SCIP CDSS Model

The SCIP Core Measures for Surgical Intervention were developed in 2003 and revised and required for use by hospitals in 2006. The literature supports a positive relationship between those hospital's that have better patient safety cultures have higher rates of providing care in accordance with SCIP measures. Mardon et al. 2006.

The goal of any healthcare system is 100% compliance of the SCIP Core Measures. The current CDS Model for the SIP Decision Support Product we are proposing focuses on SIP 1-2. There is room for expansion to SCIP INF=3.

SCIP Measures the CDSS addresses

Surgical Care Improvement Project (SCIP) - Process and Outcome Measures	
SURGICAL INFECTION	
Focus of Model	**SCIP INF 1:** Prophylactic antibiotic received within one hour prior to surgical incision.
Focus of Model	**SCIP INF 2:** Prophylactic antibiotic selection for surgical patients.
Model enhancement=Development opportunity	**SCIP INF 3:** Prophylactic antibiotics discontinued within 24 hours after surgery end time (48 hours for cardiac patients).
Addressed via backend reporting	**SCIP INF 5:** Postoperative wound infection diagnosed during index hospitalization (OUTCOME).

http://www.jointcommission.org/PerformanceMeasurement/Measurement/Current+NHQM+Manual.htm

SCIP Antibiotic Allogorithm for Surgical Type

10/01/08 – 3/31/09	**Surgical Care Improvement Project Antibiotic Recommendations**
Surgery Type	**Antimicrobial Recommendations**
Abdominal or vaginal hysterectomy	Cefotetan (Cefotan®) or Cefazolin (Ancef®) or Ampicillin-sublactam (Unasyn®) *If Beta-lactam allergy:* ▪ Clindamycin or ▪ Metronidazole (Flagy®l)
Hip or knee arthroplasty	Preferred: Cefazolin (Ancef®) High-risk for MRSA (must document) Vancomycin***** *If Beta-lactam allergy:* ▪ Vancomycin ▪ Clindamycin
Cardiothoracic and vascular surgery	Preferred: Cefazolin (Ancef®) High-risk for MRSA (must document) Vancomycin***** *If Beta-lactam allergy:* ▪ Vancomycin ▪ Clindamycin
Colorectal Surgery	Cefotetan (Cefotan®) or Cefazolin (Ancef®) and Metronidazole (Flagyl®) or Ampicillin-sublactam (Unasyn®) or Ertapenem (Invanz®) as a single dose *If Beta-lactam allergy:* Clindamycin combined with Gentamicin or parenteral Fluroquinolone or Aztreonam or Metronidazole (Flagyl®) with Gentamicin or parenteral Fluroquinolone (Levaquin®)

