Bridging the Gap Between Clinicians and HTM Staff

James H. Philip MEE MD CCE, Professor of Anaesthesia, Harvard Medical School, Anesthesiologist and Medical Liaison for Anesthesia, Department of Biomedical Engineering, Brigham and Women's Hospital

Healthcare Technology Managers (HTMs), BMETs and CEs, as we used to call them, play an important role in the healthcare system. Healthcare providers, or Clinicians, are Physicians, Registered Nurses, and now, Physician's Assistants in most states. They are assisted by allied health care group members usually called therapists (e.g., Respiratory Therapists, Physical Therapists) or technologists or technicians (e.g., Anesthesia Technologist, Anesthesia Technician, Radiology Technician). Clinicians are well educated, well trained, and possibly experienced in their area of healthcare. They study anatomy, physiology, and pharmacology. They are generally not well educated or trained about their equipment, its use, care, or safety. The Healthcare Technology Manager fills that gap, as well as many other healthcare system gaps not discussed here.

For hospitalized patients, almost every clinical intervention is delivered to the patient through some form of technology. For medication safety, nurses know they must assure the right patient, medication, dose, route, time, documentation, reason, and response. For equipment safety clinicians must assure the right patient, equipment, connections, settings, response, monitoring, and documentation. Any of these can be done wrong. Even when every one of these is done right, the patient's condition may deteriorate. When this happens, there may be a question of equipment function. It is in these situations that the HTM is called to the patient's bedside to render opinion and help to the clinician using the equipment and taking care of the deteriorating patient.

In each encounter with a clinician, the HTM brings knowledge, skills, behavior, attitude, and insight to the interaction. These attributes account for the success or failure of the interaction. The clinician's memory of past interactions forms the basis for the beginning of each new interaction. The interaction itself should lead to improvement in the patient's condition based on improvement in care that is based on the clinician's new understanding or use of the equipment. Sometimes, the equipment is malfunctioning or mis-chosen, and either way must be replaced. The crucial differentiation for the HTM on site is whether the equipment is performing as it was designed and specified to perform. Once the equipment performance answer is yes the HTM takes on a new role. The HTM will use knowledge, skills, and insight to help the clinician resolve the problem and provide the best possible care for the patient.

Every one of these clinical-technical interactions should lead to other positive outcomes. It should lead to the clinician's better knowledge, skills, and understanding of the problem and the equipment that was involved. It should also lead to the clinician's greater respect for the individual HTM and the institution's HTM Department. For the HTM, the encounter should lead to a better understanding of what goes wrong and how to correct it quickly the next time it occurs. More importantly, the HTM should explore how to prevent this problem and this class of problems occurring in the future. If the institution's culture and infrastructure mandate "quick fix and hope it doesn't happen again" overall quality will never improve. If the culture and infrastructure promote safety and foster investigation, root cause analysis, and systemic correction then quality improvement should result. Once it is clear how to use the equipment properly, leaders in the HTM and Clinical Departments should implement a program to improve all of the clinicians' use of the equipment through comprehensive clinical
staff training. All the HTMs should be involved in clinical training so that they, too, understand the complex clinical-technical problems in clinical care.

At Brigham and Women’s Hospital we have a long tradition of close interaction of clinicians with the Department of Biomedical Engineering. For the nursing patient care areas there is an RN bedside technologist and an MD medical liaison. For the anesthesia care environment there is an MD-CCE anesthesiologist medical liaison. These professionals lead the effort to bridge the gap between clinicians and HTM staff.

The Anesthesia Department maintains a secure intranet and publicly available internet information source. They both provide the same educational material for anesthesia clinicians and the intranet portion also provides User Manuals for all anesthesia equipment. The public site can be reached at the address below. This site also links to as set of lectures on clinical anesthesia and anesthesia clinical equipment written for the HTM.

http://etherweb.bwh.harvard.edu/education/resources/technology_resources.php

Dr. Philip's presentation will consist of examples of bridging the gap between clinicians and HTM staff in the Department of Anesthesiology, Perioperative and Pain Medicine at Brigham and Women's Hospital.

