PASTEUR’S QUADRANT
COUPLING KNOWLEDGE TO ACTION

JOHN R. FEUSSNER, M.D., M.P.H.
MEDICAL UNIVERSITY OF SOUTH CAROLINA

Linear model of basic research
to new technology

Basic research → Applied Research → Development → Production and operations

“APPLIED RESEARCH INVARIABLY DRIVES OUT PURE”

Vannevar Bush
Science, the Endless Frontier, 1945
White House, Executive Office
Scientific Research & Development

“We prided ourselves that the science that we were doing could not in any conceivable circumstances have any practical use. The more firmly one could make that claim, the more superior one felt.”

C.P. Snow
1964

• “The physician-scientist has a very special role both in posing relevant medical questions and in applying new knowledge to the investigation of disease and the teaching of students.”

James B. Wyngaarden
NEJM 301:1254, 1979

PASTEUR’S QUADRANT
BASIC SCIENCE AND TECHNOLOGICAL INNOVATION

Donald E. Stokes
Pasteur’s Quadrant, 1997
Quadrant Model of Scientific Research

Research is inspired by:

<table>
<thead>
<tr>
<th>Considerations of use?</th>
<th>No</th>
<th>Yes</th>
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<tbody>
<tr>
<td>Quest for fundamental understanding?</td>
<td></td>
<td></td>
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<tr>
<td>Yes</td>
<td>Pure basic research (Bohr)</td>
<td>Use-inspired basic research (Pasteur)</td>
</tr>
<tr>
<td>No</td>
<td>Pure applied research (Edison)</td>
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“A Revised Dynamic Model

Evidence Based Medicine

• Conscientious, explicit & judicious use of current best evidence in making decisions about the care of patients
• The practice of evidence-based medicine means integrating clinical expertise with clinical evidence from systematic research

Advocacy Vs. Evidence

Evidence to Action

There is not pure science and applied science but only science and the applications of science.”

Louis Pasteur 1863

The Two Translational Blocks
**EVIDENCE BASED MEDICINE AND YOU**
- Create the evidence
  - Clinician researcher
- Teach how to evaluate the evidence
  - Clinician educator
- Apply the evidence in your practice
  - Clinician
- Create systems to implement the evidence

**EVIDENCE TO ACTION**
*Proof of Concept*
- HAS ANYONE DONE THIS?
- CAN WE DO IT?

**QUERI**
*Ultimate Objective*
A national system to *translate* research discoveries and innovations into patient care and systems improvement

Feussner, Med Care 6:2000

**Integrating Research, Clinical Care and Health Policy**

**Quality Continuum**

Quality Assurance  →  Safety  →  Risk Management  →  Documentation  →  Regulatory Concern  →  Accreditation

Quality Management & Improvement  →  Research & Development Dissemination Implementation

Patient Satisfaction  →  New Clinical Standard

**TRANSLATE RESEARCH RESULTS**
- Improve Patient Outcomes
- Improve Quality of Care
- Enhance Systems Efficiency
- Inform or Create Health Policy

**Steps in the Process**
- Identify high risk/high burden conditions
- Identify best practices
- Define existing practices
- Document variation from best practices
- Identify interventions to promote best practices
- Implement interventions
- Document patient outcomes
- Document system improvements

Feussner, Med Care 6:2000
“QUERI could become the preferred paradigm for purposefully linking research and patient care, thus demonstrating concretely the direct benefit of health care research.”

Feussner, Med Care, 2000

“One of the strongest examples of synthesizing the evidence base and applying it to clinical care is offered by the VHA’s Quality Enhancement Research Initiative (QUERI)”

Crossing the Quality Chasm
A New Health System for the 21st Century
Institute of Medicine, 2001

### VA Prevention Index

<table>
<thead>
<tr>
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<tbody>
<tr>
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<td>Pneumococcal Influenza</td>
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<tr>
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<td>100%</td>
<td>53%</td>
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### IMMUNIZATION @ MUSC

- **Influenza vaccine** screening
  - Roper, 78%
  - St. Francis, 68%
  - MUHA, 70%

- **Pneumococcal vaccine** screening
  - Roper, 75%
  - St. Francis, 62%
  - MUHA, 76%
**Immunization Strategies**
- Immunization Assess & Order Sheet implemented 10/01
- Immunization Assess added to Nursing Admission Database 09/02
- Immunization Assess Sheet revised to Standing Order-- approved 12/02

**EVIDENCE BASED MEDICINE**

**What is Next?**
- Post MI medications
- Congestive heart failure treatment
- Diabetes care
- Pain management & palliative care
- Hypertension management
- HIV care

**CMS**

**Quality Information YTD 2004**
- **AMI**
  - Aspirin at arrival 99%
  - Aspirin prescribed at discharge 97%
  - ACEI for LVSD 85%
  - Beta Blocker at discharge 91%
  - Beta Blocker at arrival 99%
  - Median Time to PTCA (min) 140

**Heart Failure**
- Discharge Instructions 37%
- LVF Assessment 99%
- ACEI for LVSD 91%
- Smoking cessation 56%

**CMMS Smoking Indicator**

**MUSC & ME**

Help Your Patients Quit Smoking
Patient counseled **quit smoking** due to health risks

**smoking cessation** offered

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**Smoking Cessation Proposal**

- Physician’s document when patient’s counseled regarding smoking
- Use CHF, AMI or CAP preprinted orders consulting Respiratory Therapy
- Hospital wide policy for RT Consult – pilot on 8 East & PCU before implementation

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**Health Care Advisory Board**

- Medicare to test *pay-for-performance* bonus program (Pilot Project for 3 years)
- Medicare wants to *reward hospitals* that provide “superior care” to beneficiaries … WSJ
- Federal officials deciding if low performance hospitals should “lose a small portion of their funds” in the third year” or simply receive regular Medicare reimbursements

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**Translate Research Results**

- Introduce Research Rigor
- Improve Clinical Measures
- Capitalize on QI Initiatives
- Operationalize Research

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“Knowledge finds its *purpose* in action and action *its reason* in knowledge.”

Charles Coulston Gillispie
The Edge of Objectivity: An Essay in the History of Scientific Ideas
RESEARCH IS GOOD
RESULTS ARE BETTER.
LYNDON B. JOHNSON

EVIDENCE BASED MEDICINE
MUSC & ME

• CMMS Quality Indicators @ MUSC
  - Exceed all local performers, start NOW

• Department of Medicine Performance
  - Monitor, report, & stratify by specialty service
  - Compare new Hospitalists service to others
  - Performance metrics for house staff

EVIDENCE BASED MEDICINE

“Knowing is not enough; we must apply.
Willing is not enough; we must do.”

Goethe

For a difference to
BE a difference it must
MAKE a difference.

William James
Varieties of Religious Experience
When Alice met the Cheshire cat, she asked, “would you please tell me which way I ought to go from here?” said the cat, “that depends on where you want to get to.”

Lewis Carroll
*Alice in Wonderland*

“It would be an unsound fancy and self-contradictory to expect that things which have never yet been done can be done except by means which have never been tried.”

Francis Bacon
*The New Organon*