feedback of surgeon-specific SSI rates occurs. The three activities involved in achieving the project goal are: 1) design and test methods to risk stratify surgical patients for SSI on the basis of data collected from major surgical procedures; 2) assess surgeon and surgical team acceptance of risk-stratification models; and 3) determine SSI rates for major surgical procedures by using sensitive electronic detection algorithms.

Networks and Collaboration

During 2010 the Division moved from being a primary project leader in AHRQ's ACTION initiative to being a partner in the ACTION II initiative. Within the framework of the evolving conception of the Division's role, this change is positive, allowing the Division to begin to move the balance between contract-driven and investigator-initiated projects toward the latter. Investigator-initiated projects have greater potential for enhancing the careers of DH faculty and for enhancing national perceptions of DH's intellectual strength:

ACTION II: Accelerating Change and Transformation in Organizations and Networks

DH PI: Edward P. Havranek, MD
Partners: Denver Health, University of Colorado Denver (CAIANH)
Period: 3 years base contract, plus projected 2-year extension; award date Oct 1 2010
Sponsor: Intermountain Healthcare, under AHRQ ACTION II Contract No. TBD
HSR Personnel: TBD on per-project basis

The goal of ACTION II is to promote and accelerate the development, implementation, dissemination and sustainability of evidence-based innovation in health care delivery and organization to measurably improve health care in the U.S. In support of this goal, ACTION II will focus on practice-based research to achieve the following 4 objectives:

- Implementation of a proof of concept, through which a previously untested innovation is tested on a small scale to demonstrate its feasibility for addressing an identified problem (OR: to determine whether it works to solve/address an identified problem);

- Implementation of an innovation or improvement approach, to provide information for decision-makers about structural, contextual and process factors that play a critical role in increasing (or reducing) the chances that a proven, evidence-based innovation will actually work in a given setting;

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- Spread, or the taking to scale, of one or more proven innovations or delivery system improvements, including the active, wide dissemination of information about what works, accompanied by concrete guidance on how to maximize the likelihood of successful implementation and sustainability. Increasing knowledge about strategies used to promote the systematic uptake of research findings and other evidence-based practice by providers and other decision-makers is an important ACTION objective as well.
- Sustainability, to increase knowledge about the factors that contribute to, or impede, the long term sustainability of innovation. In particular, we will look to ACTION II to closely examine the experiences and outcomes of ACTION projects that were implemented 3 or more years ago, with a focus on measuring whether and to what degree positive outcomes were sustained and enhancing understanding of the factors that supported or impeded sustainability.

D. NOTABLE EVENTS IN 2010

A New Director

Dr. Havranek joined the HSR team as Director on September 1, devoting 0.25 FTE to this role; the remainder of his time is divided between clinical work in the Cardiology Section (~0.5 FTE) and three NIH-funded grant projects (~0.25 FTE). Dr. Havranek's stated goals in assuming this position are to have the Division (1) evolve toward a more even balance between contract-driven and investigator-initiated projects funded by a broader array of sources, and (2) engage a broader array of MD and PhD staff from across the institution in HSR projects.

The High Value Health Collaborative

Beginning in October 2010, members of the HSR Division began to support Denver Health's role in the High Value Health Collaborative under the overall direction of Dr. Tom MacKenzie, participating in regular teleconferences of the Collaborative's Measurement Team and Innovation Team, and attending the group's in-person meeting in Salt Lake City in November.

DH research collaborative meetings.

Beginning in December 2010, the Division began hosting a twice-monthly meeting of a core group of 16 MD and PhD staff with ongoing research activity in health services research. The purpose of the meeting is to facilitate and encourage publication and grant application, as well as to foster cross-disciplinary cooperative research.