Dr. Philip is Anesthesiologist and Director of Anesthesia Clinical Bioengineering at Brigham and Women's Hospital and Professor of Anaesthesia at Harvard Medical School. He spends one day per week as Medical Liaison for Anesthesia for the Department of Biomedical Engineering at Brigham and Women’s Hospital.

Dr. Philip holds Bachelor's and Master’s Degrees in Electrical Engineering from Cornell University and the MD degree from SUNY Syracuse. Dr. Philip is an anesthesiologist practicing Ambulatory Anesthesia at Brigham and Women's Hospital. He teaches and researches engineering the medical environment, especially anesthesia, to make it safe, effective, and affordable. He is a member of the Harvard Anesthesia Risk Management Committee and was co-author of the Harvard Anesthesia Monitoring Standard of 1984. Dr. Philip created several medical products including Perkin-Elmer Lifewatch™ CO2 Monitor, Baxter InfusOR™ IV Pump for Bolus + Infusion, Edwards Vigilance® Continuous Cardiac Output Monitor, IVAC-Carefusion Signature Pump to monitor hydraulic resistance and detect catheter infiltration, IV fluid pressure infuser, and Gas Man® computer simulation of inhaled anesthetics, distributed by, Med Man Simulations, Inc., a nonprofit charitable organization http://www.medmansimulations.org.
Bridging the Gap Between Clinicians and HTM Staff

James H. Philip, M.E.(E.), M.D.
Anesthesiologist and Director of Bioengineering, Department of Anesthesia, Brigham and Women’s Hospital
Medical Liaison for Anesthesia, Department of Biomedical Engineering Partners HealthCare System
Associate Professor of Anaesthesia Harvard Medical School
Outline

Describe the gap between Clinicians and Equipment Technology Resources to bridge the gap
Personal Interaction to bridge the gap
Show what we get done once we have bridged gap
Why the need to bridge the gap?

Anesthesiologist training
clinical care, physiology, pharmacology

Biomedical Engineering training
technical, electronics, engineering principles

The safe and effective use of patient care technology requires understanding of both worlds
How to bridge this gap

**Motivate**
Clinicians to consider technology important
Clinicians to learn about technology

CEs/BMETs to understand clinical care and how equipment is used - “Technology Use Model”

Make CE/BMET more clinical and clinicians more technical.
Expand the boundaries of each group’s knowledge and expertise
Technology Resources for Clinicians

Technology matters website
Biomedical Engineering website
Technology Grand Rounds
Medical Liaison with Clinical and Technical expertise
Technology Matters website

Intranet (password) and

Internet
http://etherweb.bwh.harvard.edu/education/resources/technology_resources.php

this address is in handout

Maintained by Anes Dept Webmasters
Technology Resources

Contact: Dr. James Philip

Anesthesia Delivery Systems (ADSs) Clinical:

Anesthesia Intro for non-clinician colleagues (6MB)

Fire Safety for All Anesthesia Delivery Systems:
Fire Safety Circuit and Mask (420K)
Anesthesia Machine Alarm Settings for Fire Safety Circuit and Mask (2MB)

General:
Technology Topics 2007 (30K)
Technology Topics 2007 Summary (13K)
Technology Topics 2007 Slides (2.5MB)
New ADS Text 2010 (6.1MB)
New ADS Slides 2010 (3.3MB)
New ADS Workshop ASA 2013 (3.5MB)
Anesthesia Machine Use and Pre-use Check Slides (75MB)
Anes Machine Intro 2011 (2.4MB)
Peak vs Plateau Pressure 2008 (32MB)

Pre-Use Check for ADSs:
Aestiva Pre-use Check (26K)
Modulus 2 Pre-use Check (26K)
Fabius Pre-use Check (34K)
More

Miscellaneous Equipment
- Skytron 3600B UltraSlide OR Table Lecture 2009 (2MB)

Clinical Technology Cases and Lectures from Clinical Conferences and Elsewhere:
- What Our Gas Monitors Teach Us, October 2004 (32MB)
- Fabius Loose Vaporizer, December 2004 (1MB)
- Ohmeda Mod 2 ADS Failures, October 2002 (5MB)
- Anes Equip Probs, July 2003 (5MB)
- Technology Topics, August 2005 (6MB)
- Fabius Low FGF Alarm, November 2005 (4MB)
- Anesthesia Machine Observations...while giving breaks at BWH, July 27, 2007 (4MB)
- Clinical Case - S-T Changes, Sept 2007 (600K)
- Reservoir Bag Physics, 2001 (6MB)
- Arterial Pressure Measurement and Errors (11MB)

Anesthesia Technology Links:
- Virtual Anesthesia Machine, University of Florida
- Partners and BWH Biomedical Engineering
- Gas Man
- Capnography
- ASA Standards, Guidelines and Statements
More

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- Gas Man
- Capnography
- ASA Standards, Guidelines and Statements
Monitors

Specific ADSs:
(For User Manuals, please see the private version of this page on our Intranet)
Draeger Fabius
   Fabius Auto Set Airway Pressure (500K)
   Fabius Orientation 1 (Philip) (20MB)
   Fabius Orientation 2 (Bradish) (32MB)
   Fabius Pre-use Check (33K)
   Fabius Virtual Anesthesia Machine

GE (GE-Datex-Ohmeda) Modulus 2+
   Ohmeda Modulus 2 Pre-use Check (26K)

GE Aestiva
   Ohmeda Aestiva Pre-use Check (26K)

GE Aisys
   Aisys Bootup Sequence: Video
   Aisys Ventilation Modes (63MB)

Monitors:

ASA Basic Anesthetic Monitoring Standard 2011 (21K)
BWH Anesthesia Monitoring - Outline (10K)
BWH Anesthesia Monitoring - Lecture (4MB)

GEMS IT Physiologic Monitors
Solar 8000
   Solar 8000 Alarm Defaults (75K)

DASH
   Dash Alarm Defaults (75K)
and other equipment
Academic Year: 2014-2015

Biomedical Engineers

Lou Abber, BMET
Matthew Beagan, BMET
Claire Cabral, Sr BMET
Man Ching Cheung, CE
Ernst Daniel, CE
Steven Hicks, BMET
Eddie Holmes, (CPD)
Ross Jacques, Sr BMET
Anthony Johnson, BMET
Daniel Kacher, CE
Prakhar Kapoor, CE
Mark Kovac, BMET
Sivaprasan Nelluruvalappil, BMET
James Philip, ME(E), MD
Emerson Priest, BMET
Trevor Roberts, CE
Biomedical Engineering Website

Audience is BMETs/CEs
Technical Resources
Manuals
Equipment Management Plans
Training Materials
  Certification information for CEs/BMETs
  Anesthesia Lecture series
Unannounced JCAHO visit at MGH
No problems with medical equipment were noted during the survey the week of Dec. 11th.

Staff recognized for years of service
Click here for details and photos.

Department members receive PIE Awards
Click here for details on the 2006 Partners in Excellence Awards.

PBME Patient Safety Awards presented
Two staff members receive the 2006 Patient Safety Award. Click here for photos and more info.

Staffing changes at both hospitals
Click here to find out more.

Partners Biomedical Engineering (PBME)
is comprised of the Departments of Biomedical Engineering at Massachusetts General Hospital and Brigham and Women's Hospital and also serves the biomedical engineering needs at... more

Send comments regarding the website to: ehall@partners.org

This page was last updated on 2/14/2007
BWH Anesthesia Lecture Series
by James H. Philip ME(E), MD, CCE

Click on a topic below to open a lecture in PowerPoint.

To navigate through the slides, use either the Page Up and Page Down buttons or left and right arrow buttons on your computer keyboard. To show the full screen, right click on the slide and select Full Screen. To see an outline of text and pictures, right click and choose Edit Slides. Use the Back button on the browser to return to this list of lectures.

Clinical Anesthesia for the CE and BMET

Monitoring as a Science

The Anesthesia Delivery System

Inhalation Anesthesia Kinetics

Closed Circuit Anesthesia

Regional Anesthesia

Anesthesia Drugs

Vaporizers for CEs and BMETs

Inhaled Agents and Vaporizers

Agent Monitoring

Cardiopulmonary System

Trans-Esophageal Echocardiograph (TEE) Monitoring

Continuous Cardiac Output Monitoring

Links:
BWH Clinical Anesthesia Department Technical Information
2007
Biomedical Engineering & Anesthesia Collaboration

Medical Liaison communicates
Technology Clinical Conferences
with Biomed involvement
New resident training - Biomed component
Technology Elective Resident
– learns, teaches, does a project
Technology Teaching Block for clinicians q yr
2014
Biomedical Engineering & Anesthesia Collaboration

Everyone communicates
CEs, BMETs, All Anesthesia Clinicians
Technology Elective Resident teaching Technology in OR
Hospital Demographics

Brigham and Women’s Hospital
779-bed nonprofit teaching affiliate of Harvard Medical School
Founded Partners HealthCare System with MGH
Consistently in US News and World Top 10
OR Control Desk
<table>
<thead>
<tr>
<th>Date/Time</th>
<th>Procedure Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>08:00</td>
<td>PROCEDURE 1</td>
</tr>
<tr>
<td>09:00</td>
<td>PROCEDURE 2</td>
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<td>23:00</td>
<td>PROCEDURE 16</td>
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*Note: This is a sample schedule for demonstration purposes.*
Projected Schedule Mid-day
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<thead>
<tr>
<th>Color</th>
<th>Description</th>
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<tbody>
<tr>
<td>Purple</td>
<td>Case Scheduled</td>
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<tr>
<td>Grey</td>
<td>Room ready for patient</td>
</tr>
<tr>
<td>Green</td>
<td>Patient in room</td>
</tr>
<tr>
<td>Red</td>
<td>Surgery in progress</td>
</tr>
<tr>
<td>Teal</td>
<td>Surgery closing</td>
</tr>
<tr>
<td>Blue[dark]</td>
<td>Surgery ended</td>
</tr>
<tr>
<td>Yellow</td>
<td>Patient out of room</td>
</tr>
<tr>
<td>Brown</td>
<td>Case delayed</td>
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</table>
Screens everywhere (e.g., pre-op)
<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
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<tbody>
<tr>
<td>Patient</td>
<td>0527/1168</td>
</tr>
<tr>
<td>Birthdate</td>
<td>02/01/56, 33 M</td>
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<tr>
<td>Surgeon</td>
<td>BLACK, PETER MCLAREN, M.D., PH.D.</td>
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<tr>
<td>Surgeon 2</td>
<td></td>
</tr>
<tr>
<td>Location</td>
<td>Surgical Liaison — Check in time 0615</td>
</tr>
<tr>
<td>Original Schedule</td>
<td>Start: 07:30, End: 18:00, Duration: 02:30</td>
</tr>
<tr>
<td>OR date</td>
<td>10/29/93</td>
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<tr>
<td>OR time</td>
<td>07:30, Duration: 02:30</td>
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<tr>
<td>Room</td>
<td>ROOM4</td>
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<tr>
<td>Set-up Begin</td>
<td>07:00</td>
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<tr>
<td>Room Ready</td>
<td>07:20</td>
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<tr>
<td>Patient in</td>
<td></td>
</tr>
<tr>
<td>Induction complete</td>
<td></td>
</tr>
<tr>
<td>Incision made</td>
<td></td>
</tr>
<tr>
<td>Procedure Text</td>
<td>EXCISION MASSES LT. FRONTAL SCALP</td>
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<tr>
<td></td>
<td>BONE &amp; RT. HIP</td>
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Screen to enter or view data
Anesthesia Department Statistics

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<td>Faculty Anesthesiologists</td>
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<td>173</td>
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<tr>
<td>Faculty Anesthesiologist FTEs</td>
<td>70</td>
<td>126</td>
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<tr>
<td>Residents</td>
<td>92</td>
<td>102</td>
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<tr>
<td>Fellows</td>
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<td>33</td>
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<tr>
<td>CRNAs</td>
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<tr>
<td>SRNAs</td>
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<td>Clinicians</td>
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<td>ORs</td>
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<td>OOORs daily</td>
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<td>OB OR</td>
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<td>1</td>
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<td>D&amp;E</td>
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<tr>
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<tr>
<td>Faulkner</td>
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<tr>
<td>850 Boylston – Pain and 1 Endo</td>
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<td>10</td>
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<tr>
<td>Anesthetizing Locations</td>
<td>57</td>
<td>115</td>
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<tr>
<td>Cases performed annually</td>
<td>68,000</td>
<td>117,000</td>
</tr>
<tr>
<td>Year</td>
<td>Infusion Technology</td>
<td>OR</td>
</tr>
<tr>
<td>------</td>
<td>---------------------</td>
<td>----</td>
</tr>
<tr>
<td>2007</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>2014</td>
<td>5</td>
<td>10</td>
</tr>
</tbody>
</table>
Why the need to bridge the gap?
Examples
What do I do about this?
Bridging the Gap

Know your stuff
Know what you don’t know
Learn what you don’t know
Be prepared to learn
Be prepared to teach
Bi-directional Bridging the Gap

Professionalism
Communication
Respect
Good behavior is good behavior

Boy Scout Law
Trustworthy,
Loyal,
Helpful,
Friendly,
Courteous,
Kind,
Obedient,
Cheerful,
Thrifty,
Brave,
Clean,
and Reverent.

Girl Scout Law
I will do my best to be
honest
fair,
friendly,
helpful,
considerate,
caring,
courageous,
strong,
responsible for what I say and do,
respect myself and others,
respect authority,
use resources wisely,
make the world a better place

Boy Scout Motto
Be prepared
### Peer/Self Assessment: Interpersonal Attributes

<table>
<thead>
<tr>
<th>Displays insensitivity and lack of understanding for others’ views.</th>
<th>Seeks to understand others’ views.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lacks appropriate respect, compassion and empathy.</td>
<td>Always demonstrates respect, compassion and empathy.</td>
</tr>
<tr>
<td>Doesn’t share information or resources; impatient when others are slow to learn; hinders group process; tends to dominate the group.</td>
<td>Shares information or resources; truly helps others learn; contributes to the group process; able to defer to the group’s needs.</td>
</tr>
<tr>
<td>Does not seek feedback; defensive or fails to respond to feedback.</td>
<td>Asks classmates and professors for feedback and then puts suggestions to good use.</td>
</tr>
<tr>
<td>Pleases superiors while undermining peers; untrustworthy.</td>
<td>Presents him/herself consistently to superiors and peers; trustworthy.</td>
</tr>
<tr>
<td>Hides his/her own mistakes; deceptive.</td>
<td>Admits and corrects his/her own mistakes; truthful.</td>
</tr>
</tbody>
</table>

Ronald Epstein MD, Dean U of Rochester Medical Center
<table>
<thead>
<tr>
<th>#</th>
<th>BWH</th>
<th>BME</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
<tr>
<td>9</td>
<td>7</td>
<td>14</td>
</tr>
</tbody>
</table>

| Count | 9   | 9   |
| Max   | 35  | 31  |
| Min   | 2   | 2   |
| Mean  | 12.11 | 11.78 |
| St Dev| 9.75 | 8.36 |
Some discover HTM is not for them

Evelyn Fan was a CE at BWH
2009 she resigned
Graduated from Nursing School
Happy as an RN at MGH
Reasons for leaving

Not satisfied
Too much pressure to do SM and not enough time to analyze
What, where, when, why and by whom
And solve the underlying problem
Managers should change the pressure direction
Reasons for staying

Job satisfaction
Like being treated as a professional colleague
Feeling good about helping the health care process
Thank you

Jphilip@partners.org