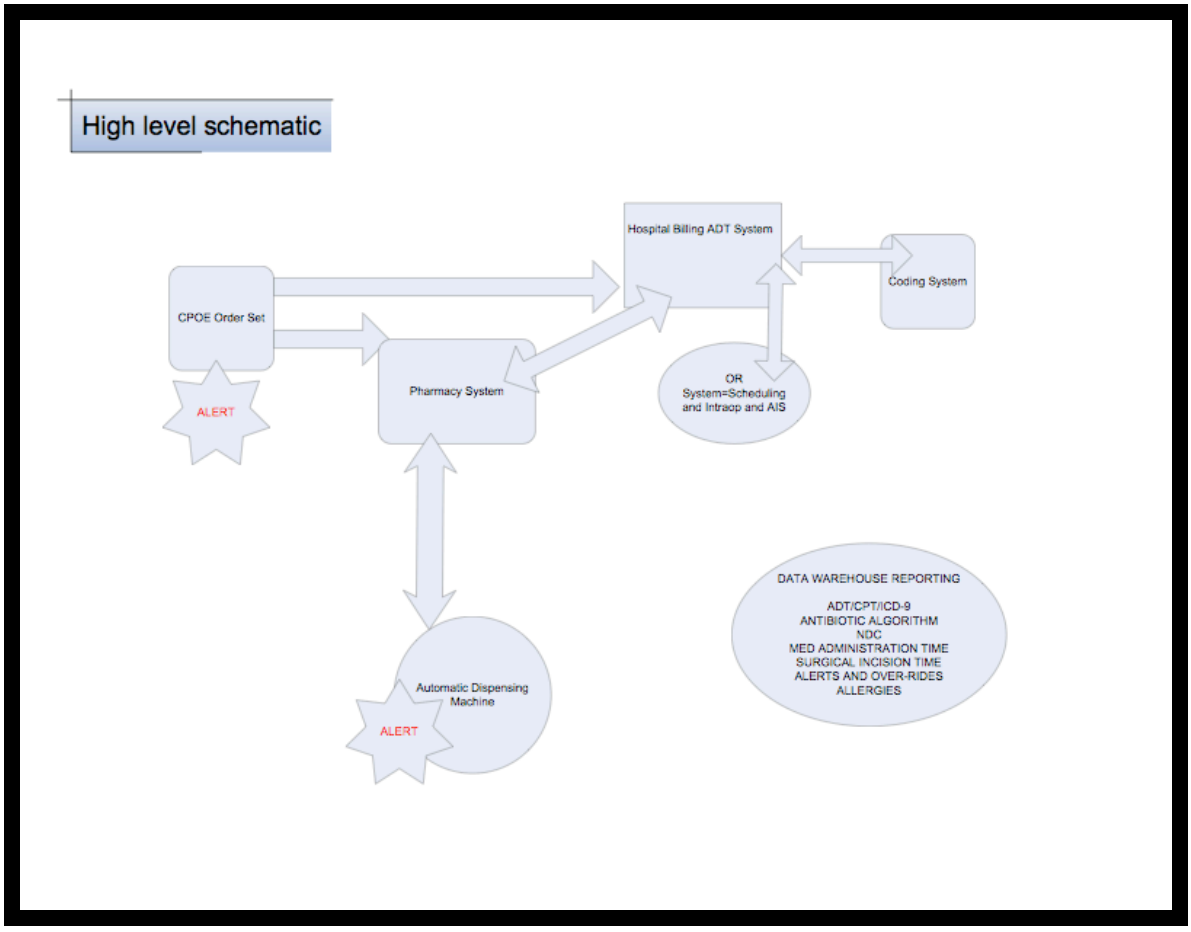
Use of Vancomycin for surgical prophylaxis, in the absence of a documented beta-lactam allergy, requires physician-documented rationale in the medical record.

HSAG, 2006

The SCIP Decision Support System (CDSS)

The product is being devised for intelligently aiding clinical operations in the daily management of surgical patients. Precisely, five system targets have been identified that would highly benefit the SCIP CDSS point-of- care intervention;

(i) Appropriate ordering of antibiotic for surgical types-Therapy
(ii) Appropriate delivery of antibiotic for surgical types-Therapy
(iii) Appropriate administration time <= 1 hour
(iv) No HAI =prognosis
(v) Reporting and analysis-follow-up.



Example of System Decision Flow

Populations

Included Populations:

- ICD-9-CM Principal Procedure Code or ICD-9-CM Other Procedure Code for selected surgical types.
- Discharges with an ICD-9-CM Principal Procedure Code or ICD-9-CM Other

Excluded Populations:

- Admission DX suggestive of preoperative infectious diseases
- Antibiotics within 24 hours prior to arrival (except colon surgery patients taking oral prophylactic antibiotics).
- Readmissions of patients with MDRO history
- Post-surgical re-admits
- Micro lab confirmation of reportable diseases

Denominator Statement: All selected surgical patients with no prior evidence of infection.

eligible patients who received recommended care
total # patients eligible to receive the care

User Needs

- Diagnosis, assessment and evaluation of surgical intervention core measure SIP 1-2
- Identification of suitable orders sets
- Planning of adequate, patient's specific therapy using antibiotic specific alogorithms.
- Analysis of data
- Suggestion of changes in management and treatment
- Improve CMS reimbursement
- Streamline reporting process.

Considerations for design and reliability of SCIP CDSS

- Data elements and computational modeling
- Knowledge discovery methodologies
- Medical Front- end functionalities of Decision Support
- Diagnostic Data Analysis services and reporting.

