Application of Evidence-based Decision-making to Purchasing of an Imaging System

Matthew D. Mitchell, PhD; Craig A. Umscheid, MD, MSCE.

www.uphs.upenn.edu/cep

SIGNIFICANCE OF THIS WORK:

Once the attributes were rated and we had evalu-
ated the relative importance of system attributes.

SITUATION:

Penn Presbyterian Medical Center (PPMC) is the cardio-
vascular specialty hospital of the University of Penn-
sylvania Health System.

The interventional cardiology suite at PPMC includes four catheterization laboratories, the oldest of
which was installed in 1992 and upgraded in 2000.

The purpose of this investigation was to use evidence-based practice techniques to select a new
imaging system to replace the 1992 system.

STEP 1: UNDERSTAND THE TECHNOLOGY

Why? To communicate effectively with clients and have more credibility in their eyes.

TA organizations are largely made up of persons with
expertise in epidemiology and research methods.

We included a diagnostic imaging specialist in the
team preparing this report.

We acquired system brochures and other material
from each of the manufacturers.

We identified key technical specifications and learned
how the different manufacturer's products differed
from each other.

STEP 2: DEFINE THE ISSUE

Why? Because local factors like case mix and equipment compatibility could affect the
relative importance of system attributes.

We met with small groups of catheter-
ization lab personnel, including the division director, the lab manager,
the director of clinical engineering, and the
cardiologists who use the facility.

We learned about the history of the lab and its equipment and how pro-
dures were scheduled and performed.

We limited suppliers under considera-
tion to ones that have previously sup-
pplied cardiac imaging labs to UPenn.

STEP 3: IDENTIFY SYSTEM ATTRIBUTES

Why? This is the heart of the evidence-based decision process:
to specify the questions that we will acquire evidence to answer.

From the meetings, the manufacturers’
specifications, and the literature, we
compiled a preliminary list of system attributes.

Attributes were grouped into categories, with 3 to 8 attributes in each category.

STEP 4: REVIEW THE PUBLISHED LITERATURE

Why? Because other organizations may have already done much of the work.

We searched the published literature for guidelines and standards applying to these devices.

Clinical trials comparing different imaging systems from different manufacturers are
rarely peer-reviewed literature.

The most recent standards from the American College of Radiology were published in 2001.

All systems being considered for purchase met those standards.

We did find a evaluation of catheterization lab equipment published in 2005 and 2006 by the
Device Evaluation Service of the UK National Health Service. The NHS evaluation also
included a survey, in which users of each system were asked to subjectively rate aspects of
the equipment such as ease of use and image quality.

STEP 5: OBSERVE CATHETERIZATION PROCEDURES

Why? Many of the attributes relate to how real-life users interact with the device.

We observed cardiologists perform catheterization procedures on labs from
different manufacturers.

We reviewed how ergonomic and other aspects of the imaging system
affected the procedure.

The cardiologists were quite helpful, and called our attention to aspects of
the procedure that were helped or hindered by specific features of the
imaging system.

We made note of times when the
clinicians had to interrupt the
procedure.

We also observed the cardiologists
review images after completion of the
procedure.

In some cases of use, we counted the
number of steps required to carry
out procedures using different equipment.

STEP 6: INTERVIEW LAB MANAGERS

Why? Because they have important lab management
evidence about the performance of the system in the
context of their institution.

We spoke to the technical managers at each of
the hospital where we observed procedures.

Interview topics included the service history of their
imaging system, system reliability, and responsiveness
of field service personnel.

This allowed us to see whether problems experienced at
PPMC were unique to an institution, characteristic of
an X-ray device, or typical of all catheterization systems.

We also obtained the detailed service records of the
imaging and PACS systems at PPMC.

With this information we determined what aspect of the
equipment the lab manager thought was the
most important to consider.

The cardiology division director, lab
manager, and director of clinical engineering
were interviewed for this purpose.

We learned about the number of service issues that were
resolved on the day of or day after a service call.

We learned about common components
that were replaced.

We also learned about the
training provided to users.

The lab director at Burdette is very
pleased with the performance of the Philips system and the responsive
service that is provided.  She was
particularly satisfied with the user support web site and with the
prompt response to telephone calls.

The lab director at Burdette-Tomlin Memorial Hospital (Cape May, NJ) was
observed.  This system is used for both interventional radiology and cardiac
catheterization procedures, so it is equipped with a
fluoroscopy system.

We learned about the
functionality of the system.

The system has a variety of features that were specifically designed for this
hospital.

The cardiologists were quite helpful, and called our attention to aspects of
the procedure that were helped or hindered by specific features of the
imaging system.

We identified key technical specifications and learned
how the different manufacturer's products differed
from each other.

We observed the cardiologists
perform catheterization procedures on labs from
different manufacturers.

We reviewed how ergonomic and other aspects of the imaging system
affected the procedure.

The cardiologists were quite helpful, and called our attention to aspects of
the procedure that were helped or hindered by specific features of the
imaging system.

We made note of times when the
clinicians had to interrupt the
procedure.

We also observed the cardiologists
review images after completion of the
procedure.

In some cases of use, we counted the
number of steps required to carry
out procedures using different equipment.

STEP 7: EVALUATE SYSTEMS BY ATTRIBUTE AND PREPARE REPORT

Why? To not only document the results of our analysis, but also to document methods.

Once the attributes were rated and we had evalu-
edated the relative importance of system attributes.

To help direct readers to areas where systems
varied, we applied a light shading to table cells
where one system’s performance was somewhat inferior to the others, and a heavy shading to
cells where one system’s performance was markedly inferior.

By documenting our methods as well as the
results of the investigation, the executives were
assured that the findings were based on sound evidence rather than the subjective preferences
of the cardiologists.

STEP 8: REVIEW REPORT AND RATINGS WITH USERS

Why? To prioritize system attributes as decision criteria, and to make sure the report is
free from errors in our understanding of the attributes and their significance.

After the draft table were completed, we met with the PPMC cardiologists and lab managers.

The committee went through each of the attribute lists and rated each attribute’s importance as
high,” “medium,” or “low.” These ratings were assigned in a blinded manner, before the
committee members saw how each system performed on the respective attributes.

Ratings were discussed by the participants until consensus was reached on each.

The clinical expert also reviewed each of the tables as any errors or omissions could be corrected.

This was necessary because we could not observe every clinician and see each system function in
all kinds of clinical situations.

OUR FINDINGS IN THIS CASE:

Because the PPMC cardiologists perform procedures by themselves, without a fellow or resident
assisting in the procedure, the ability to pair (shift views) from groin to heart was more important for
this hospital than for other hospitals in our system.

Some of the problems reported by the cardiologists and the lab managers stemmed from the fact
that the cardiology PACS system at the hospital was obsolete and did not conform to current SCOM
interoperability standards.  Thus we recommended that a modern PACS be acquired too.

We concluded that the cardiologists would like to
select different hardware options for the equipment purchased for PPMC than was selected for the other affiliated hospitals.

For instance, with device “2,” specifying a ceiling-mounted C-arm instead of a floor-mounted C-arm would allow
pausing from groin to heart.

STEP 9: REPORT THE FINDINGS

Why? To prioritize system attributes as decision criteria, and to make sure the report is
free from errors in our understanding of the attributes and their significance.

After the draft table were completed, we met with the PPMC cardiologists and lab managers.

The committee went through each of the attribute lists and rated each attribute’s importance as
high,” “medium,” or “low.” These ratings were assigned in a blinded manner, before the
committee members saw how each system performed on the respective attributes.

Ratings were discussed by the participants until consensus was reached on each.

The clinical expert also reviewed each of the tables as any errors or omissions could be corrected.

This was necessary because we could not observe every clinician and see each system function in
all kinds of clinical situations.

CONCLUSIONS:

• Principles of evidence-based medicine can be applied to decisions outside the
usual practice of technology assessment.

• Criteria to inform the selection of a specific medical device vary from institution
to institution.

• Evaluating devices in light of user preferences and under the specific characteristics where they will be used will facilitate discovery of important differences that may affect decision-making.

• Including physicians and other device users in the technology assessment process not only improves the results of the assessment, but yields important insights into the attributes on which decisions should be based.

• Evidence-based practice centers can contribute to better purchasing decisions.