Strategic Plan for VUMC Informatics & Roadmap to 2010

Vanderbilt Pillar Goals

**People**
- Reduce turnover rate
- Elevate retention
- Elevate employee satisfaction
- Evaluate physician satisfaction

**Service**
- Elevate patient satisfaction
- Service satisfaction
- Medical care
- Would return
- Would recommend

**Quality**
- Achieve lowest mortality rate
- Perform in top 10% of clinical quality measures
- Eliminate medication errors

**Growth**
- Expand patient volumes
- In-patient admissions
- Out-patient visits
- Surgical operations
- Emergency visits
- Increase sponsored research
- Expand referring physician base

**Finance**
- Increase annual revenue:
  - Hospitals and clinics
  - Vanderbilt Medical Group
- Increase annual net income
- Save 5% of VMC cash flow

September 2005
# Informatics Strategy and Priority Committee (ISPC)

Jeffrey Balser, MD, PhD  
*Associate Vice Chancellor for Research*

Roger Chalkley, D.Phil  
*Senior Associate Dean, School of Medicine*

Colleen Conway-Welch, PhD, RN, CNM  
*Dean, School of Nursing*

Steven Gabbe, MD  
*Dean, School of Medicine*

Larry Goldberg  
*CEO, Vanderbilt University Hospital*

Wright Pinson, MD  
*Chief of Staff, Vanderbilt University Hospital  
Chief Medical Officer, Vanderbilt Medical Group*

David Posch  
*Chief Operating Officer, Vanderbilt Medical Group*

Martin Sandler, MD  
*Chairman, Department of Radiology*

William W. Stead, MD (Chair)  
*Associate Vice-Chancellor for Health Affairs  
Director, Informatics Center*

Norm Urmy  
*Executive Vice President Clinical Affairs*

Rick Wagers  
*Senior Vice President and  
Chief Financial Officer*

Betsy Weiner, PhD, RN  
*Senior Associate Dean for Educational Informatics,  
School of Nursing*

# Informatics Center Executive Committee (ICEC)

William W. Stead, MD (Chair)  
*Associate Vice-Chancellor for Health Affairs  
Director, Informatics Center*

Carol Aronson  
*Administrative Office  
Informatics Center*

Donna Forsythe  
*Department Administrator  
Informatics Center*

Tim Getsay  
*Assistant Vice Chancellor, MIS  
Informatics Center*

Nunzia Giuse, MD, MLS  
*Director, Eskind Biomedical Library*

Jeff Kimble  
*Director, Network Computing Services*

Nancy Lorenzi, PhD  
*Assistant Vice Chancellor for Health Affairs*

Dan Masys, MD  
*Chairman, Department Biomedical Informatics*

Nancy Proctor  
*Director, Information Systems  
Chief Information Officer Vanderbilt University Hospital/Vanderbilt Children’s Hospital*

Ed Shultz  
*Director Information Technology  
Integration/Information Management*
## TABLE OF CONTENTS

**I. Prolog: A New Approach to Academic Medicine for the 21st Century**

- A System of Evidence Based Individualized Care .......................................................... 3
- Translational Research .................................................................................................... 5
- Adaptive Life Long Learning ........................................................................................... 7
- Putting It All Together: Vignettes of this Future System of Care .............................. 8

**II. Introduction** ................................................................................................................. 11

**III. Mission of VUMC Informatics** ...................................................................................... 11

**IV. VUMC <=> VUMC Informatics Goal Alignment Challenge**

- Two-way Strategic Visioning and Planning .............................................................. 12
- Evolution of VUMC Informatics “Leading Edge” ........................................................ 14
- Assessment of Current State ........................................................................ 15

**V. Goals, Objectives, and Strategies for VUMC Informatics**

- Goal #1: To partner with leadership of VUMC operating units to achieve maximum beneficial use of information and information technology in support of VUMC’s missions ................................................................. 19
- Goal #2: To exploit informatics architectures and techniques to manage data and knowledge as shared resources while supporting distributed work, role-specific views and task-specific tools ................................................................. 21
- Goal #3: To provide cost effective information technology infrastructure that scales up to support VUMC’s goals ................................................................. 22
- Goal #4: To drive change in the practice of health care and wellness, biomedical research, and health education at a pace that lets VUMC set the bar for academic medicine ......................................................................................... 23
- Goal #5: To gain recognition as the world leader for contributions to the biomedical informatics knowledge-base and work force ................................................. 25
- Goal #6: To achieve academic to business and academic to academic partnerships that provide depth and breadth while allowing each party to focus on areas of strength ............................................................................ 26

**VI. Roadmap to Guide Execution** ...................................................................................... 27

- 5-year VUMC Informatics Infrastructure Roadmap ......................................................... 27
- Achieving Critical Mass in Biomedical Informatics ....................................................... 32

**VII. Epilog: Vignettes of a Possible Outcome** .................................................................... 37

*Appendix: Roadmap to 2010*

*Project Glossary*
I – PROLOG: A NEW APPROACH TO ACADEMIC MEDICINE FOR THE 21ST CENTURY

Vanderbilt University Medical Center (VUMC) has engaged in iterative cycles of implementing information technology infrastructure, then enabling a new way of doing an old task, augmenting the infrastructure and next enabling people to do things they could not do before. Through this process, VUMC has begun to think about fundamentally new approaches to health care and biomedical science as well as education programs to support providers, researchers and consumers. The VUMC clinical, education and research enterprises have each engaged in planning and prototyping to figure out aspects of this opportunity. Novel strategies have begun to emerge from these design-build efforts. Taken together, they represent VUMC’s vision of a new approach to academic medicine for the 21st century.

A System of Evidence Based Individualized Care

The first fundamental observation guiding our vision is that publication and reading are necessary but insufficient mechanisms to turn knowledge into effective action in the 21st century. A health care enterprise that depends principally upon the cognitive capacity and reliability of autonomous individual practitioners and their interpretations of what they read will continue to be error-prone and have unacceptably high rates of suboptimal disease prevention, diagnosis and treatment. We need a systems approach to health care like the systems approach to aviation safety. The clinician and patient should be supported by a system of behaviors, processes and tools that make it easy to do the right thing, in the right way, at the right time.

Evidence Based System of Care
With a systems approach, much of the energy previously spent on individual education and patient-by-patient decision making would be redirected to guiding the system. This guidance follows a cycle beginning with review of evidence. Evidence may be formal and graded, e.g. research trial showing one approach better than another, or record of practice experience, e.g. data of what was done for various patients together with process or clinical outcomes. The cycle continues with design of a process for what should be done, when it should be done, and how it should be done. Next, these decisions are represented in information tools such as advisers and order sets for use in clinical workflow. Finally, process control triggers and sentinel events feed into clinical workflow for course correction and outcomes are banked to grade process performance.

A systems approach to health care would self-drive to achieve ever improving outcomes. This improvement follows a cycle beginning with display of dashboards of clinical and process outcomes both for VUMC as a whole and for each of the units within VUMC that impact an outcome. The cycle continues with establishing accountability for each outcome. The largest gaps between target and performance with the highest volume of cases are priorities for evidence based process redesign. The redesigned process includes measures of process performance to support a process dashboard as a real time control of performance.
A systems approach to health care would be supported by “executable knowledge” in the form of computerized logic that embodies the collective best understanding and best practice for health-related practices. To support the development of this form of knowledge, the library provides a cycle of evidence services.

These services begin with a digital library providing search tools and a single source to the published literature, guidelines and databases. Context sensitive links between clinical workflow tools and these information sources provide just-in-time access to information and reduce the need to search. Consultation is available for complex queries. The results of these searches are banked in the digital library for re-use. We expect our approach to translational research to lead to direct generation of executable knowledge reducing this downstream processing over time.

Translational Research

As a systems approach to health care comes together with an increasing understanding of the human being on a molecular level, the electronic health record will evolve into a personal health knowledge-base. It will be a dynamic real-time field of knowledge enriched by new information automatically added when the knowledge of biology and health evolves in ways useful to the individual involved and in turn providing depersonalized information for the world wide web of health knowledge and biological research. It will include individual preferences, genetic make-up, best practices applicable to the individual, self tracking, and a record of care. All of this information will be in a form permitting understanding by the individual and execution by computer programs.
The vision of a systems approach to health care requires a systems approach to translational research. The cycle begins with gaining access to a population record with as much information about as large a population as possible. Information sources range from electronic health records and gene samples to records providing indications of lifestyle, environment and education. This information will be multimode, e.g. categorical, text, image, with high dimensionality, e.g. time, organism to molecular level, etc. The next step is to use computer science and statistical algorithms to mine these information sources to detect concepts, patterns and relationships. These discoveries are then represented in information structures, networks and models. These representations also support linkage into discovery workflow tools for data analysis and visualization during hypothesis generation and testing. As relationships are validated, they are linked into the tools used to support practice in the system of care. If additional clinical or health services research is required those same tools deliver the protocol directly into the affected care process. Basic research, clinical research and practice each augment the population record providing “post market” surveillance and additional information sources.
Adaptive Life Long Learning

In a systems approach to health care, adaptive life-long, just in time professional learning would replace the combination of discipline-specific just in case education and continuing education programs of the 20th century.

Adaptive Life-Long Learning

The learning process begins by assessing competency for a role or task. If justified by the assessment, the individual proceeds to perform the role or task, supported by information delivered into the work process. Clinical and process outcome tracking feeds back into the assessment justifying either continued certification or a learning intervention. A learning intervention begins by assembling a curriculum and learning resources to develop understanding of key concepts. The information is then assimilated. Simulation develops process and technical skills. Simulation results feed back into assessment justifying probationary certification or requiring an additional learning intervention. Good outcomes during performance justify full certification.

In this systems approach to learning, learning resources are on line, 24-7, and pulled forward on demand by the professionals who need it. An integrated model of learning supports all professionals and includes an ascending series of complexities in language so individuals and their families can use the basic level while very sophisticated advanced specialists use the most complex layer. Simulations replace trial and error on patients and are used routinely to show an individual their limits. Immersion facilities and personalized simulations help in experiencing the hard to imagine.
Putting It All Together: Vignettes of this Future System of Care

The systems approach to health care is standardized, but in a way that individualizes the plan to the patient’s values, brain, genetics and environment.

Scene 1: Doctor and her patient are in the doctor’s office.

DR: Well Mr. Jones, I see that your blood pressure is 150/95 today. Let me access your record from home. (retrieves Jones’ self record) It looks like it’s been up consistently since you started checking it for me. Now that we know you have high blood pressure, we need to decide what to do. There is strong evidence that you will benefit from getting it down.

JONES: I have been pretty worried about it. My mother had high blood pressure and I remember her trying all kinds of different medications and none of them seemed to work very well. I looked up hypertension on MedlinePlus and it does seem like I need to be on some sort of medicine, but I don’t like the idea of medicines with so many side effects.

DR: We have learned a great deal in the past few years about gene tests. The tests use your own genes taken from your blood, to figure out which drugs will work best for you and which drugs to avoid due to likely side effects. Let me pull up the report for those tests which I ordered last time you were here.

DR: Now, if you look at this chart, your gene test profile suggests that you will have a good response to thiazides. This is an inexpensive water pill you take once a day. On the other hand, the chart also shows that you should avoid this other type of drug because you would probably have a bad response.

JONES: Okay…but, I’d feel better if I knew more about this medication and how it could work for me.

DR: Let me link the guideline for hypertension to your MyHealth@Vanderbilt portal. That way you can sign onto the portal to read through the information at your own pace. The computer will check your electronic record and show just the information relevant to your own gene test profile.

JONES: Thanks, Doctor. I like the portal – it’s easy to understand and I like being able to track my progress on it.

DR: I’m also sending the prescription for hydrochlorothiazide to your pharmacy. Read the information in the portal on changes in lifestyle and diet and try to implement these along with the medication. And let’s schedule a visit for six weeks to check your chemistries since thiazides affect the levels of minerals in your blood in ways we can not predict with the gene tests. If you’ll continue to enter your blood pressure in the portal, I’ll keep an eye on it.

JONES: Great…Thanks, Doctor.
The systems approach to health care brings together scientific medicine with complimentary and alternative approaches to health improvement.

Scene 2: Mr. Jones is in the drug store with his wife and they pass a health food display.

JONES: You know, I take a multivitamin every day, but I heard about this new supplement and I'm wondering if it might be better for me.

Mrs. J: The doctor did warn you about mixing medications and supplements.

JONES: You're right. I better check to see if this supplement will cause any problems with my blood pressure medicine. Let me pull up the portal at MyHealth@Vanderbilt, and I'll look up supplements. (Uses PDA to access portal) It's asking me for the product code?

Mrs. J: 473521X.

JONES: Good...It says the supplement is OK to use. And yes... (pause as he taps a few keys on his PDA) I do wish to change the entry in my health record from the multivitamin to this supplement.

The systems approach to health care engages the patient as a full partner in tracking their progress and correcting course.

Scene 3: Doctor is looking through her electronic message basket and sees a message from Mr. Jones and calls him.

DR: Good afternoon, Mr. Jones, this is Dr. Prince. I received your message through the portal about your leg cramps. Do you have a minute to talk with me about them?

JONES: Yes I do, and thank you for returning my call. Well, I woke up last night with a bad cramp in my leg. I looked on the portal this morning and it says that thiazide can cause cramps by lowering my potassium.

DR: That's true. If you have your computer handy, why don't you log on to the portal and we can take a look at your record together.

JONES: Okay. Give me one second to access the portal (logs on) all right, I'm there.

DR: What I see here looks very good, Mr. Jones. Your weight is down a pound.

JONES: That's right.

DR: And your blood pressure has begun to come down.

JONES: Yes, I'm very pleased about that.
DR: It looks like your potassium level was normal when we started the medicine, and it’s unlikely to have fallen this quickly. And I see last week you purchased an over the counter vitamin supplement that contains potassium. Is this the first time the leg cramps have happened?

JONES: Yes.

DR: And how are you feeling now?

JONES: I’m feeling fine right now.

DR: Then let’s see if it happens again. If it does, we’ll repeat your potassium test. How are you doing otherwise?

JONES: You know, Doctor Prince, I have to say that it gives me a lot of confidence to track my progress like this. The charts on the portal let me see exactly how I’m doing, and it makes me feel really involved in my care, like I’m helping myself get better.

DR: You are helping yourself, Mr. Jones. And in many ways, that’s just as important as the help I can give you.

A systems approach to health care proactively updates each patient’s plan as standards of practice evolve.

Scene 4: The doctor is working at her desk when an alert chime sounds on her computer. She turns to the computer and hits a key.

COMPUTER: This is an alert from your disease management service. Today, April 24th, clinical advisors have altered the guidelines regarding the use of thiazide in treating hypertension. Do you wish to link to the relevant announcement and related articles?

DR: Not at this time. Please put the articles in my mailbox – I’ll read them tonight.

DR: Also give me a list of the current patients that might be affected by this announcement and bring up their records so that I can look at them in the morning.

Scene 5: Next morning Mr. Jones gets a message from the doctor:

Mr. Jones, we may have an answer on your leg cramps. I have just learned of a gene test marker associated with a rapid decrease in potassium from thiazides. From your profile, it looks like you might be affected. I am including the announcement for you to read. Can you please come in tomorrow for a potassium test?
II – INTRODUCTION

The Informatics Center at Vanderbilt University Medical Center (VUMC) has had a distinguished set of accomplishments during its 14-year history. Many of the accomplishments involved collaboration between pioneering users with ideas of better ways to do their work and informatics faculty and staff who had ideas about how to organize information for linkage into workflow to enable new approaches to work. Planning has been another hallmark of the effort. A well understood plan coordinates implementation of infrastructure with process change to meet operational objectives.

It is now time to once again more clearly outline our direction. This strategic plan for VUMC Informatics is the amalgamation of multiple general and targeted planning efforts during the last two years. Hundreds of people from VUMC and selected people beyond VUMC have contributed to the creation of this plan. We have assembled the outcomes of the multiple planning efforts in this plan according to mission, goals, objectives, strategy and roadmap.

<table>
<thead>
<tr>
<th>Mission:</th>
<th>Reason for being; purpose.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal:</td>
<td>On-going behavioral target related to the mission. Goals focus attention on core competencies.</td>
</tr>
<tr>
<td>Objective:</td>
<td>Measurable step supporting a goal. Objectives establish performance targets. Achieving an objective consumes resources.</td>
</tr>
<tr>
<td>Strategy:</td>
<td>The approach chosen to achieve goals and objectives. Strategy provides a competitive edge by increasing effectiveness or decreasing resources required.</td>
</tr>
<tr>
<td>Road map:</td>
<td>The critical path to achieving goals and objectives. Guides execution by showing how work comes together to achieve desired outcomes in the desired time frame. The road map makes explicit dependencies; work that can take place in parallel; and time steps that must be completed.</td>
</tr>
</tbody>
</table>

III - MISSION OF VUMC INFORMATICS

The purpose of VUMC Informatics is to help people use information and communication to improve health and health care processes and to expand knowledge related to human health and disease.

Given the multiple missions of an academic medical center, this purpose requires two interlocking missions for VUMC Informatics:
IV - VUMC <=> VUMC INFORMATICS GOAL ALIGNMENT CHALLENGE

Two-way Strategic Visioning and Planning

It is implicit that the goals of any function within VUMC must align with one or more of VUMC’s three mission areas: clinical, education and research. Proper alignment of VUMC and its informatics function requires iterative proactive two-way strategic visioning and planning. This alignment challenge reflects two aspects of informatics that set it apart from other functions within VUMC.

The first aspect—informatics is cross cutting. Informatics connects patient care, research and education. These connections enable synergistic use of information across mission areas that might otherwise compete. Therefore, it is critical that the VUMC informatics goals align explicitly with each of the VUMC three mission areas. Responding to each area’s needs in isolation does not allow the leverage that is needed for the other areas. Thus the key is selecting one of the many ways to respond to an area’s need that helps the other areas as well. Such reuse conserves resources while supporting the other mission needs.

Informatics infrastructure as a strategic resource includes the following capabilities:

- Management of data and knowledge as shared resources;
- Communication, data aggregation and analysis, and visualization across boundaries of geography, organization, discipline and data type;
- Methods and tools for continuous improvement, process redesign and change management.

Fusion of informatics research with translation into practice includes:

- Dissemination to operational use through informatics infrastructure, to individuals through education programs, and to society through technology transfer and services;
- Feedback of operational experience into research.

Missions of VUMC

Informatics

- To provide informatics infrastructure as a strategic resource enabling VUMC to achieve the highest standard in health care, biomedical research and health education.
- To fuse scholarly research in biomedical informatics with translation of the resultant knowledge into practice.
VUMC’s electronic patient chart (StarChart) is an example of this reuse. Its initial purpose was clinical—assembling all information about a patient and organizing it for access as needed in clinical workflow. The preexisting data processing approach to electronic medical record systems involves automating clinical processes and capturing patient data as a byproduct. This approach is slow and expensive because it is hard to support multiple clinical processes within a single data processing system, and today’s information standards do not make it easy to preserve the meaning of data during exchange among systems. StarChart uses an informatics approach to get around these barriers. It accepts information in any form (data, text, and image) from any system. Various informatics techniques, parsing, concept mapping and indexing are used to organize the data into various views and to identify data (e.g. what was the last creatinine reading) that are needed for automated decision support. This informatics approach permits inexpensive rapid consolidation of all information about a patient. StarChart is also a critical building block of the research infrastructure. Because it is all encompassing, StarChart is a source for detailed phenotypic information on any patient seen at VUMC. For example, work is underway to provide de-identified extracts to use with the DNA sample bank to support large scale bioinformatics. This same information plays an equally important role to support competency based education. Since it can incorporate information from any facility used by a student, it can provide infrastructure for a learner’s case records within their learning portfolio.

The second aspect—informatics can be disruptive to the status quo. It is often not practical to use informatics work processes designed for a time where people wrote information on paper and passed the paper around for others to read. In fact, when you try to “automate” a paper-based process, it is common to cause more problems than you solve. Success requires finding a new way of working that optimizes the interaction among people, process, and technology.

VUMC’s experience with computer provider order entry (CPOE) is an example of finding “new ways”, generally called discontinuous or transformational change. In the paper world, the physician looks at the patient and his/her data, makes decisions about what needs to be done, and writes those decisions (orders) in the chart in clinical shorthand. A clerk then reads the written order sheet and fills out administrative requisitions, adding all the information needed to get the decision carried out. In 1994, VUMC tried a commercially available CPOE system using an approach that was first used in the 1970’s. This system represented the conventional “paper-modeled” approach i.e., the physician becomes the clerk, answering administrative process questions such as how the patient should be transported. This system/approach wasted physician time and introduced process errors since the administrative processes vary by patient care unit. Instead of forcing physicians to put up with these problems, VUMC stopped using the system. Faculty and fellows in Biomedical Informatics worked with their clinical colleagues to prototype other approaches. WizOrder, now marketed by McKesson as Horizon Expert Orders, emerged through this iterative process.
prototyping. It was further refined during live use as it was rolled out, first from unit to unit, and then from service to service. The “new way” used an “informatics-based” approach.

WizOrder/Horizon Expert Orders helps the care providers walk through the decision making process. They can browse data about a patient and enter a decision in clinical shorthand. An informatics algorithm then figures out what they might be trying to do and presents them with an outline of best practice that they edit to the patient’s circumstance. The provider remains the decision maker and does not become a clerical person. The program becomes their clerk, automatically generating the orders to carry out their decisions while double checking them for safety.

The iterative strategic visioning and planning requires two intertwined paths. The first path begins with the various operating units identifying their goals and strategies. Informatics then looks across this set of plans, identifies common infrastructure requirements, and suggests a plan for providing a mixture of common and stand alone infrastructure. The second path takes place in parallel with the first. It begins with informatics facilitating discussion among people from across operating units to consider the purpose of their work and how that purpose might be achieved in a world unconstrained by today’s silos and infrastructure. Guided by these visions, the informatics professionals test plans for common infrastructure and adapt those plans if possible to better prepare them to scale up to what may be needed. Similarly, the “art of the possible” from the second path feeds back into the operating unit goal-setting in the first path.

**Evolution of VUMC Informatics’ “Leading Edge”**

VUMC made its commitment to biomedical informatics in 1991. Since that time, the missions of VUMC and its informatics function have been fairly constant. However, the goals of each have changed with time. These changes were in part in response to powerful shifts in the external environment. Increasingly these changes have been driven by growing internal informatics capabilities coupled with growing awareness by people throughout VUMC of the opportunity to use those capabilities to improve everything they do.

Initially (1991-1994) the informatics effort focused exclusively on putting in place a foundation of infrastructure: building the Eskind Biomedical Library, installing the fiber optic backbone network, implementing information systems to handle administrative and ancillary transactions, and recruiting faculty into the newly formed Division of Biomedical Informatics in the School of Medicine. By 1995 this infrastructure reached a stage permitting the biomedical informatics faculty and fellows to use VUMC as a “real world laboratory” to test alternative combinations of people, process and technology to see which helped people be more effective. This experimentation resulted in novel informatics approaches to the electronic patient chart and to clinical decision support with order generation. By 1999 decision support tools were in wide use across the inpatient facility permitting systematic change in practice to reduce clinical resource utilization. In 2002 the focus extended to the outpatient clinics. Before the end of 2003, panel management and intra-team communication and documentation tools had eliminated use of the paper chart across the clinics.

In the late 1990s, the Informatics Center picked as its audacious goal that “By 2004 policy makers, health care payers, health care providers, individuals, and the information/information
technology industry will recognize Vanderbilt as the best place in the world to see how information and communication can be used to improve health and health care processes.” This goal did not indicate a desire to focus VUMC Informatics externally. Rather we recognized that to achieve it, VUMC Informatics would have to do so well internally that people would want to come to VUMC to see what was possible through informatics. Three events in 2004 suggest this audacious goal has in large part been reached. First, President George W. Bush came to VUMC to see WizOrder and StarPanel. This visit was his first look at health care information technology in an actual inpatient setting. Second, Tennessee’s Governor Phil Bredesen turned to Vanderbilt to work with the Regional Medical Center in Memphis to test how informatics might be used to increase quality and reduce the cost of TennCare. This request led to funding by the state and AHRQ of a test, based upon StarChart, of regional patient data sharing for the 22% of Tennesseans that live in the three counties in the southwest corner of Tennessee. Third, the staff of the US Senators on the Senate Health Committee came to the Vanderbilt Center for Better Health to learn about health care information technology and to develop an action plan for the Administration and Congress.

For the past two years, joint VUMC and Informatics teams have worked to understand how to build upon these successes to achieve the following medical center priorities: supporting inpatient team communication and documentation processes; closing the loop on clinical quality, exploiting the intersection of clinical research and bioinformatics; enabling competency based learning appropriate to evidence based practice; and building out the Department of Biomedical Informatics. This Strategic Plan for VUMC Informatics 2005-2010 grew out of those plans.

Assessment of Current State

Strengths

<table>
<thead>
<tr>
<th>VUMC</th>
<th>VUMC Informatics</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Common governance for hospital, clinic, medical group and schools</td>
<td>• The Informatics Center structure focuses scarce skills through common governance for IT infrastructure, Eskind Biomedical Library, Department of Biomedical Informatics and Vanderbilt Center for Better Health</td>
</tr>
<tr>
<td>of medicine and nursing</td>
<td>• Approaching critical mass of biomedical informatics faculty with departmental status in the School of Medicine and PhD, MS, MD/MS programs in the Graduate School; and an MSN nursing informatics online program in the School of Nursing</td>
</tr>
<tr>
<td>• Geographic proximity of the university and collaborative faculty</td>
<td>• VUMC provides an operational lab to work out how to use informatics techniques to consolidate information,</td>
</tr>
<tr>
<td>culture</td>
<td></td>
</tr>
<tr>
<td>• Leadership commitment to evidence based medicine and leadership</td>
<td></td>
</tr>
<tr>
<td>track record in entrepreneurial ventures</td>
<td></td>
</tr>
<tr>
<td>• VUMC made the list of Top 50 clinical departments in 7 out of 17 specialties ranked by US News and World Report—Cancer, Otolaryngology, Gynecology, Hormonal Disorders, Kidney Disease, and Respiratory Disorders.</td>
<td></td>
</tr>
</tbody>
</table>
• Regional market dominance in children’s services with Children’s Hospital ranking in the top 10 nationally.
• Financial performance of the clinical enterprise
• Central Office of Research providing infrastructure to support shared research cores
• #1 in growth in NIH research funding 1999-2004
• #1 ISI citation factor in pharmacology, #5 in clinical medicine
• School of Medicine accredited for maximum permissible period of 8 years in 2005
• School of Medicine #1 in student satisfaction
• The School of Nursing has a tradition of innovation in nursing education; clinical research and advance practice delivery systems.
• VUMC has had a substantial growth in its physical facilities and has continued plans to further increase its facilities.
• Elevate demonstrates VUMC’s willingness to address social-behavioral-cultural issues as well as its missions.

support decision making, and organize workflow
• VUMC’s IT infrastructure scales up to increasing demand through focus on architecture instead of individual systems
• Transparent budget process for Informatics Center shared cost centers
• Proven methods for executing on transformational change
• Adoption of an electronic patient chart across the enterprise; provider order entry with decision support throughout the hospitals; and computer-based panel management throughout the clinics
• VUH & VCH rated in the 100 most wired hospitals in the H&HN bench mark study in 2005
• Clinical Informatics Consult Service recognized nationally as a new model for librarianship where the informatics expert identifies the set of alternative answers for consideration by the domain expert
• Editorial home of the Journal of the American Medical Informatics Association and the Journal of the Medical Library Association
• License of WizOrder to McKesson and execution on transition to Horizon Expert Orders and back install to VUMC establishes a new model for technology transfer
• Vanderbilt Center for Better Health and the Regional Informatics Program have begun to extend the operational laboratory beyond VUMC
## Weaknesses

<table>
<thead>
<tr>
<th>VUMC</th>
<th>VUMC Informatics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Historic academic culture places the individual before the enterprise</td>
<td>Competition among the units and skill sets that make up the Informatics Center</td>
</tr>
<tr>
<td>Lack of clarity about alignment of incentives among the hospital, school and departments</td>
<td>Lack of clarity across VUMC about the overarching informatics plan and how to get something done</td>
</tr>
<tr>
<td>Lack of transparency in the budget process across the enterprise</td>
<td>Lack of agreement on how to book anticipated increases in revenues or decreases in cost into budgets of operating units to offset costs of IT infrastructure</td>
</tr>
<tr>
<td>Lack of mechanism for building revenues, cost savings, and costs of new programs into operational budgets and multi-year forecasts</td>
<td>Lack of a holistic process for linking VUMC clinical faculty and staff with informatics developers and setting priorities</td>
</tr>
<tr>
<td>Lack of a mechanism for focusing on the must haves and delaying or stopping other things</td>
<td>Fragmented implementation and support services</td>
</tr>
<tr>
<td>Competition for capital among buildings, academic development, routine capital</td>
<td>Unacceptable downtime for certain infrastructure components</td>
</tr>
<tr>
<td>Conservative approach to philanthropy</td>
<td>Limited clinical research informatics and bioinformatics research resources</td>
</tr>
<tr>
<td>Conservative medical school curriculum</td>
<td>Limited formal evaluation of impact of technology</td>
</tr>
<tr>
<td>House staff programs less competitive than school</td>
<td>Limited percent of biomedical informatics faculty with grant funding</td>
</tr>
<tr>
<td></td>
<td>Conservative biomedical informatics degree program</td>
</tr>
<tr>
<td></td>
<td>Limited non-degree education</td>
</tr>
<tr>
<td></td>
<td>Limited computer science and computation in the University</td>
</tr>
<tr>
<td></td>
<td>Limited technical staff pool in Nashville</td>
</tr>
</tbody>
</table>
Opportunities

<table>
<thead>
<tr>
<th>VUMC</th>
<th>VUMC Informatics</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Achieve an undeniable level of high performance</td>
<td>• Be first to demonstrate the organizational impact of a comprehensive enterprise approach to informatics and a critical mass of biomedical informatics faculty</td>
</tr>
<tr>
<td>• Increase organizational capacity to change culture by adopting Studer techniques to communicate a common message, align incentives, create accountability, and help people execute (<em>Elevate</em>)</td>
<td>• Connect knowledge discovery with linkage of new information directly into practice by exploiting the intersection of bioinformatics and clinical informatics</td>
</tr>
<tr>
<td>• Lead transition to a system of evidence-based individualized care with closed loop quality improvement</td>
<td>• Prove that a broad based database of phenotypic and genotypic information can be used to detect unknown relationships for targeted study</td>
</tr>
<tr>
<td>• Make clinical trial management a natural by-product of practice</td>
<td>• Model combining agile data analysis of multiple data sources with enterprise data warehouse techniques to answer questions</td>
</tr>
<tr>
<td>• Create shared research resources that give VUMC investigators a competitive edge in team science related to population research, personalized medicine and therapeutic discovery</td>
<td>• Model linking just in time management decision support with operational execution</td>
</tr>
<tr>
<td>• Create focused interdisciplinary research teams to tackle grand challenge problems such as cancer detection and individualization of pharmacotherapeutics</td>
<td>• Become the preferred partner for academia and industry</td>
</tr>
<tr>
<td>• Model life long learning by transitioning to education programs that use the system of care and team science as the instructional environment</td>
<td></td>
</tr>
<tr>
<td>• Model use of simulation to help people recognize their limits by regularly pushing them past those limits</td>
<td></td>
</tr>
<tr>
<td>• Provide education and quality improvement services to graduates throughout their life</td>
<td></td>
</tr>
<tr>
<td>• Increase income from both technology transfer and philanthropy to the level provided by the clinical enterprise</td>
<td></td>
</tr>
</tbody>
</table>
Threats

<table>
<thead>
<tr>
<th>VUMC</th>
<th>VUMC Informatics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus upon growth and performance may overwhelm collaborative culture</td>
<td>Hyper growth may dilute culture and strategic focus</td>
</tr>
<tr>
<td>Clinical pricing pressures from Medicare, and employers</td>
<td>Increasing appetite for informatics support by the operating units may exceed available human bandwidth</td>
</tr>
<tr>
<td>Increase in uncompensated care from TennCare</td>
<td>Pace at which IT is becoming essential to work flow may exceed ability to make the infrastructure adequately reliable</td>
</tr>
<tr>
<td>Requirements to demonstrate quality and safety</td>
<td>Comprehensive digital information may lead to user overload and reduce efficiency and utility</td>
</tr>
<tr>
<td>Reduction in new grant awards during transition from period of doubling the NIH budget</td>
<td>Capital constraints may limit capacity to grow and maintain the infrastructure</td>
</tr>
<tr>
<td></td>
<td>Distribution of biomedical informatics funding across NIH requires a multi-institute strategy at the scale we are considering</td>
</tr>
</tbody>
</table>

V – GOALS, OBJECTIVES, and STRATEGIES for VUMC INFORMATICS

VUMC Informatics has three goals for each of its dual missions. Each goal is followed by objectives by which we can assess progress. Strategies are included where VUMC’s approach is distinctive.

The goals related to providing informatics infrastructure as a strategic resource to VUMC are:

Goal #1

To partner with leadership of VUMC operating units to achieve maximum beneficial use of information and information technology in support of VUMC’s missions

Objectives for Goal #1

1) Align enterprise and informatics strategies

   a) Identify and plan for informatics infrastructure implicit in the goals of VUMC’s operating units
b) Discover and test new strategies for meeting the goals of VUMC’s operating units that increase competitiveness by leveraging informatics and information technology.

c) Develop consensus about informatics strategy and understanding about how to get things done throughout VUMC.

2) Manage projects and operations to achieve objectives

a) Maintain rolling multi-year “roadmaps” of initiatives in the critical path of the goals of VUMC and its operating units.

b) Optimize the fit among user role, process and technology.

<table>
<thead>
<tr>
<th>Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario planning</td>
</tr>
<tr>
<td>Prototyping</td>
</tr>
<tr>
<td>Usability Testing</td>
</tr>
<tr>
<td>User Feedback</td>
</tr>
</tbody>
</table>

In 2004, 8N/8S and the Trauma Unit piloted aspects of an all electronic unit. The following vignette depicts the vision of one possible new model for shift change report.

Setting: Night RN (Robin) comes in a half-hour before shift change to get ready to assume care for her patients. She signs on. The computer has assembled her patients for the shift into a work list. She is joined by the day RN (Pam) at the workstation to give report.

Robin: Hey. Long day?

Pam: Yes. Are you just coming on?

Robin: Yes. I’m just looking at my list of patients. (Robin pulls up a display with the 1st patient’s current orders, current labs and summary sheet.) I took care of him yesterday. What’s his status today?

Pam: He’s not meeting his homodynamic goals because of his hypertension. He was started on Metoprolol 5 mg every 4 hours this morning, but his systolic blood pressure is still in the 170s.

Robin: Okay… (and she begins to type and cut and paste). Let me send a message to Dr. Smith suggesting an increase to a therapeutic dose. I’ll include his current dose, last two blood pressures and then, set a reminder for one-hour so I won’t forget to check back.

Pam: Let me tell you about this next patient. She’s stable, but she needs a Dobhoff Tube for a new tube feeding order.

Robin: Yes…and the system is reminding me that I have not been certified on inserting this type of feeding tube.

Pam: Let’s click on the Trauma Nursing Web site. I’ll show you how to find the tutorial for the procedure. Here it is…

Robin: Great! It looks like I can work through it in about 10 minutes (checks her watch). I should be able to get to it in a couple of hours. (Begins typing)…Let me enter a request for the nurse practitioner to stop by and check me off. That way I can still get the feeding order done on time.
c) Address barriers to technology adoption

### Strategies
- Engage Stakeholders and Users
- Listen
- Communicate
- Sequence change to match user effort and benefit
- Provide direct support through the change

---

d) Align incentives to adapt course as needed to achieve desired results

### Strategy:
Build assumptions about operating returns and costs into the budgets and forecasts of the affected operating units at the time central IT costs are built into shared budgets

---

**Goal #2**

To exploit informatics architectures and techniques to manage data and knowledge as shared resources while supporting distributed work, role-specific views and task-specific tools

**Objectives for Goal #2**

1) **Support capture of data at the time and place it is first created with reuse when and where needed across the enterprise**

---

a) Manage information separately from the systems or tools that automate process

### VUMC’s Information Architecture Principles:
- View individual applications as components (data capture devices, transaction processors, etc) not as repositories
- Externalize business logic in general purpose, application independent tables
- Externalize completed transactions into general purpose repositories
- Designate one as master and the rest as slaves when more than one applications use a datum
- Represent each view of a datum if multiple roles/applications collect it and they have a different view of its meaning or importance
- Provide global functions (ordering, notification, escalation, access to Management reports) where the users need like information integrated across application components
- Use interface engine technology to provide a single logical connection between an application component and the repositories
b) Support the appearance of an integrated user interface through sharing of context (user, patient, encounter) with one application designated to control coordination of workflow

c) Support the appearance of single sign on, with differential levels of authentication and distributed authorization to use services

d) Adopt national standards directly where practical and manage local terms as controlled vocabularies when augmentation of national standards is needed

e) Provide access to application components, and repositories through reusable services

2) Provide a common source to knowledge, whether of local or global origin, in a digital library

a) Achieve the lowest cost per use for purchased information resources

b) Provide tools to manage local knowledge as library resources permitting reuse as appropriate internal and external to VUMC

Collection Strategy:
- Provide breadth and depth through remote access
- Limit collecting as justified by nature of the resource or volume of use

c) Develop digital forms of unique items in the print library

3) Provide a data warehouse infrastructure to support management decision making, process monitoring, research and collaboration

Goal #3

To provide cost effective information technology infrastructure that scales up to support VUMC’s goals

Objectives for Goal #3

1) Facilitate development and adoption of best practices for obtaining and utilizing information technology infrastructure on an enterprise scale

a) Develop and maintain policies, standards and procedures to manage mutual dependency on critical shared resources

b) Minimize total cost of ownership of technology required to achieve the desired service level

c) Ensure availability, security and confidentiality appropriate to business need
2) Coordinate information technology investments across the University and VUMC

3) Provide project evaluation, management and quality assurance for implementation and development initiatives

4) Operate or obtain infrastructure according to service level agreements

5) Measure cost, use satisfaction and impact on effectiveness and efficiency

The goals for fusing research with translation of the resultant knowledge in practice are:

Goal #4

To drive change in the practice of health care and wellness, biomedical research, and health education at a pace that lets VUMC set the bar for academic medicine

Objectives for Goal #4

1) Enterprise

   a) Support understanding of interdependencies by providing integrated access to data across functional areas to support management decisions

   b) Support accountability by displaying progress toward Elevate Goals at enterprise and operating unit levels

   c) Support execution through just in time display of alerts and trends

2) Health Care

   a) Provide tools to support workforce scheduling and competency-based workplace learning

   b) Support operational processes that reduce transactions and the opportunity for error.

   c) Provide the information base, workflow tools and monitoring to enable evidence based medicine and closed loop clinical quality

   d) Provide the tools to report process and clinical outcomes

Strategies

- Design infrastructure to scale up to maximum anticipated need while building out just in time according to business need
- Redirect departmental investment where appropriate to build reusable infrastructure through a mixture of planning and investment of central funds at the margin
e) Support optimal patient throughput and resource scheduling involving multiple points of scarcity

f) Provide tools to manage health in a non-episodic fashion across the continuum of settings at the lowest level of intensity

g) Provide tools to engage patients in decision making and tracking their progress

3) Biomedical Research

a) Support streamlined administrative and compliance processes

b) Establish a bioinformatics research resource to provide consultation and access to tools

c) Increase the routine capture of categorical clinical data and outcomes

d) Mine the phenotypic information from the clinical infrastructure and marry it to routine DNA sampling to provide the most complete resource for detecting unknown or unexpected relationships

e) Build support for clinical trial management directly into clinical workflow and communication tools

f) Provide shared research data management infrastructure

g) Provide collaboration tools to support team science

4) Health Education

a) Support systems of care and research environments that provide learning environments that model the next generation of medicine

b) Provide tools allowing the learner to construct a self-directed curriculum from available resources

c) Support competency based credentialing and life long learning through tools to track experiences, outcomes and mentoring

d) Support use of simulation to teach technical skill and to test individual limits

e) Support just in time supervision
Goal #5

To gain recognition as the world leader for contributions to the biomedical informatics knowledge-base and work force

Objectives for Goal #5

1) Execute on a targeted approach to biomedical informatics research and development

a) Maintain an agenda of questions that provide keys to VUMC’s approach to academic medicine for the 21st century

b) Prioritize resources toward problems in the critical path of VUMC’s operating unit goals

c) Design and instrument informatics infrastructure supporting the VUMC operating units for reuse as core resources to support biomedical informatics research and development at marginal cost

d) Establish a measured course to achieve top rank in the world based upon:

   i) Competition for funding
   
   Funding sources:
   - Biomedical informatics research grants & contracts
   - Support from operations for technology development and evaluation
   - Technology transfer income

   ii) Competition for people
   
   Measures of attractiveness: quality of incoming faculty and students, incentives required to recruit them, and satisfaction of faculty, students and staff

   iii) Impact on outcomes
   
   Outcome measures:
   - Effectiveness of operations
   - ISI citation factor, patents
   - Performance of graduates
   - Informatics competency of the region
2) **Achieve a critical mass of faculty and students in each required informatics competency**

   a) Recruit, develop and mentor the best faculty and students where VUMC has the resources to provide a home base

   b) Obtain additional depth through partnership agreements with academia and industry

   c) Excel in collaboration through policy, tools and culture

3) **Develop a portfolio of education programs sized to make a difference**

   a) Contribute to the next generation of biomedical informatics leaders

   b) Provide informatics competency for health management and health science learners

   c) Systematically raise the level of understanding in the community (practitioners, researchers, policy makers, industry) of how to take advantage of informatics

**Goal #6**

**To achieve academic to business and academic to academic partnerships that provide depth and breadth while allowing each party to focus on areas of strength**

**Objectives for Goal #6**

1) **Execute on the potential of the McKesson WizOrder license, development and innovation agreements to demonstrate an effective model for technology transfer of a novel product from academia to an established industry**

   a) Partner with marketing to explain the paradigm shift and development to commercialize the product without changing the look and feel that made it successful

   b) Back install the commercial product (HEO) into the academic setting to: force the product to stay up with ongoing evolution; get the academic setting the benefit of other commercial components that integrate with the innovative piece; get to common development architecture for potentially related products easing subsequent bidirectional transfer

   c) Maximize return of the license by exceeding the required net revenues from HEO during the earn out term

   d) Negotiate transfer of two or more additional products to McKesson before the end of the innovation term
2) **Develop the Vanderbilt Center for Better Health into the leading vehicle for bringing people together to accelerate change in health care**

   a) Shift the balance of the work in the Innovation Center from design alone to design with support for execution.

   b) Manage the design and consulting work to provide a self supporting base from which to develop new programs

   c) Develop and prove a model for anchor partnership that makes business sense to industry

   d) Execute with the Nashville Health Care Council to establish the Think and Act Tank as a major force developing workable health care policy

   e) Develop the next 4-6 research pods (Regional Informatics was the first) to leverage Vanderbilt’s strength to focus on issues in the critical path of accelerating change in health care

   f) Test the feasibility of establishing a faculty consulting practice to provide deep expertise for projects around the globe, a means of supporting a larger faculty than would otherwise be possible, and a new source of unregulated income to support ongoing academic development

   g) Franchise the concept at a second academic center

3) **Execute on Star Technology to model technology transfer to a new company where the needed business model does not exist**

4) **Establish partnerships with academia or industry to obtain access to faculty, practice settings or research settings where it is not cost effective to build the resource at Vanderbilt**

**VI – ROADMAP TO GUIDE EXECUTION**

**5-year VUMC Informatics Infrastructure Roadmap**

1. **Roadmap Planning Framework**

   The planning framework provides a structure for looking at the five layers of VUMC Informatics projects:

   - VUMC’s three missions
     - Clinical Mission
Strategic Plan for VUMC Informatics

- Education Mission
- Research Mission
- Enterprise Management
- Technology Infrastructure

The complexity within the clinical mission is further sub-divided into three layers centered on the patient’s experience:

- Direct Care layer
- Support of Direct Care layer
- Unit/Clinic/Service Support layer

The eight layers are inter-dependent. Their relationships can be visualized in the following manner.

One informatics capability frequently impacts multiple Elevate Pillars as depicted in the following graphic showing the key capabilities in the three clinical layers.
2. Current View of the Roadmap

From December 2004 through July 2005, the Informatics Center iteratively created a multi-year roadmap through a collaborative process that involved appropriate stakeholders from the organization. The process included:

- Internal Informatics Center Sessions to:
  - Develop the planning framework
  - Populate the first iteration with decisions that had been made and existing “go-live” targets
  - Identify the decisions that needed to be made to meet high priority operational and transformational goals, in particular achieving inpatient closed loop medication administration by 2007

- Collaborative sessions with the leadership of the clinical enterprise to:
  - Re-sequence projects, add projects, and move projects to “out of bandwidth”, with particular attention to work that needed to be underway in FY06.
  - Create a second iteration focused on a 3-year plan for supporting the clinical enterprise
  - Iterate through discussions at Informatics Center Executive Council (ICEC), Clinical Cost-Effectiveness Committee (CCEC), and Clinical Enterprise Group (CEG).
  - Align immediate use of resources and FY06 budget requests to achieve the first portion of the roadmap
  - Build in the high priority “out of bandwidth” projects in the out years

- Collaborative sessions with research leaders to incorporate the informatics infrastructure to support the needs identified through the Research Strategic Design Sessions.

- Incorporation of the work underway between the schools and informatics to develop tools to support needs identified through the Education DesignShop and curriculum revision processes.

- Update to reflect new information through 7/15/05.
The roadmap is organized using the planning framework’s eight layers as “swim lanes” with time across the top. The following view shows the major end point(s) for each VUMC mission area as circles. The major project groups that support these end points are shown as bars in the appropriate swim lane. The left hand margin of a project group bar shows when that work can begin and the right hand shows its possible completion. Since the work is inter-dependent within and across swim lanes, this layout shows dependencies and work that can be in parallel. At the same time, the layout avoids the silos inherent in focusing on specific organizational structures, care processes, or technical architecture.

Detailed views of the roadmap are presented in the Appendix. Two different symbols represent different points in time associated with any tools-based transformation. The symbols include:

- Decision points that drive down stream activation of a new or improved capability are represented by a diamond.
- Activation or “go-live” dates for a capability are represented by a square.

In addition the state of each of these symbols is captured on the plan based on its shading. Items shaded green reflect decisions that have been made and activation points for work that has been funded and is under active management. Items that are non-shaded reflect potential
best case dates when additional decisions need to be made and the best case for activation of the associated capabilities.

On the critical path views, blue lines show how parallel work comes together to achieve an objective. For example, the learning infrastructure critical path shows we will work out how to use the Knowledge Map, Learning Portfolio and Simulation to support competency based continuous learning within the education swim lane. The closed loop quality process and the fully electronic environments from the clinical swim lanes, and the mechanisms to support agile data aggregation and analysis from the research swim lane then come together to collectively support a complete transition to a curriculum appropriate to a system of care.

Presentation of the roadmap in the Appendix is broken into six basic views and a project glossary. The views show:

- Projects that are in process with target “go-live” dates
- Closed loop inpatient medication administration critical path
- Closed loop clinical quality critical path
- Agile data aggregation and analysis for research critical path
- Learning infrastructure critical path
- Consolidated 5-year view

This roadmap sets the ultimate of a “reach” course. It would put Vanderbilt in a position to set the bar for academic medicine by 2012. This “reach” is within the art of the possible because it requires changes that others are slow to accept and the roadmap provides the focus needed to achieve aggressive milestones.

At first glance, the roadmap does not appear to address certain capabilities in time to meet critical current needs. For example, it sequences patient throughput into the out years. This timing is for full optimization of throughput according to the theory of constraints. A theory of constraint approach requires the tools to manage care across the continuum at the lowest possible level of intensity. In addition rich real time data is needed to prevent bottle necks. These resources will be created through work in the earlier years and brought to bear downstream. In the meantime point solutions to improve patient throughput may be implemented along the way to meet near term operational goals. In this way the plan helps us know how to scope each effort by showing if the work is being done as a long term strategy or as a quick fix for subsequent replacement.

The parts of the plan that start in FY06 have been funded through the budget process. Decision about funding work that starts in the out years will be made year by year through the budget process based upon the success of the work underway and our collective ability to generate the needed resources.
The roadmap will serve as a management dashboard and “war room map” to guide choices as we move forward. Formal collaborative revision according to experience and operational priorities will take place quarterly.

**Achieving Critical Mass in Biomedical Informatics**

1. **Background**

Over the past decade, Vanderbilt has built an international reputation in academic biomedical informatics. The following figure shows the evolution of the program in terms of number of faculty, disciplines represented by the faculty, and organization structure through its first two phases of growth.

The institution is widely regarded as being among the top three informatics programs nationally, along with Columbia and Harvard. It is viewed as dominant in informatics related to clinical practice and library services.
As data intensive molecular biology begins to inform decisions made for clinical care, and the volume and types of biomedical research data expand in the era of genome-enabled life sciences, opportunities and demand for the Department of Biomedical Informatics are increasing in the areas of service, research and education. We expect the historical strength of the department in providing service to clinicians by development, deployment and evaluation of clinical information systems to be matched and perhaps overtaken by emerging needs and opportunities in bioinformatics. The current emphasis on genomics and proteomics will be supplemented by new forms of “array science informatics”, which pose the general problem of detecting meaningful associations and patterns in n-dimensional arrays of data derived from thousands to millions of simultaneous measurements. (Note that although 2-D protein gels, time-of-flight mass spectroscopy and gene expression slide and chip microarrays may be component sources of array science classes of data, the analysis problems in ‘array science’ will increasingly involve higher order data sets where pattern detection occurs across as well as within data from heterogeneous sources, i.e., arrays of arrays.)

Within academic informatics departments and divisions nationwide, it is common to view clinical informatics and bioinformatics as separate organizational activities with relatively little overlap. Both are intersection disciplines that apply computer and information science methods to a professional domain, and historically each has had roots in a different community. Clinical informatics grew from a focus on hospital information systems, and bioinformatics grew from a focus on research tools for understanding sequence, structure and function of nucleic acids, proteins, and other molecules. Although a small number of information resources (e.g., Online Mendelian Inheritance in Man, and Human Genome Organization database) bridged the domains of molecular and clinical science, the professional cultures of bioinformatics and clinical informatics have tended to remain separate in most academic environments. A justifiable method for expanding departmental capabilities might begin with a division of labor between bioinformatics and clinical informatics, and an apportioning of faculty recruitments and programs within those divisions.

2. A Framework for Growth

An alternative framework for projecting growth can be constructed by listing informatics competencies (and corresponding research interests) that need to be resident in a comprehensive academic informatics department, and developing a scoring matrix that notes whether the competency applies to a variety of applications within clinical informatics, within bioinformatics, or both. The more widely applicable a method is the greater would be the value in creating a critical mass of faculty competent in the application of that method, and the teaching of it. (Stated in the negative, the more widely applicable a method is, the more likely that a single or very small number of faculty would become overwhelmed with institutional needs relative to it, and thus become a rate limiting step to overall organizational success of the research and/or health care enterprise.)

A representative, but not exhaustive, list of faculty competencies in biomedical informatics would include those listed below:
### Representative Faculty Competencies in Biomedical Informatics

<table>
<thead>
<tr>
<th>Competency</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Database design</td>
<td>Computerized repositories of data are the sine qua non of most research and clinical systems. Data and database modeling is a fundamentally important aspect of system design and implementation.</td>
</tr>
<tr>
<td>System Architectures</td>
<td>Designing the overall blueprint for flow of data and information into and out of databases and associated information retrieval and analysis tools is a major component of designing systems architectures.</td>
</tr>
<tr>
<td>Vocabularies</td>
<td>The naming and coding of biological and clinical entities provides the basis for reliable search within information resources, and linkages among resources.</td>
</tr>
<tr>
<td>Data Mining</td>
<td>Methods for detecting relationships within large collections of data, and approaches to establishing relationships among heterogeneous databases (including those created for different purposes and without the original intent to support external linkages) are the focus of data mining.</td>
</tr>
<tr>
<td>Expert systems</td>
<td>Computing systems that embed the knowledge of human experts to support goal-directed reasoning has application in a broad range of areas including clinical diagnosis, therapy planning, epidemiologic surveillance, and molecular structure-function prediction.</td>
</tr>
<tr>
<td>Knowledge Architectures</td>
<td>The creation of ontologies that encode both facts and the relationships among those facts is a central focus of the skills involved in designing and maintaining knowledge architectures.</td>
</tr>
<tr>
<td>Discovery methods and systems</td>
<td>Adaptive systems that improve their performance and systems capable of automatically detecting patterns and associations within complex data sets are examples of methods that can be usefully applied to both molecular and clinical data.</td>
</tr>
<tr>
<td>Scientific Visualization</td>
<td>The ability to turn the relationships present within large volumes of numerical data into pictures is an important analytical capability in the era of data intensive life science.</td>
</tr>
<tr>
<td>Human Factors</td>
<td>The perceptual psychology and cognitive science aspects of user interface design and system performance can determine whether an application of information technology is widely and effectively used, or abandoned by its intended audience.</td>
</tr>
</tbody>
</table>
Educational Processes | There is often a gap between teaching and learning, and the study of computer-based and computer-assisted educational methods is a component of applied informatics in educational settings.

Evaluation | Formal technology assessment methods about process and outcomes can provide scientific knowledge about the impacts of information technologies in research, education, and health care, as well as evidence for return on investment in business environments.

Modeling | Computer-based simulations and modeling can be useful for most objects or systems that have measurable properties and multiple interacting components. Modeling methods are applicable in diverse settings, including single molecules, cells, tissues, biochemical pathways and systems, and organizational processes.

Organizational Development | The management of modern health care enterprises, the information infrastructure that supports that management and the sociological aspects of change within organizations are closely linked to information systems and their role in workflow and governance.

The competencies and research areas listed above have relevance to a variety of specific applications and classes of data and information. The following table summarizes a rough approximation of the relative importance of each to application areas important to Vanderbilt’s missions of research, education, and patient care. It provides a feasible basis for estimating the needed composition of the department and the relative priorities for faculty recruitment. It is designed to explicitly represent the skills of faculty members across the domains of bioinformatics, clinical care, and organizational development rather than creating ‘silos’ with those labels.
### Relative Importance of Competencies in Selected Application Areas

<table>
<thead>
<tr>
<th></th>
<th>Alphanumeric Clinical Systems</th>
<th>Clinical Imaging</th>
<th>Molecular Biology &amp; Genetics</th>
<th>Integrative (Systems) Biology</th>
<th>Molecular, Cell and Tissue Imaging</th>
</tr>
</thead>
<tbody>
<tr>
<td>Database design</td>
<td>Н</td>
<td>Н</td>
<td>Н</td>
<td>Н</td>
<td>Н</td>
</tr>
<tr>
<td>System Architectures</td>
<td>Н</td>
<td>Н</td>
<td>Н</td>
<td>Н</td>
<td>Н</td>
</tr>
<tr>
<td>Vocabularies</td>
<td>НН</td>
<td>НН</td>
<td>НН</td>
<td>Н</td>
<td></td>
</tr>
<tr>
<td>Data Mining</td>
<td>Н</td>
<td>НН</td>
<td>НН</td>
<td>НН</td>
<td>Н</td>
</tr>
<tr>
<td>Expert systems</td>
<td>НН</td>
<td>Н</td>
<td>Н</td>
<td>Н</td>
<td>Н</td>
</tr>
<tr>
<td>Knowledge Architectures</td>
<td>НН</td>
<td>Н</td>
<td>Н</td>
<td>Н</td>
<td></td>
</tr>
<tr>
<td>Discovery methods and systems</td>
<td>Н</td>
<td>Н</td>
<td>НН</td>
<td>НН</td>
<td>Н</td>
</tr>
<tr>
<td>Scientific Visualization</td>
<td>Н</td>
<td>НН</td>
<td>НН</td>
<td>НН</td>
<td>Н</td>
</tr>
<tr>
<td>Human Factors</td>
<td>Н</td>
<td>Н</td>
<td>Н</td>
<td>Н</td>
<td>Н</td>
</tr>
<tr>
<td>Educational Processes</td>
<td>Н</td>
<td>Н</td>
<td>Н</td>
<td>Н</td>
<td></td>
</tr>
<tr>
<td>Evaluation</td>
<td>Н</td>
<td>Н</td>
<td>Н</td>
<td>Н</td>
<td>Н</td>
</tr>
<tr>
<td>Modeling</td>
<td>Н</td>
<td>Н</td>
<td>Н</td>
<td>НН</td>
<td></td>
</tr>
<tr>
<td>Organizational Development/Management</td>
<td>Н</td>
<td>Н</td>
<td>Н</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
It can reasonably be expected that new competencies, methods, and technologies will emerge over time, and additional application scenarios will become important within the overall mission of the institution. Targeting recruitments to developing and maintaining faculty capabilities commensurate with organizational needs will be an evolving management task, and the elements of matrices such as those outlined above should be revisited at least annually.

**VII – EPILOG: VIGNETTES OF A POSSIBLE OUTCOME**

Cancer detection and personalized treatment is one area where VUMC has an opportunity for a grand challenge breakthrough by focusing a team on its translational research strategy. The following vignettes depict possible outcome of such an effort coming together with the future system of care.

**Scene 1: A physician is sitting with a patient in his office**

**DR:** Hello Mrs. Walker. Thank you for coming in today. The results from your annual check-up have come in and I’d like to talk with you about your blood test.

**WALKER:** Did you find something that wasn’t normal, Doctor?

**DR:** I'm afraid so, Mrs. Walker. As you know, some families have an inherited tendency to develop certain cancers. The lab found trace amount of proteins in your blood that indicate you have a very early stage of colon cancer… I’m so sorry to give you this news.

**WALKER:** Oh no…How serious is this? Is there anything that can be done? My father died of colon cancer.

**DR:** The form of colon cancer you have is not a common one, but you do have some very important things going in your favor. First, the blood test has found the cancer in its very early stages by detecting the proteins it produces. (Pulls an image of a tumor and related proteins) You see, each tumor uses unique proteins to signal to the cells around it that it needs more blood vessels to grow, while other proteins help the tumor avoid the body’s own immune system. It was these proteins that the lab detected in your blood.

A few years ago, doctors would use a colonoscopy to find and biopsy small polyps in the colon – clusters of millions of cancer cells were needed to be able to see the tumor. Now, a blood test can find a tumor with as few as 1000 cells – invisible to a colonoscopy.

**WALKER:** I never liked those colonoscopies anyway. Tell me – does knowing the type of protein help you know how I can be treated?

**DR:** Absolutely. You see, each tumor acts a little differently – different locations create different tumors. For example, breast cancer and colon cancer are different kinds of cancer cells, but we also know that each person's cancer is different. The colon cancer you have is different than a neighbor’s. It is even different than your father’s, although it is probably very similar.
WALKER: Oh my... I don’t want to go through what my father did. He had a terrible experience with his treatment.

DR: The way we treat cancer today is very different than it was when your father had cancer. We have learned how to target drugs and treatments to the unique “personality” of each tumor. By looking at the protein profile, we are now able to find just the right chemotherapy to treat your tumor with near 100% success.

WALKER: Chemotherapy? That’s what I was talking about. I saw how awful it was for my father. He was sick every time he had a treatment and was weak for days afterwards. Not to mention his hair fell out and he had some very painful rashes. Will I have the same side effects he did?

DR: You should have a great deal less discomfort. The new approaches have few if any side effects, and if you do have any, they shouldn’t last long at all.

WALKER: How is that possible?

DR: The chemotherapy your father had used powerful poisons that worked not only on cancerous tissue but also poisoned healthy tissue. The new chemotherapies are even more toxic to cancer cells, and they have a much greater impact on cancer cells than healthy cells. These new drugs travel through the bloodstream and “bind” themselves to unique places on the tumor called receptors.

WALKER: That does sound more effective... What kind of medicine will you give me?

DR: Since every cancer is unique, our best course of action is to consult the molecular tumor information database for the most up to date information on the treatment that will work best with your type of protein. (Begins to access a database) Here’s the database. Let me request your complete medical record, including the protein profiling of the tumor and your genotypic information.

DR: It appears there are 1504 cases with protein profiles that match at the 90% level. The current treatment has produced complete remission in 1351 cases. Let me see if there are any new treatments that are being used for tumors of this sort.

It looks like there are 50 people under treatment with a new compound that in tests has proven to be far more effective. In 49 out of 50 cases the tumor is not detectable after 6 months.

DR: So these are our options: Using the first treatment which is very effective, or using the new compound that is still under evaluation. The new compound does not have as long a track record, but does appear to be more effective.

WALKER: I think I’d like to try the new one, Doctor, if you agree.
DR: I do. I think it sounds very promising. (Clicks on the computer) There – you are now registered for the on-going national study. The Study Coordinator will contact you directly with details about the study and confirm your participation.

DR: In the meantime, let’s get you on the schedule for chemotherapy next week.

WALKER: This is so much to take in… I think I’d feel better if I had some information to take home with me on the type of cancer I have and the type of therapy I’ll be going through.

DR: Absolutely. I’ll also include some statistics for you on recurrence with these treatments, and a link to a discussion group for you to take part in through the internet if you would like. (She nods). Mrs. Walker, I know this has been hard to hear, especially since you lost your father to colon cancer. But I want you to know that since your father had this type of cancer, the treatments have improved so that 98 out of every 100 patients are cured.

WALKER: Thank you, Doctor.

DR: We will need to monitor the effects of next week’s treatments to see how well we do. I’ll have the computer update your periodic health screenings.

DR: Based upon what the computer shows, it is helpful for you to have monthly screening tests to monitor the levels of the abnormal protein we detected, and to watch how their levels fall in response to chemotherapy. I will have the computer set up reminders on your calendar to come in for tests.

DR: I am also going to send the system’s recommendations to your portal to increase your consumption of broccoli, and to take a modest daily dose of a Cox 2 inhibitor. Both have been shown to prevent a recurrence of colon cancer.

WALKER: Thank you, Dr. Phillips. I appreciate you taking the time to help me to understand. I hope the treatment will take care of this cancer once and for all.

DR: So do I, Mrs. Walker.

WALKER: Do I need to see the nurse on the way out?

DR: No - The system has set up appointments for you on your PDA and forwarded this information to your personal secure website at home. Goodbye, Mrs. Walker – I’ll see you in two weeks, ok?

Scene 2: It is several months later and the patient walks into the doctor’s office

WALKER: Hello Dr. Phillips! It’s a big day today!

DR: Hello Mrs. Walker! It is a big day! You’ve finished your treatments. Tell me, how did it go?
WALKER: Well, I was pretty scared at first, to be honest. I know you gave me all the statistics about success rates, but all I could think of is that I had just been told I had cancer. That was really hard to take at first. But the treatments went like you said they would. I was a little tired, but it was nothing like what my father went through. I didn’t have pain, nausea or hair loss. And I feel great now.

DR: I’m so glad to hear that. You’ve done very well.

I’m just looking back through the messages you sent me using the MyHealth@Vanderbilt website. We keep those as part of your medical record. You asked about taking an over the counter medicine for your spring-time allergies, and I OK’d that. Are you still having problems?

WALKER: No. The itchy eyes only lasted a week or two when there was lots of pollen in the air, and the medicine helped with that.

DR: Good. Any other problems?

WALKER: No, things are going pretty well otherwise. I really appreciate being able to go to the website and see my blood test results and treatment-to-date summary. And having the future appointments download to my PDA really makes it easy to keep things organized.

DR: Did you get a chance to look at the support groups on line?

WALKER: I have to tell you, the online support groups have been great. I started out with lots of everyday-type questions, and other people were so kind to give me their experiences. Now I’m one of the ones who has ‘been there, done that’ and I can tell others what it was like! It really makes you feel like you’re not alone going through all this.

DR: Mrs. Walker, you will never be alone while going through an illness. We will always be there for you with whatever help you need. And speaking of the future, we’ll want to see you again in about a month to see how you’re doing and check your blood test. That should be…

WALKER: (clicks on her PDA) Monday the 24th at 2pm. I’ve got it right here.

DR: Right you are, Mrs. Walker. I’ll see you then. And in the meantime, please call or send me a message via the website should you have any questions between now and then.
Informatics Center 5-Year Plan

Major Project Groups Supporting Milestones

- Breakthrough from focused Interdisciplinary research team.
- Curriculum appropriate to a system of care.

Strategic Plan for VUMC Informatics – Appendix – Page 2
Swim lane axis covers Missions (Clinical, Research, & Education), Enterprise Wide Management Decision Support, and Informatics Center Process & Infrastructure.

The Clinical Mission is subdivided into three layers of functionality, namely, Direct Care, Support of Direct Care, and Unit/Service/Clinic Support.

Time axis covers three and a half years. Time scale for the template provides increased fidelity for the current year with decreasing fidelity for the out-years.

Area above the line is reserved for known Unscheduled Plans and Decisions.
Informatics Center 5-Year Plan

Projects in Process with Target Go-Live Dates (3-Year View)

- SEMIS
  - Patient Trans
  - Staff Sched. TBA

- Support of Direct Care Layer
  - SEMIS Patient Trans
  - Staff Sched. TBA

- Direct Care Layer
  - Star Panel Patient View Go-Live
  - WIZ Order Set Editor Go-Live
  - PEV Order Backnatal

- Support of Direct Care Layer
  - Star Panel Patient View Go-Live
  - WIZ Order Set Editor Go-Live
  - PEV Order Backnatal

- Unit/Service/ Clinic Support Layer
  - SEMIS Patient Trans
  - Staff Sched. TBA

- Research Mission
  - AHRQ State & National Contracts
  - National Center for Biomedical Computing Submitted

- Education Mission
  - Online MSN
  - Frat Center for Nursing Informatics

- Management Decision Support
  - CCCEC Launch
  - Malaysia DBMI Chair

- Informatics Center Process & Infrastructure
  - Enterprise Authent. & Author
  - HP Ser Disk, Ch Mgmt, & Config Mgmt
  - COO on Board for Informatics

Strategic Plan for VUMC Informatics – Appendix – Page 4
Informatics Center 5-Year Plan
Critical Path to Closed-Loop Medication Administration [Inpatient] (3-Year View)
Informatics Center 5-Year Plan

2004 2005 2006 2007

Clinical Mission
- Direct Care Layer
- Support of Direct Care Layer
- Unit/Service/Clinic Support Layer

Research Mission

Education Mission

Management Decision Support

Informatics Center Process & Infrastructure

Critical Path for Learning Infrastructure (3-Year View)

Strategic Plan for VUMC Informatics – Appendix – Page 8
The image contains a flowchart and a timeline of events related to VUMC Informatics. The timeline spans from 2004 to 2007, with specific months highlighted in the text. The flowchart includes various boxes representing different aspects of the Informatics program, such as Clinical Mission, Direct Care Layer, Support of Direct Care Layer, Unit/Service/Clinic Support Layer, Research Mission, Education Mission, Management Decision Support, and Informatics Center Process & Infrastructure. Each box contains further details and related tasks or initiatives. The chart also includes references to specific dates and phases of implementation, such as the Go-Live date for different systems and the completion of various projects like the PHV Decision. The chart is a strategic plan summarizing the development and implementation of Informatics initiatives at VUMC.
### Agile Data Acquisition
Assembly and analysis of data to support clinical, health services and population research.

### AHRQ State and National Contracts
$18 mil over 5 years obtained in contracts to support implementation and evaluation of regional patient data sharing and provision of national infrastructure for quality improvement/safety grants.

### Alerts and Notification
Alerting of critical information, with escalation. Example would be critical laboratory values.

### Bar Code Medications in Pharmacy
Medications and other pharmacy prepared products must be bar-coded in the Pharmacy prior to distribution to pt units in preparation for closed-loop medication administration. There is a 6-9 month lead time for this project completion prior to implementing Closed-Loop Medication Administration Online.

### Bioinformatics Resource Core
Provide bioinformatics consultation and tools to support molecular biology research.

### Blackboard Course Management Campus Wide
Vanderbilt University's online course management system supporting class lists, course outline, course materials and faculty student communication.

### Blood Ordering in the OR's
WizOrder and VPIMS have been enhanced to provide order entry in the OR's for blood products and delivery to the correct OR location of the patient.

### Cardiology Outcome Registry
Cardiology and Cardiac Surgery database for accreditation submission, quality monitoring and research.

### CCEC Launch
The Clinical Cost Effectiveness Committee was launched in July, 2004 to succeed the Resource Utilization Committee. The work of the Committee includes: evaluate the benefit and cost of informatics approaches to improving quality and resource utilization; prioritize and sequence the WizOrder queues; support initiatives to enhance linkage of evidence into practice and feed back of outcomes into practice.
<p>| <strong>Chemo Wiz</strong> | Improve patient safety and clinic efficiency in the Cancer Center by providing computerized provider order entry for outpatient oncology patients. This requires a Protocol Creation system to create and manage protocols as order sets with conditional arguments for dosing based on patient condition. Currently order sets can use a weight or body surface area based dose calculation but there is no mechanism for holding or attenuating dose based on laboratory results (ANC &lt; 1000) or toxicity criteria. The WizOrder Set Editor is a prerequisite. |
| <strong>Clinical Research Data Management Resource</strong> | We need data management services ranging from support for a single PI through a data coordinating center. |
| <strong>Clinical Team Role Explicit Accountability</strong> | Proactively assign care team roles so that responsibilities (expert supervision, consultation, discharge planning, etc.) are explicit. Map individuals and teams to clinical care roles, track who is cross-covering during non-primary hours. |
| <strong>Closed-loop Medication Administration Online</strong> | The &quot;safety check&quot; for medication administration and documentation at the bedside. Caregivers use scanning devices to identify themselves, the patient and medications at the point of administration. It is the final step to close the loop in support of the goal to eliminate medication errors. |
| <strong>Closed-loop Quality Plan</strong> | Establish a process for agreeing on evidence based practice; updating pathways and order sets to link those decisions into practice; feed back of threshold triggers and indicators of bad outcomes into the care process for proactive correction; modification of best practice based on experience. |
| <strong>Controlled vocabulary plan</strong> | Mechanism to manage the semantic relationships among terms used in clinical documentation tools. |
| <strong>COO On-board for Informatics Center</strong> | A national search has been launched to recruit a Chief Operations Officer for the Informatics Center to provide a single focus for support of VUMC operating units. |
| <strong>Database linking de-identified patient records with the results form molecular analysis</strong> | Extracts from StarChart, SNPs, and ultimately results from all cores. |</p>
<table>
<thead>
<tr>
<th><strong>Data warehouse framework</strong></th>
<th>Plan clarifying the levels through which data is prepared for use in decision support.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Discharge Summary Note Wizard</strong></td>
<td>Auto generation of sections of a discharge note with relevant events of an inpatient stay, with options to point-and-click additional information.</td>
</tr>
<tr>
<td><strong>DNA Bank</strong></td>
<td>Create a de-identified database of DNA samples &amp; genomic test data linked to deidentified phenotype information extracted from StarChart.</td>
</tr>
<tr>
<td><strong>DxR Clinical Reasoning Exercise</strong></td>
<td>Software license providing 102 cases designed for clinical reasoning exercises for medical and nurse practitioner students.</td>
</tr>
<tr>
<td><strong>ED Nurse Charting</strong></td>
<td>Electronic nursing documentation for the Adult and Pediatric emergency departments. The McKesson clinical documentation product (HED) will be reviewed to determine if any components could be used for this.</td>
</tr>
<tr>
<td><strong>Enterprise Authentication &amp; Authorization</strong></td>
<td>The infrastructure to support secure single sign-on (log on once and access what you need within authorization). Common university-wide authentication infrastructure (making sure you are who you say you are) linked to common authorization infrastructure (deciding what functions you can use).</td>
</tr>
<tr>
<td><strong>Enterprise Monitoring</strong></td>
<td>End-to-end monitoring to immediately identify when a server is down, when a service has become unusually slow, or an area has lost connectivity. Includes anticipatory alerting.</td>
</tr>
<tr>
<td><strong>Frist Center for Nursing Informatics</strong></td>
<td>The School of Nursing Information Technology Center.</td>
</tr>
<tr>
<td><strong>Fully Electronic Inpatient Unit</strong></td>
<td>A fully electronic patient care unit, with elimination of paper-based processes and the need for the paper chart.</td>
</tr>
</tbody>
</table>
### Project Glossary

<p>| <strong>HEO Content Management Plan</strong> | Develop tools to manage clinical content that is sharable between our order entry system (HEO), our pharmacy system (HMM), our nurse documentation (HED), and our other clinical systems (StarPanel RxStar etc). There are three tiers of knowledge: Source Data - example data coming from the FDA, NLM, NIH. This could be provided as a file or as a database. It may be repackaged by a vendor similar to how FDB repackages FDA knowledge about drugs. |
| <strong>Horizon Expert Documentation</strong> | The McKesson clinical documentation system. It is also referred to as &quot;HED&quot;. The suggested plan is to use an expedited roll-out strategy to all VUH and VCH patient care units. Initial focus would be on viewing of data from monitors and ventilators; charting against orders; flow sheet documentation. |
| <strong>Horizon Expert Orders Back install</strong> | Horizon Expert Orders (HEO) is the McKesson &quot;commercial version&quot; of WizOrder circa 2001. The suggested plan is to perform a rapid &quot;back-install&quot; of the HEO product at Vanderbilt by 1) migrating WizOrder content into HEO syntax; 2) editing in function developed since 2001 as is; and rationalizing after the fact. |
| <strong>HP Service Desk, Change Mgmt &amp; Config Mgmt</strong> | These tools are part of the HP OpenView product that provides technology to decrease the work of supporting the IT infrastructure of the Medical Center. HP Service Desk allows support teams to track all calls to the Help Desk and track issues that support teams find in support of Medical Center applications. HP Change Management records application and system changes and allows proactive planning, tracking and review so that the incidence of adverse impacts due to changes is reduced. HP Configuration Management works hand-in-hand with Service Desk and Change Management to help us understand impacts and dependencies of proposed changes across systems. |
| <strong>Imaging Informatics Plan</strong> | We need a plan for imaging informatics (concept recognition, registration, representation of relationships) to complement our strengths in image modalities and processing. |
| <strong>Informatics Architecture Plan</strong> | Convergence on a strategy to proactively handle issues ranging from human factors, through systematic identification of need; to testing. |
| <strong>Inpatient Physician Documentation Plan</strong> | Plan for the set of Informatics tools to support inpatient documentation for physicians. |
| <strong>Inpatient/Outpatient Medication Boundary Plan</strong> | Movement of appropriate inpatient medication information/changes into the outpatient record at discharge. |
| <strong>Integrated Testing Infrastructure</strong> | Provision of a test system to systematically detect flaws that occur in interaction/information exchange between systems, as well as within a system. |
| <strong>Interdisciplinary Care Plan</strong> | We need a way of developing and maintaining an interdisciplinary plan of care for a patient across the inpatient and outpatient continuum. |
| <strong>Knowledge map</strong> | Multiphase project beginning with aggregation of all curricular content, the mining the content to identify related concepts, providing a browser so that the learner can locate learning resources on demand, and establishing links from each curricular concept to information resources in the digital library to maintain currency. |
| <strong>Learning portfolio</strong> | Multiphase project beginning with aggregation of an electronic record of a learner’s experience, then assessing specific competencies. |
| <strong>Dan Masys DBMI Chair</strong> | The Department of Biomedical Informatics is being expanded to assemble faculty with the key competencies need to exploit informatics across the biological science, population science and clinical practice spectrum. The vision involves doubling the size of faculty over the next 5-7 years and developing divisions in areas of focus. Dr. Daniel (Dan) Masys assumed his role as Chair of the Department of Biomedical Informatics (DBMI) and Chief Academic Officer in the Informatics Center on January 1, 2005. |
| <strong>National Center for Biomedical Computing</strong> | $20 mil over 5 years grant proposal submitted to develop a center for pharmacoinformatics as a national resource - spanning basic computer science research, support for the new biology, and linkage of discovery into decision support. |
| <strong>NCPI Reboot Plan</strong> | The proposal to fund a National Center for Biomedical Computing was not funded. We will resubmit as a series of grant proposals. |</p>
<table>
<thead>
<tr>
<th><strong>Online MSN</strong></th>
<th>The School of Nursing MSN nursing informatics online program.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OR Instrument Tracking</strong></td>
<td>The new Censitract system to support Instrument-level and Tray-level tracking is being implemented in the OR's. It will replace the existing GE tray-level tracking system. VUMC requires enhanced ability to track instruments at the individual instrument level. Goals are to address the number one quality issue identified by staff: missing instruments within a pan, as well as provide detailed productivity reporting, provide infection control recall and reduce instrument replacement cost.</td>
</tr>
<tr>
<td><strong>Outcome Registry Plan</strong></td>
<td>Strategy to utilize categorical data collected for compliance, accreditation, research and quality monitoring.</td>
</tr>
<tr>
<td><strong>Outpatient Order Entry Plan</strong></td>
<td>Strategy to support outpatient order entry with Medicare compliance, billing support, resident education and decision support.</td>
</tr>
<tr>
<td><strong>PathworX</strong></td>
<td>PathworX is a tool linking pathway management, standardized nursing documentation and variance tracking. A strategy is needed for support of this functionality post HED.</td>
</tr>
<tr>
<td><strong>Patient Education Plan</strong></td>
<td>Give patients information and tools to learn about their condition and participate in their care.</td>
</tr>
<tr>
<td><strong>Patient ID Lab Specimen Labeling</strong></td>
<td>Project in support of the Safety and Quality initiatives for implementing a technology and workflow solution to address patient identification and lab specimen labeling. It is expected this project will involve a multi-year timeline and will require a significant effort in planning to ensure alignment with other major initiatives already planned for the same areas of the Medical Center. An initial pilot of key areas of opportunity is planned for FY06, with further rollout planned in remaining patient care areas in FY07.</td>
</tr>
<tr>
<td><strong>Patient Intake Plan</strong></td>
<td>Multiple methods to capture clinical information as patients enter in clinics, often currently in overlapping, duplicative manner. May include home entry, kiosks, etc.</td>
</tr>
</tbody>
</table>
### Project Glossary

<table>
<thead>
<tr>
<th><strong>Patient Throughput Plan</strong></th>
<th>Plan for addressing the requirements and technologies to track patients at all points in the patient care process, modeling the flow, and identifying emerging problems in advance, thereby improving patient access and throughput, length of stay.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patient to Provider Messaging</strong></td>
<td>Provided in conjunction with <a href="http://www.MyHealthAtVanderbilt.com">MyHealthAtVanderbilt.com</a> to allow patients to communicate with their providers using secure messaging. The system utilizes the StarPanel message baskets and routes the patient messages to their provider's message basket within StarPanel and also stores the message in the patient's electronic medical record.</td>
</tr>
<tr>
<td><strong>Perioperative Nurse Charting</strong></td>
<td>Tools are needed to support clinical documentation by nursing in the ORs to ensure accurate documentation of supply utilization, charging and billing compliance.</td>
</tr>
<tr>
<td><strong>Pharmacy Horizon Meds Mngr</strong></td>
<td>The McKesson Pharmacy system integrated with WizOrder (and HEO) so that the pharmacy can electronically receive, verify, and send medication orders to automated dispensing and administration applications, eliminating the need for any manual transcription. It is integrated with First DataBank’s knowledge bases for compliance monitoring, drug-dose checking, patient consultations, allergy screening, drug-interaction screening, therapeutic duplication and drug-disease interactions.</td>
</tr>
<tr>
<td><strong>Pharmacy Robotics</strong></td>
<td>Automated packaging and dispensing equipment for the Pharmacy, with a goal of increased pharmacist efficiency. The robotic systems automate the storing, dispensing, returning, restocking and crediting of bar-coded, unit-dose inpatient medications. This is <strong>not</strong> a requirement to do bar-coded medication administration at the bedside.</td>
</tr>
<tr>
<td><strong>PHV Wiz</strong></td>
<td>WizOrder is to be implemented in the Psychiatric Hospital at Vanderbilt. Requirements are in the process of being finalized with a plan for rollout with minor Wiz changes. This assumes minimal need to separate access to VUH &amp; PHV orders.</td>
</tr>
<tr>
<td><strong>Point-of-Care Testing Plan</strong></td>
<td>A plan is required to address the workflow and technology challenges with point-of-care testing in intensive care units and the ED areas. The problem is assurance of quality and integration of results with information from the labs.</td>
</tr>
</tbody>
</table>
### Strategic Plan for VUMC Informatics – Appendix – Roadmap to 2010

#### Project Glossary

<p>| <strong>Provider to Provider Messaging</strong> | Allows for secure messaging via StarPanel message baskets and a provider directory to replace utilization of email for communication between providers. This function will be used both for internal and external provider communication. |
| <strong>Quality Metric Plan</strong>            | dashboards for quality and process indicators. |
| <strong>QMI Replacement</strong>               | The QMI fetal monitoring system used in L&amp;D and the OBGYN clinics must be replaced. A new system is required to a) allow for consistency in documentation across the different obstetrics practices in the medical center and b) allow for integration with StarPanel and other documentation systems. |
| <strong>Radiology IDX 10</strong>              | The new version of the Radiology Information System which will provide new functionality and improved workflow for Radiology, support charge capture for similar but small ancillaries and current technology to better meet HIPAA security guidelines. |
| <strong>Research Informatics Core Plan</strong>| Effort to establish a roadmap of areas of focus for informatics support of clinical, health services and population research. |
| <strong>Research Subject Tracking &amp; Billing</strong> | Research Subject Tracking is required to improve the billing process for Clinical Trials at VUMC. It is intended to provide a secure, accurate and independent record of the procedures that are performed on subjects who are part of a specific clinical trial. This independent record will then be used by the Department of Finance to ensure that only the appropriate charges are charged to that Clinical Trial. This system will help with mis-charging of procedures to the subject’s insurance. It could also all but eliminate improper billing to Medicare and insurance providers. It would also ensure that grants and contracts are paying appropriately for patient care services. |
| <strong>Rx Star</strong>                       | Outpatient prescription writer. |</p>
<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SEMIS Patient Transport</strong></td>
<td>Installation of software designed to track the patient transport function. Will be used in conjunction with e-bedboard to monitor bed cycle times and improve efficiency of patient discharge processes. The new software will also allow notification to Environmental Services to clean discharge and transfer rooms.</td>
</tr>
<tr>
<td><strong>Simulation</strong></td>
<td>Use of simulation for learning, evaluation and demonstration of individual limits. Begins with OSLE standardized patients.</td>
</tr>
<tr>
<td><strong>Staff Scheduling</strong></td>
<td>An automated staffing and scheduling system, Workbrain, is being implemented in Patient Care Services in support of nursing retention, satisfaction and patient safety. The plan is to have the ability to monitor patient census and match nurse staffing to meet the needs of the patient care units. The goal is to complete the rollout in Patient Care Services then plan for other areas in VUMC.</td>
</tr>
<tr>
<td><strong>StarPanel Application Component Integration On-line</strong></td>
<td>Link applications such as OPOC, Quill &amp; StarRx into StarPanel to make them appear as an integrated application.</td>
</tr>
<tr>
<td><strong>StarPanel Patient View</strong></td>
<td>This feature was created as a &quot;condensed view&quot; of patient data for the inpatient setting. Patients View allows staff to see at a glance critical patient data utilizing Rounding View. The display can be based on a panel of patients or the inpatient census. It contains a user-customizable set of columns and actions.</td>
</tr>
<tr>
<td><strong>Student Learning Portfolio</strong></td>
<td>Tracking of the types and numbers of patients which a student has interacted with together with clinical notes. Training exercises are also tracked.</td>
</tr>
<tr>
<td><strong>System Response Time Plan</strong></td>
<td>Study and implementation of a plan to identify and address response time problems, and monitoring to identify future occurrences.</td>
</tr>
<tr>
<td><strong>Time and Attendance</strong></td>
<td>This is the project to replace the Matrix Time and Attendance system with the new Kronos Time and Attendance system. It will be used by the Medical Center and portions of the University for time reporting for hourly employees.</td>
</tr>
<tr>
<td><strong>Vigilance in ICU</strong></td>
<td>The Vigilance system used in the Perioperative areas has potential benefit in the ICU setting for patient monitoring and coverage by the patient care team. A plan is needed for possible pilot sites in FY06.</td>
</tr>
<tr>
<td>---------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Tissue Management</strong></td>
<td>We need a strategy for managing and accessing banks of biological samples (Human and animal).</td>
</tr>
<tr>
<td><strong>Whiteboard in Cancer Center</strong></td>
<td>Safe order entry needs the correct orders to be activated on the correct patient at the right time. In the inpatient environment, this is provided by hospital's ADT system. In the outpatient setting, there is currently no mechanism that tracks where a patient is actually located at any given time. Patients who have multiple appointments per day may have all their visits &quot;activated&quot; at the same time so it appears the patient is simultaneously at their cancer clinic visit, their infusion room visit, and a urology clinic visit. A whiteboard prototype has been developed and is being integrated into StarPanel.</td>
</tr>
<tr>
<td><strong>Whiteboard Technical Framework</strong></td>
<td>We need a framework rationalizing the relationship among our various white board tools including the ED white board, order tracker, PICU/NICU order and result notification, StarPanel preop checklist, and the new functionality developed for the cancer center.</td>
</tr>
<tr>
<td><strong>Wiz Go-Live in the CRC (Phase 1 vanilla)</strong></td>
<td>&quot;Vanilla&quot; WizOrder without protocol-based order sets in place is being implemented in the CRC as a Phase 1 plan. Once this is completed, the next phase includes a team, plan, and infrastructure to support order set development and maintenance with the long-range goal of having order sets that match each protocol (and perhaps other decision support to support other goals of the CRC).</td>
</tr>
<tr>
<td><strong>Wiz in the OR Plan</strong></td>
<td>A plan is required to implement Wiz Order in the Operating Rooms.</td>
</tr>
<tr>
<td><strong>Wiz Order Set Editor Go-Live</strong></td>
<td>The new editor that uses the current Wiz Order client and servers to create and save the order sets. There are additional tools that let the librarian/analyst see the changes made to the order sets prior to activating the order sets. Subsequent work will allow order sets to contain patient condition based dosing to support oncology protocols. It should be noted this work benefits the entire hospital. Order sets will be able to be created from any clinical workstation. The new tools and database will make maintenance and analysis easier.</td>
</tr>
</tbody>
</table>