2023 CCE Written Exam Review Webinar Series

August 9, 2023, through October 11, 2023
Session #2: Service Delivery Management 2

August 16, 2023
Faculty: J. Tobey Clark, CCE, FACCE, AAMIF, SASHE
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About the host/moderator

• Alan Lipschultz is President of HealthCare Technology Consulting based in Maryland, primarily consulting as an expert witness in legal cases. He is a registered Professional Engineer (PE), Certified in Clinical Engineering (CCE), Certified Safety Professional (CSP), Certified Professional in Patient Safety (CPPS), Fellow in the American College of Clinical Engineering (FACCE), and an AAMI Fellow.

• From 1989 to 2011, Alan was the director of Clinical Engineering @ Christiana Care Heath System in Delaware. He received his Master’s Degree in Health Care Technology from Washington University, St. Louis in 1973
Logistics

❖ All attendees have their microphones muted during the presentation.
❖ Questions to the faculty must be submitted via the “Q&A” feature in Zoom at any time. They will be addressed at the Q&A portion.
❖ If there is any urgent issue, please use the “chat” feature to communicate with the host/moderator.
❖ Please remember to complete the webinar evaluation after attending. A link will be provided at the end.
About the faculty

J. Tobey Clark, BSBME, MSEE, CCE, CHTM, FACCE, AAMIF, SASHE

- **J. Tobey Clark**, Co-Director of the World Health Organization Collaborating Center for Health Technology Management at Technical Services Partnership (TSP), University of Vermont (UVM) and serves as a consultant for the Pan American Health Organization. Following 12 years as a biomedical/clinical engineer, he served as Director of TSP from 1985-2017. Tobey is also a part-time Lecturer in both Electrical & Biomedical Engineering and Biomedical and Health Sciences.

- Tobey is the 2017 ACCE Lifetime Achievement award winner. In 2009, he received the 2009 AAMI/ACCE Robert Morris Humanitarian Award and became a Fellow of the American College of Clinical Engineering. He also received the 2002 AAMI Biomedical/Clinical Engineering Career Achievement Award.
Learning Objectives

Service Delivery Management 2

• Service Management – Contracts/Other Payment Options
• Maintenance Software (CMMS) Administration
• Parts/Supplies Purchase and/or Inventory Management
• Technical Library / Service Manuals Management
A jury in Philadelphia USA awarded a family $78.5 million on behalf of a child who suffered severe brain damage as a result of a delayed cesarean section.

The ultrasound imaging unit initially diagnosed the fetus as dead. This misdiagnosis delayed the C-section for 81 minutes.

There was no documentation that the ultrasound machine had been calibrated or maintained for 10 years, whereas the manual indicates that annual maintenance was necessary.

The hospital was found liable.

Managing Your Medical Equipment Maintenance Program

Scope of Medical Equipment

- Level 1 - stretchers, beds, wheelchairs
- Level 2 - physiologic monitors, IV pumps, electrosurgical units
- Level 3 - general radiology, lasers, anesthesia
- Level 4 - CT, MRI, PACS, PET
Level 1 or “low-tech” equipment
- Usually, in-house program

Level 2 or “medium-level” equipment
- Usually, in-house program

Level 3 & 4 or “high-tech equipment
- Usually, a mix of manufacturer, independent service organization and in-house
Breakdown of Medical Equipment Maintenance Expenses

Expenditures by Percent (% Total)

- Clinical Lab: 49%
- Imaging: 13%
- Surgery: 11%
- Critical Care: 8%
- General: 19%
Quick Question

RANK DOWNTIME COSTS FOR THE FOLLOWING EQUIPMENT TYPES BASED ON AVERAGE LOST REVENUES OF AN EXAM. ONE (1) IS THE HIGHEST COST, AND FOUR (4) IS THE LOWEST COST.

• CT SCAN
• X-RAY
• MRI
• NUCLEAR MEDICINE
Maintenance Payment Options
Options for Maintenance Coverage

Provider

Manufacturer service contract
  ◦ A number of options

Health system
  ◦ Department of Biomedical/Clinical Engineering

Independent service organization

Maintenance insurance

Plans

Contract, pay by the hour/parts, lease, other
What type of equipment is typically under service contract?