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E. ALIGNMENT WITH STRATEGIC IMPERATIVES

A. Maintaining financial viability:

While the direct impact of this small group on the organization's budget is and will remain small, the potential for HSR to have an indirect impact on the financial health of the clinical enterprise is considerable. The direct concern of health services research is how care is organized, and as such can bring to the organization increased creativity in the design of care delivery, rigorous and critical evaluation of reorganized care, and broader awareness within the organization that more efficient care is of higher quality. Activities of the Division will need to be judged by the degree to which they connect with the clinical enterprise.

B. Recruiting and retaining a highly trained workforce:

As noted, there have been no personnel losses from the Division and there are no vacancies.

More broadly, this concern is at the heart of the evolving mission of the Division and cannot be overemphasized. Involvement of a broader array of MD and PhD staff in HSR can increase academic productivity and thus augment academic promotion and retention, broaden funding support for faculty through successful grant awards, and give a wider array of staff the tools to analyze and change the organization of care within their departments. Equally as important is the degree to which a cross-disciplinary enterprise like HSR can build professional social ties within the organization. Such ties are known to increase commitment and longevity within organizations.

To this end, a regular work-in-progress meeting of faculty from CHS, Medicine, Pediatrics, Emergency Medicine has been in place since December 2010.

C. Building critical partnerships:

- research partners: locally, CU School of Medicine, CU School of Public Health, Kaiser-Permanente of Colorado, The Children's Hospital. Nationally, the members of the ACTION II network as lead by Intermountain Health Care and the members of the High Value Health Collaborative.

- funding partners: locally, the Colorado Health Foundation, Caring for Colorado need to be engaged. Nationally, AHRQ, CDC, NIH.

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F. HSR GOALS IN 2011

HSR proposes to accomplish the following goals in 2011:

1. Write and submit a minimum of 2 full research proposals to federal agencies in pursuit of broader mechanisms for research funding.
2. Support the submission of at least 2 other proposals to federal, state, or local agencies. Support is considered to mean active engagement of HSR staff in writing the proposal and that salary support for staff is included in the proposal's budget.
3. Pursue 1 professional development/training opportunity apiece for all HSR personnel in order to improve departmental expertise and familiarity with both current and new methods of analysis.
4. Expand multi-disciplinary research groups from the current group focused on primary care and chronic disease to at least two others. Candidates for these groups include maternal-child health, hospital-acquired infection, and HIT evaluation.
5. Assist in mentorship of at least 5 MD or PhD staff seeking funding for a first HSR-related activity outside the confines of #4.

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The UM department now has 14 budgeted FTEs. The new FTE's allocated in 2010 are for the purpose of providing 24/7 coverage in the ED. For a short period of time we had 3 UM RNs in the ED, but one new hire found it not to be a good clinical fit and resigned after only 3 months. Significant education of all providers and ED nursing staff has been an on-going priority since the majority of admissions come via the ED.

The Out of County initiative spearheaded by Dr. Joel Hirsh gained traction in 2010. UM became involved from the beginning and worked to develop the automated reports that are now being used on a daily basis. Between .25 and .50 UM FTE was dedicated to this effort. Hopefully we will be able to support this financially driven effort with 1 FTE from UM in 2011.

The department ended the year under budget in the very modest Supplies and Expense budget line item and on target with budgeted FTE's.

UM Goals and Outcomes in 2010

1. With a new ED UM position, working on appropriate assignment of ED admissions, reduce the number of UM-initiated "flips" to less than half of all observation status admissions (baseline: 100%; goal: < 50%).

Accomplished:

2,266 Total Observation admissions for 2010

22% of the total observation status cases were flipped by UM RNs

	Inpatient Only	Observation to Inpatient	Inpatient to Observation	Observation only	Grand Totals
2009	25,172	486	890	374	26,922
2010	21,623	2,306	504	1,762	26,195

2. Update the overall Hospital UM plan to reflect the CMS condition of participation and ensure that DH is appropriately following Code 44.

Accomplished:

The Hospital plan was updated in April of 2010. A formal "UM Committee Code 44 call schedule" exists. There have been very few delays in response time from the UM physician thus assuring compliance with CMS regulations. There were 155 Code 44 cases for 2010, an average of 12.9 cases per month.

