

CLEAR TALK ABOUT SERVICE

TODAY, THE CLINICAL ENGINEERING COMMUNITY LACKS A COMMON VOCABULARY FOR MEDICAL EQUIPMENT SERVICING. IN THIS ARTICLE, WE FORMALLY PRESENT OUR NOMENCLATURE TO HELP ENGINEERS AND TECHNICIANS ASSESS THEIR SERVICE ACTIVITIES.

The Need for a Nomenclature

In the May 2007 *Health Devices*, ECRI Institute proposed the creation of a common vocabulary for describing medical equipment service activities and the findings from those activities. We called it the Universal Medical Technology Service Nomenclature, or UMTSN.

We offered that proposal because the lack of such a vocabulary has made it difficult for clinical engineers and biomedical equipment technicians to compare service activities and equipment failure data, such as by developing benchmarks. For instance, a hospital seeking to gauge the effectiveness of its clinical engineering program against programs at other facilities could be thwarted because the term “PM” (preventive maintenance) often describes somewhat different activities from one facility to another.

A standard nomenclature like the UMTSN is vital in order to create meaningful clinical

engineering indicators and benchmarks for factors such as device reliability and employee productivity. Also, the nomenclature will help in making “apples to apples” comparisons between the effectiveness and costs of a hospital’s own clinical engineering efforts (see *IN-HOUSE SERVICE*) and those of a third-party provider (see *CONTRACTED SERVICE*). And it will facilitate identifying, analyzing, filing, transferring, and communicating data associated with servicing medical equipment.

We invited readers to comment on the proposed terms and definitions and to suggest the need for additional terms. Comments were relatively minor and overall very favorable. The proposed nomenclature also received a positive response when presented at the 2007 annual conference of the Association for the Advancement of Medical Instrumentation.

We have incorporated many of the comments we received and are now formally presenting the final nomenclature.

Presenting the
Universal Medical
Technology Service
Nomenclature™
(UMTSN™)



ECRI Institute encourages the clinical engineering community to adopt the UMTSN, which will be accessible on our public Web site at www.ecri.org/umtsn. Vendors of computerized maintenance management systems (CMMSs) can obtain a free license to include the UMTSN in their programs. Please direct these licensing requests, as well as any comments and suggestions for new terms and definitions, to umtsn@ecri.org; include your name, your title, and the name of your organization. (Identifying information will not be shared or made public without permission.)

Terms and Definitions

Text marked as commentary is not part of the definitions. Terms in small capital letters are defined in this article, sometimes in an alternate form; for instance, **SERVICE** is defined, but **SERVIC-ING** is used when appropriate.

Abuse. The status assigned to a device **FAILURE** when a service representative finds damage

attributable to incorrect use (e.g., during operation, cleaning, or transport).

Acceptance inspection. A detailed **INSPECTION** performed before a device is put into use either after initial receipt (i.e., the incoming inspection of new equipment) or following other service activities (e.g., a major **REPAIR**, **MODIFICATION**, or **OVERHAUL**) as appropriate.

Acquisition cost. The total cost, including the purchase price, delivery charges, and training and installation costs, to acquire a single piece of equipment.

Comments: (1) For equipment that has annual software license fees, include the fee for the first year. (2) Do not include the cost of prepurchased software upgrades or service in the acquisition cost; prepurchased service should be treated as a contracted service cost.

Annualized failure rate. The number of **FAILURES** for a device or a group of devices (e.g., a particular model) divided by the product of the number of years being considered and

TERMINOLOGY BY CATEGORY

Maintenance/Service Activities

Acceptance inspection
Calibration
Inspection
Maintenance
Modification
Overhaul
Preventive maintenance
Repair
Service

Equipment Problems

Abuse
Annualized failure rate
Failure

Unable to duplicate
Use error

Maintenance/Service Time and Cost

Acquisition cost
Contracted service
Downtime
In-house service
Inspection time
Repair time
Response time
Time-and-materials service
Total cost of service
Vendor service

MAINTENANCE, “24 × 7” REPAIR, and all parts and software upgrades) to lesser options (e.g., parts-only service contract).

Downtime. The time that a device is not available for clinical use because of the need to perform activities such as INSPECTIONS, PREVENTIVE MAINTENANCE, and REPAIRS. Downtime is specified in hours or as a percentage. Note that it is typically calculated only over a specified “use period.” A use period is based on when a device is scheduled to be available for clinical use or when a contract’s terms specify that a device will be available. For instance, the use period might be eight hours a day for 365 days a year, or eight hours a day, five days a week for 52 weeks a year. The use period must be stated when specifying downtime.

the number of devices in use at a facility. The following are sample annualized failure rate calculations:

- ▷ A facility with 700 units of the same infusion pump model received 84 REPAIR work orders for that model during one year.

$$\begin{aligned} &84 \text{ failures}/(700 \text{ pumps} \times 1 \text{ yr}) \\ &= 0.12 \text{ failures/pump-yr} \end{aligned}$$

- ▷ For five ultrasound scanners of the same model, there were only two repair requests in three years.

$$\begin{aligned} &2 \text{ failures}/(5 \text{ scanners} \times 3 \text{ yr}) \\ &= 0.13 \text{ failures/scanner-yr} \end{aligned}$$

- ▷ A single magnetic resonance imaging (MRI) unit required nine repairs over three years.

$$\begin{aligned} &9 \text{ failures}/(1 \text{ unit} \times 3 \text{ yr}) \\ &= 3 \text{ failures/MRI unit-yr} \end{aligned}$$

Comments: (1) This approach to failure rate calculation is practical but also very basic. For example, it does not consider the age of a device or its useful life, or account for its operating time, since such information about medical devices may not be readily accessible for failure rate calculations. (2) The calculation should

be based on *all* repair work orders, including those for failures identified as UNABLE TO DUPLICATE, USE ERROR, and ABUSE, since it is not feasible to exclude such failures consistently. It is assumed that failures identified during inspection will result in a repair work order. (3) The failure rate calculation value is not expressed as a percentage because doing so would have little intuitive meaning when applied to a single device. For instance, in the MRI example above, the unit would have a failure rate of 300%.

Calibration. A procedure used to determine a device’s accuracy using test equipment whose own accuracy is appropriate and has been verified; and then, as needed, adjusting that medical device to meet the manufacturer’s specifications.

Contracted service. SERVICE provided under contract by a manufacturer or independent service organization.

Comments: (1) Within the clinical engineering community, the term “outsourced service” is sometimes used to refer to what we call “contracted service.” (2) The scope of contracted service can vary from full coverage (INSPECTION and PREVENTIVE

Comments: (1) Downtime is of greatest concern when a facility has only one or a few units of a high-demand device (such as a computed tomography or MRI scanner). (2) The use period specified in a service contract may not correspond to the time for which the facility schedules the device to be available. For a service contract with 9 a.m. to 5 p.m. coverage, if the department is open for a longer time (e.g., 8 a.m. to 8 p.m.), a FAILURE that is reported at noon and is repaired by 10 a.m. the next day counts as six hours of downtime under the contract (noon to 5 p.m. and 9 to 10 a.m.), even though 10 hours of scheduled use may be lost (noon to 8 p.m. and 8 to 10 a.m.). (3) It is often useful to specify both a short-term and a long-term downtime. For example, a service contract with 9 a.m. to 5 p.m. coverage for five days a week might include a limit of 72 hours of downtime in a year and a maximum of eight hours in any week (corresponding to about 3.5% annually and 20% weekly). (4) Downtime may be specified as scheduled (e.g., for inspection or preventive maintenance) or as unscheduled (e.g., for repair). If not otherwise specified, downtime is taken to include both categories.

Failure. The condition of not meeting intended performance or safety requirements, and/or a breach of physical integrity. A failure is corrected by REPAIR and/or CALIBRATION.

In-house service. The SERVICING of medical equipment performed by the facility's own staff.

Inspection. A procedure used to verify that the physical integrity, safety, and performance of a device meet the necessary requirements.

Comments: (1) An inspection is typically guided by a manufacturer's recommendations, the ways that the healthcare facility uses its devices, the facility's experiences SERVICING the equipment, and information from external sources when available (such as technical literature or other data sources). (2) Within the clinical engineering community, scheduled inspections are often referred to as "PMs." This terminology creates confusion between inspections and PREVENTIVE MAINTENANCE. Inspection is also referred to as "safety and performance inspection" (SPI), "performance verification," and "performance assurance."

Inspection time. The average time to perform an INSPECTION for a device or model, excluding the time spent locating

and gaining access to a device and traveling to its location.

Maintenance. A collective term comprising the following activities: ACCEPTANCE INSPECTION, CALIBRATION, INSPECTION, MODIFICATION, OVERHAULS, PREVENTIVE MAINTENANCE, and REPAIR.

Comment: MAINTENANCE and SERVICE are interchangeable terms.

Modification. The alteration of a device from its original state to improve performance, reliability, or safety, or to add new functionality. (This is distinct from restoring a device from a deteriorated state.) Examples of modifications include installing software with new functionality and adding components to a device.

Overhaul. An extensive (i.e., far exceeding routine PREVENTIVE MAINTENANCE) replacement or rebuilding of worn parts on a device to significantly extend its life.

