Information Services
2015 Benefits Realization Analysis

State of Corporate Information Services Supplement

Penn Medicine

MESSAGE FROM THE CIO

Penn Medicine is at the forefront of unifying world class patient care and research with information technology. The IT investments made by Penn Medicine have positioned Penn Medicine to rapidly respond to the ever changing healthcare environment. As organizations in all industries have recognized, a more digitized environment requires a higher performing Information Services organization.

Tied to this performance are the benefits associated with the Information Services efforts. This report focuses on the financial benefits that are the result of successfully completing multiple high profile projects over the past several years. Each highlighted project displayed exemplary teamwork and cooperation between the Information Services department and our operational colleagues. It is this collaborative spirit that serves as a cornerstone to support Penn Medicine's ongoing efforts in transforming our Patient Care, Research and Education efforts.

Thanks to everyone who has partnered with the Information Services team to attain such a high level of success and benefits realization. I look forward to continuing to work with all members of the Penn Medicine community and driving even greater benefits in the future.

Michael Restuccia
Vice President and Chief Information Officer

✱   The contents following include a summary of financial benefits realized for a 1, 3, and 5 year period for each of the select IT projects in the following categories

Purpose of the Report

This report reviews 23 high profile projects in which the Penn Medicine Information Services team collaborated with its operational partners in order to generate both financial and qualitative benefits. The projects are grouped into six different categories that define a particular strategic goal of Penn Medicine.

The purpose of this report is to demonstrate the measurable financial return on investment and benefits achieved from a cross section of IT projects from 2010 through 2015. Our mission in Information Services remains Transforming Data into Value in support of the Pathway to Personalized Medicine.

As projects have been completed, we have realized significant value from many of the investments of time, resources and technology together with our operational leaders in terms of:

> Quality patient care and safety;

> Patient, family, staff and physician satisfaction with the care and services provided; and

> Education and Research Support

In order to sustain the direct patient care value realized from the Corporate Information Services initiatives, it is critical to also measure the financial return on these investments. As evidenced by the projects in this report and the many others that have been completed, the Penn Medicine Information Services organization continually strives to exceed end-user expectations.

COMPLETE REVIEW OF SAVINGS

EMPOWERING TECHNOLOGIES

PROJECT NAME	1 YEAR	3 YEAR	5 YEAR
Service Desk Insourcing	$1,081,236	$3,541,279	$6,364,596
Insourcing End-User Support Services	$1,000,000	$3,000,000	$5,000,000
Enterprise Resource Planning Applications Hosting	$500,000	$1,300,000	$2,300,000
Vendor Neutral Archive (VNA)	$1,823,900	$6,411,264	$13,144,904
Penn Medicine Academic Computing Services (PMACS)	$849,000	$2,547,000	$4,245,000
Analytics Platform	$1,809,000	$5,427,000	$9,045,000
Epic Communication Manager	$1,266,293	$3,798,878	$6,331,464
Retired Application List	$484,800	$1,454,400	$2,424,000
Service Review Optimization	$921,000	$2,763,000	$4,605,000
Resiliency & Downtime Avoidance	$3,496,860	$3,711,420	$3,925,980
SAVINGS	**$13,232,089**	**$33,954,241**	**$57,385,944**

DIGITAL HEALTHCARE

PROJECT NAME	1 YEAR	3 YEAR	5 YEAR
Overall Benefit of Ambulatory Medical Record	$985,380	$3,145,923	$5,597,516
Epic Ambulatory Practice Management	$9,240,000	$27,720,000	$46,200,000
Epic OR Management (OpTime)	QUALITATIVE	QUALITATIVE	QUALITATIVE
Epic Emergency Department and Trauma	QUALITATIVE	QUALITATIVE	QUALITATIVE
Knowledge Based Charting (KBC)	$28,200	$84,600	$141,000
Knowledge Based Med Administration (KBMA)	QUALITATIVE	QUALITATIVE	QUALITATIVE
SAVINGS	**$10,253,580**	**$30,950,523**	**$51,938,516**

BLUEPRINT FOR PATIENT QUALITY & SAFETY

PROJECT NAME	1 YEAR	3 YEAR	5 YEAR
Early Warning System (EWS)	$751,169	$2,253,506	$3,755,844
Physician Quality Reporting System (PQRS)	$750,000	$750,000	$750,000
CMS Two Midnight Rule	QUALITATIVE	QUALITATIVE	QUALITATIVE
SAVINGS	**$1,501,169**	**$3,003,506**	**$4,505,844**

MAKING DATA MEANINGFUL

PROJECT NAME	1 YEAR	3 YEAR	5 YEAR
Facility Board	QUALITATIVE	QUALITATIVE	QUALITATIVE
Meaningful Use Stage 1 and 2	$57,677,355	$57,677,355	$57,677,355
SAVINGS	**$57,677,355**	**$57,677,355**	**$57,677,355**

MAKING THE CONNECTION

PROJECT NAME	1 YEAR	3 YEAR	5 YEAR
Patient Portal - myPennMedicine	$5,408,961	$16,226,883	$27,044,805
SAVINGS	**$5,408,961**	**$16,226,883**	**$27,044,805**

POWER TO THE PROVIDER

PROJECT NAME	1 YEAR	3 YEAR	5 YEAR
Unstructured Text Search - PennSeek	$93,300	$279,900	$466,500
SAVINGS	**$93,300**	**$279,900**	**$466,500**
TOTAL SAVINGS	**$88,166,453**	**$142,092,408**	**$199,018,963**

BREAKDOWN OF SAVINGS CATEGORY

3 YEAR SAVINGS

$3,003,506
Blueprint for Patient Quality & Safety

$279,900
Power to the Provider

$16,226,883
Making the Connection

$33,954,241
Empowering Technologies

$57,677,354
Making Data Meaningful

$30,950,523
Digital Healthcare

5 YEAR SAVINGS

$4,505,843
Blueprint for Patient Quality & Safety

$466,500
Power to the Provider

$27,044,805
Making the Connection

$57,385,944
Empowering Technologies

$57,677,354
Making Data Meaningful

$51,938,515
Digital Healthcare

EMPOWERING TECHNOLOGIES
These projects are focused on technologies and processes to address the administrative and physical infrastructure that includes financial services, operations, human resources, managed care contracting, billing , materials management and others.

DIGITAL HEALTHCARE
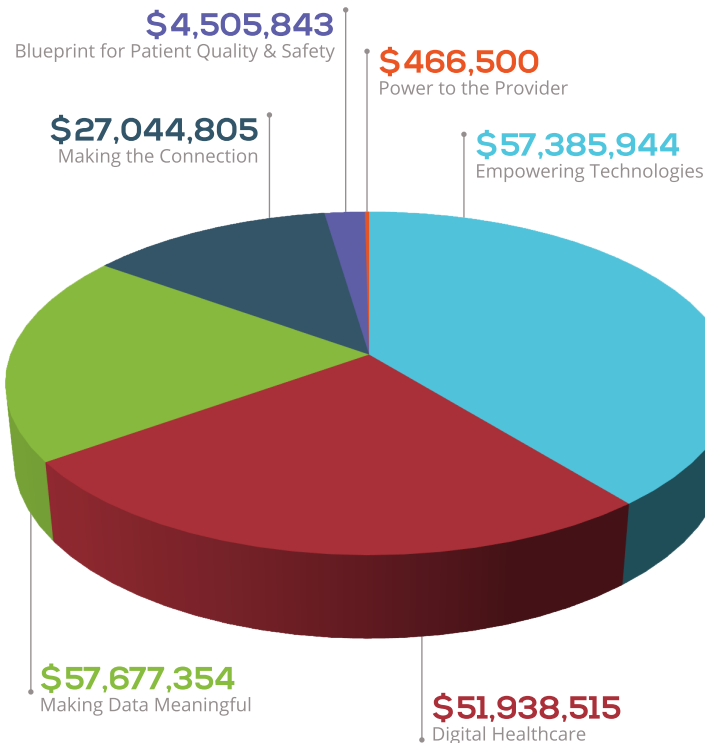These projects are focused on implementation and enhancement of the Electronic Medical Records applications in which clinical documentation is captured and used to support patient care delivery.

BLUEPRINT FOR QUALITY AND SAFETY
These projects are focused on using the features of various applications to support quality improvement in care delivery and both internal and external quality reporting requirements.

MAKING DATA MEANINGFUL
These projects are focused on effective capture and use of data from the clinical and financial systems to support improved care delivery, financial management and quality improvement.

MAKING THE CONNECTION
These projects are focused on using technology to enhance the communication and sharing of information between providers and patients across the continuum of care.

POWER TO THE PROVIDER
These projects focus on using the tools and features of the EMR to enable Providers to quickly access clinical data to support documentation and care delivery.
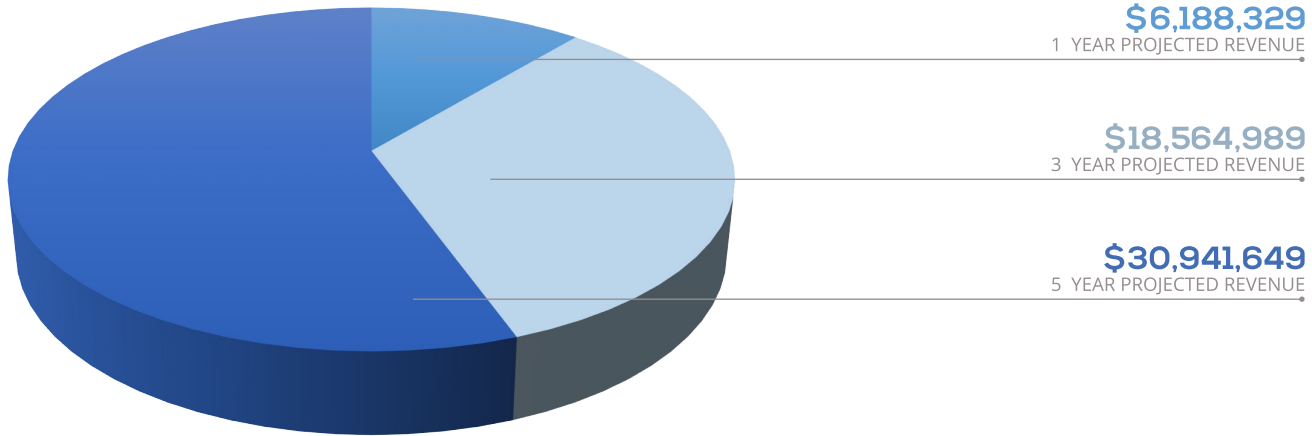
BREAKDOWN OF REVENUE BY TYPE
COST AVOIDANCE, COST SAVINGS, & INCREMENTAL REVENUE

COST AVOIDANCE

Avoided specified costs due to changes in practice or operations. The projects associated are: Knowledge Based Charting, Early Warning, and myPennMedicine.

$6,188,329
1 YEAR PROJECTED REVENUE

$18,564,989
3 YEAR PROJECTED REVENUE

$30,941,649
5 YEAR PROJECTED REVENUE

COST SAVINGS

Changes to the current cost structure of the organization which lowers the expense run rate of a given service or department. This data is relevant to the following projects: Retired Application List, Service Desk Insourcing, Ambulatory Medical Record, Resiliency & Downtime Avoidance, Service Review Optimization, PQRS, Patient Centered Medical Home, OpTime, PennSeek, Analytics Platform, Vendor Neutral Archive (VNA), Lawson Insourcing, and Insourcing End-User Support Services.

$72,738,123
1 YEAR PROJECTED COST SAVINGS

$95,807,419
3 YEAR PROJECTED COST SAVINGS

$121,877,315
5 YEAR PROJECTED COST SAVINGS
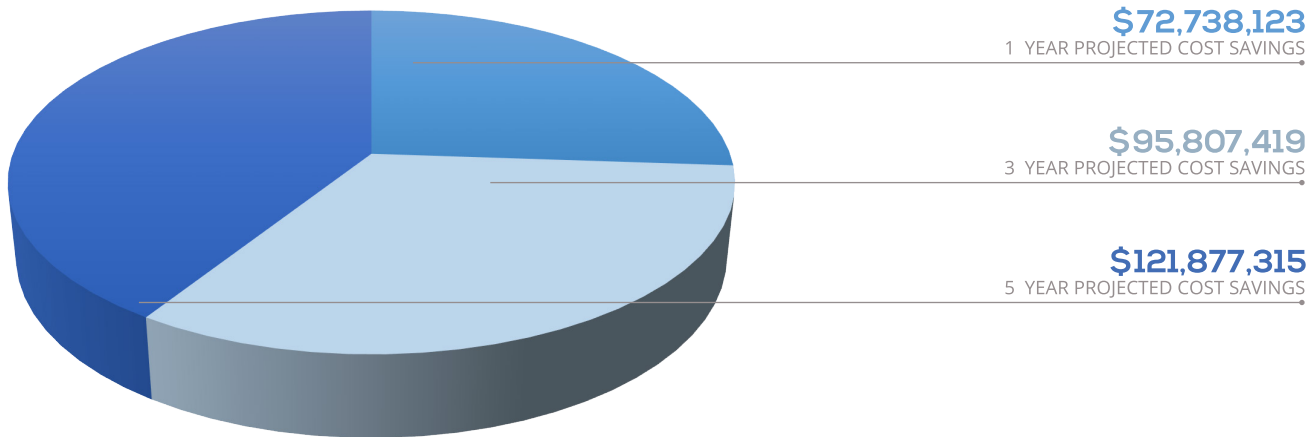
INCREMENTAL REVENUE

Activities that bring in new top-line revenue to the organization.
The following data is relevant to the Epic Ambulatory Practice Management & Meaningful Use

$9,240,000
1 YEAR PROJECTED REVENUE

$27,720,000
3 YEAR PROJECTED REVENUE

$46,200,000
5 YEAR PROJECTED REVENUE

Legend:
- 5 YEAR SAVINGS
- 3 YEAR SAVINGS
- 1 YEAR SAVINGS

Service Desk Insourcing
- $1,081,236
- $3,541,279
- $6,364,596

Insourcing End-User Support Services
- $1,300,000
- $500,000
- $1,000,000
- $3,000,000
- $5,000,000

Enterprise Resource Planning Applications Hosting
- $2,300,000

Vendor Neutral Archive (VNA)
- $13,144,094
- $6,411,264
- $1,823,900

PMACS
- $849,000
- $2,547,000
- $4,245,000

Analytics Platform
- $1,809,000
- $5,427,000
- $9,045,000

Epic Communication Manager
- $1,266,293
- $3,798,878
- $6,331,464

Retired Application List
- $921,000
- $484,800
- $1,454,400
- $2,424,000
- $2,763,000

Service Review Optimization
- $3,496,860

Resiliency & Downtime Avoidance
- $3,925,980
- $3,711,420
- $4,605,000

Service Desk Insourcing

BACKGROUND DESCRIPTION

Prior to 2012, the IS Help Desk was outsourced to a 3rd party vendor. The outsourced IS Help Desk was limited in their Penn Medicine institutional knowledge and heavily dependent on corporate processes and antiquated ticketing tools when delivering Help Desk service. Being located in another part of the country, there was an institutional disconnect with both the end-users and the Tier II resolver teams. The net result was overall customer dissatisfaction at a premium price. The project was a phased implementation from 2013-2015.

QUALITATIVE RESULTS

Since insourcing the IS Service Desk, significant improvements in end user service has been recognized along with a reduction in overall operating expense.

Several of the service improvement metrics include:

Call abandonment rate: 0.57% (10/1/2014 – 9/30/2015)
Calls answered within 30 seconds: 91.0% (10/1/2014 – 9/30/2015)
First call resolution: 61.5% (10/1/2014 – 9/30/2015)
Commitment to improving end user service, prompting the renaming of the IS Service Desk.
Improved call handling (abandon rate / wait times / etc.)
Trained analysts on Penn Medicine applications and processes
Reduced cost per contact
Added support responsibility (Radiology, Telecom, Telephony)
Improved end user satisfaction
Customized new ticketing system to meet Penn Medicine workflow with an end user IS self-service tool
Created a real-time "pulse" of the overall IS activities at any given time
Improved Command Center phone support
Enhanced relationships with Tier II teams

SAVINGS INCLUDE
Savings of $1,081,236 per year were achieved through staffing efficiencies, reduced expenditures, and improved processes.

FINANCIAL BENEFITS

$6,364,596
Five year projected savings

$3,541,279
Three year projected savings

$1,081,236
One year projected savings

Insourcing End – User Support Services

BACKGROUND DESCRIPTION

Re-align outsourced services from a third party firm to Penn Medicine from 2011-2013. The re-alignment included the following services:

- Desktop Support
- Network Support
- I/T Security Support
- Messaging Support
- 3440 Data Center Operations Support

QUALITATIVE RESULTS

Insourcing the end-user support services has resulted in a significant improvement in technical productivity, responsiveness and prioritization.

This efficiency has translated not only into financial savings, but also improved end-user satisfaction and productivity.
Additional benefits to Penn Medicine include:

- Assumed direct control of End User Support Services
- Discontinued resource floating and pooling; replaced with permanent entity assignment
- Dramatically improved technician productivity
- Provided direct oversight and control of resource work effort allocation
- Moved to a 'dispatch' model using Service Coordinators to schedule EUS services that require 'touch'
- Blended desktop and entity network staff responsibility and accountability to reduce unnecessary handoffs
- Balanced internal resources resulting in a more efficient and cost effective model
- Built a strong Central Support Function to handle services that do not require 'touch'
- Established a Central Desktop Engineering group and entity EUS groups that collaborate to establish device and configuration standards

SAVINGS INCLUDE
$1,000,000 savings in personnel costs realized from outsourced vendor by managing internally. Additional savings recognized from operational efficiency and productivity improvements.

FINANCIAL BENEFITS

$5,000,000
Five year projected savings

$3,000,000
Three year projected savings

$1,000,000
One year projected savings

Enterprise Resource Planning Applications Hosting

BACKGROUND DESCRIPTION

Over the five years that the outsourced vendor has hosted Penn Medicine's ERP application, there have been instances of ongoing instability. Additionally, the project work performed by the hosting vendor (application environment upgrades, hardware migration/upgrades, security upgrades) have been poorly managed – work often behind schedule, takes longer than anticipated, and is sub-par resulting in delays, rework, and retesting. This project represents the migration of our current ERP environment from a 3rd party externally hosted vendor environment to an internally hosted environment by Penn Medicine. A decision was made to host internally based upon inconsistent service with the prior 3rd party hosting vendor. The implementation lasted from 2013-2014.

QUALITATIVE RESULTS

A smooth transition to an insourced environment has resulted in the recognition of the following benefits:

- Increased end user support
- Greater control over Lawson environment utilizing local talent
- Increased stability of technical environment
- Effective Project Management
- Improved response to end user needs
- Enhanced flexibility in supporting new entities

SAVINGS INCLUDE

$500,000 per year savings comes from:

- Increased end user support
- Greater control over Lawson environment utilizing local talent
- Increased stability of technical environment

FINANCIAL BENEFITS

$2,300,000
Five year projected savings

$1,300,000
Three year projected savings

$500,000
One year projected savings

Vendor Neutral Archive (VNA)

BACKGROUND DESCRIPTION

A Vendor Neutral Archive is a medical imaging technology in which images are stored (archived) in a standard format with a standard interface, such that they can be accessed in a vendor-neutral manner by other systems. The goal of the project is to condense the multiple existing image repositories into one image repository for all medical images. The archive provides the ability to configure rules to direct when studies are moved from one tier of storage to another (i.e. from expensive fast disk to slow inexpensive disk after X number of years). The project led to reduced storage costs and the ability to launch a non-diagnostic image viewer within Penn Medicine's EMR and patient portal providing greater functionality for the clinicians and patients. *Note: The VNA has been re-branded as PennChart Image Library (PennCIL).* The project was implemented in three phases from 2014-2015.

QUALITATIVE RESULTS

As departmental image archives are migrated to the VNA, Penn Medicine is on-track to recognize the projected financial and clinical benefits.

- Storage capacity is able to grow by 380% by 2017
- The VNA will reduce the amount of storage actually needed, which in turn will reduce the cost of storage across the health system
- Liberated all images to enhance patient care through a common vendor

SAVINGS INCLUDE

Savings of $1,823,900 in year 1, and $6,411,264 by year 3 achieved by:

- Reduced terabytes in use and reduced storage costs which include active storage, archive storage, and archive backup storage
- Elimination of duplicative image technologies and associated maintenance costs
- Reduced personnel costs and enhanced operational productivity and efficiency

FINANCIAL BENEFITS

$13,144,904
Five year projected savings

$6,411,264
Three year projected savings

$1,823,900
One year projected savings
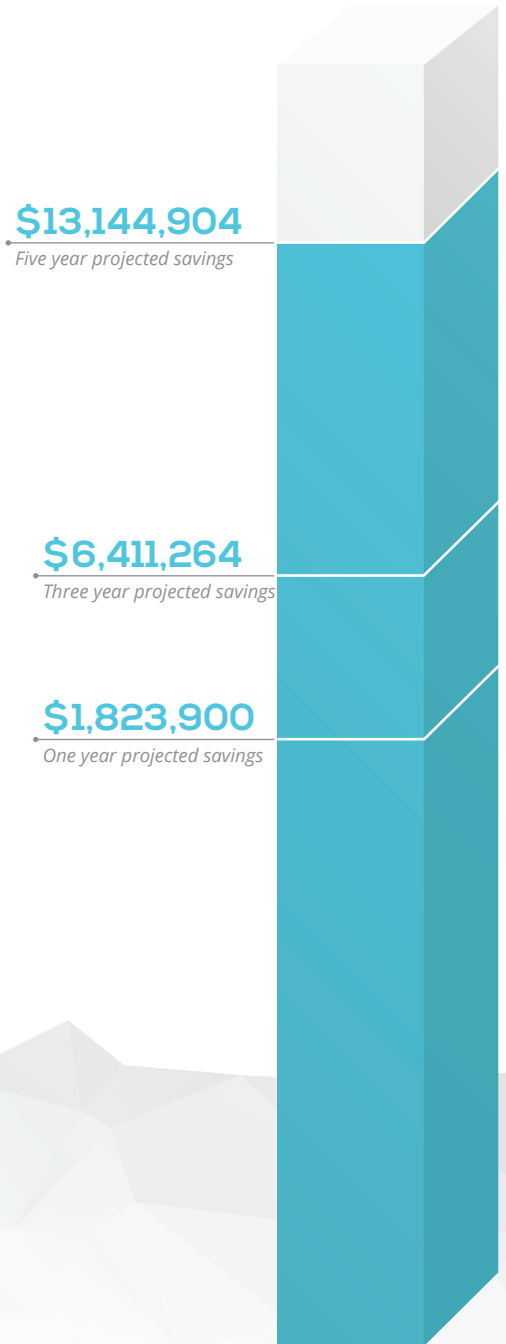
Penn Medicine Academic Computing Services (PMACS)

BACKGROUND DESCRIPTION

The Penn Medicine Academic Computing Services (PMACS), a consolidation of previously decentralized computing resources into one central team, was created with the understanding that information technology is an increasingly critical component of basic science, clinical research, education delivery and medical school operations. The previously isolated systems resources had been the source of high-turnover of Penn Med IT professionals, leading to an understaffed and under-trained workforce. The Project was implemented from 2012-2014.

QUALITATIVE RESULTS

The aggregation of disparate resources into the PMACS organization has reduced redundant skill sets and provided additional breadth and depth of support services to the School of Medicine end-user community. Additional qualitative results are as follows:

- Provides a single point of contact and accountability for the provision of computing services for the entire Medical School
- Added depth in support coverage for researchers when individual computer staff is unable to provide necessary services
- Closer alignment with the health system Information Services staff – improving communication, collaboration and problem resolution for projects across Penn Medicine
- Optimal utilization of spare service capacity for both staff and computing
- Enhanced career opportunities for computing-focused staff
- Improved the overall depth and breadth of the technical team
- Improved responsiveness to end users
- Established a tighter relationship and overall improved end user satisfaction

SAVINGS INCLUDE

PMACS has saved the Center for Clinical Epidemiology and Biostatistics (CCEB) $849,000 annually through:

- Achieved staff economies of scale through consolidation
- Provided high performance computing services at a reduced rate as compared to industry standard services.
- Improved application development speed to value by nearly 6% through the use of central management and improved tools.
- Reduced software maintenance and report fees through centralized consolidation.

FINANCIAL BENEFITS

$4,245,000
Five year projected savings

$2,547,000
Three year projected savings

$849,000
One year projected savings
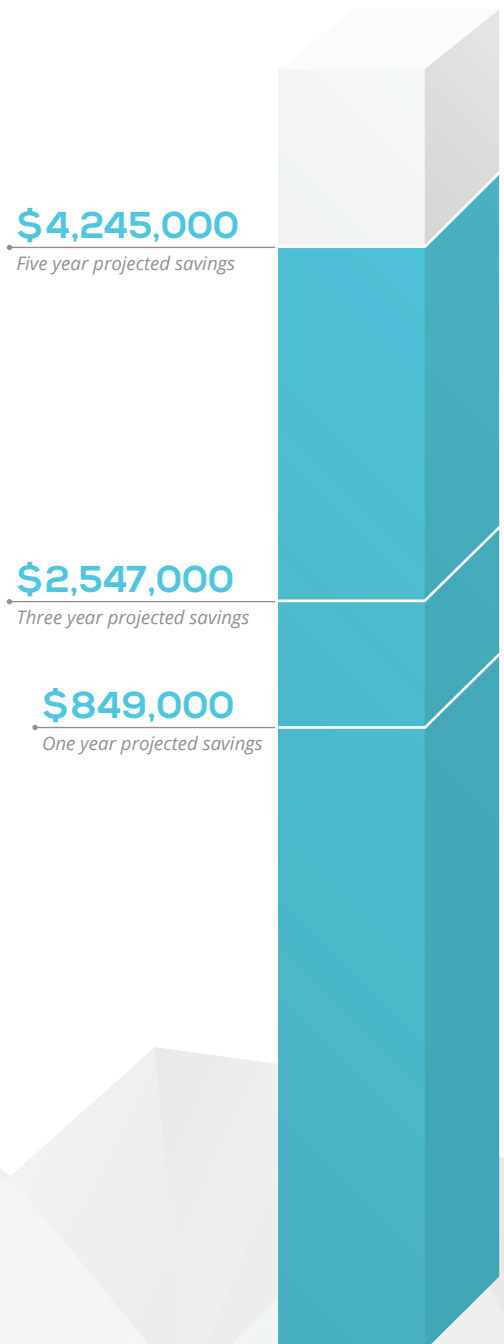
Analytics Platform

BACKGROUND DESCRIPTION

In an effort to maximize the value of its data, Penn Medicine has invested in analytics databases which provide meaningful information to clinical and other key stakeholders across the system. The analytics platforms were implemented from 2010-2015; the following datamarts are currently operational:

DATAMART	INITIAL LAUNCH
QDM - *Quality and patient safety information*	2012
SDS - *Strategic Decision support*	2010
Ambulatory Analytics - *Dashboards & Trending data for CCA and CPUP*	2013
Faculty Analytics - *Management tool for school of medicine to track specific performance metrics*	2015
Labor Analytics - *Staff productivity management system for optimized staffing models*	2015
Clinical Capacity Calculator - *Provider revenue management tool*	2014
Optime Universe - *Financial outcomes of surgical procedures*	2014

FINANCIAL BENEFITS

$9,045,000
Five year projected savings

$5,427,000
Three year projected savings

$1,809,000
One year projected savings

QUALITATIVE RESULTS

As indicated in the chart, providing end users with the data necessary to make improved clinical and operational decisions has had a significant impact. This impact and associated benefits are ongoing and continue to accumulate over time. Expected benefits include:

- Foster an environment for data driven decision making
- Enable objective vs. subjective decision making
- Extend data driven decision making throughout the entire organization
- Improve operational performance transparency

SAVINGS INCLUDE
The full savings details are included in the chart on page 17.

Analytics Platform

SAVINGS DETAILS
Please see the chart below regarding the Analytics Platform:

DATAMART	CURRENT PHASE	INITIAL LAUNCH	AMOUNT
Optime Universe	Clinical Variation / Major Joints	Estimated opportunity to manage variation in implant costs among physicians on major joint cases	$120,000
Optime Universe	Clinical Variation / Spinal Fusion	Opportunity to shift patients from SICU to Med/Surg (Ravdin 6; consistent with PAH treatment)	$94,000
SDS	Move TAVR to HUP	Shift TAVR cases from PPMC to HUP to take advantage of higher MC rate	$315,000
Labor Analytics	PPMC Nurse Staffing Management	Move PPMC nurse staffing from 'high' to 'average' occupancy assumption with additional use of swing staff. Move average staffing levels closer to target levels (lower than current)	$1,250,000
Labor Analytics	Early Punch-In at PPMC	Identified issue with employees punching in early resulting in increased hourly pay	$30,000

Epic Communication Manager

BACKGROUND DESCRIPTION

Communication Manager is a function within Epic that allows clinicians a simple way to write, route, fax, and print letters and other communications to other providers and recipients. The tool offers flexibility to meet the communication needs of the recipient (mail, fax, In Basket, My Chart) with one tool rather than multiple tools in the application. Communication Manager was implemented in 2014.

QUALITATIVE RESULTS

- Clinicians can create high quality letters in less time by utilizing standardized text and speed buttons
- Letters for other clinicians and patients are created using a single tool
- Clinicians can send patient letters directly to the patient's MyChart account, cutting printing and postage costs
- Allows for eFaxing of letters to referring providers outside of the health system
- Based on results in pilot sites, higher letter utilization and recipient satisfaction across specialties is expected.
- Decrease in turnaround time for letter generation and letter faxing/printing
- Increased utilization of the tool as clinician and operational comfort has increased

SAVINGS INCLUDE
$1,266,293 annual savings from personnel time, supply costs, and mailing costs for letters previously sent through the mail, which are now replaced with the message transfer technology of Epic Communication Manager.

FINANCIAL BENEFITS

$6,331,464
Five year projected savings

$3,798,878
Three year projected savings

$1,266,293
One year projected savings

Retired Application List

BACKGROUND DESCRIPTION

As Penn Medicine deploys new application systems, it is common that data contained in the legacy system is not converted to the new system. Therefore, it is important that data on the legacy system be extracted and made available to end users prior to retiring the legacy system. Retirement of the legacy system is important so that there is an official end to the Penn / vendor relationship and also to eliminate legacy system operational costs. Retired Applications have been tracked beginning in 2012-2015 and the applications were retired in three major phases.

QUALITATIVE RESULTS

Corporate IS has developed a strategy and associated processes for extracting data and placing that data in a secure, HIPAA compliant application that is running on low cost, current hardware and OS technologies. This strategy allows Penn to terminate the legacy system vendor agreement and decommission the hardware, eliminating costs and preserving key data. Additional qualitative results include:

- Migration to a common platform provides for enhanced resource support
- Fewer contracting and business associate agreements; additional HIPAA compliance; less upgrades and patching

SAVINGS INCLUDE

Savings of $2.4 million over 5 years from applications that were retired. These savings include the cost of vendor conversion services, software licenses and replacement hardware.

- Revenue application savings: $51,000
- Clinical application savings: $1,599,000
- Administrative application savings: $750,000

FINANCIAL BENEFITS

$2,424,000
Five year projected savings

$1,454,400
Three year projected savings

$484,800
One year projected savings

Service Review Optimization

BACKGROUND DESCRIPTION

Service review optimization aimed to eliminate unnecessary costs through Penn servers and backup procedures. The overarching strategy for this project is to keep Penn Medicine's IT infrastructure functioning on the highest performing technology. It is part of Penn Medicine's standard operating process to constantly review technology for upgrades and additional functionality through partnering with vendors in the most cost effect manner. The project implementation occurred in 2013 and the project goals were as follows:

- Reduce cost of all UPHS server backups where possible
- Realize savings due to timely decommission of old/outdated servers.
- Realize savings due to timely retirement of old/unused Storage Area Network (SAN) space.

QUALITATIVE RESULTS

Leveraging new technology, virtualizing servers and matching the proper level of storage to the ever changing end-user requirements has generated a culture of efficiency within the organization. Additional QUALITATIVE RESULTS are:

- Improved integrity and effectiveness of backups and restores.
- Backup procedure functionality is comprehensive, accurate, and timely.

SAVINGS INCLUDE
$1,000,000 annual savings was achieved through decommissioning servers, reconfiguring server backups for efficiency gains, and through the retirement of unused SAN space.

- Server backup changes: $600,000/yr. (209 servers)
- Server decommissions: $214,000/yr. (48 servers)
- SAN changes: $107,000/yr. (18 TB)

FINANCIAL BENEFITS

$4,605,000
Five year projected savings

$2,763,000
Three year projected savings

$921,000
One year projected savings
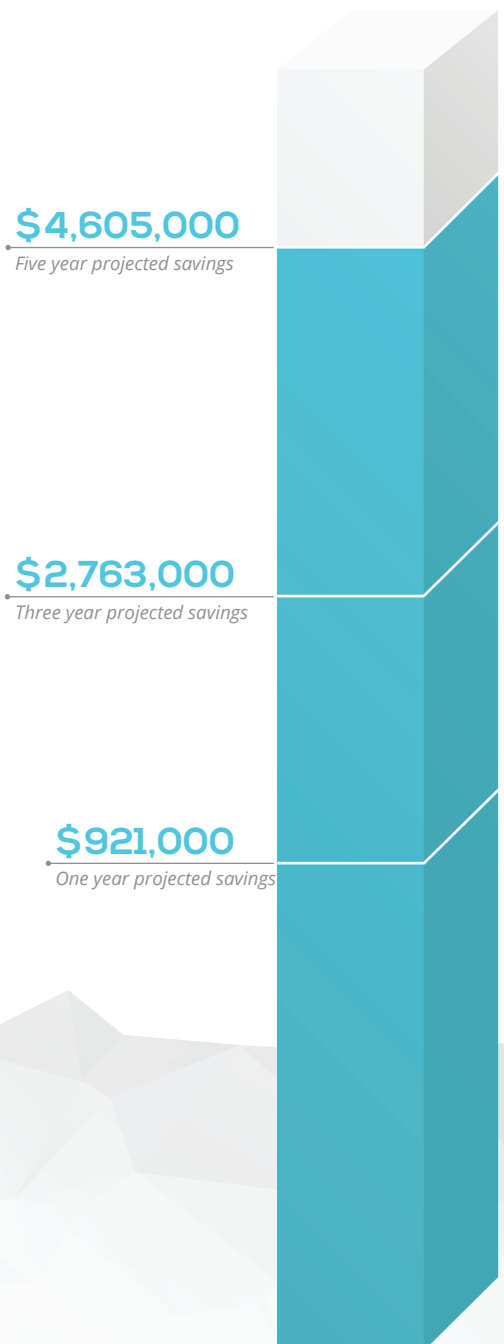
Resiliency: Downtime Avoidance and Cost Savings Activities

BACKGROUND DESCRIPTION

Enterprise Infrastructure Services initiated a program to implement infrastructure redundancy and resiliency in an effort to reduce enterprise outages. Clinical or Information Services FTE's are not added during network downtime, therefore there is not a direct cost savings to Penn Medicine but many qualitative results to the health system. The network downtime program was initiated in 2012 and continues today through monthly tracking and reporting.

The decrease in downtimes since the initiative began are outlined below:
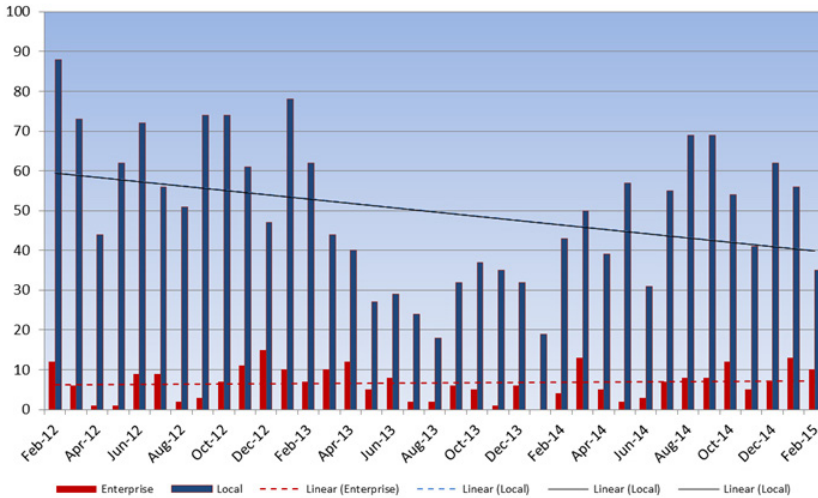
The Information Services organization within Penn Medicine also led a cost savings initiative in 2014 and 2015 where existing IS contracts, consultants agreements, and other business arrangements that fell within the Penn Medicine IS infrastructure were evaluated to reduce the IS cost structure . These savings are listed in the financial section below.

FINANCIAL BENEFITS

$3,925,980
Five year projected savings

$3,711,420
Three year projected savings

$3,496,860
One year projected savings

QUALITATIVE RESULTS

Downtime
- Created a more stable computing environment through the introduction of redundant and resilient technologies
- Reduced outages has improved productivity and reduced "lost changes" documentation
- Reduced outages have improved patient safety risks
- Improved staff satisfaction
- Improved wait times and delays

IS Cost Savings
- Less HIPAA and security risks

Paper Savings
- Better access to data that was previously in paper form.
- Culture of resource stewardship

SAVINGS INCLUDE
- IS Cost Savings: $3,389,000 from contract terminations for resources that are no-longer needed in the Penn Medicine Information Services infrastructure, or renegotiations of existing contractual agreements.
- Paper Savings: $107,280 cost savings includes the reduction of sheets of paper consumed and consolidation of Xerox printers.

5 YEAR SAVINGS

3 YEAR SAVINGS

1 YEAR SAVINGS

$46,200,000

$27,720,000

$9,240,000

$5,597,516

$3,145,923

$985,380

$28,200

$84,600

$141,000

Overall Benefit
of Ambulatory
Medical Record

Epic Ambulatory
Practice
Management

Knowledge
Based Charting
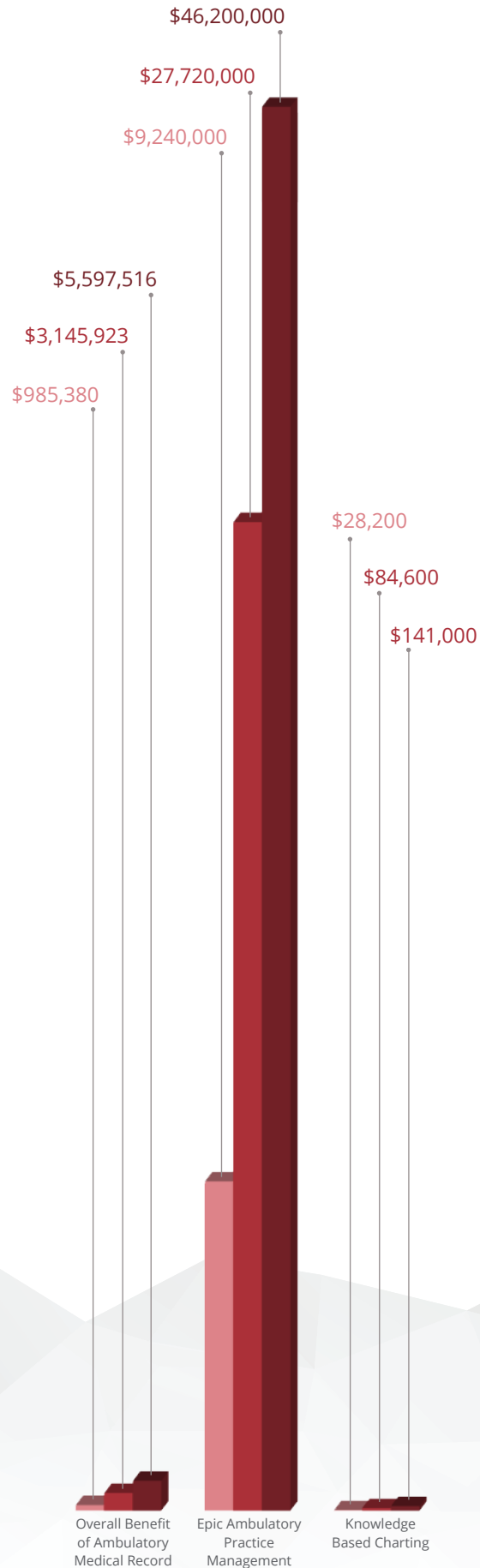
Overall Benefit of Ambulatory Electronic Medical Record

BACKGROUND DESCRIPTION

By moving from paper based charts to electronic chart review, order management, and documentation, Penn Medicine was able to organize patient information, suggest actions, and guide coordinated care across physical care settings. As part of Penn Medicine's overall strategy to move to a common Epic core platform, the EMR was implemented as the first Epic patient electronic record within the health system. The implementation of Epic EMR in the outpatient setting began in 2008.

QUALITATIVE RESULTS

Leveraging technologies such as speech recognition has simplified physician documentation in the ambulatory setting while also significantly reducing transcription related expenditures and vastly improving patient clinical documentation.

OTHER AMBULATORY EMR BENEFITS

- Reduction of manual chart audits, eliminates unrecognizable content and saves manual hours
- Chart check compliance rose to 100% with automation – overall improved compliance, readiness for surveys/audits by Joint Commission, etc.
- Potential to reduce malpractice rates because of better documentation
- Increased communication regarding patient care
- Better access to real-time patient information
- Increased reliability of an electronic solution
- Better communication and flow of information between sites of care

SAVINGS INCLUDE

Transcription Savings: Transcription expenses were tracked as a KPI for the Epic EMR roll-out and were reduced after go-live of the EMR.

- $170,145 savings in CPUP per year due to the electronic information entry capabilities of the new EMR that reduced the need for medical transcriptionists.
- The greatest cost reduction in CPUP occurred in Medical Oncology.
- Chart transports costs $2.2 million visits, estimated 20% chart pulls at $4.50 per chart.
- Saving of $985,380 annually from the automation of transferring patient information which replaced the manual process of retrieving, printing, and shipping charts to another provider's office as part of a patient's treatment. Savings number includes replacement of regular chart retrieval and STAT chart retrievals which were more resource intensive.

FINANCIAL BENEFITS

$5,597,516
Five year projected savings

$3,145,923
Three year projected savings

$985,380
One year projected savings

∗ There is a growth assumption of 8% annually included for the growth of CPUP

Epic Ambulatory Practice Management

BACKGROUND DESCRIPTION

Epic Ambulatory Practice Management System (APM) was implemented in all 250+ ambulatory practices in 2011, replacing a non-integrated, dated technology. This software is used to manage the ambulatory business, specifically, scheduling, professional billing, and registration across Penn Medicine. Epic APM integrates with the ambulatory medical record already in place to provide a common platform for ambulatory operations across the enterprise.

- Epic Prelude-enterprise ambulatory registration
- Epic Cadence-enterprise ambulatory patient scheduling system
- Epic Professional Billing Module-Resolute professional patient billing modules

QUALITATIVE RESULTS

Effectively implementing the new Epic ambulatory practice management solution into the integrated clinical and practice management workflows has yielded significant financial and operational benefits. No project within Penn Medicine displayed as much teamwork as this one.

AMBULATORY EMR BENEFITS

- Realigned processes from back end to front end placing emphasis on proper documentation
- Implemented 30 days to chart close program which closes out charts with outstanding documentation after 30 days eliminating audit and no-payment risks
- Moved to electronic payment posting which eliminated the manual payment posting process
- Eliminated manual charge entry which increased gross charges by 1%
- Ability to qualify for CMS pay for performance programs (PQRS, GPRO, etc.)
- Enable and standardize registration process across the enterprise
- Shifted resources from back end to front end, focusing on error reduction and accuracy

SAVINGS INCLUDE
- Gross charges increase of 1% from better information and documentation capture for CCA and CPUP with an annual savings of $5,280,000.
- Reduction in billing costs of 15% due to automation for CCA and CPUP with an annual savings of $3,960,000.

FINANCIAL BENEFITS

$46,200,000
Five year projected savings

$27,720,000
Three year projected savings

$9,240,000
One year projected savings

Epic OR management (OpTime)

BACKGROUND DESCRIPTION

The goal of Epic OR Management implementation was to reduce the cost per surgical case through Optime/Anesthesia and other supporting systems including Lawson. The Epic OpTime/Anesthesia project included over 120 surgical operating rooms and endoscopy suites at HUP, PPMC, PAH, Tuttleman, and Perelman. The software helps manage the operating rooms and ambulatory surgical centers throughout Penn Medicine. Optime/Anesthesia replaced PHS scheduling, HSM documentation, and Docusys in the ORs and Endoscopy suites. Additionally, paper charting has been replaced with online tools. Optime go live helped to achieve Penn Medicine's strategy of having a single integrated patient record. Epic implementation began in 2010 and the final site went live in 2013.

QUALITATIVE RESULTS

- Improved billing accuracy and charge capture
- Improved operational efficiency
- Improved surgeon productivity
- Increased schedule utilization

- Implemented Perioperative documentation in the operating room setting
  - Scheduling
  - Preference card management
  - Anesthesia record keeping
  - Pre-op assessments
  - Procedure record
  - PACU documentation

Epic Emergency Department and Trauma (ASAP)

BACKGROUND DESCRIPTION

The system replaced the existing EMTRAC home-grown patient tracking and electronic medical record. The PennChart Emergency Department Information System is designed to allow clinical staff to track patients through their visits and document their treatment. It supports workflows for providers in an ED setting by streamlining the tasks doctors and nurses perform every day and connecting them with up-to-date clinical records. PennChart ED will be fully integrated to all ambulatory facilities upon implementation, and inpatient once PennChart Phase 2 project is completed (2016). ASAP go live helped to achieve Penn Medicine's strategy of having a single integrated patient record.

QUALITATIVE RESULTS

- Better-informed and faster medical decisions
- Streamlined workflows for better patient throughput
- Established standards of care and treatment protocols
- The system offers Access, Security, and Intuitive Workflow (ED Manager, Track Board, Navigators, NoteWriter, Narrator)
- Active decision support functionality
- Seamless, instantaneous access to comprehensive information and can be simultaneously accessed by multiple users at multiple locations
- PennChart secures medical records by restricting access to charts with role-based, user-based, and context-based record access
- Necessary information is just a few mouse clicks away at any time
- Provides an "at-a-glance" summary of all patients in your emergency department
- Displays detailed information about a patient's status and order status

SAVINGS INCLUDE
- Epic OR Management (OpTime) & Epic ASAP benefits are qualitative only at this time.

Knowledge Based Charting (KBC)

BACKGROUND DESCRIPTION

KBC (Knowledge Based Charting) is an interdisciplinary, clinical documentation module within the Allscripts Sunrise EMR system. It integrates evidence-based content built by the Clinical Practice Model Resource Center (CPMRC), and is based on academic literature and feedback from nearly 300 medical centers on best practice for all clinicians. The content within this module is called Clinical Practice Guidelines (CPGs), and users refer to this library of content to guide them in specific workflows. These CPGs were reviewed, validated, and specifically configured for Penn Medicine. It is designed to increase standardization of care across all disciplines, improve communication, and facilitate collaboration among healthcare providers.

A system-wide Partnership Council was developed and included representatives from all Penn Medicine entities comprised of nurses, respiratory therapists, physical therapists, social workers, nutrition support, pharmacists, and others to define a unified method to deliver patient care.

The implementation timeline was from 2010 to 2011.
Full details are below.

QUALITATIVE RESULTS

- Increased standardization of care
- Improved communication about patient care
- Better collaboration between care teams
- Evidence based medicine, best practice guidelines
- Improved patient care and outcomes

SAVINGS INCLUDE

- After implementation, fewer patient records were scanned due to the discrete entry of patient data. The savings incurred from reduced scanning was $28,200 per year.

FINANCIAL BENEFITS

$141,000
Five year projected savings

$84,600
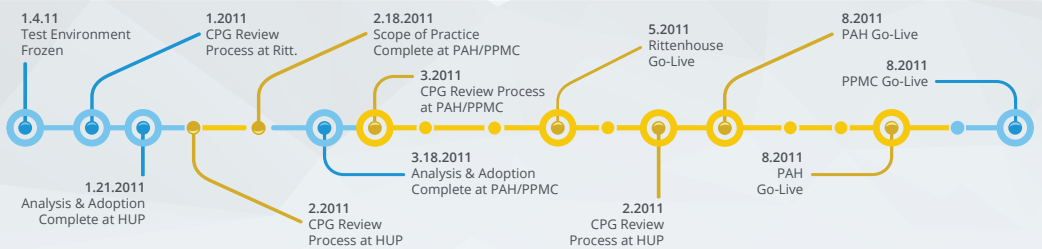*Three year projected savings*

$28,200
One year projected savings

KBC APPLICATION IMPLEMENTATION TIMELINE
CRITICAL MILESTONES

YEAR 2010 | AUGUST – DECEMBER : DESIGN & BUILD

- **7.14.10** Site Coordinator Planning Mtg
- **8.8.10** KBC Loading in 5.0 environment
- **9.10.2010** KBC Loading in 5.0 environment
- **10.4.2010** CPG Endorsement Complete
- **11.19.2010** Scope of Practice Complete at Ritt.
- **12.17.2010** Scope of Practice Complete at HUP
- **12.29.2010** Analysis & Adoption Complete at Ritt.
- **12.31.2010** Training Material Finalized

YEAR 2011 | MARCH – AUGUST : TRAINING

- **1.4.11** Test Environment Frozen
- **1.2011** CPG Review Process at Ritt.
- **1.21.2011** Analysis & Adoption Complete at HUP
- **2.18.2011** Scope of Practice Complete at PAH/PPMC
- **2.2011** CPG Review Process at HUP
- **3.2011** CPG Review Process at PAH/PPMC
- **3.18.2011** Analysis & Adoption Complete at PAH/PPMC
- **5.2011** Rittenhouse Go-Live
- **2.2011** CPG Review Process at HUP
- **8.2011** PAH Go-Live
- **8.2011** PPMC Go-Live
- **8.2011** PAH Go-Live

Knowledge Based Medication Administration (KBMA)

BACKGROUND DESCRIPTION

Ensuring the 5 rights of medication administration-the right patient, drug, dose, route and time- for patient safety is of utmost concern in medication administration. The goal of this project was to provide a technological solution using Penn's existing electronic medical record to maximize patient safety. Additionally the initial pilot was launched to comply with Meaningful Use Stage 2 requirements for 10% entity Bar Code Medication Administration.

The Penn Medicine inpatient electronic medical record (EMR) was enhanced with the implementation of the Bar Code Medication Administration (BCMA) module. This addition interfaced the scanning capability into the Medication Administration Record (MAR) where nurses document medication administration at the point care.

QUALITATIVE RESULTS

The overwhelming success of the pilot units at all four entity hospitals allowed full adoption of BCMA across the health system on all inpatient units. Hardware was ordered and fitted by Information Services (IS) for all inpatient rooms and units. Nursing has undergone extensive training to ensure proficiency in the new system. With the valuable support from pharmacy , processes are now in place to inventory and catalog new medications as well as troubleshoot any scan issues with stock. Other benefits include:
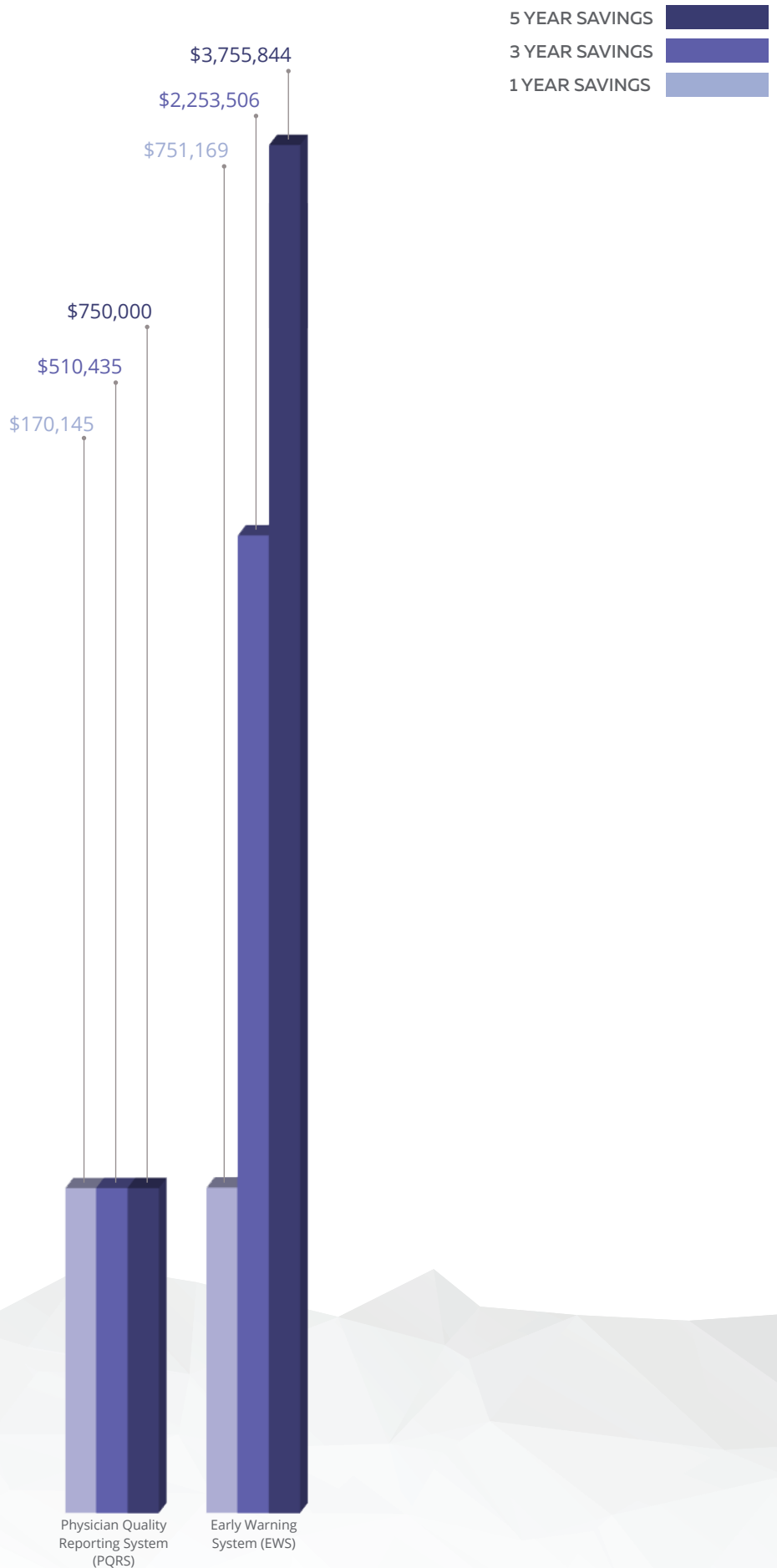
- Reduced Medication Errors
- Intercepted Medication Near Misses
- Improved patient safety through the reduction of administration errors while minimally increasing nurses staffing time
- Increased patient satisfaction
- Improved Employee (Nurse and Pharmacy) worklife satisfaction

SAVINGS INCLUDE
- Knowledge Based Medication Administration (KBMA) benefits are qualitative only.

BLUEPRINT FOR PATIENT QUALITY & SAFETY

5 YEAR SAVINGS
3 YEAR SAVINGS
1 YEAR SAVINGS

$3,755,844

$2,253,506

$751,169

$750,000

$510,435

$170,145

Physician Quality
Reporting System
(PQRS)

Early Warning
System (EWS)

Early Warning System (EWS)

BACKGROUND DESCRIPTION

A clinical decision support (CDS) tool, the Early Warning System (EWS), was developed to notify providers about inpatients at risk for developing sepsis. Early recognition and timely intervention significantly reduces sepsis-associated mortality. The availability of vital sign and provider data in our EHR created the opportunity to detect sepsis early and notify providers with the goal of reducing our sepsis mortality rates. Patients with sepsis, which accounts for 17% of all hospital deaths nationwide, have a severe response to bacteria or other germs. THE EWS Project and accompanying academic study by Penn Medicine researchers was conducted from 2011-2012.

QUALITATIVE RESULTS

- Reduced likelihood of sepsis-associated deaths
- Allowed providers to better manage patient care
- Improved patient safety through the reduction of administration errors while minimally increasing nurses staffing time
- Improved patient satisfaction
- Improved nurse job satisfaction
- Enabled early clinical intervention
- Reduced patient length of stay
- Reduced ICU days where infection can occur
- Improved sepsis documentation and care plans

SAVINGS INCLUDE

Over $750,000 saved annually by the avoided cost of Sepsis ICU days through use of the early warning system. with vulnerable Sepsis patients in Penn Medicine ICU settings. The cost savings assumes that without the EWS, Sepsis patients would not receive early interventions and would have greater ICU average length of stay.

FINANCIAL BENEFITS

$3,755,844
Five year projected savings

$2,253,506
Three year projected savings

$751,169
One year projected savings

Physician Quality Reporting System (PQRS)

BACKGROUND DESCRIPTION

The Physician Quality Reporting System (PQRS) is a quality reporting program that encourages individual eligible professionals (EPs) and group practices to report information on the quality of care to Medicare. PQRS gives participating EPs and group practices the opportunity to assess the quality of care they provide to their patients, helping to ensure that patients get the right care at the right time. The Epic PQRS functionality allows Penn Medicine to provide the proper documentation needed to report PQRS outcomes and avoid applicable penalties. PQRS began in 2006, transitioned to GPRO in 2014 and will coalesce with MU into MIPS in 2017.

QUALITATIVE RESULTS

- Increased accountability for high-quality care
- Better preventative care for patients
- Improved chronic and acute care management
- Better care coordination and documentation
- Improved reportable quality metrics
- Evidence based practice administration through adherence of protocols and documentation
- Provider specific scorecards and outcomes through the Epic functionality
- Better management of PQRS reportable conditions

FINANCIAL BENEFITS

$750,000*
Five year projected savings

SAVINGS INCLUDE

The project supported penalty avoidance which would have occurred if PQRS metrics were not met, totaling $750,000 a year. The Epic PQRS outpatient functionality enabled Penn Medicine providers to have the electronic reporting and information capture needed to avoid the penalty.

- *Note: Savings penalty is calculated off of 2% annual total Medicare payments in the Penn Medicine outpatient practices*

Centers of Medicare and Medicaid Services (CMS) Two Midnight Rule

BACKGROUND DESCRIPTION

Centers for Medicare and Medicaid Services (CMS) established a two midnight benchmark for physicians to use in determining patient status for inpatient or outpatient care. CMS specifies that when the physician expects the patient to require care that spans two midnights or more, CMS would require authentication and certification by the inpatient admitting physician. For stays within two midnights, no authentication is needed. This rule only applies to patients with Medicare as their payor. Re-certification is also necessary every 12 days (12th day, 24th day, etc.).

The CMS Two-Midnight electronic solution notifies attending providers when their patient is approaching a two midnight stay and seeks documentation for the patient's hospital stay to remain in compliance with the CMS regulation. A compliance report is then generated on a monthly basis which notifies administration of which providers are not documenting the necessary information to be compliant with the regulation. The CMS two-midnight electronic solution ensures that Penn Medicine providers are following the new CMS Two-Midnight guidelines and reduces audit and denial risk for the health system. Entity-wide implementation was on December 4, 2013.

QUALITATIVE RESULTS

- Increased accountability for high-quality care
- Those who report satisfactorily for the 2015 program year will avoid the 2017 PQRS negative payment adjustment
- Reduce possible Medicare denials
- Better payment and documentation compliance
- Improved patient understanding of observation status
- Improved individual physician compliance
- Better throughput for short stay patients

SAVINGS INCLUDE

Two Midnight Rule benefits are qualitative only.

Note: Costs of Denials resulting from 2 month rule non-compliance have not been calculated at this time.

Facility Board

BACKGROUND DESCRIPTION

The Facility Board provides a summary view of high priority patient-specific elements to facilitate patient level care planning. Clinical systems and Sunrise Clinical Manager in particular, typically excel at providing single patient-centric views of clinical data. The goal of the Facility Board is to provide a population level view of a hospital unit or service.

The Facility Board is a census of the selected floor, service, or attending physician with key indicators for each patient, grouped into the following categories:

- Patient Flags
- Daily Review
- Risk Factors
- High Risk Conditions

Each indicator displays based on data from Sunrise (including KBC), MedView, Epic OpTime, and/or Epic ASAP. The data for the Facility Board from MedView and Sunrise is refreshed every 15 minutes, and from Epic every four hours. The top of the Facility Board page indicates when the data was last refreshed. The population view allows providers and clinical staff to be better informed about their patient's risks and current status. The project was implemented from 2013 to 2014.

QUALITATIVE RESULTS

Facility Board enables our staff to more efficiently plan their daily reviews of patients, assess patient care levels, and manage high risk conditions.

- Clinical and provider satisfaction due to increased information about their patients
- Early interventions for patients that are starting to decline
- Enhanced patient safety
- Better unit level communications among providers and staff about their patients
- Improved patient satisfaction
- Improved nurse job satisfaction

> ### SAVINGS INCLUDE
> Facility Board benefits are qualitative only.

Meaningful Use Stage 1 and 2

BACKGROUND DESCRIPTION

Meaningful Use is the Medicare and Medicaid EHR incentive program to provide financial incentives for the "meaningful use" of certified EHR technology. To receive an EHR incentive payment, providers need to show that they are "meaningfully using" their certified EHR technology. Those organizations that do not meet the CMS specified meaningful use criteria are subject to annual reductions of up to 2% of Medicare and Medicaid claims.

There are three stages that are anticipated for meaningful use. The first two stages have been completed and CMS has just proposed stage 3. Each of these three stages has increasing requirements. CMS has provided objectives and quality measures which must be presented from certified systems to get the incentives. There is one set of requirements for inpatient and another set for ambulatory.

QUALITATIVE RESULTS

- Create an IT infrastructure that supports delivery of higher-quality patient care
- Better patient outcomes through advanced technology
- Complete and accurate information
- Improve coordination of patient care across the health system
- Implement an IT infrastructure that is sustainable in the changing landscape

SAVINGS INCLUDE
- Medicare and Medicaid incentive payments from 2012-2015 for HUP, PPMC, PAH, UPHS
- Note-Meaningful Use is a one time savings, does not compound for 3 and 5 year savings
- Savings also include penalty avoidance of $ 6,066,553=1% of Medicare billing for the system, penalty would have been incurred in 2015.

FINANCIAL BENEFITS

$57,677,355*
Five year projected savings

PENN MEANINGFUL USE INCENTIVE PAYMENTS
MEDICARE | TOTALS

FISCAL YEARS	HUP	PPMC	PAH	UPHS
2013-2015	$5,701,376	$5,450,851	$5,1076,475	$16,259,704

MEDICAID | TOTALS

FISCAL YEARS	HUP	PPMC	PAH	UPHS
2011-2015	$3,775,467	$2,208,522	$3,611,706	$9,595,697

GRAND TOTAL

FISCAL YEARS	HUP	PPMC	PAH	UPHS
2012-2015	$9,476,844	$7,659,374	$8,719,182	$25,855,401

✻ Included 6 million of MU avoided Penalty 2015 | Calculated same savings number for 1-5 years. Did not calculate as compounding savings

Patient Portal - myPennMedicine

BACKGROUND DESCRIPTION

myPennMedicine (MPM) is Penn Medicine's patient web portal. In addition to providing a secure means to communicate with their practice and providers, the portal gives patients access to their lab and radiology results, visit summaries, medication lists, and other information that makes up their health record. Functionality also includes the ability to make or cancel appointments online, request renewals for prescribed medicines, and complete health questionnaires. The portal was initially rolled out in 2010 to a select group of primary care providers.

After a successful pilot, rollout continued to remaining primary care and specialty practices. The majority of practices at Penn Medicine now offer myPennMedicine to their patient population. From 2013 to 2014, MPM saw enrollment more than double with over 219,000 active users at the beginning of 2015.

QUALITATIVE RESULTS – 2014 USAGE RESULTS (APPROXIMATES)

	USAGE RESULTS
Total Radiology Results Released	300,000
Lab Results Released	1,800,000
Appointment Auto-schedule (Direct Appointment)	6,000
Appointment Direct Cancel	19,000
Appointment Schedule (Request)	40,000
History Questionnaire	3,000
Medication Renewal Request	66,000
Questionnaires	12,000
Messages sent by patients to their Care Team	572,000
Messages sent by the Care Team or system reminders	2,552,000
Mobile Logins	32,000

FINANCIAL BENEFITS

$27,044,805
Five year projected savings

$16,226,883
Three year projected savings

$5,408,961
One year projected savings

ADDITIONAL BENEFITS

- Patient Satisfaction and patient loyalty tool
- Staff and provider satisfaction
- Patient ease of access to obtain information from medical record
- Better communication between patients and providers
- Better medication management and adherence with patients
- Tool to help manage chronic diseases and stay closely in touch with vulnerable patients

SAVINGS INCLUDE
$5,408,961 annual savings which includes the cost savings from lab results that would have been sent on paper through the mail and were instead provided to patients electronically in 2014[1]. This cost savings assumes the staff time to prepare and mail the letters and the actual paper and postage.

✱ Epic assumes $3.00 savings per test result based on 1998 study. Industry best practice assumptions range from $3.00-$5.00 on potential savings.

Unstructured Text Search - PennSeek

BACKGROUND DESCRIPTION

PennSeek is a search tool that uses pattern recognition to abstract information from patient charts. PennSeek allows providers to quickly data mine records for selected clinical patterns and reduces the need for manual abstraction of clinical documentation. This process helps with clinical research, quality monitoring and improvement efforts, and decision support functionality.

The first phase of development completed in March 2014. During the following months leading into the summer of 2014, additional source categories were added, such as radiology, echocardiograms, administered medications, and myPennMedicine messages.

QUALITATIVE RESULTS

Clinical Research Applications:

- **Penn Cardiology**
  PennSeek is displaying early indicators of development of aortic stenosis, which has traditionally been difficult to identify in its early stages.

- **Penn Gastroenterology**
  PennSeek is dynamically determining patients who meet three complex criteria consisting of discrete ICD 9 codes, positive identification of unstructured text patterns, and specific treatment regimens.

- **Penn Dermatology**
  PennSeek is using pattern recognition to recognize the annotation style of three physicians for the presence of zoster (shingles) and utilization of zostavax treatment.

ADDITIONAL QUALITATIVE BENEFITS

- Reduced errors through manual documentation
- Time saver for researchers and data analysts
- Greater reliability of information for research and quality improvement
- Increased access to patient information abstracted at a population level

SAVINGS INCLUDE
$93,300 annual labor savings includes the reduction of manual abstraction hours through automation of the previous data abstraction process.

FINANCIAL BENEFITS

$466,500
Five year projected savings

$279,900
Three year projected savings

$93,300
One year projected savings

GLOSSARY

ARRA: American Recovery and Reinvestment Act

BCMA: Barcode Medication Administration

CCA: Clinical Care Associates

CDS: Clinical Decision Support

CIO: Chief Information Officer

CMIO: Chief Medical Information Officer

CPOE: Computerized Physicians Order Entry

CPUP: Clinical Practices of University of Pennsylvania

DAC: Data Access Center

ED: Emergency Department

ePD: Electronic Provider Documentation

EHR: Electronic Health Record

EMR: Electronic medical record

ENIAC: First programmable electronic computer

EIO: Entity Information Officer; This is the IS Executive at each entity, including HUP, PAH, PPMC, HCHS, & CPUP/CCA

Epic APM: Ambulatory Practice Management

EpicCare: The enterprise ambulatory EMR system

e-Prescribing: The workflow of ordering a non-controlled medication in order entry and electronically transmitting it to a (retail) pharmacy using a certified e-prescribing vendor.

EUS: End User Support, the desktop and network support technicians who work at each entity facility

EWS: Early Warning System

HIE: Health Information Exchange

HIPAA: Health Insurance Portability & Accountability Act of 1996

HPC: High Performance Computing

HSX: HealthShare Exchange

HUP: Hospital of the University of Pennsylvania

ICU: Intensive Care Unit

KBC: Knowledge Based Charting (Allscripts / Eclipsys) Clinical Documentation component of Sunrise (all Clinical documentation except physicians)

MedView: Web-based clinician portal that displays patient data from over 25 UPHS systems

MeSH: Medical Subject Headings

MDM: Mobile Device Management

MU: Meaningful Use

Navicare: Patient Census & Location Tracking

NIH: National Institutes of Health

NLP: Natural Language Processing

OpTime: Epic Perioperative Management system

MDM: Mobile Device Management

MPM: myPennMedicine

MU: Meaningful Use

Navicare: Patient Census & Location Tracking

NIH: National Institutes of Health

NLP: Natural Language Processing

OpTime: Epic Perioperative Management System

OR: Operating Room

PACS: Picture Archiving & Communication System

PaH: Pennsylvania Hospital

PAM: Penn Access Manager

PCAM: Perelman Center for Advanced Medicine

PDA: Personal Digital Assistant

PDS: Penn Data Store (Clinical Data Warehouse)

PHCHS: Penn Home Care and Hospice Services

PMACS: Penn Medicine Academic Computing Services

PMAR: Penn Medicine at Rittenhouse LTAC (Long Term Acute Care), Rehab facility (partners with Good Shepherd) and Inpatient Hospice

PMO: Project Management Office

PMR: PennOmics Medical Record

PPMC: Penn Presbyterian Medical Center

PSOM: The Perelman School of Medicine

RFID: Radio Frequency Identification

SAN: Storage Area Network

SCM: Sunrise Clinical Management System

SICU: Surgical Intensive Care Unit