Penn Medicine

THE STATE OF PENN MEDICINE CORPORATE INFORMATION SERVICES

ACHIEVING THE MOST; INSPIRING THE BEST

2013 - 2014

Purpose of the Report:

This report demonstrates the achievements of Information Services in supporting Penn Medicine's three integrated missions by leveraging technology to provide service excellence in patient care, education and research through the design and delivery of innovative, advanced technology and services.

Penn Medicine

"Penn Medicine's continued investments in Information Services will further advance our leadership role in Precision Medicine by integrating an individual's genetic information with their patient care to ensure each patient receives the most appropriate course of care for their diagnosis. Our newly formed Institute for Biomedical Informatics (IBI) will provide the essential partnership to achieve Precision Medicine.

J. Larry Jameson, MD, PhD

Executive Vice President, University of Pennsylvania for the Health System
Dean of the Perelman School of Medicine at the University of Pennsylvania
Robert G. Dunlop Professor of Medicine

"Penn Medicine's Information Services strategy of providing common application solutions through the centralized Information Services organization provides a solid foundation to support excellence in advanced patient care as well as strategically positions Penn Medicine for upcoming key initiatives such as Connected Health and Accountable Care.

Ralph W. Muller

Chief Executive Officer, University of Pennsylvania Health System

Penn Medicine's Information Services (IS) department has evolved into one of the most reliable and innovative information services organizations in the United States. This is evidenced by Penn Medicine's achievement of all Meaningful Use Stage 1 criteria, attainment of Level 6 of HIMSS Analytics, and consistent recognition by Information Week, Most Wired, and other technology publications as a leader in technology innovation.

These achievements, along with many others, could not be realized without the passionate and tireless efforts of the Penn Medicine Information Services department and their operational counterparts throughout the organization. This collaborative relationship between Information Services and Operations is the cornerstone for the many successful application implementations which have further enhanced patient care, patient safety, and improved operational efficiency throughout the organization.

As healthcare organizations have recognized the benefits of integrating patient care throughout many healthcare settings, so has the need for information services increased. Penn Medicine's Information Services' approach of centralizing many institutional resources, migrating to common applications and technological solutions for the entire enterprise, and ensuring collaboration with operational representatives on all projects allows technology to better support the patient experience at Penn Medicine.

Going forward, there is still much to be accomplished. In our quest to advance Personalized Medicine, the Information Services team will further collaborate with operational leaders of patient care and research to leverage the value of our patients' genomic and phenotype data. Such an approach will ensure our patients receive the most appropriate care based upon their personal attributes.

Michael Restuccia
Vice President and Chief Information Officer
Penn Medicine

CONTENTS

MISSION

CREATING THE FUTURE OF MEDICINE® THROUGH:

P Patient Care and Service Excellence

E Educational Pre-eminence

N New Knowledge and Innovation

N National and International Leadership

ORGANIZATION

Penn Medicine, which consists of the Perelman School of Medicine, founded in 1765 as the nation's first medical school, and the University of Pennsylvania Health System (UPHS), is a $4.3 billion enterprise dedicated to the related missions of medical education, biomedical research, and excellence in patient care. The Perelman School of Medicine and the Health System are often referred to together as Penn Medicine.

VISION

Penn Medicine is committed to remain a world-leading institution in three equally valued and inter-related missions of patient care, education, and research. The success of these missions requires the integration of the Perelman School of Medicine and Health System and a shared destiny with the University of Pennsylvania. By recruiting and retaining a world-class faculty and staff who strive for excellence, innovation, quality, and professionalism, we will accomplish our missions. Our goal is to be recognized nationally as the most accomplished and respected School of Medicine and Health System.

2,080,269 Outpatient Visits[+]

136,374 Emergency Department Visits

78,262 Adult Admissions

8,971 Births

2,593 Physicians*

1,632 Licensed Beds

SUPPORTING THE BLUEPRINT FOR QUALITY AND PATIENT SAFETY

In addition to our mission and vision, The Blueprint for Quality and Patient Safety is the cornerstone of Penn Medicine's clinical strategic initiatives. Linking clinical information technology initiatives to support the program aligns Information Services toward achieving the goals of the blueprint.
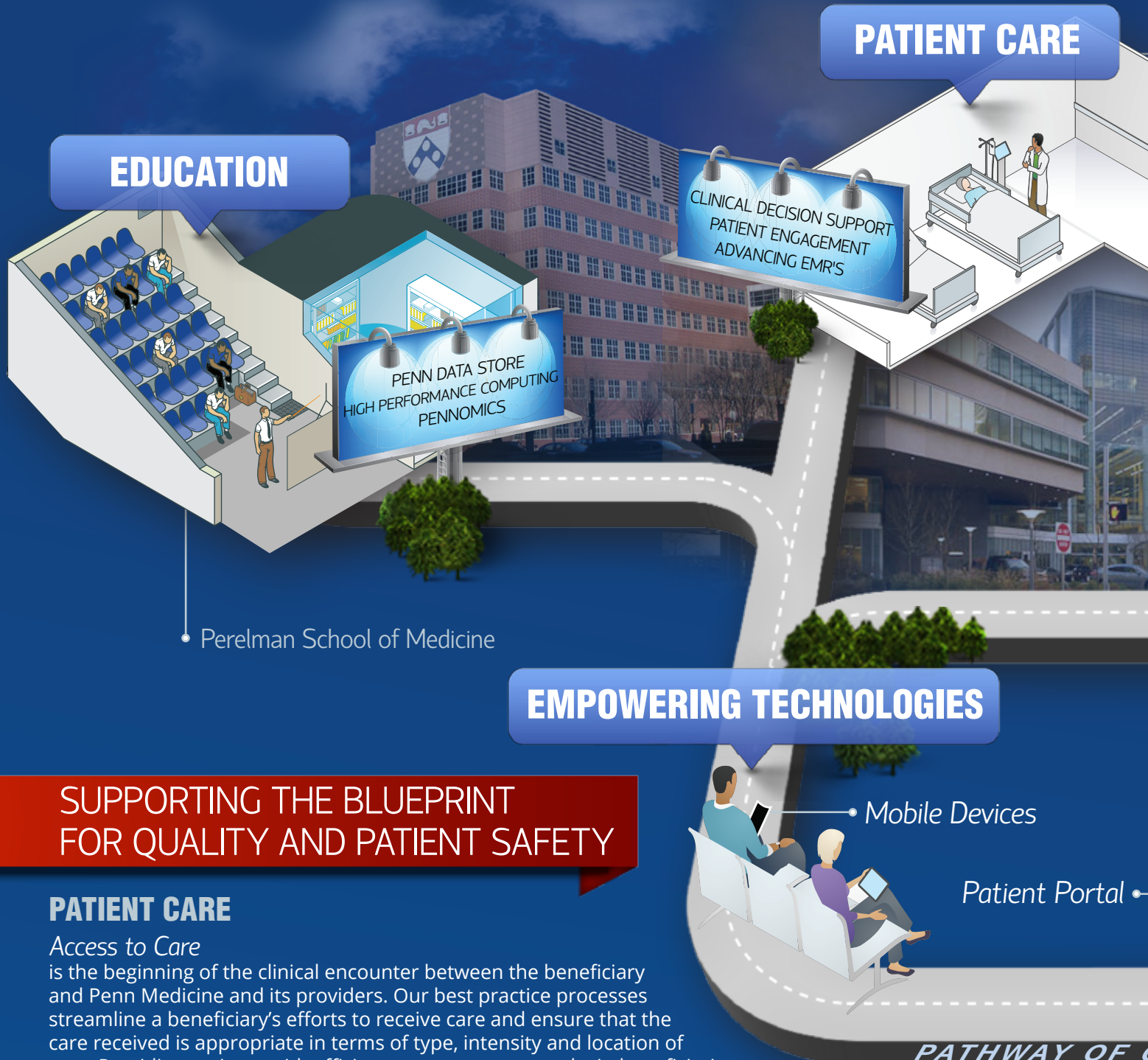
FY 2012
+ Includes CCA/CHCA
* Incudes physicians with privileges at more than one hospital

For more Penn Medicine statistics visit: http://www.uphs.upenn.edu/news/facts.htm

Pathway to Personalized Health Care

Supporting the Penn Medicine Mission Statement

PATIENT CARE

EDUCATION

CLINICAL DECISION SUPPORT
PATIENT ENGAGEMENT
ADVANCING EMR'S

PENN DATA STORE
HIGH PERFORMANCE COMPUTING
PENNOMICS

Perelman School of Medicine

EMPOWERING TECHNOLOGIES

SUPPORTING THE BLUEPRINT FOR QUALITY AND PATIENT SAFETY

Mobile Devices

Patient Portal

PATHWAY OF C

PATIENT CARE

Access to Care
is the beginning of the clinical encounter between the beneficiary and Penn Medicine and its providers. Our best practice processes streamline a beneficiary's efforts to receive care and ensure that the care received is appropriate in terms of type, intensity and location of care. Providing patients with efficient access to care, results in beneficiaries receiving the right care, at the right time, at the right location for the most appropriate cost.

Provision of Health Services
expands the scope of care delivery beyond treatment of illness to illness prevention and wellness promotion in order to achieve optimal health status for individuals and populations. These processes take a person-centered, person-empowering approach to health care. They recognize interrelationships among physical, mental, social, environmental, and spiritual dimensions of health and well-being. They require interdisciplinary and inter-professional working relationships among practitioners: supporting continuity and coordination in care while minimizing unnecessary variations in care through the use of evidence-based guidelines and system-wide clinical protocols.

Population Health Management
is the coordination of health services and the monitoring of health status across a well defined population to improve clinical outcomes and manage financial outcomes. Population health management programs are the foundation of this process and can include care coordination, case management, disease management and health promotion, all based upon managing patient care and services to an evidence based standard.

Penn Medicine

Hospital of the University of Pennsylvania
Penn Presbyterian Medical Center
Pennsylvania Hospital
Penn Medicine Chester County
Perelman Center for Advanced Medicine
Roberts Proton Therapy Center
Abramson Cancer Center
Home Care and Hospice Services

RESEARCH

Smilow Center for Translational Research
Abramson Family Cancer Research Institute
Institute for Biomedical Informatics

CLINICAL TRIALS
GENETIC SEQUENCING
BIO-BANKING

Personalized Medicine

Tele-Health

CONNECTED HEALTH TO PERSONALIZED MEDICINE

EDUCATION

The Perelman School of Medicine's education programs develop the next generations of leaders in medicine and biomedical research. To attract the most qualified students and trainees, the Pereleman School of Medicine and Clinical Practices of the University of Pennsylvania (CPUP) engage the most outstanding educators and researchers in teaching and training and foster educational relationships with the University and Penn Medicine network. We maintain and reward outstanding educators by providing an environment that promotes creativity and rewards teaching excellence. The Perelman School of Medicine, its faculty, and its alumni share a commitment to lifelong learning.

RESEARCH

Penn Medicine will enhance its status as a world leader in advancing medical science by continually improving the quality and impact of its research. The areas that Penn Medicine emphasizes are the fundamental mechanisms of biology and human disease; the translation of discoveries into new approaches for the diagnosis, treatment, and prevention of disease; and the evaluation of medicine's impact on the health of the public.

Transforming Data Into Value
Foundation of Initiatives Leading to the Current State of FY13

Penn Medicine has made a considerable investment in implementing the critical transactional applications that allow clinicians, caregivers and others to store, aggregate and distribute key pieces of patient data throughout the Penn Medicine network. Now, we are leveraging this data to deliver value back to the stakeholders. This value is represented in the form of alerts, clinical decision support, early warning systems, ongoing surveillance and customized reports. With an ultimate goal of aggregating patient care and genomic data to support Personalized Medicine, Penn Medicine's journey to drive value from data is depicted below:
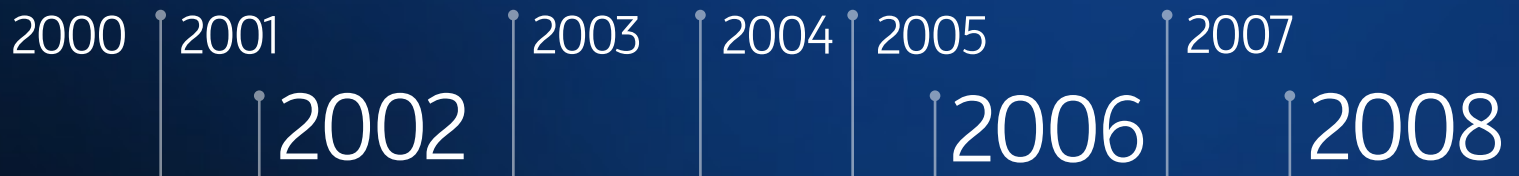
PHASE 1 - FOUNDATION
» Infrastructure & Networks
» Data Acquisition & Distribution
» Clinical Application Focus

PHASE 2 - MEANINGFUL USE
» Data Accuracy
» Alerts & Protocols
» Systems "talk" to each other

PHASE 3 - PERSONALIZED MEDICINE
» Develop innovative IS strategies to tailor care
» Evaluate impact on patient & system
» Enable implementation

| 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |

PHASE 3

PHASE 2

« 100% Inpatient Clinical Documentation

PHASE 1

« 100% Computerized Physician Order Entry with Fully integrated Pharmacy Application

« 1,800 Physicians Utilizing Ambulatory Electronic Medical Record (EMR) & Integrated Practice Management Solution
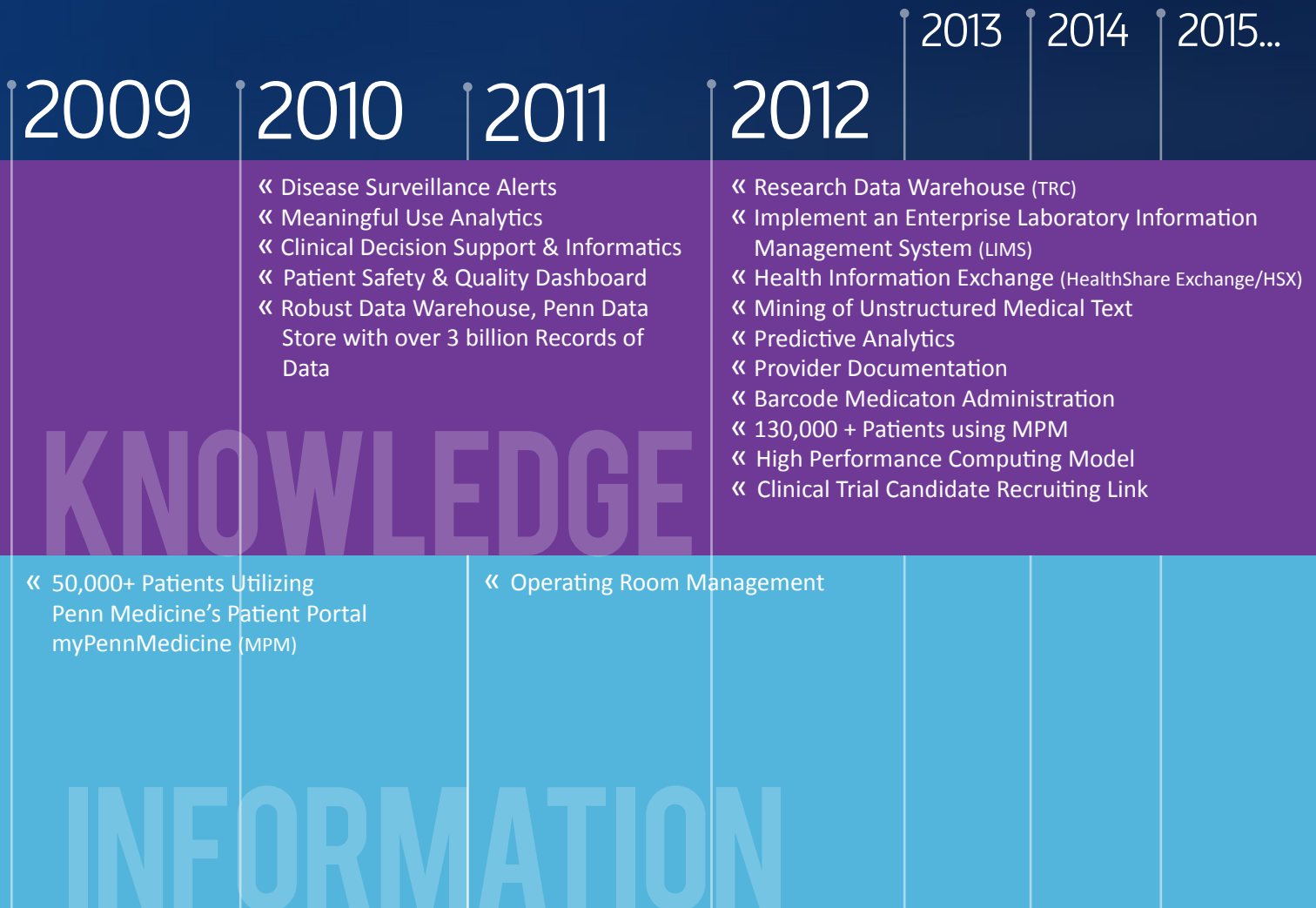
DATA

EMPOWERING TECHNOLOGIES

These technologies and processes address the administrative infrastructure and physical infrastructure support that includes financial services, operations, human resources, managed care contracting, billing, materials management and other administrative services. This enterprise-wide approach designs and implements product and service processes to achieve performance gains and decrease costs while optimizing resources.

IS DEPARTMENT PROGRAMS

An atmosphere of solidarity is fostered where our employees are encouraged to attain professional growth, continual learning and personal enrichment while enjoying what they do. Programs such as Employee Enrichment, WeCARE for community service, IT Nursing Group, Lunch and Learn are examples of the building blocks that create a supportive atmosphere among our colleagues to network and participate in initiatives which enhance us as individuals and as an IS community.

AWARDS AND PUBLIC RECOGNITION

Penn Medicine is a leader in pursuing healthcare technology innovation and applying best practices toward delivering service excellence. Our leadership team adopts a progressive approach toward knowledge sharing and collaborating among the Healthcare IT communities. Healthcare IT committees, collaborative forums, conferences, published articles and speaking engagements are several ways in which we engage with others in the industry. Penn Medicine has also received multiple award recognitions for its accomplishments in implementing new, transformational IT initiatives.

2013 | 2014 | 2015...

2009 | 2010 | 2011 | 2012

2010
- « Disease Surveillance Alerts
- « Meaningful Use Analytics
- « Clinical Decision Support & Informatics
- « Patient Safety & Quality Dashboard
- « Robust Data Warehouse, Penn Data Store with over 3 billion Records of Data

2012
- « Research Data Warehouse (TRC)
- « Implement an Enterprise Laboratory Information Management System (LIMS)
- « Health Information Exchange (HealthShare Exchange/HSX)
- « Mining of Unstructured Medical Text
- « Predictive Analytics
- « Provider Documentation
- « Barcode Medicaton Administration
- « 130,000 + Patients using MPM
- « High Performance Computing Model
- « Clinical Trial Candidate Recruiting Link

KNOWLEDGE

2009
- « 50,000+ Patients Utilizing Penn Medicine's Patient Portal myPennMedicine (MPM)

2011
- « Operating Room Management

INFORMATION

PATIENT CARE

In support of our mission, the following are exemplary projects completed. These projects summarize "what" outcome was delivered and "why" the initiative was pursued with respect to supporting patient care. Visit the page number associated with each vignette to see the entire story.

MEDICATION ON DEMAND ▸

28

Tracking Allergies - Saving Lives
A data integration tool was built to electronically transfer a patient's allergy information from their outpatient EMR to their inpatient EMR. This data interoperability improves patient safety by increasing protection against administering inappropriate medications, food ,or products to which they may be allergic.

29

Temp Trak
A temperature control system was implemented that provides electronic surveillance of refrigerators and freezers that store critical patient specimens in order to alert appropriate personnel if patient specimens and medicines are in jeopardy of expiring.

MAKING THE CONNECTION ▸

myPennMedicine – Patient Portal
Our electronic patient portal provides over 130,000 patients with the ability to participate in the management of their care. This tool, known as myPennMedicine, improves communication between the patient and their caregivers, reduces patient anxiety, and improves patient satisfaction.

Patient Kiosks
Patient friendly kiosks now appear in selected patient access locations to improve the patient registration experience. Decreased wait times and capture of more accurate patient data have led to an overall increase in patient satisfaction.

30

Patient Navigation Software Upgrade
Upgrading our patient progression software, Navicare, was a necessary step to enhancing patient care and improving operational efficiency. The upgrade has improved tracking of patients through both the inpatient and many of the ambulatory environments, which facilitates the transport and clinical care activities.

Patient Room Devices
Computers were installed in each patient room to ensure that caregivers have reliable and consistent access to patient data at the point of care.

MAKING DATA MEANINGFUL ▸

Health Information Exchange
Penn Medicine participates in multiple data exchange initiatives to ensure the comprehensive wellness of our patients. Sharing data at the state level and ultimately at the national level maximizes an individual's patient care data to be comprehensively available any time and place throughout the U.S.

Clinical Decision Support - Alert Reduction Initiative
New advanced clinical decision support (CDS) capabilities leverage patient data captured in the EMR to propose industry best practice protocols for patient care.

31

Penn E-Lert
Electronically connects Intensivists in a central command center to monitor critically ill patients and prescribe rapid care results in improved patient outcomes and reduced patient mortality.

Surface   phase 70%
Ex: 383
Se: 534
Volume Rendering   No cut

DFOV 19.0 cm
STND/C2 Ph:70% (No Filt.)
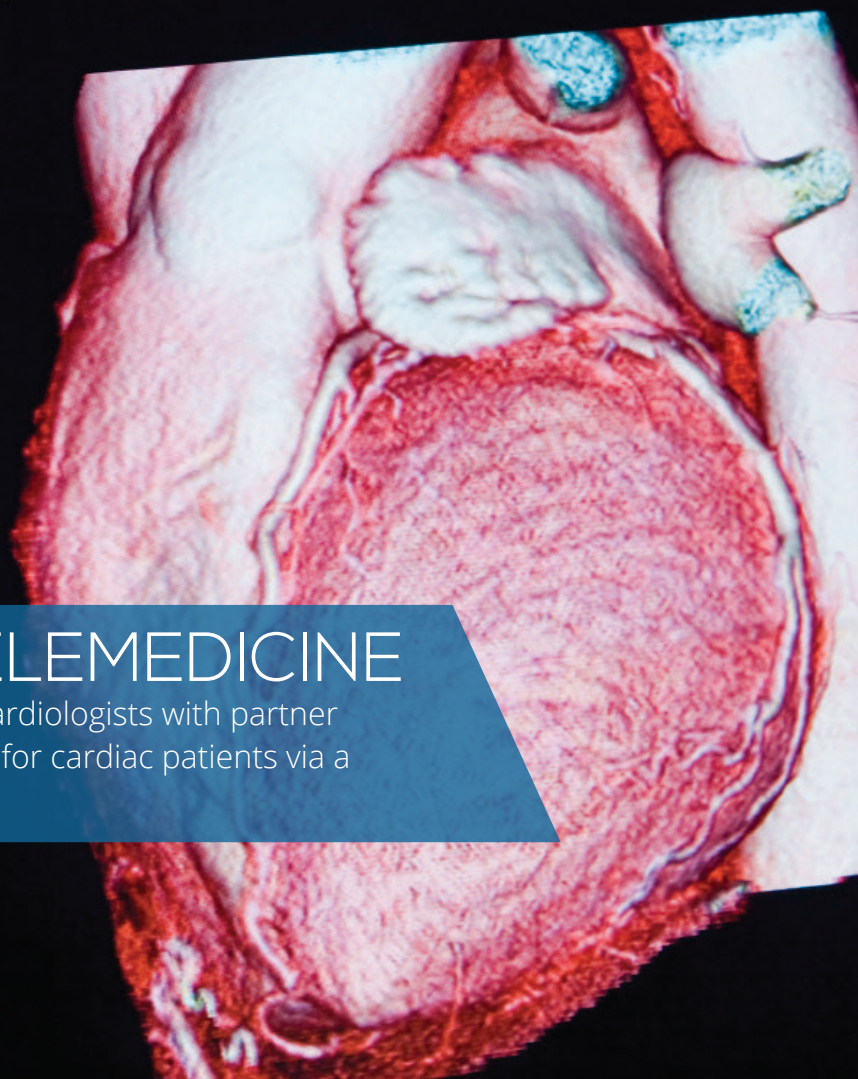
Learning Solutions

Exam Rx   ImageWorks   Manual

InSite

InSite   Service   Shutdown

January 25 12:51

512: 6973   256: 27893

Idle

Removed Image 2278/1/1

Sent: 2284/11 (GEPACS)

**** Film Composer started ****

Retro enqueue of image 2284/108/57.
scan 2284/8/1 successful.

Browser   Exam   -   +
                  Series -   +
Film Composer   Image   -   +

Paging   Image   5

Compare

Image
Analy

Pres

RESUSCITATION TELEMEDICINE

Electronically connecting Penn Medicine's Cardiologists with partner
institutions provide acute resuscitation care for cardiac patients via a
telemedicine tool called REACH Carts.

Rect.   Erase   Hide
Matte   All

                    Display
Measure   Normal

Format   Reference   Flip
          Image   Rotate

PATIENT CARE

POWER TO THE PROVIDER

31

Care Everywhere
Penn Medicine participates in the Epic Corporation sponsored health information exchange that provides secure transfer of selected patient clinical information to and from other Epic Corporation clients throughout the United States. This exchange improves patient care, reduces unnecessary tests, and supports the patients' overall continuum of care.

Resuscitation Telemedicine
Electronically connecting Penn Medicine's Cardiologists with partner institutions provide acute resuscitation care for cardiac patients via a telemedicine tool called REACH Carts.

Linking Physicians
We provide non-Penn Medicine referring physicians with the ability to easily and securely retrieve information for patients that they refer to Penn Medicine in order to improve the overall continuity of patient care and eliminate unnecessary tests and treatments.

IMAGING FOR THE FUTURE

32

Differential Diagnosis Generators – Visual DX and Isabel
Easy access is provided to third party on-line reference tools which aid and accelerate the identification of the correct patient diagnosis so that appropriate treatment protocols can readily be prescribed.

GE PACS Activation for the Radiology Department at PaH
The Picture Archiving and Communication System (PACS) has been standardized across the enterprise in order to support a unified staffing and image interpretation capability across Penn Medicine.

Enterprise Radiology Voice Recognition Software
All Health System radiologists are now provided with the same speech recognition software capabilities to support the accuracy and timeliness of their clinical documentation.

Outside Clinical Image Import and Management
Image management technology now provides clinicians the ability to rapidly and easily access images and studies found on media generated at another non-UPHS facility. This technology improves the physician's efficiency, allows for more direct time with the patient and reduces unnecessary tests.

EDUCATION & RESEARCH

In support of our mission, the following are exemplary projects completed. These projects summarize "what" outcome was delivered and "why" the initiative was pursued with respect to supporting education and research. Visit the page number associated with each vignette to see the entire story.

33

Data Access and Data Analytics (Dashboards)
Presenting needed information in a continually changing healthcare industry is in high demand. Accessible, accurate information helps improve patient care, accelerate research into action, and helps to sustain Penn Medicine's mission as a leading medical center while adapting to these changes.

Clinical Trial Recruiting
Clinical trial recruiting protocols were embedded into the ambulatory EMR system in order to accelerate clinical trial candidate recruitment and advance research efforts.

Penn Data Store
The creation of the Data Analytics Center (DAC) serves as a central organization to aggregate, analyze, and report upon clinically and financially rich data to improve patient outcomes and overall operational efficiency.

34

High Performance Computing (HPC) Cluster
Installation of a new high performance computing platform now supports the large scale processing and storage needs of Penn Medicine's research and patient care personnel as they advance Penn Medicine's bioinformatics efforts to support Personalized Medicine efforts.