Core Components of the SCIP CDSS

- Formalized clinical knowledge by way of alerts pre-existing guidelines,
- Experts' know-how procedures,
- Robust and reliable reasoning approaches

Machine Learning (ML) and

Inference methodologies on
Declarative procedural domain knowledge;

Model Choice
Based on review of the literature we could not find any similar product on the market. We adapted the SCIP CDSS on similar type of decision support systems that utilized transactional data elements from feeder systems within the EMR infrastructure. The use of the DROOLS oracle/java database technology could be utilized on the backend within the data warehouse. Colontonio, et al 2008, Flink, et al, 2008

Model Categories
- **Signal processing**, developed for assessing patients' status and acquiring diagnostic parameters. Processes belonging to this category consist of calls to algorithmic procedures, are activated by the user's interaction, e.g. entering orders or obtaining meds from ADC
- **Inference***,* involved in inferential reasoning. This would allow for the query of the database for specific criteria. Specifically this resides at the server level and can be activated on demand. An example of this would be "Tell me how many surgical patients had over-rides or the order set?."
- **Computational decision***,* concerned with computational reasoning for included patients (surgical types coupled with appropriate antibiotic algorithm processing.

Architecture
The SCIP CDSS architecture has been designed according to a multilevel concept utilization for distinguishing among the *knowledge level*, corresponding to all the information needed by the system for performing tasks, e.g. data, domain knowledge, computational decision models;
- ***processing level***, consisting of the system components that are responsible of tasks accomplishment by using the knowledge level;
- ***end-user application level,*** including the system components whose functionalities are specifically defined for interacting with the user.

The SCIP CDSS Architecture consists of:
- ***Domain Knowledge Base***, consisting of the domain knowledge, formalized
- from the guidelines and of the clinicians' know-how;
- ***Model Base***, containing the computational decision models, signals and
- images processing methods and pattern searching procedures;
- ***Meta Knowledge Base****,* composed by the strategy knowledge, i.e. about the organization of the CDSS tasks.
- ***Brai****n*, the system component endowed with the reasoning capability, which is divided into the meta and object level;

Model Validation/Usability Testing:
One of the key criteria we would incorporate into the model design would be the Model Validation testing. This form outlined below is an example of what the model validation/usability testing results would look like.

MODEL TABLE-CDS Model Validation					
Total	**Baseline**		**Post-Intervention**		***P*-value**
	Number of Patients		**Percent**	**Number of Patients**	**Percent**
	117			144	
Over-ride of PFO at time or ordering with incorrect documentation	15	12.8	19	13.2	0.54
Over-ride of PFO at time or ordering with correct documentation	3	2.6	3	2.1	0.55
Over-Ride of Alert at ADC-MD with correct selection or documentation	12	10.3	8	5.6	0.12
Over-Ride of Alert at ADC-MD with incorrect selection or documentation					
Antibiotic given within one hour of incision time					
Antibiotic Not given within one hour of incision time. Manual review of case required					
Post Operative infection with antibiotics					

Rates

eligible patients who received recommended care
total # patients eligible to receive the care

- Only included rates where total # eligible patients >=
- Only included rates with a full year of data (

www.hospitalqualityalliance.org/hospitalquality alliance/qualitymeasures/qualitymeasures.html

One of the key steps after Model Validation would be **usability testing** whereby we would be evaluating the system use in several hypothetical cases. Analysis of appropriate action at the alert junctures would be reviewed and the action-triggering event would be evaluated for the appropriate clinical action. Items to be evaluated are ability to read and understand the alert message, contrast on the screens, perceived time pressure during the simulated cases, action before alert read completely. System alerts would be revised based on the summary and analysis of the usability testing. Colontonio, et all, 2008