3. Measure and report the rates of medical necessity denials and show measurable improvements in performance within 6 months of baseline measures (dependent on denials management software installation).

Not accomplished:

This goal will be carried over into 2011. Granular information is currently unavailable.

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4. Create a meaningful productivity tool to measure individual UM nurse activity.

Not accomplished:

This goal will be carried over into 2011. Attempts to obtain tools from peer departments in other UHC hospitals have come up short.

5. Enhance the Hospital UM Committee Dashboard with meaningful metrics that promote interdisciplinary collaboration.

On-going:

This has greatly improved over 2010, but this will be further refined in 2011.

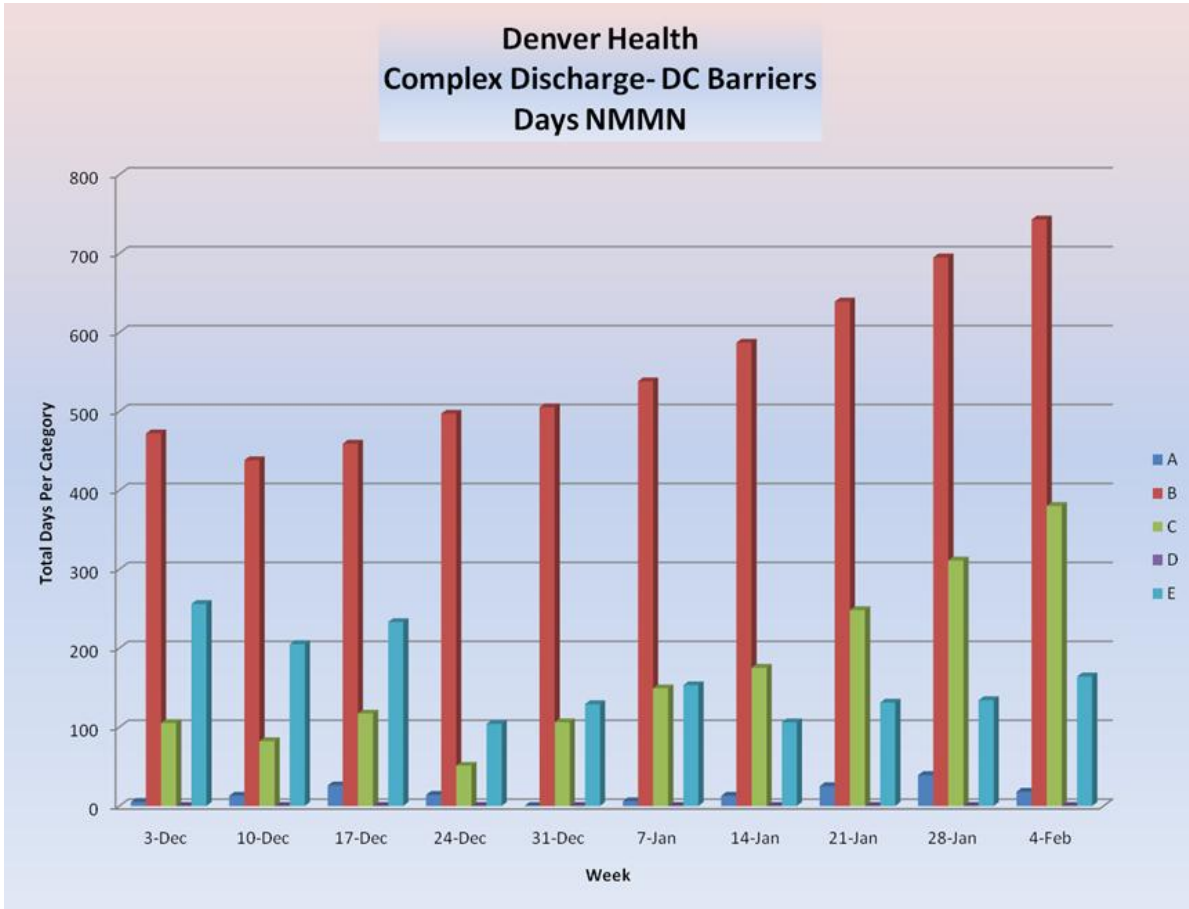
6. **UM LEAN Activities in 2010**

- Managing Commercial AR (consultant) April, 2010
- Interdisciplinary Plan of Care RIE April, 2010
- Authorization Process RIE May, 2010
- Rapid Post Discharge Plan RIE June, 2010
- Expedited Discharge Event (one day) September, 2010
- Continual Readiness VSA November, 2010
- Revenue Cycle VSA December, 2010

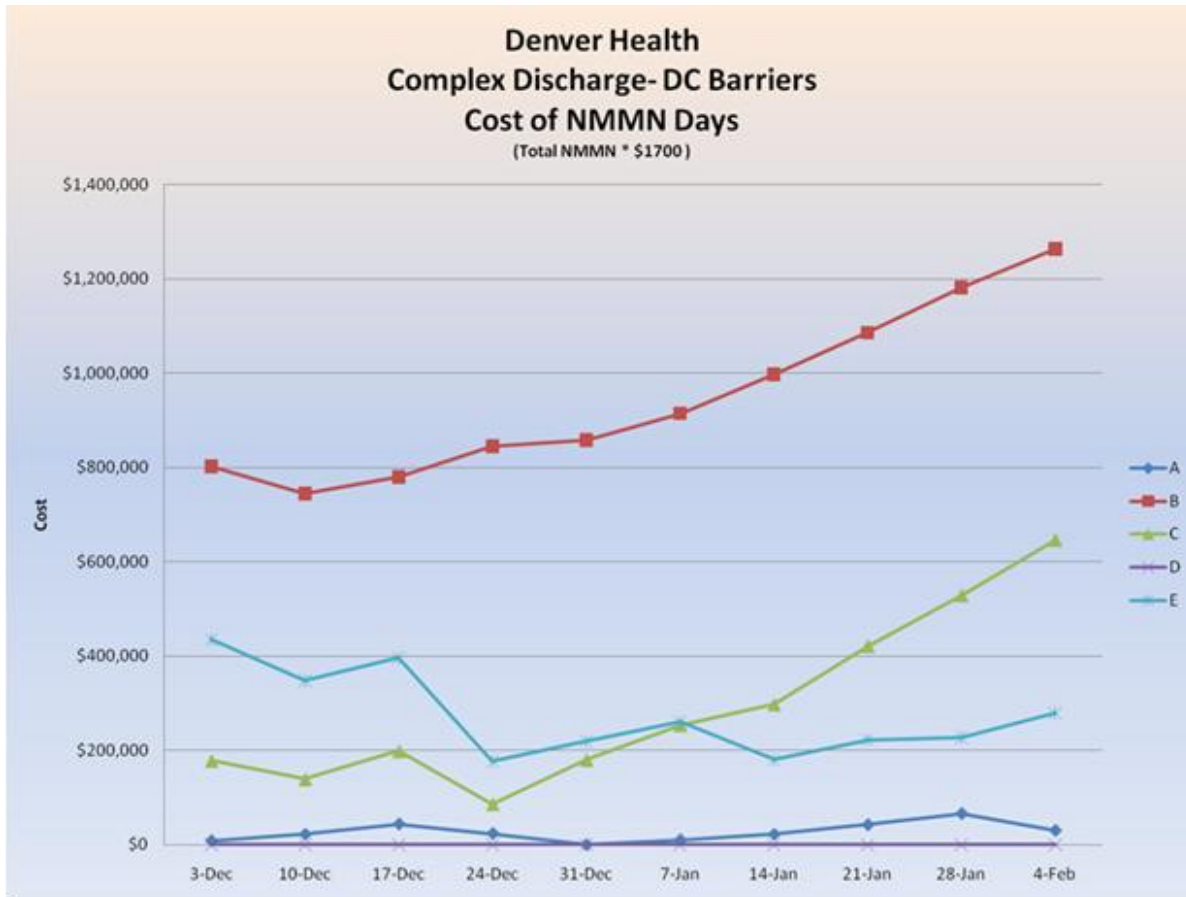
7. **UM Accomplishments Outside of “Official Goals” in 2010**

- a. Took the Complex Discharge reports to a whole new level. The barriers to discharge were listed by the committee and then divided into 5 major categories. During the review, the patients are placed into one of the five categories and the NMMN (Not Meeting Medical Necessity) days were quantified.

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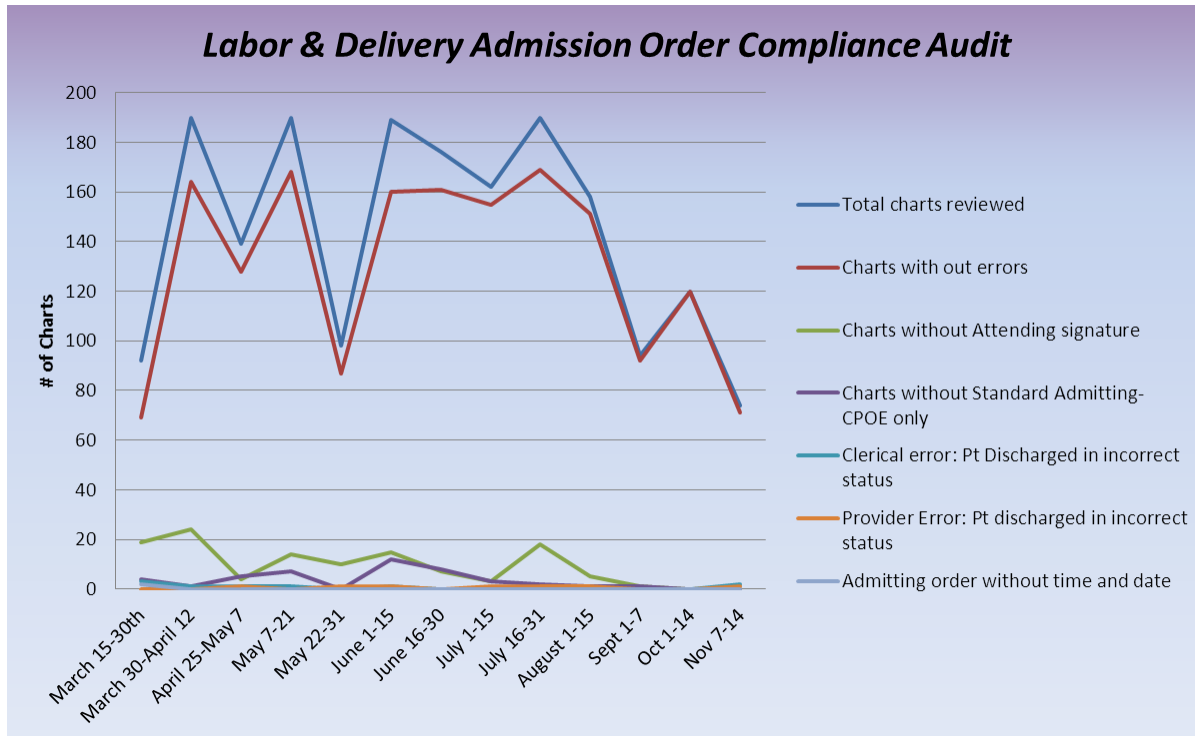


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- b. Audited and reported a number of audits specific to UM functions. Included among them are: Same day and One-day stays; Observation vs. Inpatient retro-reviews; OB Screening Room Admission Order compliance; Use of Telemetry in the ED; Code 44 cases; and weekend Observation and Out Of County reviews and reports. Below are the Labor and Delivery Admission Order Compliance Audit. Our initiatives to bring Labor and Delivery into compliance were so successful that we will now be auditing only on a quarterly basis.