35

PennOmics
In order to support the goals of Personalized Medicine and the mission of the Center for Personalized Diagnostics, Penn Medicine procured and implemented a research data warehouse to store, analyze, and interpret the growing amounts of complex genetic data and other research related patient information - a PennOmics Medical Record (PMR).

Unstructured Text Mining
We have deployed an industry tool to search over 28 million (and counting) unstructured or semi-structured medical documents currently residing in Penn Medicine's EMRs and diagnostic applications (Radiology, Pathology, Cardiology, Gastroenterology, etc.) to analyze and mine this data for identifying trends and input for patient care and research.

CLINICAL TRIAL RECRUITING
Clinical Trial recruiting protocols were embedded into the ambulatory electronic medical record system in order to accelerate clinical trial candidate recruitment and advance research efforts.

ENGINEERED T-CELL THERAPY

Carl H. June, M.D. Program Director of Translational Research,
Abramson Family Cancer Research Institute, Professor, Department
of Pathology and Laboratory Medicine

36 Genetically Engineered T-cell Therapy

A dashboard was constructed for monitoring Penn Medicine patients as they prepare for and receive genetically engineered T-cell therapy for chronic leukemia. The combination of real-time Health System clinical data, clinical trial data and treatment manufacturing data into one dashboard is a unique accomplishment for Penn Medicine and an example of true teamwork across the research and clinical domains.

37 Institute for Biomedical Informatics

The Perelman School of Medicine recently established the Institute for Biomedical Informatics (IBI) through the generous endowment donated by the Smilow family. The intention of bridging together the communities of bioinformatics and medical informatics creates the opportunity to catalyze research and education in both disciplines, and usher in a new era of informatics research and medicine at Penn Medicine.

Institute for Biomedical Informatics

Clinical and Translational Science Award (CTSA)

Penn Medicine won the Clinical and Translational Science Award as a result of supporting the strategic initiatives of the informatics goals. The award supports a national consortium of medical research institutions that work together to improve the way clinical and translational research is conducted nationwide to enhance its efficiency and quality. Its goals are to accelerate the process of translating laboratory discoveries into treatments for patients, to engage communities in clinical research efforts, and to train a new generation of clinical and translational researchers. This award forged a transformational alliance between Penn Medicine, the Children's Hospital of Philadelphia (CHOP), the Wistar Institute (WI), and the University of the Sciences in Philadelphia (USP).

38 Establishment of Penn Medicine Academic Computing Services

We combined many of the decentralized Information Services departments within the Perelman School of Medicine to form the Penn Medicine Academic Computing Services team in order to gain operational efficiencies, increase depth, and achieve greater integration of resources.

BLUEPRINT FOR QUALITY AND PATIENT SAFETY

In support of our mission, the following are exemplary projects completed. These projects summarize "what" outcome was delivered and "why" the initiative was pursued with respect to supporting our blueprint for quality and patient safety. Visit the page number associated with each vignette to see the entire story.

PROVIDER PORTALS

An in-house web portal application, called MedView, provides clinician access to data from over 25 clinical systems in order to improve the efficiency and quality of care they deliver.

EMPOWERING TECHNOLOGIES

In support of our mission, the following are exemplary projects completed. These projects summarize "what" outcome was delivered and "why" the initiative was pursued with respect to supporting empowering technologies. Visit the page number associated with each vignette to see the entire story.

39

Integrated Ambulatory EMR and Practice Management
Aging niche and enterprise wide ambulatory computing solutions were replaced with an integrated practice management and EMR solution that improves the continuity of patient care, improves communication between caregivers, simplifies the patient experience, and results in a more accurate capture of provided services.

40

Infrastructure Resiliency
Penn Medicine's data and telecommunications networks were enhanced in order to reduce system downtime, increase system availability, and maintain clinical operations.

Mobile Device Management
Penn Medicine implemented technology to manage mobile devices that access the Penn Medicine data network in order to ensure patient data is securely stored and the device can be located and/or erased in the event that it is lost or stolen.

Meaningful Use
The hospital and eligible provider requirements associated with the American Recovery and Reinvestment Act Meaningful Use Stage 1 were attained. These are designed to leverage technology to support and improve patient care.

iPad Support
Our clinicians are provided with Health System procured iPad tablets in order to facilitate secure and reliable access to patient clinical data from any location.

Relocation of Labs at PaH
Pennsylvania Hospital relocated its laboratory in order to support the hospital's strategic initiative to have more private patient rooms.

40

Support of New Practice Integrations
We rapidly implemented the Health System's core IS functions in newly acquired physician practices in order to ensure proper patient identification, patient continuum of care, and compliance across the enterprise.

Data Centers
Multiple small data centers were consolidated into two main, environmentally-sound data centers. This consolidation resulted in reduced system outages and improved overall system security.

Clinical System Access – Just a Tap Away
Provides the ability for caregivers to gain access to selected clinical systems by simply "tapping" their RFID enabled ID badge on the keypad in order to gain rapid access to selected clinical systems.

EMPOWERING TECHNOLOGIES

42

Medical Device Integration
Processes and an organizational structure were developed to support the integration of data into the Penn Medicine IS environment from medical devices.

Standard Clinical Desktop
A standardized desktop image was developed for the approximately 2,500 shared clinical workstations throughout the Health System in order to improve desktop reliability, application performance, and user satisfaction.
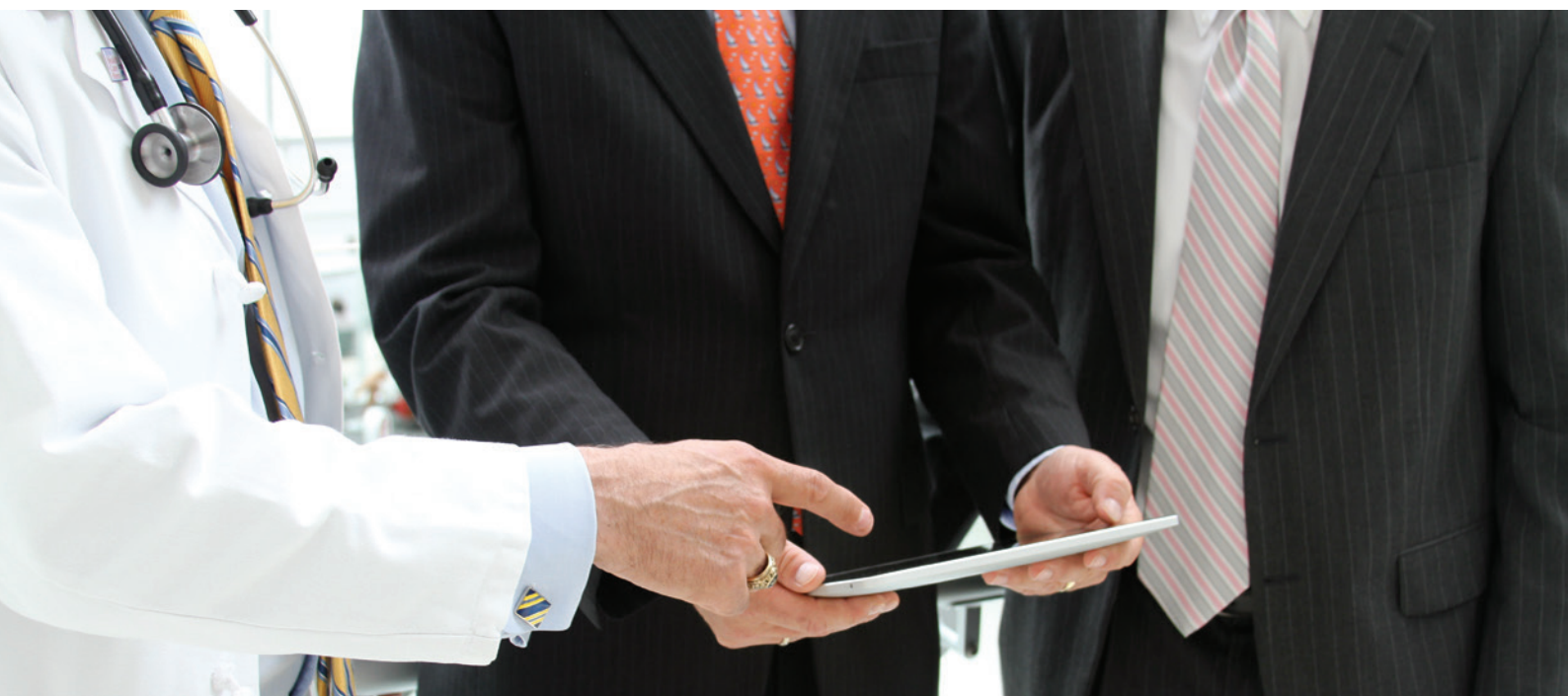
Developing a Project Management Organization
A centralized Information Services Project Management Office (PMO) was organized to facilitate all IS projects and ensure consistency in the prioritization, documentation, and methodology used throughout the enterprise.

Second Shift Coverage for End User Support
We extended onsite end user support (EUS) coverage to accelerate device support during the second shift, reduce the support burden for on-call resources, and reduce the level of overtime associated with off hours support.

IS Service Desk Insourcing

43

Information Services transitioned operational control of its support desk from a outsourced third party firm to Penn Medicine in order to increase service levels to the Penn Medicine user community and lower expenses associated with the service.

Privacy Monitoring and Breach Detection

In order to identify inappropriate access to data and provide a more private and confidential environment, a software solution to continuously monitor utilization of Penn Medicine's EMRs was deployed.

Attainment of HIMSS Stage 6

We attained HIMSS Stage 6 of our inpatient EMR deployment. With the completed implementation of electronic provider documentation (ePD) later this year, we will be ready to submit for Stage 7 HIMSS certification.

Human Resources Employee Self-Service Portal

44

We supported the implementation of an employee self-service portal that provides employees with single sign-on access to many of their Human Resources (HR) capabilities from either onsite or remote locations. This resulted in improved employee satisfaction and reduced inquiries to the HR department.

Learning Management System

A new learning management solution was installed to improve the learner's experience and facilitate the ability to manage improved function of course content.

PROGRAMS & HONORS

IS DEPARTMENT PROGRAMS

44

Continuous Learning
In an effort to promote continuous learning, an ongoing series of regularly scheduled educational programs, called Lunch & Learn sessions, educate and inform IS employees of the many roles, responsibilities, and relationships that exist within the IS department.

Employee Promotion within Information Services
A clear process was established for employees regarding the manner in which they can advance their careers at UPHS. This understanding has ensured all employees are considered fairly for open opportunities and has supported an internal promotion rate greater than 80%.

45

Employee Enrichment
We established the Employee Enrichment Program (EEP) as a dedicated effort to focus on responding to employee provided input to further improve the professional environment, increase employee satisfaction, and reduce employee turnover.

Information Services New Hire Orientation Program
Information Service's new orientation program was assembled to help assimilate newly hired IS employees into their roles, which has improved resulting in improved productivity and employee satisfaction.

WeCARE @ Penn Medicine IS
WeCARE is an Information Services charitable organization that provides the many caring Penn Medicine IS employees a home-grown organization to participate in many diverse charitable activities.

46

IS Nurses and Magnet
An Information Services Nursing Council was established to actively participate in the Penn Medicine Nursing Magnet activities. This participation has resulted in a strengthening partnership with the clinical community and improved use of the information systems throughout the enterprise.

PEOPLE IN ACTION

WeCARE is an Information Services charitable organization that provides the many caring Penn Medicine IS employees a home-grown organization to participate in many diverse charitable activities.

AWARDS AND PUBLIC RECOGNITION

SmartCEO's EXECUTIVE MANAGEMENT AWARDS — HONORING YOUR LEADERSHIP TEAM MEMBERS

2013 CSO40 SECURITY CONFAB

The Hospital of the University of Pennsylvania was ranked as one of the nation's top hospitals by U.S. News & World Report in 2013.

MAGNET RECOGNIZED — AMERICAN NURSES CREDENTIALING CENTER

The Hospital of the University of Pennsylvania and Penn Presbyterian Medical Center have achieved 2013 Magnet® status—the highest institutional honor awarded for nursing excellence— from the American Nurses Credentialing Center (ANCC).

HealthCare's most wired WINNER 2013 — CELEBRATING 15 YEARS

This prestigious award is based on an annual survey which polls the nation's health care systems on their use of Internet technologies to connect with patients, physicians and nurses, payors, health plans and employees. Penn Medicine has been recognized by this award for nine years in the last decade.

2012 Healthcare IT News WHERE TO WORK: BEST HOSPITAL IT DEPARTMENTS

2013 HEALTH DATA MANAGEMENT NURSING INNOVATION

HealthData Management

TOP 50 HOSPITALS 2013 — SOCIAL MEDIA FRIENDLY HOSPITALS

InformationWeek 500 — 2012 BUSINESS TECHNOLOGY INNOVATORS

THE HEALTH CARE IMPROVEMENT FOUNDATION — Building Partnerships For Better Health Care

PENN MEDICINE HEALTHCARE IT ORGANIZATION AFFILIATIONS

» American College of Healthcare Executives (ACHE)	http://www.ache.org/
» American Health Information Management Association (AHIMA)	http://www.ahima.org/
» American Heart Association (AHA)	http://www.heart.org/HEARTORG/
» American Medical Association (AMA)	http://www.ama-assn.org/ama/
» American Medical Informatics Association (AMIA)	http://www.amia.org/
» American Nurses Association ANA	http://www.nursingworld.org/
» American Nursing Informatics Association	https://www.ania.org/
» Association of Medical Directors of Information Systems (AMDIS)	http://www.amdis.org/
» American Telemedicine Association (ATA)	http://www.americantelemed.org/
» CHIME (College of Healthcare Information Management Ex.)	http://www.cio-chime.org/
» CPM – Resource Center (Clinical Decision Support)	http://http://www.cpmrc.com/
» Gartner	http://www.gartner.com/
» Greater Philadelphia Senior Executive Group (GPSEG)	http://www.gpseg.org/
» Healthcare Information and Management Systems (HIMSS)	http://www.himss.org/
» HealthShare Exchange of Southeastern Pennsylvania (HSX)	http://www.hsxsepa.org/
» Healthcare Financial Management Association (HFMA)	http://www.hfma.org/
» KLAS Research	http://www.klasresearch.com/
» Medical Group Management Association (MGMA)	http://www.pmi.org/
» Project Management Institute (PMI)	http://www.mgma.com/
» Society for Information Management (SIM)	http://www.simnet.org/
» UHC	http://www.uhc.com/

BY THE NUMBERS

IS DEPARTMENT SUPPORTS

NETWORK PORTS	**36,123**
DESKTOP COMPUTERS/LAPTOPS	**20,292**
CELL PHONES/SMARTPHONES	**5,343**
SERVERS	**1,211**
INTERFACES CONNECTED BETWEEN APPLICATIONS	**400**
APPLICATIONS	**235**
DATABASES	**221**
MANAGED PROJECTS AT ANY GIVEN TIME	**200**

PERFORMANCE BY NUMBERS

» Our MedView web based clinician portal receives over 1.2 million hits a month.
» Our clinical data warehouse has over 3.0 billion rows of data within data warehouse.
» Our data and voice network supports users at over 90 separate physical locations throughout the Delaware Valley.
» We have 100% deployment of CPOE at all 3 hospitals.
» Fully implemented -100% on our ambulatory EMR, with 1,800 physicians that are currently using it.

MyPennMedicine.com
130,000+ PATIENTS ENROLLED

eGATE ARCHITECTURE PROCESSED
1.4 BILLON HL 7 INTERFACE TRANSACTIONS *FY13*

3.2 MILLION *FY13* APPOINTMENTS SCHEDULED in EPIC *FY13*

1.2 *INBOUND EACH YEAR* **BILLON EMAILS**

126,958+ IS SERVICE DESK CONTACTS OPENED & SUPPORTED *SINCE 12/31/2012*

1,463 WIRELESS ACCESS POINTS MAINTAINED

29,131 *FY13* APPOINTMENT & REFERRAL REQUESTS ON WWW.PENNMEDICINE.ORG

38,048,451 PAGES VIEWED ON WWW. PENNMEDICINE.ORG & UPHS.UPENN.EDU *INTERNET SITES FY13*

EPIC BILLING SYSTEM
1,548,429,535 IN PROFESSIONAL FEES
1,767,003,965 IN PRODUCED CLAIMS *FY13*

SECURITY MANAGEMENT SYSTEM MONITORS
100 MILLION EVENTS DAILY

29,091,950 TOTAL PAYMENTS MEANINGFUL USE *for* MEDICAID & MEDICARE

597 CLASSES ADMINISTERED & OVER
4,587 INDIVIDUALS EDUCATED *WITHIN FY2013*

OR Management and Anesthesia Record System

This year, continuing with the goal of using enterprise-wide clinical information systems, Penn Medicine implemented OpTime – Epic's Operating Room Management and Anesthesia Record System in all perioperative units in the Health System. This system replaced the HSM documentation system used by nursing and the Docusys and paper systems used by the anesthesiologists and surgeons. With this system rollout, our clinicians now have better access to comprehensive patient information throughout the perioperative episode while offering streamlined workflows that increase productivity and operating room use.

The OpTime implementation has resulted in approximately 400 surgeons, 500 anesthesiologists, and 700 nurses actively documenting in the system; integration of clinical documentation throughout the pre-op, intra-op, and post-op settings; and enhanced ability of the clinicians to monitor the patient's condition throughout the surgical encounter because the physiological monitors and anesthesia equipment were integrated.

1,800+
PHYSICIANS ON A COMMON AMBULATORY EMR

230 PRACTICE SITES

40+ SPECIALTIES

DIVISION OF REPRODUCTIVE ENDOCRINOLOGY
RESULT OF OPTIMIZATION INCREASED YEARLY REVENUE BY
$740,000

Optimization of Ambulatory Outpatient EMR

Recognizing the need for an integrated electronic medical record in the late 1990s, the EpicCare Ambulatory EMR was implemented into 3 small practices and the Radnor multidisciplinary center in 1998. By 2006, the implementation process gained momentum - implementing to the rest of the ambulatory practices. We have achieved one of the largest and widest deployments of an ambulatory EMR in the country with over 230 practice sites, over 40 specialties, and 1,800+ physicians on a common ambulatory EMR. Since gaining widespread automation, Information Services formed a team of Optimization Analysts to help users refine the customized tools that were provided during the implementation. As our users have become more familiar with using the EMR, they are asking for better ways to use the application to improve outcomes, patient satisfaction, and practice operations. The Optimization Team has partnered with various departments to further enable our users through deeper system knowledge.

One such project the Optimization Team worked on was within the Division of Reproductive Endocrinology. They changed a lab workflow which resulted in an estimated $740,000 increased yearly revenue for the department." The team also worked closely with the internal medicine and GI departments to improve the rate of colonoscopy recalls to ensure patients receive this important cancer screening. Other optimization efforts have been instrumental in educating providers in the tools and workflows they must follow in order to achieve Meaningful Use and PQRS goals. The team worked with the surgical departments and the periop area to rollout an electronic OR chart process that has saved time and helped improve the accuracy of OR charts. Recently, partnering with the department of Urology, CPUP Operations, and Marketing, the team has built and developed workflows, via the myPennMedicine patient portal to communicate with patients about their upcoming visit and collect clinical information prior to their appointment to save time during the visit.

Implementation of Inpatient EMR

As a national leader in the deployment of clinical systems in the inpatient care settings, 100% Computerized Provider Order Entry (CPOE) was implemented when less than 3% of hospitals nationwide had even a pilot in place. Leveraging from the successful adoption of our clinical system, UPHS recently implemented clinical documentation for nursing, respiratory therapy, nutrition, and physical/occupational therapies. Known as Knowledge Based Charting (KBC), this functionality is oriented around the patient and allows us to capture information at the point of care.

To aid the KBC initiative, we installed state of the art computer devices at the bedside in every room, which interface to the physiological monitors and integrate clinical data views to help support patient care. No longer paper-bound, the patient's clinical information is accessible on any clinical device in the hospital allowing care providers the opportunity to view and share integrated data simultaneously. We are now implementing automated provider documentation.

Electronic Inpatient Provider Documentation

Until inpatient provider documentation became electronic, patient record keeping was done through hand-written paper documentation, making it very difficult for this information to be shared on a real-time basis. This data could not be coded, readily retrieved and analyzed in support of patient care, or easily accessed for research and educational purposes. Additionally, paper documentation made it more difficult to provide users with feedback that improve patient care and business outcomes.

IS, the office of the CMIO, department-specific providers and operational resources implemented an enterprise-wide, all-electronic Inpatient Provider Clinical Documentation system. No longer does a provider have to be on the nursing unit to review a patient's paper chart because they can now easily read provider notes from any Penn Medicine computer. Also, as a result of this effort, Penn Medicine was able to develop a common clinical vocabulary that may be used to improve research, education and improve quality patient outcomes among the Health System.

Care at Home

Our Home Care and Hospice Services provide patients with comprehensive, specialized health care for short or long-term illness and end-of-life care in their home, primary residence or our inpatient facility, while extending support services and education to their family care givers. In order to be able to provide point-of-care, back office documentation, and communication for our providers, we implemented point-of-care EMR documentation systems for all business lines, compatible with a variety of devices and access depending on the discipline and task. Devices include a variety of solid state drive laptops, iPads and PDAs. Integration to other Penn Medicine clinical systems is provided with the other components of UPHS through the use of our common patient registration system and issuance of the universal patient identifier.

We increased access to information, reduced visits into the office to retrieve or drop off information, eliminated entering data from written forms, reduced paper storage, and eliminated redundant labeling. Additionally, care providers are able to communicate with prescribers throughout the day as needed.

Sunrise Barcode Medication Administration

Barcode Medication Administration (BCMA) completed our implementation of complete closed-loop medication administration. As orders are entered, checked for allergies and interactions, dispensed, administered, and documented entirely within an integrated electronic system, potential errors are now caught and wrongful medication administration is now prevented due to the error message that appears after the medication is scanned. Similarly, should a medication be delivered to the wrong patient, scanning the patient's bar coded wrist band now produces an error indicating that the medication was not ordered for this patient. The implementation of this feature is the last critical piece of the electronic safe medication administration puzzle to add to the benefits of our patients and caregivers.

Sunrise Orders Reconciliation Management

The proper reconciliation of medications and other orders represented a major opportunity to provide the safest possible patient care. Each transition in care: from outpatient to inpatient; from ICU to floor; from hospital to home, increased the potential for errors and omissions.

EMRs offered a major opportunity to address these challenges. The proper reconciliation of all orders indicates whether each order is continued, explicitly stopped or pended, so that accidental oversights are avoided. Implementing Orders Reconciliation Management within Sunrise assisted our caregivers in managing this complex process, and makes our patients safer as they move through the many transitions in care within our Health System.

Outpatient Pharmacy Solution

Pennsylvania Hospital had an aging outpatient pharmacy system which was very labor intensive to use compared to current retail pharmacy practices. Also, the system was not integrated with the cash register or the medication wholesaler. As a result, pharmacists were not able to spend as much desired time with patients to assist with their medication management.

To improve this situation, Pennsylvania hospital implemented a new state of the art, full function solution, to replace their old, limited function system. Now, pharmacists are able to spend more time with their patients. The system also eliminates human error by providing an automated reordering feature to manage inventory levels, digital scanning of prescriptions to improve patient safety, and a patient friendly and efficient automated refill process with digital signature for improved auditing.

Tracking Allergies – Saving lives

Allergic reactions in hospitals are common -- and potentially serious. In fact, 15-30 percent of all patients hospitalized in the U.S. at some point experience an unintended reaction as a result of medications, dyes, materials such as tape and latex, or food. We have established a new allergy integration tool that transfers allergy information from our outpatient EMR into our inpatient EMR, eliminating the possibility that an allergy only entered in the outpatient record would be missed by a clinician while the patient is in the hospital. The allergy information is electronically transferred from our outpatient EMR into our inpatient EMR when the inpatient is registered, and is thus immediately available when the clinician goes to the inpatient chart.

This tool increases patient safety since clinicians now have immediate access to a patient's complete allergy list. The project also allows clinicians to spend more time with patients, since they no longer have to carefully check to see that all outpatient allergies are entered into our inpatient EMR and manually enter any missing allergy data. Patients benefit from increased protection against being inadvertently given a medication, food, or product to which they are allergic. Our clinicians report that they spend about one minute on allergy issues now per patient, compared to three minutes before the tool was introduced; this allows them to spend more time with patients.

EMR

INCREASED PATIENT SAFETY FOR ALLERGIC REACTIONS
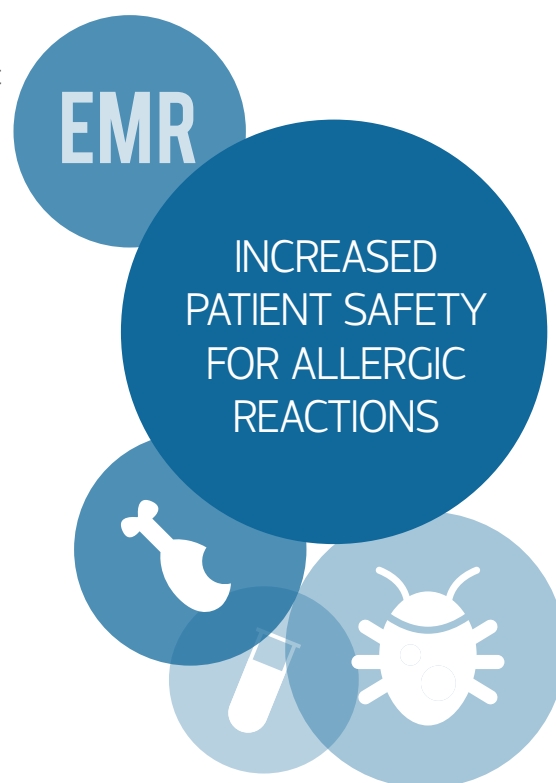
Temp Trak

Refrigerator and freezer requirements for temperature monitoring needed improvement in consistently meeting guidelines. The temperature monitoring was a very manual process involving nurses, pharmacists and laboratory staff, to take and record multiple daily readings and report issues.

A technology solution was implemented to alert the appropriate staff, 24 hours a day, 7 days a week, if a temperature is out of range, requiring attention. Pennsylvania Hospital is now 100% effective in attaining consistent refrigeration temperature monitoring; avoiding potential expiration of any blood products or medications.

MyPennMedicine – Patient Portal

Including patients in their care management is one of the most important factors to improving overall patient care and community health. In 2009, Penn Medicine began providing patients with the ability to participate in their care management through the activation of Penn Medicine's ambulatory patient internet portal, myPennMedicine. Our patients have the ability to access their health information from the comfort of their home office or any remote location through the internet. Current features include:

> » Review of laboratory results and radiology reports
> » Physician referral requests
> » Medication refill requests
> » Secure email messaging with one's care provider team
> » Research surveys

Over 130,000 patients use the myPennMedicine patient portal to manage their own health and the health of their loved ones. With over 1,496,500 results released and 784,500 result views (52.43%), Penn Medicine patients recognize the convenience, accuracy, improved care and overall satisfaction associated with participating in their care and achieving new levels of health at Penn Medicine.

Patient Kiosks

In 2012, Penn Medicine held an Innovation Tournament seeking new ways to improve the patient experience. One of the winning entries suggested the deployment of "kiosk technology" to support patient engagement and gain efficiency with patient flow, specifically the registration/check in process. UPHS used its outpatient Practice Management system to configure the technology hardware and software. The IS team worked closely with the hospital and practice operational teams to ensure that the use of the kiosks would enhance patient flow. Several patient kiosks were initially designed, tested and implemented in high volume areas at PPMC; such as hospital registration and outpatient Orthopedics.

The Welcome Kiosk allows patients to check-in for their appointment without waiting in line for a patient service representative to assist them through the check-in process. Also, the kiosk enables patients to confirm demographic, insurance and emergency contact information, and allows for certain documents to be signed directly on the kiosk. Patients also have the ability to sign forms and sign up for our patient portal, My Penn Medicine.

Within days of installing two kiosks in the admissions area, UPHS was able to reduce wait times – over 95% of the patients had a wait time of less than 15 minutes, which was a 10% increase. As this new patient satisfier became an immediate success, an enterprise-wide implementation strategy was also developed in order to begin installing the Welcome Kiosks into the other Penn Medicine locations.

95% OF PATIENTS WAIT LESS THAN 🕐 **15** MINUTES
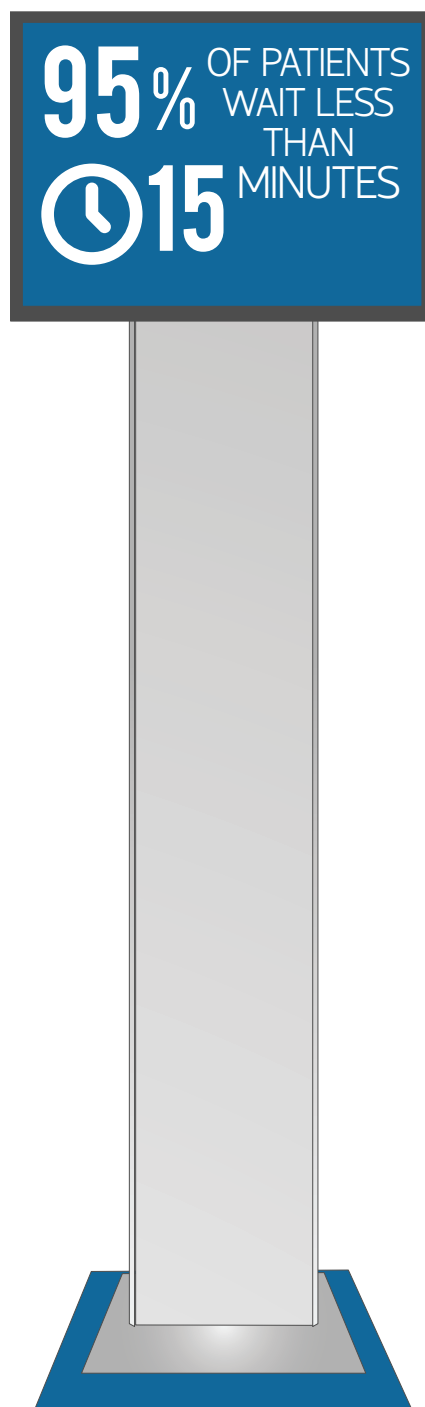
Patient Navigation Software Upgrade

Navicare was upgraded to provide a better way to track patient in-bed data through automated data interchange between core clinical systems and the Navicare system. Changes were coordinated to update all active interfaces between Navicare, SCM, Emtrac and other systems, as well as the training of HUP personnel on the new Navicare system.

Because of this new automation, patient in-bed data is more accurate and available to providers more quickly while also providing providers more time to focus on delivering patient care and other important clinical functions.

Patient Room Devices

As part of the effort to implement KBC, patient room PC's were installed in order for nursing and other clinicians to perform real-time electronic charting while gathering vital information at the patient's bed-side. We realized that entering this data while it was being captured rather than keying it into the system at some later time was essential to improving care because vitals can quickly change over a very short period of time. Patient vitals can quickly change over a very short period of time. Therefore, capturing that data real-time is essential, especially for accurate vitals trending.

The implementation was as large as the implementation of KBC itself as over 1,100 in room devices were updated in our hospital facilities. EUS Teams, hospital vendors, and the nurse managers of every unit, all working together to ensure a successful installation. Our Entity Information Officers were also heavily involved in the planning in order to ensure that the mounted devices were seamlessly part of clinician workflow and non-intrusive to patient care.

Health Information Exchange

Recognizing that patients often seek their care from multiple healthcare organizations and that patient data is a foundation for sound clinician decision making, Penn Medicine participates in multiple data exchange initiatives to ensure the comprehensive wellness of our patients. On a regional basis, Penn Medicine is a member of the HealthShare Exchange (HSX), which connects 44 hospitals and several large health insurance organizations throughout southeastern Pennsylvania to exchange patient data. This regional exchange shares data at the state level and ultimately at the national level so that an individual's patient care data may be available any time and any place throughout the United States.

In addition, Penn Medicine also directly exchanges patient data upon request with other healthcare organizations that use the Epic Corporations electronic medical record software. This capability, known as Care Everywhere, provides for the exchange and storage of an individual's clinical care record between healthcare organizations.

Clinical Decision Support - Alert Reduction Initiative

After careful analysis of the volume and content of clinical alerts that present to nurses, pharmacists and providers, a systematic review and reduction initiative was done to ensure that only the most clinically relevant alerts present to point of care providers. Data analysis taken from our inpatient EMR revealed several alert categories that present with high frequency, are regarded as clinically irrelevant, and result in high override rates. Our initial efforts focused on removing these "nuisance" alerts and ensuring that only the most relevant alerts are designed and implemented.

Targeting the highest volume alerts, coupled with survey data from the provider community, allowed us to create a specific reduction strategy to systematically review and turn off several high volume nuisance alerts in the categories of task reminders, duplicate medication and drug-drug interaction.

Through this targeted strategy we have significantly reduced the number of non-relevant alerts presenting to our providers, nurses and pharmacists. This resulted in an overall 18% reduction in alerts firing for nurses, providers and pharmacists over an equivalent seven day period.   Our efforts have expanded to include a similar review and reduction strategy in our ambulatory practices in 2013.

CARE EVERYWHERE

Care Everywhere provides health information exchange at the point of care with other Epic organizations. In February 2009, as part of the American Recovery and Reinvestment Act (ARRA), the Health Information Technology for Economic and Clinical Health (HITECH Act) was passed to deliver incentive payments to physician and hospitals who meet the Meaningful Use objectives within the stated time period as well as penalties to those who do not.

UPHS is committed to improving patient care through the efforts of achieving Meaningful Use. This project generates the capability to electronically exchange key clinical health information among providers of care and patient authorized entities. This measure required that at least one test be performed of the certified EHR technology's capacity to electronically exchange key clinical information.

Care Everywhere was used successfully to exchange electronic patient information with Geisinger. We then deployed Care Everywhere in the Cardiology department where referrals from Lancaster General and Geisinger are common. On average, 24 attempts per month to exchange data with other organizations are made and approximately 7 exchanges of data per month are successful. By January 2014, all providers will be prepared to use Care Everywhere to electronically exchange data for at least 10% of transitions of care or referrals to outside organizations.

Resuscitation Telemedicine

As Penn Medicine's network of physicians and specialists continues to grow, more community members have come to depend on our doctors for specialized care. A newly introduced initiative is the use of a telemedicine tool called REACH Carts. This new tool allows cardiologists to monitor a patient from a remote site, making quality health care analysis possible - anywhere at any time.

Information Services, multiple network teams, and operations personnel from three Penn Medicine hospitals worked to ensure the REACH Carts were properly installed and connected from the remote emergency departments to the Penn Medicine network. Through this initiative, our physicians are able to provide acute resuscitation care for cardiac patients who are not able to make it to a Penn Medicine hospital emergency department. These patients receive Penn Medicine physician care from their local ED, ensuring that our commitment to community health continues to move forward.

Linking Physicians

The ability to easily and efficiently share secure patient information with referring providers is a challenge that many health care organizations face. Traditional manual processes of sending information to referring physicians often times remain prevalent despite the implementations of EMR. These antiquated processes are usually slow, and prone to security risk and delays.

Penn Medicine implemented a physician portal for referring providers to obtain patient information in an easy and secure fashion. The portal provides a way for referring physicians to see patients associated to them. They also have the ability to send secured messages to Penn Medicine providers. Implementing a physician portal has facilitated the ability to provide collaborative care for patients. Providing this service is helpful to the referring provider community, increases patient care and reduces unnecessary delays and errors that are common in traditional paper methods. As we continue to grow our referring physician community, services such as this will help support collaborative care.

Penn E-Lert

The Institute of Medicine as well as other clinical thought leaders share a vision that a key driver to reducing mortality is to reduce medical errors. At Penn Medicine, we receive many critically ill patient transfers into our hospitals. Studies have shown that with critically ill patients, errors can be reduced and patient outcomes improved when monitored by intensivists. Intensivists are in demand 24 hours a day, 7 days a week and are often in short supply. Penn E-LERT provides a team approach to monitoring critically ill patients, by intensivists who are monitoring patients using audio visual technology remotely.

As a result, intensivists have been able to provide timely suggestions and interventions to nurses and residents who are in the room with the patients. The team approach provides confirmation as well as another set of eyes on the big picture for very critically ill patients where a multitude of problems and interactions are necessary in rapid order. Penn Medicine has achieved the finest ratio of mortality throughout the nation and has saved more lives than any other eICU in the US.

DIFFERENTIAL DIAGNOSIS GENERATORS - VISUAL DX AND ISABEL

At times, providers need assistance in appropriately diagnosing an atypical patient presentation. Differential diagnosis generators can help providers make diagnoses by providing a set of possible diagnoses based on patient demographics, symptoms, signs and lab values entered into the system.

UPHS's Center for Evidence-based Practice worked with Information Services to provide access to the Internet based differential diagnosis generators Visual DX and Isabel in targeted clinical areas of the Health System. VisualDx helps providers diagnose the causes of skin, eye and mouth illnesses, as well as findings related to other medical images. It includes over 1,200 adult and pediatric diseases with more than 23,000 associated images. A link to it was placed in Sunrise, Epic, Emtrac, and the biomedical library, and it was publicized to all providers across UPHS, including CPUP and CCA. Isabel is a general differential diagnosis generator, and allows providers to enter illness signs and symptoms, returning a list of possible diagnoses. A link to it was placed in Sunrise and Epic only, and it was exclusively marketed to inpatient and outpatient general internal medicine physicians at HUP.

Penn Medicine providers can easily access these on-line reference tools during patient encounters, from their office or home, from the Emergency Department (for Visual Dx), nurse station, or clinic. These services are important tools that help providers determine the correct diagnosis, so that the appropriate treatment protocol can be prescribed. These systems are accessed hundreds of times per month by our providers.

VISUALDX INCLUDES OVER **1,200** ADULT & PEDIATRIC DISEASES

23,000 ASSOCIATED IMAGES

GE PACS Activation for the Radiology Department at PaH

The Radiology Department at PaH used a medical imaging PACS that was different from the PACS used by the other Penn Medicine facilities. Radiology results at PaH were stored separately from all other radiology studies that were performed at the other Penn Medicine entities making it difficult for radiologists at non-PaH entities to offer interpretation assistance on studies performed at PaH.

In FY13, all major radiology systems throughout the Health System were unified. New hardware was installed at PaH, radiologists and technologists received training, and new 3D imaging software was implemented as well as prior studies and results being migrated from the old PaH PACS to the enterprise-wide GE PACS.

Studies performed at PaH radiology can now be read at Penn Medicine by any radiologist, anywhere, at any time. Additionally, the entire radiology medical imaging history of all UPHS patients is now available in a single repository. Radiologist cross-staffing is now possible among all UPHS entities. Patient care is enhanced by the immediate retrieval of all relevant studies for review and comparison.

Enterprise Radiology Voice Recognition

UPHS had been using multiple, distinct Voice Recognition Systems to manage radiology report dictation, all entities merged to a single Voice Recognition solution which provides a common system for clinicians to use and offers better efficiency for the Health System to support this technology. The Health System is now also able to manage a single vendor for radiology voice recognition for contract maintenance and budgeting rather than maintaining multiple vendor products.

Outside Clinical Image Import and Management

UPHS was using an open-source solution to provide some support for managing clinical images brought into the Health System by patients for studies conducted at other healthcare facilities. The system was difficult to support. An enterprise-wide implementation of a product called LifeImage allows for full vendor support, HIPAA compliance, and effective management of outside clinical images for UPHS clinicians. We effectively reduced the re-imaging that occurs when outside study CD's can't be opened/read as well as reduced frustration and delays associated with trying to open/read CD's.

Data Access and Data Analytics

Presenting accessible and accurate information in a continually changing health care industry is in high demand to improve patient care, accelerate research into action, and help sustain Penn Medicine's mission as a leading medical center.

Data warehousing, collection and presentation talents were centralized into one IS team for the purpose of maximizing resources and focusing collectively on Penn Medicine's ability to access and share information with the entire organization. We also merged disparate data sources into single sources and constructs.

The team has invested in building more self-service analytics features using SAP Business Objects, which allows the Penn Medicine community to retrieve information in an increasing self-service fashion and puts the capabilities of information retrieval directly into the hands of the users. A platform has been built for accelerated reporting and the potential user data exploration. This will continue to expand the abilities of the users throughout the coming fiscal year, making data more easily available.

By responding to the user community needs, our ability to provide data for a larger request audience has increased significantly, making our service more valuable and the research/QI/finance community able to have their needs met with less technical work on their part. The future roadmap includes building upon high performance computing and unstructured search capabilities to further expand this team's capabilities and head down a path of predictive analytics.

Clinical Trial Recruiting

Penn Medicine created a new method to ease the challenges of clinical trial recruitment where conventional methods yield few eligible participants. This approach attempts to bridge the gap between the physician and the researcher by identifying the patient at the point of care. By embedding the criteria for the study in the EMR, a physician is alerted with a message when their patient meets the study criteria during a patient visit. The physician briefly asks the patient if they are interested in being contacted. A message is automatically sent to the Research Coordinator who contacts the patient if they are interested.

This improved ability to identify patients for clinical studies reduces the amount of time it takes research coordinators to identify patients. Patients may also benefit having new treatment options made available in primary care. Overall, researchers, physicians, and patients benefit by the closer connections between researchers and primary care physicians to further research discovery.

PENN DATA STORE

Much of the patient data that our caregivers diligently record in our clinically oriented systems is also acquired and stored in Penn Medicine's data warehouse. This data warehouse, known as Penn Data Store, transforms clinically rich patient data into even more meaningful information for use among the entire Penn Medicine community – caregivers and researchers alike.

For the Penn Medicine community, the challenge is to leverage and maximize the value of this data for patient care, patient safety, quality, research and other uses. Already, Penn Medicine IS has in place:

» Over 3.0 billion rows of data within data warehouse sourced from 12 clinical applications;
» A multi-disciplinary Data Governance committee that oversees the policies and procedures surrounding the use and distribution of data within the Penn Medicine environment;
» Enterprise wide dashboards that provide 197 quality measures to unit based clinical leadership throughout the organization;
» Hundreds of supported research queries designed to facilitate scientific discoveries, grant applications, clinical trial recruitment and patient outcomes;
» Service line and departmental financial analysis through daily, weekly and monthly financial decision support reports;
» Ambulatory dashboards to further facility patient access, physician support and patient outcomes;
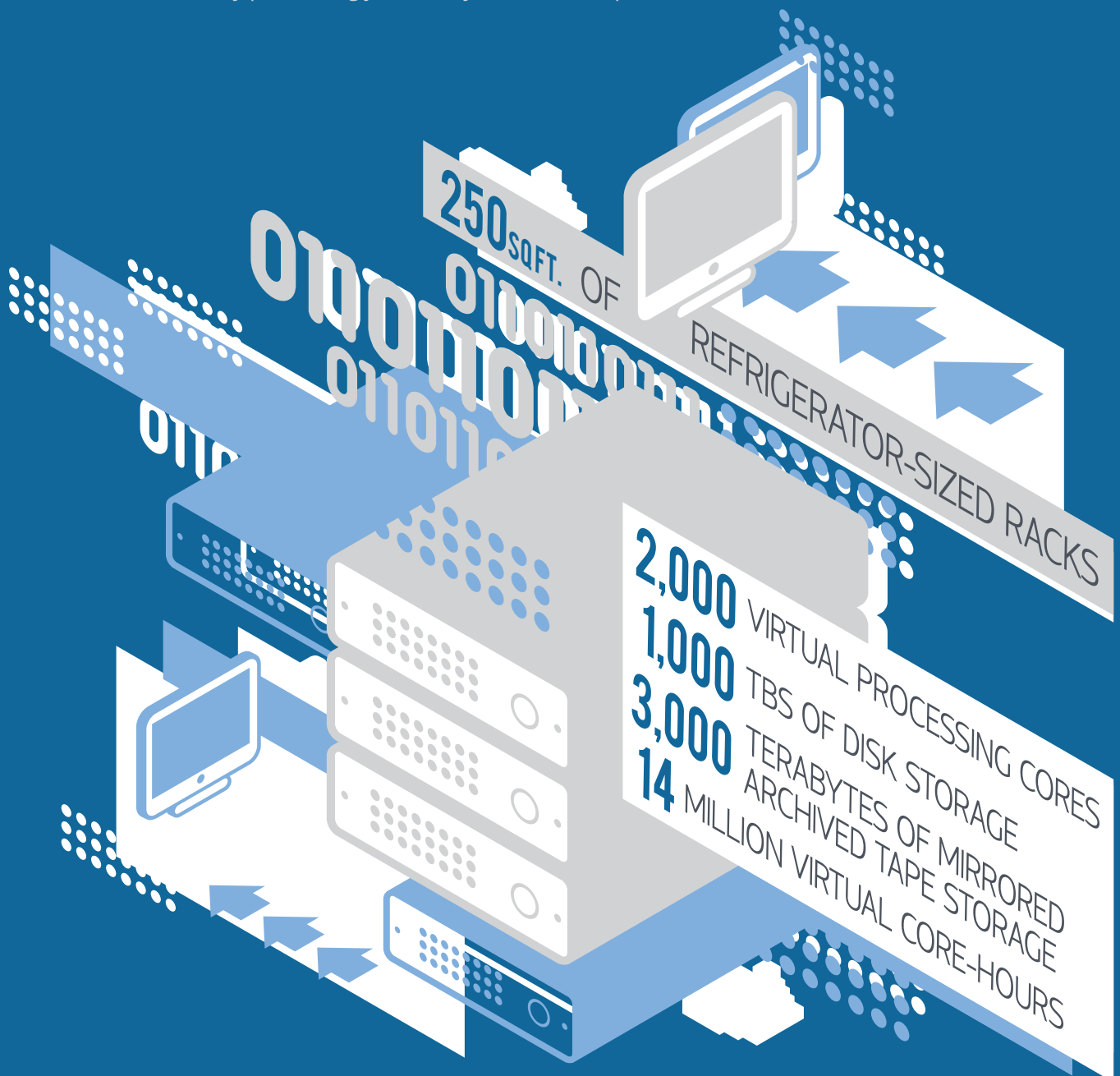
This clinically rich data is mined for its value by representatives of the organization's Data Analytics Center (DAC). Through report writing, surveillance, analytics and ongoing searches, Penn Medicine clinicians are able to more rapidly respond to identified patient care items and prescribe more accurate and timely care resulting in overall improved patient care.

HIGH PERFORMANCE COMPUTING CLUSTER

A new Penn Medicine High Performance Computing Cluster resides at the Philadelphia Navy Yard Technology Park. The system consists of over 2,000 virtual processing cores (1,000 physical cores), 1,000 terabytes (one petabyte) of disk storage, 3,000 terabytes (3 petabytes) of mirrored archive tape storage, and a host of other hardware and software components enabling various aspects of the installation. The system occupies nine refrigerator-sized racks covering approximately 250 square feet, including utility/access space and provides over 14 million virtual core-hours of processing time per year.

For comparison, the first programmable electronic computer (ENIAC), built in partnership with the US Military at the University of Pennsylvania in the 1940's, was about three times as large in terms of floor space, and about five times heavier. The ENIAC required much more electrical power than the new Penn Medicine HPC to drive its 18,000 vacuum tubes, which are analogous to the transistors used in today's microprocessors. The Penn HPC system's processors house about 2.26 billion transistors each, and the system has a total of 128 of these processors, for a total of about 290 billion transistors. If the original ENIAC was sized accordingly, with 290 billion vacuum tubes, it would cover approximately 400 square miles/11 billion square feet, or about 2.7 times the total area of the city of Philadelphia.

The system will be used for various computational needs, most commonly the analysis of genomic data, though the system is multi–purpose and can be used for a wide range of complex problems requiring large-scale computing. Testing and benchmarking is underway, as is the configuration of the queue management system that controls the many processing jobs the system will compute.

250 SQFT. OF REFRIGERATOR-SIZED RACKS

2,000 VIRTUAL PROCESSING CORES
1,000 TBS OF DISK STORAGE
3,000 TERABYTES OF MIRRORED ARCHIVED TAPE STORAGE
14 MILLION VIRTUAL CORE-HOURS

PennOmics

To support the goals of Personalized Medicine and the mission of the Center for Personalized Diagnostics, Penn Medicine needs to create a system to store, analyze and interpret the growing amounts of complex genetic data and other research related patient information - a PennOmics Medical Record (PMR). This collection of information will come from research subjects but primarily patients as a diagnostic byproduct of the treatment of cancer, cardiovascular and neurodegenerative diseases.

The system can be thought of as a funnel where the genetic data about many patients and research subjects enter at the top and are used, along with reference data bases of genetic information from our peers and the pharmaceutical industry, as well as Penn Medicine's rich collection of phenotype and other research data (Penn Data Store, Tumor Registry, bio-bank, Velos etc.), to determine unique genetic bio markers that are highly predictive of disease prevalence or effective drug therapies. Out of the bottom of the funnel comes a Personalized Medicine Report for a single patient, which is used from within the EMR by their care team to develop a specific treatment plan for a specific tumor, or prevention plan for a likely disease. A patient consumable version of this report would ideally also be viewable by the patient from within myPennMedicine.

To build this funnel will require software, hardware and the expertise of bioinformaticians, data modelers, software developers and clinicians. In late February, 2013, Penn Medicine purchased foundational database software and hardware. Once the foundation is in place, the clinicians and researchers will be able to query the data independently.

This foundational investment will enable Penn Medicine's researchers and clinicians to locate applicable cohorts of patients and monitor patients already in trials in ways that are not possible today without significant manual effort across many disparate databases. This will improve our ability treat our patients with the most advanced medical science.

Unstructured Text Mining

There are 27 million (and counting) unstructured or semi-structured medical documents currently residing in Penn Medicine's EMRs and various diagnostic applications (Radiology, Pathology, Cardiology, Gastroenterology, etc.). In spite of the Health System's significant investment in systems that capture and store discrete data items about patient care, there are still many pieces of valuable clinical information (family history, external treatments, signs and symptoms, surgical pathology findings, etc.) that are only stored as free text. Today we have no easy to use, generally available tool for researchers and clinicians to employ to mine this data.

While many in the healthcare industry continue to pursue natural language processing (NLP) technology to extract facts from unstructured text, it is not a highly reliable process given the challenges of building computerized logic to read and understand what was written by many different humans. A more viable approach is to provide a guided search technology that incorporates medical concept ontologies. This allows a human to quickly isolate the textual documents that contain the concepts for which they are searching. With a tool that can also incorporate discrete data in the search logic, the likelihood of finding documents tied to patients with the desired clinical characteristics will improve.

To meet this challenge Penn Medicine will soon be using a new technology to index these documents and link the embedded clinical terms to the National Library of Medicine's Medical Subject Headings (MeSH) ontology. In summer 2013, users will be provided with a first release of an easy to use, web based self-service search tool with an initial area of focus.

Genetically Engineered T-cell Therapy

The PMACS, Sunrise, and the Data Access Center teams worked with the Clinical Research Computing Unit (CRCU) and Dr. June's lab to construct a dashboard for monitoring Penn Medicine patients as they prepare for and receive genetically engineered T-cell therapy for chronic leukemia. The combination of real-time Health System clinical data, clinical trial data and treatment manufacturing data into one dashboard is a unique accomplishment for Penn Medicine and an example of true teamwork across the research and clinical domains.

The driving forces behind this achievement include:

» **Healthcare system data**, necessary for monitoring the clinical course of a patient, typically resides in separate electronic data systems that are rarely linked.

» **Personalized Medicine**, especially during the course of life-threatening critical follow-up periods, requires that investigators and treating physicians be presented with a dashboard of integrated data and visualization tools, in real time, for daily monitoring of clinical signs/symptoms and critical biomarkers from all relevant sources.

» **T-cell immunotherapy cancer clinical trials** at Penn Medicine use infusions of genetically engineered personalized T-cells.

» **Intense cytokine release syndrome** marked by fever, nausea, hypoxia and low blood pressure - needs to be monitored and treated.

» **Integrated personalized data** must be summarized and displayed visually to support treatment decisions, including anti-cytokine agent administration.

Supporting Image below:
A Dashboard of Integrated Clinical Trial Data and Visualization Tools for Monitoring Patients Receiving Genetically Engineered T-cell Therapy:
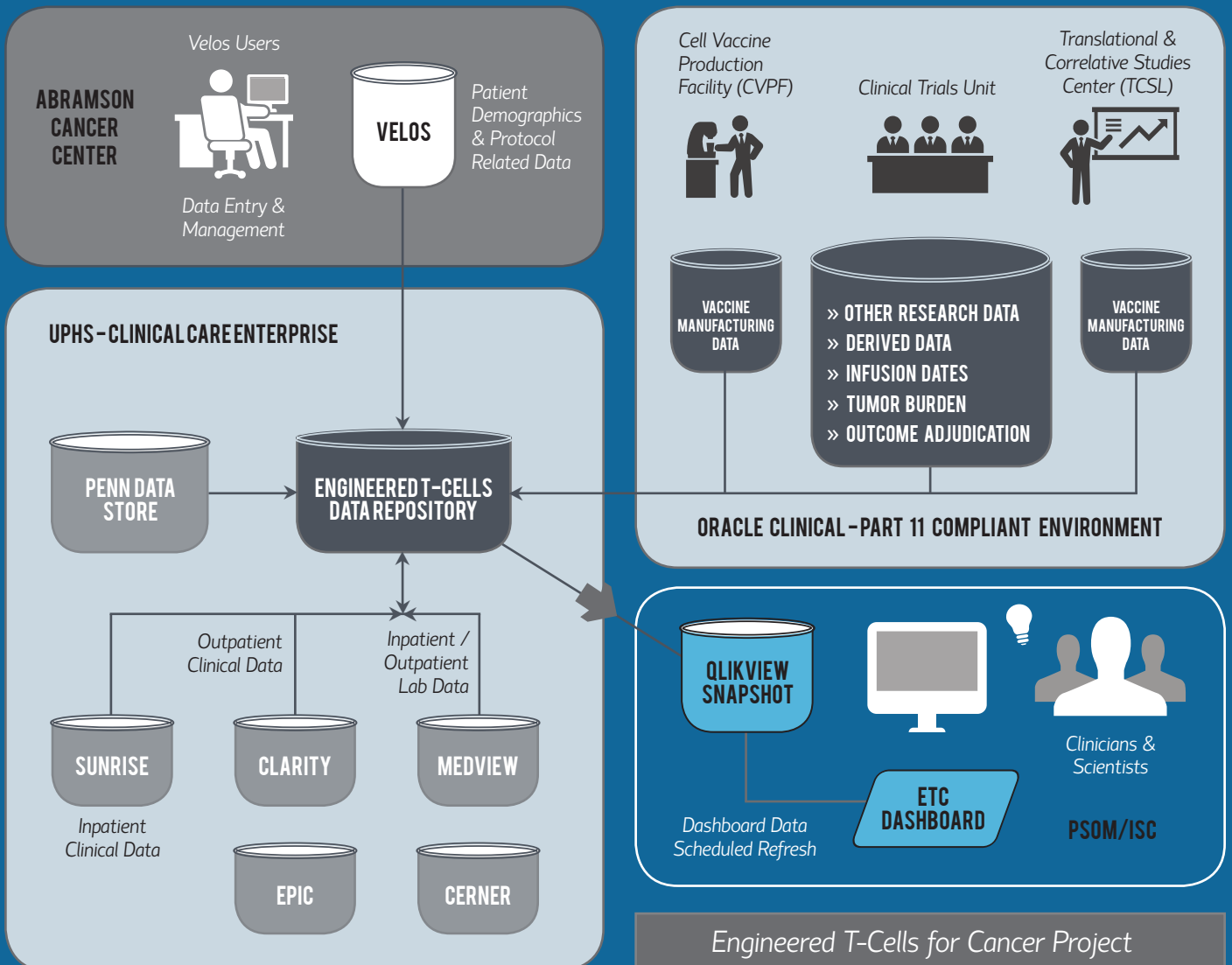
Institute for Biomedical Informatics

The Perelman School of Medicine recently established the Institute for Biomedical Informatics (IBI) through the generous endowment donated by the Smilow family. The intention of bridging together the communities of bioinformatics and medical informatics creates the opportunity to catalyze research and education in both disciplines, and usher in a new era of informatics research and medicine at Penn Medicine.

As Personalized Medicine evolves, high impact biomedical research needs greatly increase. The advent of cheap 'omics sciences such as next-generation sequencing data, genome sequence, proteomics, and high throughput metabolomics are useful tools sought to empower clinical diagnostics. As the healthcare industry continues to shift toward the pursuit of big data and genetic research, bioinformatics and genome scientists are applying their contributed knowledge to medically relevant problems and clinical applications. As this new paradigm emerges, the contribution will impact health care delivery in new ways for scientists, caregivers, and patients alike.

Today, informaticians are increasingly working in both of these disciplines. Even the techniques (e.g. decision theory), algorithms (e.g. PCA), and infrastructure (e.g. HPCs) used in both disciplines are becoming the same. Fostering integrated communication between these two communities may enable advancements such as powerful image analysis techniques used in MRI analysis to be applied to high throughput cellular images. These communities need each other, both to accomplish new advancements in their research and for the betterment of health care and the benefit of the patient.

IBI will help catalyze these interactions. Additionally, the newly formed Penn Medicine Academic Computing Services (PMACS) team is poised to provide the technology infrastructure, software, and services required to enable the IBI to meet their objectives.

Clinical and Translational Science Award (CTSA)

Penn Medicine was an early recipient of the The PMACS team won the Clinical and Translational Science Award as a result of supporting the strategic initiatives of the informatics goals. The award supports a national consortium of medical research institutions that work together to improve the way clinical and translational research is conducted nationwide to enhance its efficiency and quality. Its goals are to accelerate the process of translating laboratory discoveries into treatments for patients, to engage communities in clinical research efforts, and to train a new generation of clinical and translational researchers. This award forged a transformational alliance between Penn, the Children's Hospital of Philadelphia (CHOP), the Wistar Institute (WI), and the University of the Sciences in Philadelphia (USP).

In support of the informatics related objectives of this important award, the PMACS team has provided outcomes in these areas:

> » Penn Medicine's REDCap use has nearly tripled since 2012, with 1,710 users listed and 958 active projects (348 in production, 529 in development- test, pilot, funded and unfunded), of which 369 are clinical research studies or trials.
> » The Penn Abramson Cancer Center upgraded their Velos implementation. A committee has been formed to develop an RFI for a Perelman School of Medicine-wide Clinical Trial Management System (CTMS) solution.
> » Penn Medicine has installed an enterprise Laboratory Information Management System (LIMS) that is being configured for the first pilot bio-banks. A comprehensive data standards framework is being put into place, based on the Ontology for Biomedical Investigations (OBI). A newly formed LIMS Governance Council will continue to provide oversight and guidance to ensure the LIMS rollout schedule is aligned with institutional goals and objectives.
> » The open source VIVO solution was selected to provide researcher-to-researcher networking services. VIVO became available in January, 2013 to all Penn Medicine faculty members.
> » The PSOM IT governance structure is now fully implemented and functioning. Bimonthly advisory board meetings for Educational Computing, Research Computing, and Administrative Computing are held. A Data Governance Committee (DGC) has also been formed, co-chaired by the CMIO and the AVP for Health Technology and Academic Computing, which focuses on access, security, standards, and data warehouse content.

Establishment of Penn Medicine Academic Computing Services

Until 2012, computing resources in the Perelman School of Medicine were decentralized and unevenly distributed among several teams. Our resources were not optimally positioned to support the new trends emerging in educational and research computing, primarily in the areas of bioinformatics and Personalized Medicine. The Perelman School of Medicine and Information Services leadership centralized several existing computing teams into a new organization named Penn Medicine Academics Computing Services (PMACS).

Through PMACS, the Perelman School of Medicine is now positioned to:

> » Provide a centralized computing infrastructure with economies of scale to support educational and research computing.
> » Recruit and retain the highly-skilled technology professionals that can free Perelman scientists to focus on their research.
> » Support the Perelman School's goal of preeminence in the field of bioinformatics with tools such as the new High-Performance Computing cluster.

ESTABLISHING A CLINICAL INFORMATION TECHNOLOGY GOVERNANCE STRUCTURE

Our clinical decision-makers rely on patient data collected as well as information generated by our clinical information systems to help them make decisions. We practice in a setting where there is greater demand for clinical IS services than we can meet. Requests for new projects need to be prioritized, funded and resources allocated. We needed a structure that would accomplish this fairly while ensuring that the clinical IS priorities were in alignment with the clinical strategies and operations of UPHS.

We developed a multi-tiered Clinical IT Governance Structure comprised of clinicians and IS professionals from across the Health System. The Clinical IT Governance Committee sets the clinical IS agenda ensuring that the projects support the Blueprint for Quality and Patient Safety. The Inpatient and Ambulatory EMR committees oversee projects and determine the timelines and resources required to implement new clinical systems. The Prioritization committees determine what enhancements will be made to make our clinical systems more meaningful to the clinicians. The Clinical Decision Support committee oversees the implementation of system alerts, order sets and other decision support tools that help providers in decision making.

This committee structure has enabled us to sequence projects in support of new patient care initiatives while continuing to rapidly release enhanced functionality in our current systems.

Inpatient Sepsis Early Warning System

The mortality from sepsis can be dramatically reduced if it is recognized and treated early. In support of the Penn Medicine Blueprint imperative to eliminate preventable mortality, the Sepsis Early Warning System (EWS) was developed to identify patients with clinical deterioration who may be at risk of developing this often fatal disease. Using lab and vital sign data from our inpatient EMR system (SCM), patients who may be at risk of developing sepsis can be identified and treated before the disorder occurs.

The Penn Medicine Clinical Decision Support team worked closely with our vendor to develop this early warning system. The system uses vital sign data to identify at-risk patients, and it also sends automatic notifications to the patient's covering provider, the nurse listed in the EMR, and the nursing coordinator. This ensures at-risk patients are evaluated as early as possible, and that appropriate treatment regimens are initiated. This early detection and treatment can contribute to dramatically reducing the mortality rate associated with sepsis, and is a step forward for Penn Medicine's Blueprint initiative.

Provider Portals and MedView

Clinical staff uses our in-house developed web portal application, MedView, to improve the efficiency and quality of care they deliver. MedView provides access to data from over 25 clinical systems and provides custom functionality, such as a patient clinical overview that combines data from multiple sources in a single view, user-configurable notifications of events of interest, and work lists tailored to specific tasks and departments.

Some of the enhancement requests submitted for MedView are driven by changes or upgrades to the source clinical systems that MedView interfaces with; others are driven by various departments or initiatives at Penn Medicine.

Below are a few highlights of new or enhanced features added to MedView this year:

» Primary Care Connector Census - Allows a dedicated team of nurse practitioners to monitor patients from key practices in order to better coordinate care with the patient's primary care provider and prevent readmissions.
» Facility Board (currently available at PPMC) - Provides a population level view of a hospital unit. This enables our staff to more efficiently plan their daily reviews of patients, assess patient care levels, and manage high risk conditions.
» Outside Hospital Transfer Module - Enhances the ability of the Admissions Center to receive and place patients from outside Penn into our hospitals. It facilitates coordination between the Admissions Center staff and the admitting physician, both during the intake process and at admission, and makes the information gathered during the intake process available to all clinicians.
» Sepsis Sniffer - Provides early warning for those patients at risk for developing sepsis, so preventive actions can be taken.

Single Sign-On and Context Management

IS provided a single sign-on/context management tool which allows physicians to access multiple clinical systems by logging into the clinical workstations once while launching the other applications to make them available to the physician. Additionally, this solution provides "context" as the physician moved from system to system. The physician is able to simply open another clinical application (which had already been launched) and they will be presented with the same patient.

As a result of the new system, the time to login and access systems has been reduced significantly over the previous method. Physicians also are more satisfied that they do not have to memorize multiple logon credentials. Lastly, there has been an improvement in patient safety as the context management component ensures that the right patient is being accessed when the physician changes systems during patient care.

INTEGRATED AMBULATORY EMR AND PRACTICE MANAGEMENT

To improve the flow of data between our outpatient EMR and Practice Management systems, we implemented a fully integrated scheduling, registration, clinical and billing workflow for all practices which contributes to improved clinical workflows, efficient billing, patient care and patient satisfaction. Together, operations run more efficiently. Central scheduling allows for more convenient patient access. A common patient registration system ensures a consistent patient check in procedure. An integrated patient Electronic Medical Record allows providers to access key patient data regardless of specialty or location. Timely and accurate billing workflows are the direct result of integrated patient encounter demographic and clinical information.

INFRASTRUCTURE RESILIENCY

Information Services initiated a method to identify and eliminate enterprise single points of infrastructure failure across Penn Medicine. The majority of the improvement opportunity identified was in the wide area network and at the data center locations. Information Services prioritized each remediation opportunity and applied new solutions which resulted in a much more resilient technology infrastructure and improved overall access to clinical systems.

MOBILE DEVICE MANAGEMENT

Support for user devices is an ever expanding state of change for on-site technicians. Not only do device models change, they now also include mobile versions and BYOD (Bring Your Own Device). Tracking and securing these mobile devices has warranted the procurement of an MDM (Mobile Device Management) tool.

Just as Penn Medicine manages desktop PCs and laptops, mobile devices are an extension of the technology tools that we use to support clinical care. Penn Medicine has implemented technology to manage mobile devices that access UPHS data to ensure security and protection of Health System information. The MDM system establishes a pass code on the device, encrypts data, and automatically configures email and calendar. If a mobile device is lost or stolen, the MDM system has the ability to lock the unit and erase UPHS data while leaving personal data intact. Users have been registering both their personal and system-issued mobile devices with MDM to ensure a secure method to protect usage and prevent unintended access.

18,719
DESKTOPS

5,343
MOBILE DEVICES

1,573
LAPTOPS

Meaningful Use

Regulatory requirements guide the health care industry to improve the overall care provided to patients. In 2009, The American Recovery and Reinvestment Act (the federal government's Office of the National Coordinator) introduced key criteria associated with the deployment and use of electronic medical records ("EMR"). These criteria known as "Meaningful Use" provide funding to health care organizations that meet the specified criteria in the prescribed timeframe. Alternatively, those organizations that do not meet criteria will face Medicare and Medicaid reimbursement reductions beginning in 2015.

Chaired by the organization's Chief Medical Information Officer, Penn Medicine Information Services representatives, Physician, Nursing and Administrative departments worked together to design, implement, adopt and monitor the prescribed Stage 1 Meaningful Use criteria. A solid foundation now exists to address the requirements associated with Meaningful Use Stage 2. Penn Medicine benefits by receiving the maximum level of available funding which supports additional advancements in patient care through information technology.

Relocation of Labs at PaH

In a continual effort to optimize patient care and patient experience, PaH administration initiated an effort to build new patient private rooms in the Preston building. In order to meet the new private room initiative, the existing labs on those floors needed to be relocated.

IS worked closely with the PaH Lab Department and Facilities leaders, relocated eight labs (Blood Bank, Central Processing, Chemistry, Microbiology, Hematology, Anatomic Pathology, Cytology and Pathology Administration) to new locations in the Preston building. This effort was an important initial step in PaH's strategic plan to build new private rooms.

iPad Support

As mobile devices have become more pervasive in the healthcare environment, iPad tablet usage is on the rise- as is interest in accessing clinical systems on the part of clinicians with iPads. iPads are not easily supported in hospital IT environments because of architectural, security, and privacy concerns. The convergence of the support complexity and user demand for more support is a significant challenge.

Our Clinical IT Governance Committee endorsed the use of iPads to access clinical systems with certain caveats to ensure appropriate use of the device. IS then formulated a support plan, documentation, and conducted internal training for support teams. Self-Service tools, documentation, and communications were developed for the UPHS user community. A standard, well developed, and compliant process was developed to meet the needs of the clinical community and their use of iPads in the clinical environment.

Support of New Practice Integrations

Penn Medicine continues to build new facilities, open new practices and acquire practices into the Health System. Successful practice integration involves being able to bring the new practice online so that they can operate similarly to other existing practices in the Health System and realize the full benefits of being part of the Penn Medicine network. Some key challenges we face with new practice integrations are fluctuating negotiations, practice operation impact and resource limitations.

The main components of our implementation method include: using a consistent approach to the integration, engaging early with our Business Development/Ambulatory Practice partners, keeping an open dialogue and clearly communicating with organization stakeholders, defining the scope of integration, and understanding the business goals. Internally within IS, we understand how to forecast resource demands, make accurate estimates, conduct thorough assessments, develop project plans, create support models and deliver training.

We aim to implement our enterprise Ambulatory Practice Management system (APM) by the first day of integration, in some cases we also go live on the EMR at the same time. We provide support in the pre-go live activities such as appointment conversions, chart abstraction, hardware, infrastructure, training, etc. Our process yields high results. More importantly, however, is the ability to onboard new practices in a smooth manner where patient care and practice operations do not become compromised, and the overall experience is a positive one.

Data Centers

Managing multiple data centers in a technology environment is a common challenge that many organizations face. Data centers are expensive to maintain, can stretch Information Services operational resources and result in more single points of failure from a technology infrastructure perspective.

Information Services began consolidating small data centers as small departmental IS groups were transitioned to the Corporate IS team. This eliminated the risks of servers in areas that were not environmentally sound. Penn Medicine restructured to operate two primary datacenters, one on campus and one managed by a vendor, though one major data center move to combine all key computing capability into one facility.

This data center consolidation has resulted in a number of positive outcomes. First, technology risk is remediated by removing several key infrastructure single points of failure. Second, consolidating greatly reduced operating costs. Lastly, IS has been able to use operational resources to develop a true Network Operations Center capability that proactively identifies and resolves operational issues.

Clinical System Access – Just a Tap Away

Nurses and clinicians who provide patient care move frequently in and out of patient rooms throughout their shifts. This frequent movement between patient rooms requires nurses and clinicians to constantly login and logout of the inpatient EMR system as they shift their care from patient to patient. Clinicians' workflow, in the EHR environment, requires accessing multiple systems, dozens of times a day. Any delay in system access directly impacts efficiency.

Information Services implemented a new feature in the Single Sign-on application to improve user access through creating the ability to sign-on to a workstation by tapping their ID badge onto a RFID chip built into a keyboard. This initiative, called "Tap and Go", brought new technology to the bedside. Users now "tap in" without having to type their username and password. With Tap and Go, a nurse only has to login one time to the inpatient EMR system during their shift. As they move in and out of patient rooms, they place their new badge on the new keyboard, and the PC automatically logs them into the inpatient EMR system. Before leaving the patient room the nurse places their badge on the keyboard again, and they are automatically logged off from the system.

The Tap and Go initiative at PaH and PPMC required the re-badging of all floor nurses and clinicians, the provisioning of new computer keyboards, and integration testing to ensure that the new badges and keyboards connected to the inpatient EMR system. This technology had been widely accepted by users as it greatly reduced log-in times, giving crucial moments back to clinicians, and made their use of available technology more efficient. Another positive, though unexpected, result was improved security.

Medical Device Integration

The changing landscape of medical devices and their integration into the IT environment requires specialized focus on applications that have medical device integration capabilities. Medical devices now routinely connect to the hospital data network (wired and wireless) and more routinely send patient data to information systems databases in order to share real-time digital information.

Clinical Engineers (that currently support medical devices) and various IT support groups have formed a virtual team to integrate support processes and address ongoing needs. UPHS now has a coordinated process and procedure for supporting applications that integrate with medical devices is in place to support systems like our OR and Anesthesia Practice Management System and Visicu.

Standard Clinical Desktop

UPHS IS manages approximately 2,500 shared clinical workstations in the Health System. While the workstations have become more streamlined over time, we never had a completely standard, controlled image for these devices. This created issues as users had the ability to change system layout and configuration, download and install programs from the internet, etc. These activities lead to unreliable workstations and frustrated users that want device to work consistently.

Desktop support staff and engineers worked with clinicians to define, build, and test a standard and controlled desktop based on the Windows 7 platform. With the rollout of this platform, UPHS will have a standard and controlled desktop image that provides consistent and reliable PC workstations for clinicians.

DEVELOPING A PROJECT MANAGEMENT ORGANIZATION

Prior to insourcing the Corporate IS staff at UPHS in late 2007, the organization had no formal framework or staffing to support intake, delivery, and management of technology projects. Project prioritization was lacking, work assessment of requests was not formally managed, scope of work was difficult to determine and resources were hard to obtain, align, and properly allocate to projects. The result was poor visibility into project work within IS, delays in project delivery, and inefficient use of resources.

PMO COMPLETED

321

PROJECTS IN 2012

The Project Management Office (PMO) was established to support intake of project requests, account for prioritization/governance review of requested work, a formal resourcing process, dashboards and standard reporting to measure project progress and outcomes. Experienced project managers were recruited as project demand increased to ensure delivery expectations were met. The PMO completed 321 projects in 2012 (an average of nearly 1 per day). There are standardized processes to manage project intake, staffing assignments, resourcing, tracking, and reporting progress.

Second Shift Coverage for End User Support

The introduction of in-room computers to support KBC created the need for our ability to respond to critical technology problem calls after prime-time support hours that generally ended at 6pm. A second shift for End User Support (EUS) services was implemented at each one of our hospital entities to provide immediate on-site response capability.

Adding the second shift coverage for EUS services provided immediate on-site response to technology issues related to in-room devices as well as other areas. This shift addition reduced the burden of on-call support needs and also provided additional capability to perform pro-active device management. This is due to the reduced clinical workload during second shift hours which allows greater access by EUS staff to devices in clinical areas.

Privacy Monitoring/Breach Detection

Regulations and security related best practices have required healthcare organizations to be more organized and proactive toward patient privacy issues. Organizations must ensure that employees are not accessing other employee's health care records and be able to protect themselves from identify theft via inappropriate access. The ability to monitor patient information access methods that are indicative of risky behavior is a priority.

Information Services implemented a tool called Fair Warning to help identify questionable access behavior. This particular solution allows Penn Medicine to identify the factors which drive what is signaled as questionable access behavior. This solution also allows the organization to filter out false positives that would require attention from privacy and security personnel.

This solution eliminated a time consuming manual process that had been in place to identify risky and inappropriate access behavior. Penn Medicine is now able to focus privacy and security resources on the investigation component which helps to mitigate the organization's overall risk profile.

IS Service Desk Insourcing

Improving the user experience with IS services is a top priority. Virtually all operational requests for service begin by our users contacting the IS Service Desk. In August 2012, an initiative was launched to insource Help Desk services from our current third-party vendor. The new IS Penn Medicine Service Desk was activated in January 2013. Users now speak to Penn Medicine colleagues who know Penn Medicine applications, locations, and who are trained to get problems resolved or routed to the correct resolver team. In the near future, users will submit and track requests for service online, electronic forms will replace paper, and user satisfaction will continue to improve.

Attainment of HIMSS Stage 6

UPHS has always been a leader in the adoption of clinical applications leading to a fully implemented Electronic Medical Record. We are currently at HIMSS Stage 6 of our Inpatient EMR deployment. With the completed implementation of electronic provider documentation (ePD) later this year, we will be ready to submit for Stage 7 HIMSS certification. There are currently 530 hospitals that have achieved Stage 6 and 117 hospitals that have achieved Stage 7 in the United States.

Supporting Image below: **UNITED STATES EMR ADOPTION MODEL**

STAGE	CUMULATIVE CAPABILITIES	2013 Q1	Q2
7	Complete EMR; CCD transactions to share data; Data warehousing; Data continuity with ED, ambulatory, OP	1.9%	2.1%
6	Physician documentation (structured templates), full CDSS (variance & compliance), full R-PACS	9.1%	10.0%
5	Closed loop medication administration	16.3%	18.7%
4	CPOE, Clinical Decision Support (clinical protocols)	14.4%	14.6%
3	CDR, Controlled Medical Vocabulary, CDS, may have Document Imaging; HIE capable	10.1%	9.0%
2	Nursing/clinical documentation (flow sheets), CDSS (error checking), PACS available outside Radiology	36.3%	34.5%
1	Ancillaries – Lab, Rad, Pharmacy – All Installed	4.2%	3.8%
0	All Three Ancillaries Not Installed	7.8%	7.2%

Data from HIMSS Analytics® Database ©2012   N = 5441   N = 5439

Human Resources Employee Self-Service Portal

Employees previously found it challenging to identify which HR applications were accessible to them remotely and had some difficulty in accessing these systems. These access issues and confusion deterred users from attempting to access the HR applications, resulting in less than optimal use.

The IS Lawson application team worked with HR leadership to design and deploy a new HR self-service portal. In addition, the IS Infrastructure Application and Web Application Group teams worked to provide easy off-site access to the Employee Self-Service module via Penn's Extranet. A key feature allows employees to connect to all HR applications using their Penn Medicine logon ID and password- eliminating the need to create and remember a unique password for HR applications.

Employees logging on to use HR applications are now presented with a single collective site of all the HR applications, which may now be accessed regardless of location using the employee's primary logon ID and password.

Learning Management System

Our learning management employee education system, Knowledge Link, is used by the staff at both the University of Pennsylvania and Penn Medicine (Perelman School of Medicine and UPHS). This system was upgraded to new software to meet new administrative requirements and improve integration with operational systems. In addition, the computer platform was upgraded.

The new Knowledge Link application significantly improves learning administrator's ability to manage course content through better functionality that leverages today's technology. It includes a more flexible report writing capability. It improves the learner experience with an intuitive graphical user interface. The integration with operational systems is easier to attain. With the new computer platform and the new software system, the number of IS Service Desk calls for user help has been significantly reduced.

Continuous Learning

The breadth and depth of knowledge that supports a healthcare information systems ecosystem is vast. It is rare, that one individual can be an expert in all areas of department support that includes applications, infrastructure and process operations. Yet, familiarity with many of these ecosystems components is a goal of many within the Information Services organization.

In order to maintain continuous learning, the Lunch and Learn program was introduced. The Lunch and Learn program provides Penn Medicine IS employees with continuous opportunities to attend ongoing educational programs during lunch time. The topics of education are identified in advance by the employees and the education is performed by the Manager responsible for the team that supports the function.

Overall feedback from employees is very positive as evidenced by the continued high level of program attendance. In addition, those performing the education have expressed a level of individual pride in being able to share their experiences with other Penn Medicine IS team members.

Employee Promotion within Information Services

Employee satisfaction surveys provided management with employee feedback about wanting to become more aware of internal promotion opportunities. Management workgroups formed to assess the promotion processes and to establish actions that would address this desire.

The workgroup reviewed employee survey feedback, met with groups of employees to collect feedback and gather their ideas on how to improve the processes. Actions were defined, IS and HR management reviewed and approved the recommended actions, and the new revised processes were presented to IS employees.

IS employees now have a clear understanding of how they may advance their careers at Penn Medicine. New position notification procedures ensure employees are aware of new job opportunities within IS, and employee promotions are published in bi-monthly IS Organizational Update. Career paths within job families are also being developed to be used by employees as a guide to their training and professional development within IS. In addition, the competencies developed under each job family will be used to assist managers in developing targeted Individual Development Plan to assure employees possess the expertise and competence needed for promotional opportunities.

Employee Enrichment

Health care organizations throughout the U.S. are racing to take advantage of the many benefits associated with the deployment of technology; especially the EMRs. The American Reinvestment and Recovery Act ("ARRA") of 2009 has also provided an incentive for health care organizations to rapidly deploy this technology. The result of this industry focus on application implementations has generated a lack of qualified support personnel across the industry. The Health Information Management Systems Society (HIMSS) published a report indicating that the industry faced a deficit of nearly 50,000 employees in order to meet the growing demand of implementation support.

Recognizing that, for the foreseeable future, the health care industry would not only have a zero percent (0%) unemployment rate, but perhaps a negative unemployment rate, the Penn Medicine Information Services team instituted the Employee Enrichment Program (EEP). The EEP was designed to ensure that key criteria identified by Penn Medicine IS employees through either surveys or direct feedback were addressed.

Key areas of focus included:

> » Employee Recognition
> » Career Opportunity and Advancement
> » Training and Professional Development
> » Compensation and Benefits
> » Workplace Culture

Through the use of a variety of feedback mechanisms that include employee surveys, team meetings, individual meetings and open door meetings, to name a few, over fifty employee focused initiatives have been implemented over the past 18 months in order to fulfill the goals and aspirations of Penn Medicine IS employees.

The results of these efforts have generated a high level of overall employee satisfaction as documented by results of the Healthcare IT News Best Places to Work survey along with a remarkably low unplanned employee turnover rate of 5.80% over the past three years. Furthermore, the retention of high quality performers has further amplified the number and quality of projects performed by the organization.

INFORMATION SERVICES NEW HIRE ORIENTATION PROGRAM

In order to improve employee engagement, IS provides a quarterly one-day comprehensive orientation program for all IS new hires in a group setting. The day includes fast paced presentations from all specialty areas within the division, team-building activities, and policies & procedures discussion. The day is followed up with an invitation to register for tours of the four inpatient facilities, primarily focused on the unique aspects of each facilities and meeting the site IS teams. The program has had very positive results including improved employee satisfaction, reduction in manager orientation tasks and increased teamwork.

WeCARE @ Penn Medicine Information Services

Various staff engage in outside charitable activities. We wanted to provide a centralized forum for the members of the Information Services Department to network and participate in voluntary charitable initiatives and community activities in order to maximize impact and participation. The "WeCARE @ Penn Med IS (CARE stands for Community Activity Rewards Everyone)" committee was formed. Events have ranged from big to small, including participating in the build of a Habitat for Humanity house, serving dinners at various facilities for up to 90 people, collections of funds for many varied causes, donations of focused items, and food drives. An average of one event occurs every month, as well as posting of opportunities for on-going volunteerism programs.

IS Nurses and Magnet

Only a handful of hospitals in the United States have earned recognition for nursing excellence by achieving designation as a Magnet Hospital. Magnet designation is nursing's top honor, identifying hospitals that have been recognized nationally as achieving the gold standard in patient care delivery by the American Nurses Association. Penn Medicine has achieved this designation three times – HUP in 2008 and 2012 and PPMC in 2012. Although the Magnet program does not require the use of information technology, both HUP and PPMC Departments of Nursing included their extensive use of clinical information technology as part of their Magnet applications.

This past year, in recognition of the 22 nurses working in the Penn Medicine IS department, Dr. Victoria Rich, RN invited the IS nurses to establish an IS Nursing Council and actively participate in the Magnet Organization at Penn Medicine. Our nurses work closely with the clinical community in varying roles. Some participate in designing and implementing clinical systems that support patient care and patient safety. Others work to build data repositories that enhance nursing research efforts. Others help establish and deploy the technical infrastructure to enable the clinicians to access electronic health records across the campuses and remotely. And still others work shoulder to shoulder educating the clinical staff on the functionality of the clinical systems available at Penn Medicine.

Although not physically at the patient's bedside, each nurse in the IS Department feels a strong partnership with the clinical teams and we view this invitation as an honor and recognition of our contribution to the highest quality of patient care delivered at Penn Medicine.

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

EEP
Employee Enrichment Program

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, and 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 and Accountability Act of 1996

HIT
Health Information Technology

HITECH
Health Information Technology for Economic and Clinical Health Act

HPC
High Performance Computing

HSX
HealthShare Exchange

HUP
Hospital of the University of Pennsylvania

ICU
Intensive Care Unit

IS
Information Services

IT
Information Technology

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

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 and 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

SCM
Sunrise Clinical Management System

SICU
Surgical Intensive Care Unit

QI
Quality Improvement

U of P
University of Pennsylvania

UPHS
University of Pennsylvania Health System

INFORMATION SERVICES 2013

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