Percent of Devices Under Service Contract

- Imaging
- Lab
- Sterilizers
- Anes/Vent
- Dialysis
- Biomedical
Service Coverage:
Manufacturer Service Contract

ADVANTAGES
Simple to set up
Known service provider
Resources including tools & parts
Service arrangements can be built into the purchase
Typically, fast service once on-site
Upgrades can be built in
Perception of preferred status
Perception of less paperwork and management

DISADVANTAGES
Usually most expensive approach
Hidden cost due to contract exclusions
Many contracts to negotiate and manage
Locked into OEM service
No incentives for clinical staff to manage maintenance
May be point of sale contract made by Supply Chain/Purchasing
Agreement language
Limited flexibility
Difficult cancellation or automatic renewal
Service Coverage: *Independent Service Organization*

**ADVANTAGES**

- Lower rates (and less travel) lowers the cost—by up to ~25%
- Typically, local
- If local, shorter travel reduces overall downtime
- May be able to cover multiple brands or device types (specialists)

**DISADVANTAGES**

- May encounter OEM reluctance to provide support for competing ISOs
- Training & parts resources may be limited
- Quality variable
- Stability
- Reliability
Service Coverage: Maintenance Insurance

ADVANTAGES
Consolidation of financial risk can reduce the cost - by up to ~25%
Eliminating contracts in favor of T&M improves flexibility
Detailed T&M service reports create good service histories
Good budget control
Good documentation
Single contract can cover all clinical equipment

DISADVANTAGES
Requires careful management
Reimbursement may lead to cash flow delays
Claims may be rejected
Administrative effort may be significant
No incentive to control cost
Service Coverage: Time and Materials

ADVANTAGES

Best documentation
Maximum flexibility
Information allows management to understand service patterns
Enables a self-insurance risk pool

DISADVANTAGES

Difficult to predict cost
High ongoing management – including parts research and ordering
Vulnerable to expensive repairs
Service Coverage: 
*Internal CE/self-managed program*

**ADVANTAGES**

- Lower labor costs and zero travel can reduce total cost up 50%
- Faster response reduces overall down-time
- On-site/local staff to provide end user support
- Vendor-neutral technical staff to assist with replacement planning and equipment selection

**DISADVANTAGES**

- On-site staff may be diverted to other duties
- Usually staff are generalists and must obtain specialist training
- Training is expensive
- Access to documentation and parts may be limited
# SERVICE PROVIDER COMPARISON

<table>
<thead>
<tr>
<th></th>
<th>Original Equipment Manufacturer (OEM)</th>
<th>Independent Service Organization (ISO)</th>
<th>In-House</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Response Time</strong></td>
<td>Questionable: in some cases, the service personnel must come from other states</td>
<td>Reasonable: usually these groups have better local presence</td>
<td>Good: the service personnel is always in the facility</td>
</tr>
<tr>
<td><strong>Expertise</strong></td>
<td>Good: manufacturers have large R&amp;D facilities and resources</td>
<td>Reasonable: a large portion of their service personnel comes from the manufacturers</td>
<td>Variable: larger facilities can do a better job at maintaining up-to-date expertise</td>
</tr>
<tr>
<td><strong>Experience</strong></td>
<td>Good: manufacturers work on a large number of similar devices</td>
<td>Reasonable: these groups can increase their experience by supporting multiple facilities</td>
<td>Variable: there is only a limited number of similar devices to service</td>
</tr>
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<td><strong>Spare Parts</strong></td>
<td>Good: manufacturers support a large number of similar devices</td>
<td>Reasonable: these organizations share the cost of specialized purchasing groups among multiple facilities</td>
<td>Variable: larger facilities can dedicate staff to purchasing functions</td>
</tr>
<tr>
<td><strong>Training</strong></td>
<td>Good: manufacturers have adequate training facilities and resources</td>
<td>Reasonable: expensive training can be justified by supporting multiple facilities</td>
<td>Variable: expensive training is hard to justify when the number of similar devices is small</td>
</tr>
<tr>
<td><strong>Price</strong></td>
<td>High: large overhead and cost shifting (sales to service). Usually over 8% of equip. acquisition cost</td>
<td>Moderate: duplication of some hospital functions. Usually around 5% to 7% of equip. acquisition cost</td>
<td>Low: cost oriented and low overhead. Usually 4% to 6% of equip. acquisition cost</td>
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</table>
What is the typical coverage?  

*A mix*

In-house

Vendor time and materials

Service contract and/or

Managed maintenance insurance
WHAT ARE THREE STEPS TO TAKE TO MANAGE VENDORS PROVIDING SERVICE CONTRACTS ON MEDICAL EQUIPMENT?
CMEMS AND REPORTING
Computerized Medical Equipment Management Systems (CMEMS)
Basic CMEMS

Equipment Inventory
Work Order Management
Incoming Inspection/Installation
Planned maintenance (PM)
Unscheduled/Corrective Maintenance (CM)
Recalls/Alerts
Incidents
Projects
Reports
Consolidated Device History
Data Integrity

Data quality: Good data quality is mandatory for good decision making (converting data to actionable information)

Accurate and complete

Data access

Unfortunately, poor data quality is common in CE/HTM
Inventory

- Unique ID
- Manufacturer
- Model
- Type
- Serial number
- Location
- Warranty
- Purchase Date & Cost
- Maintenance
Graphic Reporting