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- c. Team Awards and Star Awards:
- i. Out of County Un-sponsored Review- Awarded
 - ii. Same-Day and One-Day Stay Review- Pending
 - iii. Star Awards: Eight Star Awards were awarded to UM Staff

Education

1. **Progressive HealthCare Conferences -CMS Regulations Regarding Observation** - February 18, 2010
2. **Milliman- 14th Edition Updates**- March 5, 2010
3. **UHC: Teleconference, The Importance of Medical Necessity Compliance in Today's Regulatory Environment**- May 4, 2010
4. **Colorado Hospital Association Webinar, Observation: Questions and Answers**- May 20, 2010
5. **Global Media Dynamics: 2010 Observation Patient Mgmt Congress** - August 5-6, 2010
6. **EHR: Compliance Roadshow: Medical Necessity and Regulatory Compliance**- September 21, 2010
7. **Case in Point Webinar: Observation Status: Benchmarks and Best Practices Secure Your Status and Maximize Reimbursements**- December 15, 2010

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Committees with UM participation

1. Continual Readiness Committee
2. Observation vs. Inpatient oversight committee- redefining the admission process for both observation and inpatient status
3. Department of Corrections UM Committee (chair)
4. Hospital UM committee (co-chair)
5. Revenue Cycle Steering Committee
6. Complex Discharge Committee
7. The Out of County Uninsured Oversight Committee

2011 Goals

- Continue to develop partnership with Enrollment and Admissions:
 - To expedite patient financial information in order to capitalize on reimbursement
 - Enroll patients in programs prior to discharge
 - Identify accurate demographics that facilitate appropriate follow-up for OOC patients
- Obtaining granular information regarding denials
- Continue to work on and report the accuracy of appropriate admission status
- Better define the UM role in OOC initiative
- Participate in the RAC audit events
- 24/7 coverage in ED
- Support the PES to ultimately reduce denials
- Continue education efforts in clinics and OR re: ambulatory surgical cases appropriately discharged from the PACU. Provide immediate feedback to the areas involved
- Continue efforts using inter-rater reliability specifically related to Observation vs. Inpatient status
- Clearly define meaningful and equitable productivity measures for all UM RNs (It is not 'one size fits all')
- Increase staff UM participation in LEAN events
- Evaluate the ROI of multiple monthly audits collected by UM
- Continue to try to understand and improve DH standing in the Action OI report
- Standardize the Managed Care Transfer/Admission flow
- Improve DH ranking in UHC Action OI report to the 25th percentile

XII. PUBLICATIONS

2010 ANNUAL REPORT

A. 2010 MANUSCRIPTS

Some manuscripts are listed in the divisions sections above and not repeated below.

1. R Hanratty; M Chonchol; LM Dickinson; BL Beaty; RO Estacio; **TD MacKenzie**; LP Hurley; SL Linas; JF Steiner; EP Havranek. Incident chronic kidney disease and the rate of kidney function decline in individuals with hypertension. *Nephrology Dialysis Transplantation* 2010 Mar;25(3):801-7.
2. Carling C, Kristoffersen DT, Oxman AD., Flottorp S, Fretheim A, Schünemann HJ, Akl E, Devaraux PJ, Herrin J, **MacKenzie TD**, Montori VM. What is the effect of how outcomes are framed on decisions about whether to take antihypertensive medication? A randomized trial. *PLoS One*. 2010 Mar 1;5(3):e9469.
3. Narayanan V, Gaudinai JL, Harris RH, **Mehler PS**. Liver Function Test Abnormalities in Anorexia Nervosa—Cause or Effect. *International Journal of Eating Disorders* 43(4):378-381, 2010.
4. Gaudiani JL, Kashuk JL, Chu ES, Narayanan V, **Mehler PS**. The Use of Thrombelastography to Determine Coagulation Status in Severe Anorexia Nervosa: A Case Series. *International Journal of Eating Disorders* 43(4):382-385, 2010.
5. **Mehler PS**, Crowe S. Medical Complications of Anorexia Nervosa in Mitchell J. Gillo M. Eating Disorders Hand Book. 59-71, 2010.
6. Chadaga S, Mancini D, **Mehler PS**, Heist, K, Keniston A, Van Dyk S, Heade K, Chu ES. A Hospitalist-Led Emergency Department Team Improves Hospital Bed Efficiency. *Journal of Hospital Medicine*. 5:s1:17-18, 2010.
7. Cleary BS, Gaudiani JL, **Mehler PS**. Interpreting the Complete Blood Count in Anorexia Nervosa. *Eating Disorders: The Journal of Treatment and Prevention* 18(2):132-139, 2010.
8. Prado R, Albert RK, **Mehler PS**, Chu ES. Quality Improvement Conundrums: Looking Back Before Moving Forward. *Journal of Hospital Medicine* 51(1):E33, 2010. (Ltr)
9. Biffl WL, Narayanan V, Gaudiani JL, **Mehler PS**. The Management of Pneumothorax in Patients with Anorexia Nervosa: A Case Report and Review of the Literature. *Patient Safety in Surgery* 4(1):1-4, 2010.
10. **Mehler PS**, Winkelman A, Andersen D, Gaudiani JL. Nutritional Rehabilitation: Practical Guidelines for Refeeding the Anorectic Patient. *Journal of Nutrition and Metabolism*, 2010 Feb 7. (epub ahead of print).
11. Stahel PF, Fakler JKM, Flierl MA, Moldenhauer K, **Mehler PS**. Current Concepts of Patient Safety: Rapid Response System. *Der Unfallchirurg* 113:239-246, 2010.
12. Biffl WL, **Mehler PS**, Moore EE. Acute Care Surgery in the Safety Net Hospital: Maintaining Referrals and Optimizing Outcomes. *Scandinavian Journal of Surgery* 99:1-5, 2010.
13. Stahel PF, Flierl MA, Smith WR, Morgan SJ, Victoroff MS, Clarke TJ, Sabel AL, **Mehler PS**. Disclosure and Reporting of Surgical Complications -- A Double-Edged Sword? *American Journal of Medical Quality*, 25(5):398-401, 2010.

14. Jenkins TC, Sabel AL, Sarcone EE, Price CS, **Mehler PS**, Burman WJ. Skin and Soft Tissue Infections Requiring Hospitalization at an Academic Medical Center: Opportunities for Antimicrobial Stewardship. *Clinical Infectious Diseases* 51(8):895-903, 2010.
15. Bahia A, Chu ES, **Mehler PS**. Polydipsia and Hyponatremia in a Woman with Anorexia Nervosa. *International Journal of Eating Disorders*, 2010 Feb 2. (epub ahead of print)
16. Mascolo M, Chu ES, **Mehler PS**. Abuse and Clinical Value of Diuretics in Eating Disorders Therapeutic Applications. *International Journal of Eating Disorders*, 2010 Feb 22. (epub ahead of print)
17. Stahel P, Sabel AL, Victoroff MS, Varnell J, Lembitz A, Boyle DJ, Clarke T, Smith W, **Mehler PS**. Wrong Site and Wrong Patient Procedures in the Era of the Universal Protocol – Analysis of a Prospective Database of Physician Self-Reported Occurrences. *Archives of Surgery* 145(10):978-984, 2010.
18. Gaudiani JL, Heinrichs G, Narayanan V, **Mehler PS**. Tampon Use in Patients with Anorexia Nervosa Can Cause Persistent Vaginal Bleeding: A Case Series. *International Journal of Eating Disorders*, 2010 Dec 10. (epub ahead of print).
19. Gaudiani JL, Sabel AL, Mascolo M, **Mehler PS**. Severe Anorexia Nervosa: Outcomes from a Medical Stabilization Unit. *International Journal of Eating Disorders*, 2010 Nov 5. (epub ahead of print).