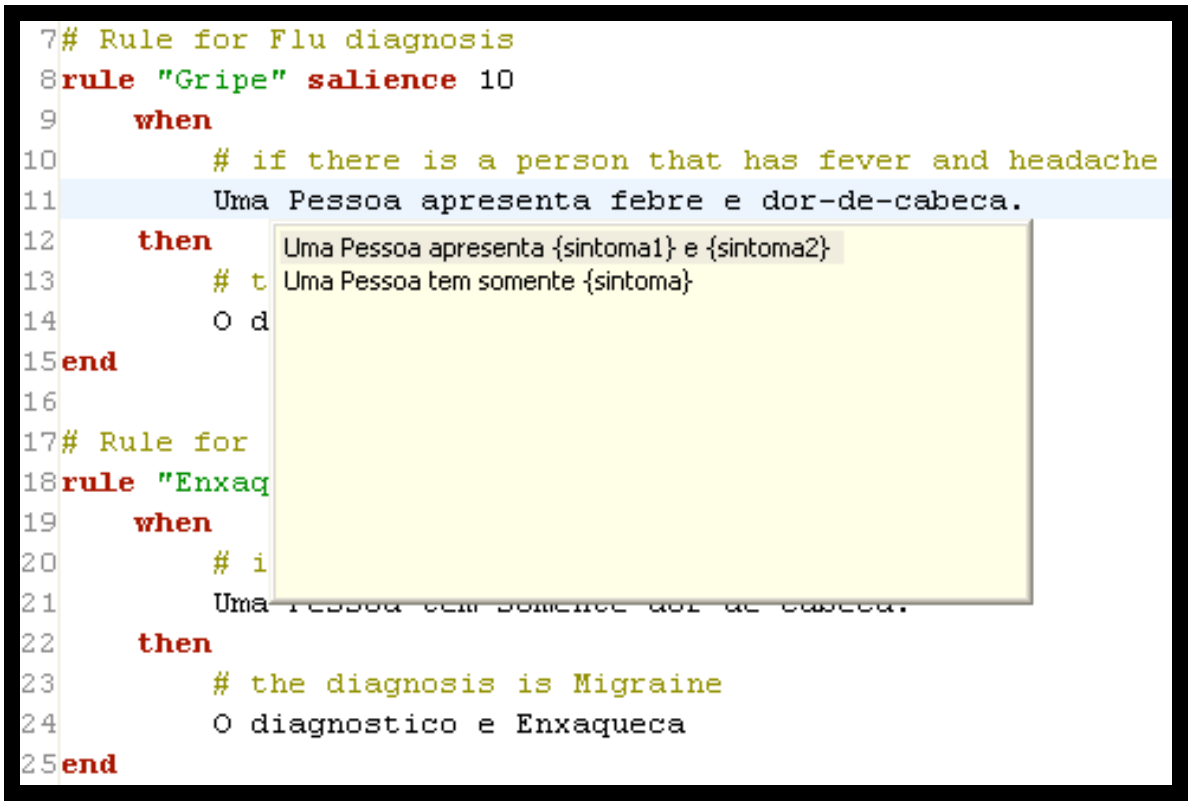
Model Processing

http://www.jboss.org/drools/drools-expert.html

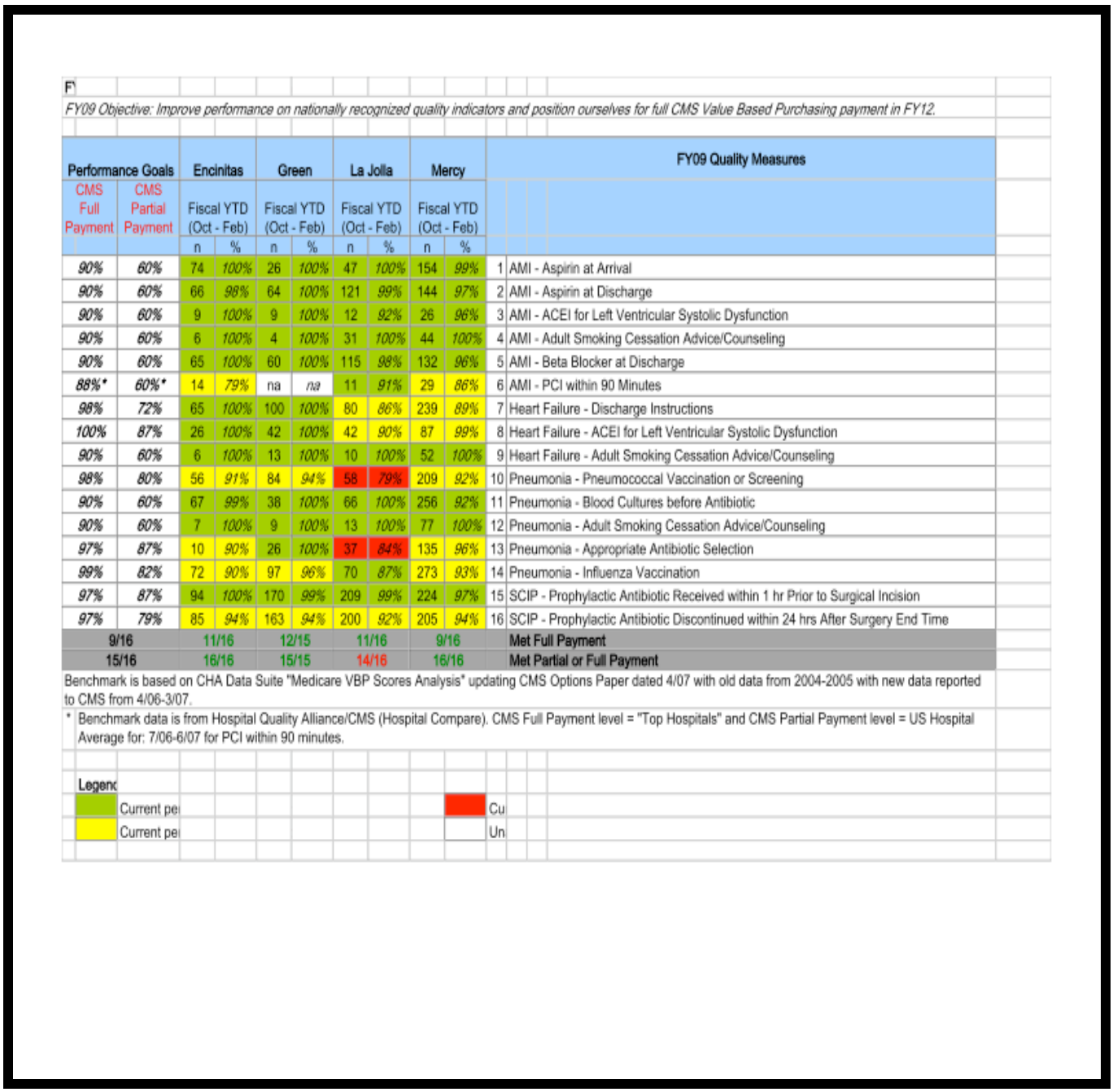
Processing is primarily an event-processing concept that deals with the task of processing multiple events with the goal of identifying the meaningful events within the event cloud. This employs techniques such as detection of complex patterns of many events, event correlation and abstraction, event hierarchies, and relationships between events such as causality, membership, and timing, and event-driven processes." Colontonio, et all, 2008

Example of Event Processing-Data example for proposed CDSS

1 #Rule for Antibiotic Treatment,
rule "Antibiotic Algorithm"
when
#surgical type from CPT code



Example of Processing in a relational database format



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FY09 Objective: Improve performance on nationally recognized quality indicators and position ourselves for full CMS Value Based Purchasing payment in FY12.