Work Order Trends Detail By Quarter

User Error and No Problem Found Work Orders By Device Type 4/1/2011 - 6/30/2011
(Excludes Devices With Inventory Count <15)
(Excludes Devices With %NPF/Use Error <4%)
Data Analytics:

Use Case: *Equipment replacement planning*

- Mean Time Between Failures (MTBF)
- Equipment age and condition
- Service history and maintenance costs
- Manufacturer end of support date
Data Analytics:

Performance monitoring

- Downtime %
  - Hard down hours ÷ system operating hours

- Response time
  - First Response Date/Time - Request Date/Time

- Turnaround time
  - Equipment back in-service Date/Time - First Response Date/Time

- Effective hourly rate
  - Internal costs ÷ Productive hours
Prepaid Service contracts

Track in CMEMS to the asset, account etc

Fields:

- Start and end dates
- Costs
- Invoice frequency
- Equipment covered
- Detailed notes on coverage (e.g., shared, parts only, PMs, uptime guarantees, exclusions etc)
- Copy of contract
Clinical Engineering Benchmarking

DEFINITION: A measurement of the quality of an organization's policies, products, or programs, and their comparison with standard measurements, or similar measurements of its peers.

The objectives of benchmarking are to:

- determine what and where improvements are called for
- analyze how other organizations achieve their high-performance levels,
- use this information to improve performance.
Clinical Engineering Benchmark Data

Cost of service ratio (COSR)

- Annual service cost = X %

Acquisition cost
- Maintenance Cost to Acquisition Cost Ratio (COSR): 5.46% *

Staffing *

- Devices per technician: 1,087
- Hourly Cost of In-house Maintenance: $89.85 USD

Ted Cohen, Staffing Metrics: A Case Study, Biomedical Instrumentation & Technology July/August 2011

*Average of all 2010 respondents (135)
COSR Numerator

- Staff expenses
- Non-staff expenses
- Training, test equipment
- Non-staff expenses (external)
- Service contract expenses
- Vendor time and materials

Cost of Service Ratio – Benchmark

4-5% is the goal

\[
COSR = \frac{\sum \text{Annual Maintenance Costs}}{\sum \text{Equipment Acquisition Costs}}
\]

COSR Denominator

- Equipment value
  - Acquisition cost
Cost of Service Ratio (COSR) Report

Figure 1: Equipment Growth (Acquisition $) vs Service $ (and Ratio of Service $ to Acquisition $)

Ted Cohen, Staffing Metrics: A Case Study, Biomedical Instrumentation & Technology, July/August 2011
*Average of all 2010 respondents (135)
Question 3

EXAMPLE CMEMS REPORTS WERE SHOWN FOR THE AREAS OF WORK ORDER TRENDS, USE ERROR/NPF, AND COSR.

WHAT IS ANOTHER EXAMPLE OF A USEFUL REPORT FROM THE CMEMS DATABASE?

WHAT ARE THREE KEY DATA ELEMENTS THAT THE REPORT WOULD INCLUDE?
Parts
Purchasing parts and vendor services

Vendor cost and service info (stock parts, fee-for-service parts and labor and service contracts) need to be entered into CMEMS.

Processes vary a lot from healthcare delivery organization (HDO) to HDO including:

- Inside CMEMS
- Totally outside CMEMS and in other HDO Supply Chain management software (e.g. Lawson, Infor, PeopleSoft, etc.)
- Variations and mix of above based on PO cost thresholds
Stock parts

“Just-in-time” more and more common

Stock parts ONLY needed for common PM parts and supplies:

- Batteries
- Misc common hardware and electrical supplies
- PM kits that are used often (e.g., ventilators, anesthesia machines)

Common failure parts where you know the part will be used
Stock parts

Stock parts should be centrally managed within CE so all techs can access them (i.e. minimize “bench stock”)

The CMEMS should contain:

- Stock part number
- Manufacturer name and part number
- Part description
- Part location
- Quantity on hand
- Minimum re-order level
- Vendor(s) info
Service Documentation
Operator and service manual on every new equipment purchase

- PDF, online, printed, etc.
- Updates, passwords, other required attributes

Reference NFPA 99 2012

- Chapter 10 (required documentation)
Service manuals/technical library

CMEMS reference to shared local resource (e.g., pdf)
CMEMS link to manufacturer service manual website (url)
CMEMS index to manual library (paper)
PM procedure (checklist or entire procedure) entered into CMEMS
References:

Evidence-Based Maintenance of Medical Equipment: An Outcomes-Based Method of Keeping Medical Equipment Safe and Reliable, Binseng Wang, 2020

WHO Respiratory Equipment Training Over the Life Cycle


OneSource

Frank’s Hospital Workshop
References

Clinical Engineering Handbook, 2nd edition, 2019
ACCE CCE Study Guide, v12.0, 2023
Questions & Discussions

Please complete the evaluation form at: https://www.surveymonkey.com/r/2023eval-CCE

or scan the QR code: