Innovation At
Vanderbilt University Medical Center
Defining Innovation

Changing perception of what is possible

Innovation is a new way of doing something. It changes perceptions about what is possible and offers dramatic improvement in value. Ideas are applied successfully in practice. Through creativity by individuals, we leverage VUMC.

Attributes of innovation:

- Substantially different
- Increases value
- Involves risk and experimentation
- Balances process & product change
- Destructive effect
- Has not been measured scientifically

VUMC’s system level of innovation focuses on identifying opportunities to increase the measurable quality, while increasing the number of individuals being helped and reducing the unit cost. An innovation project proposal has the potential to:

- Dramatically improve health and health care
- Dramatically decrease cost to VUMC and/or payers without adversely affecting patient care
- Dramatically improve undergraduate, graduate and/or continuing medical education
- Dramatically reduce the time to discovery
- Grow Vanderbilt’s reputation as a trusted source

Through Innovation, the VUMC asks its leaders to:

- Manage up the medical center’s commitment to innovation
- Help teams understand how systematic improvement and innovation work together
- Look for opportunities to participate in innovation proof of concept projects
  - Ask if it increases effectiveness and reach while decreasing cost per capita
  - Accept risk and use data to rapidly adapt
  - Keep it small until we get it right
VUMC’s System Innovation

System Innovation focuses on identifying opportunities to increase the measurable quality, while increasing the number of individuals being helped and reducing the unit cost. System Innovation is fed directly by the research engine with a three way foundation of discovery, translational and implementation sciences. A system innovation project has the potential to:

- Dramatically improve health and health care
- Dramatically decrease cost to VUMC and/or payers without adversely affecting patient care
- Dramatically improve undergraduate, graduate and/or continuing medical education
- Dramatically reduce the time to discovery
- Rapidly translate discovery science to standard clinical practice
- Grow Vanderbilt’s reputation as a trusted source

The hematologic malignancy Diagnostic Management Team (DMT) is an example of innovation. This DMT applies evidence-based standards for ancillary laboratory test utilization, informatics tools to improve evaluation of patient history, reflex pathologist-based test ordering in accordance with standards, summative reporting to guide therapy and monitoring and evaluation of the impact of these changes on test utilization and performance. Systematic collection of data on more than 2,500 bone marrow samples has provided new evidence with which these standards can be iteratively refined.

The following table contrasts the innovation to conventional practice.

<table>
<thead>
<tr>
<th>Innovation</th>
<th>Conventional Hematopathology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interdisciplinary team develops evidence-based testing standards for each condition &amp; phase</td>
<td>Clinician decides which individual tests to order at time of biopsy</td>
</tr>
<tr>
<td>Pathologist orders tests according to the standard while interpreting the biopsy</td>
<td>Pathologist interprets biopsy and lab generates test reports</td>
</tr>
<tr>
<td>Pathologist creates comprehensive report and interpretation once all required results are available</td>
<td>Clinician decides how to use the information as reports become available</td>
</tr>
<tr>
<td>The team translates basic scientific discoveries into standard testing algorithms and utilize evidence for iterative refinement of standards</td>
<td>Standard testing continues unchanged</td>
</tr>
</tbody>
</table>

A six-month retrospective examination followed by a one-year prospective analysis showed DMT eliminates the 35 percent of tests that are not necessary while adding back the 10 percent of tests that would otherwise be missed. The net improves quality while annually saving Vanderbilt payors more than $1 million. Scaled to the national population the savings on these seven conditions alone would be approximately $500 million. These 7 conditions represent a small fraction of the opportunity to improve patient care, eliminate unnecessary tests, reduce errors, costs and length of stay, and improve use of diagnostic expertise and physician time. One example of translational science applied within the DMT framework is our study of the molecular basis for bone marrow failure. Our studies show that there is no evidence of large frame molecular abnormalities as determined by cytogenetics or FISH. Therefore, testing is not appropriate and other etiologies for marrow failure need to be discovered.

Other examples include:

- **My Health Team**: A model of team-based care that couples collaborative health care teams with health information technology to improve control of chronic conditions.
• **PREDICT** (Pharmacogenomic Resource for Enhanced Decisions in Care and Treatment): Identify patients “at high risk” for receiving a drug where genotype changes response, assay genotypes important for variable actions of many drugs preemptively, store genotypes in the electronic record, provide point of care advice and track outcomes.

• **VPIL** (Vanderbilt Program in Interprofessional Learning): Interprofessional working-learning teams that use a holistic approach and allow novice learners to add meaningfully to patient and population care.

BioVU (Vanderbilt’s DNA Bank): De-identified DNA samples linked to de-identified “avatars” abstracted from electronic health records to support population scale pattern recognition and hypothesis generation
Innovation Process, Trajectory and Steps

Innovation Process

The innovation process is multistage, with each stage taking longer than the previous one.

- Origination Of An Idea
- Transformation Into Something Useful
- Implementation in practice
- Diffusion

Increasing Time/Effort

Trajectory

Innovation projects follow a pre-defined “trajectory” that allows for rapid iteration and advancement.

- Idea
- Concept Development
- Proof of Concept
- Results
- Scale at VUMC
- Scale Beyond VUMC

Idea Phase
Innovation projects begin with an idea. To move forward, the idea needs to meet certain criteria. In order to be an “innovation project” the idea needs to have the potential to do one or more of the following:

- Dramatically improve health and health care
- Dramatically decrease cost to VUMC and/or payers without adversely affecting patient care
- Dramatically improve undergraduate, graduate and/or continuing medical education
- Dramatically reduce the time to discovery
- Grow Vanderbilt’s reputation as a trusted source

**Concept Development**
This phase involves works by key stakeholders to flesh out the idea.

**Design Phase**
Approved Innovation Projects enter a design phase, intended to work out major issues or obstacles, to ensure smooth implementation of the Proof of Concept phase.

- Designing any project is an iterative process that relies on the mantra try, fail, try, fail...until either success is reached or the project is closed
- Project design can utilize any of the following methods:
  - Core Group Discovery: Leverages the knowledge and expertise of the project’s main proponents and shares with specific stakeholders
  - Design Sessions: Structured, moderated format involving key stakeholders

**Proof of Concept Phase**
Proof of Concept is the first run of an idea. Primary goals: demonstrate feasibility, clarify impact, refine and determine scalability.

- A Proof of Concept is often the first glimpse of an idea to people outside the core project team
- Tweaks and reworks the original design, scope and/or idea happen in rapid iterative cycles
- Projects may change dramatically during this phase, which requires users to maintain open minds
- Successful POCs confirm either a move forward or the need to revisit the initial design phase work

**Results Phase**
Projects need to have quantifiable results. After launch of a POC, the implementation group gathers data to determine the project impact.

- While ideas need to have measurable outcomes, how or what to measure may not become clear until the proof of concept phase
- Results need to show how the proof of concept did one or more of the following:
  - Improved patient care
  - Improve work processes and efficiency
  - Decrease cost to VUMC and/or payers without adversely affecting patient care
  - Improved Vanderbilt’s national reputation
  - Improved undergraduate, graduate and/or continuing medical education
- Results may determine whether a proof of concept moves into the final stage of development: Scale.
Scale Phase

Successful Proof of Concept projects move to the final phase. By scaling, the hope is to maximize positive results and potential return on the initial investments.

- Scaling can involve integration of the new system into operations
- A project can scale horizontally, into other areas, where it can provide similar results
- Scaling may mean dramatically changing work processes and services provided to patients and employees

Scale Beyond VUMC

Vanderbilt is committed to advancing projects that have potential for regional and/or national impact by scaling some projects beyond VUMC. Some examples of Scale beyond VUMC include RedCap, MyCancerGenome, research match and hematologic malignancy Diagnostic Management Team.
Innovation Council: Charge & Membership

Purpose
The Innovation Council oversees and manages accountability for Innovation projects. The Council consists of senior executives, project leaders and additional experts. Tasks include:

- Convey the visions and goals across VUMC
- Portfolio selection and alignment
- Review and revision of Threshold, Target and Reach goals
- Provide peer insight
- Intervene across enterprise as needed

Format
Once-a-month meetings highlight project direction, achievements, issues, and action items.

Members and their associated projects:
- **Co-Chair:** Wright Pinson – Deputy Vice Chancellor for Health Affairs; CEO of the Vanderbilt Health System; Senior Associate Dean for Clinical Affairs VUMC
- **Co-Chair:** Bill Stead – Associate Vice Chancellor for Health Affairs; Director, Informatics Center; Chief Strategy and Information Officer
- **Facilitator:** Kristy Sinkfield – Director, Strategy Development
- **Communications:** Herschel Pollard – Communications Officer, Strategy Development
- Gordon Bernard – Associate Vice Chancellor for Research; Senior Associate Dean for Clinical Sciences; PI, VICTR
- Bob Dittus – Assistant Vice Chancellor for Public Health; Associate Dean for Population Health Sciences; Director, Institute for Medicine and Public Health; PI, CMS Innovation Grant
- Phyllis Ekdall – Vice President Clinical Enterprise, Department of Finance
- John Graves – Assistant Professor, Preventive Medicine Department
- Jim Jirjis – Assistant Chief Medical Officer, Chief Medical Informatics Officer
  - MyHealthTeam
  - PREDICT
- Ed Marx – Director Strategic Analytics, Office of the Vice Chancellor for Health Affairs
  - MyHealthTeam
  - Diagnostic Management Team
- Bonnie Miller - Senior Associate Dean for Health Sciences Education, SOM
  - VPIL
  - Curriculum 2.0 (New Health Profession School, Curriculum 2.0)
- Linda Norman – Senior Associate Dean for Academics, SON
- Neal Patel – Chief Medical Informatics Officer, VUMC (inpatient); Medical Director, Pediatric Cardiac Critical Care
  - Integrated Presence
- David Posch – CEO, VU Hospital and Clinics; Executive Director Vanderbilt Medical Group
  - Value-based Care
- Jill Pulley – Director, Research Support Services
  - Genetic sequence in EHR & genetic-based prescribing (PREDICT)
- Dan Roden – Assistant Vice Chancellor for Personalized Medicine
- Genetic sequence in EHR & genetic-based prescribing (PREDICT)
  - Warren Sandberg - Chair of Anesthesiology
  - Sam Santoro – Chair of Pathology, Microbiology, and Immunology
    - Diagnostic Management Team
  - Jack Starmer – Chief Quality Informatics Officer; Assistant Chief Medical Officer
    - Warfarin
    - Systems Approach to Research Recruitment
    - Right Drug First Time
  - Mary Zutter – Assistant Vice Chancellor Integrative Diagnostics
    - Diagnostic Management Team
Key Innovation Project Fact Sheets

DIAGNOSTIC MANAGEMENT TEAM (DMT)
Evidence-Based Test Selection and Interpretation

Diagnostic Management Teams (DMTs) are interdisciplinary groups that utilize evidence-based informatics decision-making tools to guide complex clinical testing, interpretation, and recommendation for diagnosis and therapy to improve health care.

Their objectives are to:

- Enhance patient care
- Improve test selection
- Eliminate unnecessary testing
- Decrease cost
- Reduce length of stays

In phase one of the project, coagulation experts, based on patient test results, provided reports containing diagnoses, recommended testing (if necessary) and treatment options. Phase two implemented a series of Standard Operating Procedures created by pathologist-clinicians teams using evidence-based medicine. Hematopathologists order tests based on where the patient is in the diagnosis/treatment cycle. Test results are amalgamated into a single report that includes an interpretation created using the pathologist’s expertise.

<table>
<thead>
<tr>
<th>DMT</th>
<th>Conventional Diagnostic Test Ordering and Reporting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interdisciplinary team develops evidence-based testing standards for each condition &amp; phase</td>
<td>Clinician decides which individual tests to order</td>
</tr>
<tr>
<td>Pathologist orders tests according to the standard while interpreting the test</td>
<td>Pathologist interprets results and lab generates test reports that enter the system at over a period of time</td>
</tr>
<tr>
<td>Pathologist creates comprehensive report and interpretation once all required results are available</td>
<td>Clinician decides how to use the information as reports become available</td>
</tr>
</tbody>
</table>

Diagnostic Management Team algorithms, combined with Vanderbilt University Medical Center’s advanced physician order entry and electronic medical record systems reduce costs. An initial retroactive examination showed Phase Two SOPs will eliminate more than 1,500 unnecessary tests annually with a savings of more than $1 million. Continuous development of the SOPs will likely improve those numbers. Outcomes thus far have been:

- Better patient care
- Elimination of unnecessary testing
- Reduction in errors, costs and lengths of stay
- Improved use of diagnostic expertise and physician time
MYHEALTHTEAM@VANDERBILT (MHT)
Systems-based Primary Care Model for Improved Coordination and Care

An advanced, systems-based primary care model that stratifies patients based on chronic conditions and comorbidities for improved monitoring and care through the use of personalized, evidence-based medicine, care coordination, e-visits, and other methods. MHT objectives are:

- Improve patient physiologic control for chronic conditions
- Promote wellness
- Increase quality and safety
- Improve resource allocation
- Reduce long-term payer and provider costs

The patient population is divided into high-, medium- and low-risk categories based on chronic conditions like hypertension, diabetes and heart disease. Team-based care utilizes care coordinators to improve communication between patients, primary care physicians and specialists. Evidence-based medicine is used to increase physiologic and/or clinic-related measures involving specific outcomes related to things like blood pressure, insulin use, etc. Patients are advised on preventative-care practices. Appropriate follow-up is consistently applied when necessary.

<table>
<thead>
<tr>
<th>MHT</th>
<th>Traditional Care Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stratification algorithm triggers enrollment, process intensity &amp; escalation</td>
<td>Every patient has a medical home</td>
</tr>
<tr>
<td>Inter-disciplinary team personalizes &amp; manages to care plan</td>
<td>Primary care coordinates with specialists</td>
</tr>
<tr>
<td>Process control &amp; iterative design cycles support reliability &amp; improvement</td>
<td>Transparent metrics support accountability &amp; improvement</td>
</tr>
</tbody>
</table>

During the proof of concept phase, patients in physiologic control after eight weeks exceeded 81 percent. The model appears scalable. Outcomes have included improved care, increased control of chronic conditions within the cohort, and improved communication. The next steps will focus on:

- Optimization of the steady state
- Dramatically increasing patient enrollment
- Expand to include more doctors and sites
- Financial modeling
Facilitate decision-supported, personalized drug therapy by including genetic information in patients' electronic medical records to help providers choose the right drug, at the right dose, the first time. **Objectives include:**

- Guide individualized health care
- Enhance patient/provider engagement
- Identify relevant genetic variations for implementation
- Create actionable information for point-of-care decision support

PREDICT uses an assay panel (SNP chip) to prospectively test for genotype variations, including those related to clopidogrel, warfarin, and simvastatin. Data lacking clinical relevance are ignored.

An example of how the program works: For Vanderbilt patients who consent to genotyping PREDICT tests to identify the CYP2C19 genotype congruent with FDA labeling for the widely-used antiplatelet drug clopidogrel. Patients with abnormal CYP2C19 function are poor metabolizers of clopidogrel, dramatically increasing their risk of cardiovascular events. This actionable information is saved to patient Electronic Medical Records for future use. When clopidogrel is prescribed for patients with the variant genotype, point-of-care decision support deploys to recommend modifying drug therapy (e.g., modifying the dose or drug).

<table>
<thead>
<tr>
<th>PREDICT</th>
<th>Traditional Care Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predictive algorithm triggers testing protocol</td>
<td>Clinician decides to test when making a prescribing decision</td>
</tr>
<tr>
<td>Platform assays several drug-related genotypes in one test</td>
<td>Test is specific to drug under consideration</td>
</tr>
<tr>
<td>Genotype results trigger decision support during prescribing process if relevant</td>
<td>Lab generates a test report &amp; clinician decides how to use the information</td>
</tr>
</tbody>
</table>

VUMC was the first academic medical center in the country to deliver this form of “decision-supported, personalized” drug therapy. To date, the program has tested more than 8,000 patients.
VALUE BASED CARE

*Demonstrating Value in Care Cost and Quality*

Create an accountable care delivery system using Vanderbilt as a pilot by demonstrating value through cost reduction while maintaining or improving quality for the Vanderbilt Health Plan members. Objectives for Value Based Care include:

- Achieve reduction in the growth of the Vanderbilt Health plan cost per person
- Maintain or improve patient care quality
- Personalize health care
- Leverage evidence-based practice

Value Based Care uses a multi-tiered method providing VUMC economic and quality value. The current programs include pharmacy medication, processes of care improvement, and management programs for intensive care internal disease.

The term value is applied to both the quality of care and cost of care. We provide value through better quality to reduce complications, reduce risk factors, and maintain or improve patient satisfaction. We provide value through lower cost by promoting the use of cost effective drugs determined through the use of evidence based pathways, standardizing diagnostic testing to most appropriate tests and practicing at top of license.

<table>
<thead>
<tr>
<th>Value Based Care</th>
<th>Traditional models</th>
</tr>
</thead>
<tbody>
<tr>
<td>Find drug-related cost savings while ensuring patients receive the right drugs every time thru evidence based pathways and health plan design</td>
<td>Clinician prescribed drugs, typically without cost in mind; rapid pharmaceutical advancements made it difficult for clinicians to always determine the best medication for patients</td>
</tr>
<tr>
<td>Improved processes of care reduce variation and waste</td>
<td>Episodic care</td>
</tr>
<tr>
<td>Management of high cost health plan members</td>
<td></td>
</tr>
</tbody>
</table>

In FY2011, the Value Based Care initiative resulted in a year-to-year decrease in in cost per employee in the Vanderbilt Health Plan. So far in FY2012, the health care spend was managed through lower than expected spend on specialty drugs.
MHT-Georgia Tech Modeling

Computer-Based Simulation Testing Potential MyHealthTeam@Vanderbilt Model Variations

A multi-level model designed to simulate the MyHealthTeam@Vanderbilt (MHT) care process as a foundation for performing “what-if” scenario testing. The model will look at outcomes from a variety of perspectives: patients, employers, providers, and payors. The objectives are:

- Ability to rapidly test changes via computer simulation
- Increase quality
- Decrease patient care costs
- Increase clinician productivity

Partnering with Georgia Tech, a subset of MHT participants are working to provide the necessary structure and information to allow for an agent–based model to be created that tracks individual fictional “patients” over time. These “patients” are programmed with attributes and probabilities derived from actual patient data allowing simulations to determine results of changes to the system. This way we can test a number of changes via the simulation and then incorporate the most promising ones into our actual practice.

<table>
<thead>
<tr>
<th>MHT-Georgia Tech Modeling</th>
<th>Conventional Modeling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multi-level model measuring results across four levels: society, organization, process, and people</td>
<td>Most models look at impact on one level (e.g., process) and sometimes two but not at all four</td>
</tr>
<tr>
<td>Iterative validation and calibration over time</td>
<td>Create model and test once but no regular testing to ensure model is still valid or to update over time</td>
</tr>
<tr>
<td>More detailed subsystem models can plug into the core model allowing for added complexity over time</td>
<td>Models built that encompass all the complexity without ability to add subsystems over time</td>
</tr>
</tbody>
</table>

Phase one of the model is scheduled to be complete in November 2012. We anticipate outcomes will include better, more cost effective patient care, and improved use of resources including physician time.
INTEGRATED PRESENCE
Monitoring and Control System to Provide Immediate Situational Awareness

A predictive process monitoring and control system designed to deliver consistency across patients and quickly provide clinicians with situational awareness. Later phases will integrate virtual teams that monitor multiple patients in central locations and serve as augmentation for bedside teams. The project’s objectives are:

- Aggregate specific patient data for trending
- Consolidate key EMR information
- Enhance EMR access
- Ensure adherence to patient plans
- Improve care consistency across patients
- Identify adverse patterns of care
- Enhance management of acute clinical teams
- Improve logistical management

Phase one extracts concepts from Vigilance and StarPanel to create an aggregate view of key patient data. The intent is to give clinical teams constantly updated patient information, providing situational awareness, ensuring patients receive the right care even when the providing MD or nurse has not been briefed on the case. The information will also be available remotely. The new display system will be implemented in the nine-bed burn ICU in a technical proof of concept.

<table>
<thead>
<tr>
<th>Integrated Presence</th>
<th>Conventional Patient Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple windows of data on one screen</td>
<td>Information spread across multiple machines and screens</td>
</tr>
<tr>
<td>Trending data</td>
<td>Health provider scans data to mentally establish trending</td>
</tr>
<tr>
<td>Patient plan/status against plan</td>
<td>MD and Nurse document plans their separately; required hunting for the information</td>
</tr>
<tr>
<td>Aggregate key EMR data</td>
<td>Finding specific information in the EMR requires strong understanding of StarPanel and time to navigate</td>
</tr>
</tbody>
</table>

The technical proof of concept of Integrated Presence will occur during first quarter of fiscal year 13. Assessment will take place during the proof of concept. Assessment results will drive future iterations of the project.
RIGHT DRUG FIRST TIME

Patient-Specific, Evidence-Based Drug Therapy Recommendations

A systems approach to patient care, Right Drug First Time will give clinicians patient-specific recommendations for drug therapies. Objectives include:

- Expedite Use of Evidence-Based Medicine
- Reduce Polypharmacy
- Decrease costs
- Enhance patient care
- Reduced variability

The project is currently in the design stage of development. Ultimately the system will work in several modes.

Using an indication, the system will provide step therapy options to either upgrade the therapy and/or ratchet back starting doses depending on patient-specific and evidence-based data.

- Start medications at low doses and increase to toxicity or effect
- Start Therapy w/low cost/low side effect medication and increase to higher cost/higher risk therapy if necessary

The system will review the patients’ medication lists and provide clinicians with alerts and a series of recommendations to optimize the lists (remove unnecessary drugs/revise dosing).

Using emergent and evidence-based literature the system will add (or remove) therapy options as evidence presents itself.

<table>
<thead>
<tr>
<th>Right Drug First Time</th>
<th>Conventional Pharma Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evidence-based step therapy guided by decision support</td>
<td>Based on national guidelines, but rarely included in recommendations for ordering. Provider has to &quot;know&quot; them.</td>
</tr>
<tr>
<td>Automated medlist review and recommendations for optimization</td>
<td>Manual process</td>
</tr>
<tr>
<td>Addition/Removal of therapy options as evidence presents</td>
<td>Manual process</td>
</tr>
</tbody>
</table>