Performance Goals		Encinitas		Green		La Jolla		Mercy			FY09 Quality Measures
CMS Full Payment	CMS Partial Payment	Fiscal YTD (Oct - Feb)		Fiscal YTD (Oct - Feb)		Fiscal YTD (Oct - Feb)		Fiscal YTD (Oct - Feb)			
		n	%	n	%	n	%	n	%		
90%	60%	74	100%	26	100%	47	100%	154	99%	1	AMI - Aspirin at Arrival
90%	60%	66	98%	64	100%	121	99%	144	97%	2	AMI - Aspirin at Discharge
90%	60%	9	100%	9	100%	12	92%	26	96%	3	AMI - ACEI for Left Ventricular Systolic Dysfunction
90%	60%	6	100%	4	100%	31	100%	44	100%	4	AMI - Adult Smoking Cessation Advice/Counseling
90%	60%	65	100%	60	100%	115	98%	132	96%	5	AMI - Beta Blocker at Discharge
88%*	60%*	14	79%	na	na	11	91%	29	86%	6	AMI - PCI within 90 Minutes
98%	72%	65	100%	100	100%	80	86%	239	89%	7	Heart Failure - Discharge Instructions
100%	87%	26	100%	42	100%	42	90%	87	99%	8	Heart Failure - ACEI for Left Ventricular Systolic Dysfunction
90%	60%	6	100%	13	100%	10	100%	52	100%	9	Heart Failure - Adult Smoking Cessation Advice/Counseling
98%	80%	56	91%	84	94%	58	79%	209	92%	10	Pneumonia - Pneumococcal Vaccination or Screening
90%	60%	67	99%	38	100%	66	100%	256	92%	11	Pneumonia - Blood Cultures before Antibiotic
90%	60%	7	100%	9	100%	13	100%	77	100%	12	Pneumonia - Adult Smoking Cessation Advice/Counseling
97%	87%	10	90%	26	100%	37	84%	135	96%	13	Pneumonia - Appropriate Antibiotic Selection
99%	82%	72	90%	97	96%	70	87%	273	93%	14	Pneumonia - Influenza Vaccination
97%	87%	94	100%	170	99%	209	99%	224	97%	15	SCIP - Prophylactic Antibiotic Received within 1 hr Prior to Surgical Incision
97%	79%	85	94%	163	94%	200	92%	205	94%	16	SCIP - Prophylactic Antibiotic Discontinued within 24 hrs After Surgery End Time
9/16		11/16		12/15		11/16		9/16			Met Full Payment
15/16		16/16		15/15		14/16		16/16			Met Partial or Full Payment

Benchmark is based on CHA Data Suite "Medicare VBP Scores Analysis" updating CMS Options Paper dated 4/07 with old data from 2004-2005 with new data reported to CMS from 4/06-3/07.

* Benchmark data is from Hospital Quality Alliance/CMS (Hospital Compare). CMS Full Payment level = "Top Hospitals" and CMS Partial Payment level = US Hospital Average for: 7/06-6/07 for PCI within 90 minutes.

Legend

Current pe — Cu

Current pe — Un

Example of Backend Reporting for CMS-Courtesy of Scripps Green Hospital, 2009

FY09 Quality Performance Goals - SCIP Measures

FY09 Objective: Achieve 93 percent compliance on five out of seven Surgical Care Improvement Project (SCIP) Measures intended to reduce surgical site infections and surgical complications.

Goal	Encinitas		Green		La Jolla		Mercy		Carmel Valley ASC		Surgical Care Improvement Project (SCIP) Measures
	Fiscal YTD (Oct - Feb)		Fiscal YTD (Oct - Feb)		Fiscal YTD (Oct - Feb)		Fiscal YTD (Oct - Feb)		Fiscal YTD (Oct - Feb)		
	n	%	n	%	n	%	n	%	n	%	
93%	95	*97%*	171	*100%*	213	*99%*	229	*98%*	197	*100%*	Percent of Surgical Patients with Appropriate Selection of Prophylactic Antibiotic*
93%	na	*na*	58	*97%*	73	*93%*	58	*91%*	--	--	Percent of Major Cardiac Surgical Patients with Controlled Post-Operative Serum Glucose
93%	153	*100%*	249	*100%*	298	*99%*	373	*100%*	134	*100%*	Percent of Surgical Patients with Appropriate Hair Removal*
93%	21	*100%*	14	*100%*	35	*94%*	30	*90%*	--	--	Percent of Colorectal Surgical Patients with Normothermia in the PACU
93%	30	*100%*	73	*88%*	71	*90%*	85	*94%*	--	--	Surgery Patients on Beta Blocker Therapy Prior to Admission who Receive a Beta Blocker During the Perioperative Period
93%	62	*100%*	59	*92%*	82	*99%*	128	*95%*	--	--	Surgery Patients with Recommended Venous Thromboembolism Prophylaxis Ordered
93%	62	*97%*	59	*92%*	82	*87%*	128	*92%*	--	--	Surgery Patients who Received Appropriate Venous Thromboembolism Prophylaxis within 24 Hours Prior to Surgery to 24 Hours After Surgery
5/7	6/6		4/7		5/7		4/7		2/2		Number of Measures Currently At Goal
	Curre										
	Curre										

Example of Backend Reporting for SCIP Measures- Courtesy of Scripps Green Hospital, 2009

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