Comment: Overhauls may be performed at a fixed interval, at intervals determined by the use of an elapsed-time meter, or as needed.

Preventive maintenance. A routine procedure used to minimize a device's risk of FAILURE and to ensure its continued proper operation. Examples of preventive maintenance tasks are lubricating, adjusting, and replacing parts as recommended by the manufacturer (e.g., batteries, O-rings).

Comments: (1) Preventive maintenance may be performed on a regular calendar schedule (e.g., annually), on a schedule based on hours of equipment use, or on an "as needed" basis. The term "as needed" here refers to tasks that are determined to be required based on observation or measurement (e.g., during INSPECTION), not based on a device's FAILURE. (2) Preventive maintenance excludes the standard operational maintenance (not defined here) that is carried out by users.

Repair. A process used to restore the physical integrity, safety, and/or performance of a device after a FAILURE.

Comment: Within the clinical engineering community, the terms "corrective maintenance" or "unscheduled maintenance" are sometimes used to refer to what we call "repair."

Repair time. The hands-on time to REPAIR a device and have it ready to be returned to use, which is usually the amount of time entered on the associated work order.

Comment: Having a device "ready to be returned to use" includes the time to verify correct operation (i.e., perform an INSPECTION).

Response time. The time from when a request for SERVICE is initiated until a service representative solves the problem (e.g., by telephone) or arrives to REPAIR a device or to remove it for repair.

Service. A collective term comprising the following activities: ACCEPTANCE INSPECTION, CALIBRATION, INSPECTION, MODIFICATION, OVERHAULS, PREVENTIVE MAINTENANCE, and REPAIR.

Comment: SERVICE and MAINTENANCE are interchangeable terms.

Time-and-materials service. SERVICE, performed by a manufacturer or independent service organization, and paid for on the basis of the costs of labor, parts and supplies, and travel time. It may be scheduled or unscheduled.

Comment: Within the clinical engineering community, the terms "demand service" and "parts and labor service" are sometimes used to refer

ALTERNATE TERMS CROSS-REFERENCED TO UMTSN

These commonly used terms have "official" equivalents within the UMTSN.

Common Terms	UMTSN
Corrective maintenance	Repair
Could not reproduce problem	Unable to duplicate
Demand service	Time-and-materials service
No problem/fault found	Unable to duplicate
Outsourced service	Contracted service
Parts and labor service	Time-and-materials service
Performance assurance	Inspection
Performance verification	Inspection
PM	Preventive maintenance (not "inspection")
Safety and performance inspection	Inspection
Unscheduled maintenance	Repair
User/operator error	Use error

to what we call “time-and-materials service.”

Total cost of service. The total SERVICE costs for a single unit or the average per-unit cost for all units of the same model; it includes IN-HOUSE SERVICE, CONTRACTED SERVICE, and TIME-AND-MATERIALS SERVICE.

Comment: Clinical engineering managers frequently compare the annual total cost of service for a unit (or category of similar units, and/or all serviced equipment) to its ACQUISITION COST.

Unable to duplicate. The status assigned to a device FAILURE when a service representative finds no problem (e.g., when equipment passes INSPECTION) following a report of failure.

Comment: Within the clinical engineering community, the term “use error” is frequently used to refer to what we

call “unable to duplicate.” But while use error is often a speculated cause of a problem that cannot be duplicated, there may be other causes, such as electrostatic discharge or an intermittent component failure.

Use error. The status assigned to a device FAILURE when a service representative finds no problem (e.g., when equipment passes INSPECTION) following a report of failure and the representative determines that the device or an accessory was used incorrectly.

Comment: Within the clinical engineering community, the terms “user/operator error,” “possible use error,” “no problem/fault found,” and “could not reproduce problem” are sometimes used to refer to what we call “use error.” However, a problem should be characterized as “use error” on a work order only if

it can be determined that the device or accessory was used incorrectly.

Vendor service. The SERVICING of medical equipment performed by staff not employed by the facility, either under a contract, on a time-and-materials basis, or under a warranty.

Comment: This term may be useful for quantifying the amount of work not performed by in-house staff and the associated total cost. **/D**

PAIN-FREE LIFTING: MAY 20 WEB CONFERENCE

Successful patient lift programs can take the stress off healthcare workers without straining a facility’s budget. With proper implementation and training, the use of patient lifts can significantly improve overall hospital safety and reduce the costs associated with on-site employee injury. ECRI Institute presents “Pain-Free Lifting: Implementing a Patient Lift Program That Won’t Hurt Your Staff or Kill Your Budget,” a live, interactive Web conference on May 20, 2009, from 1:00 to 2:30 p.m. EDT. Expert speakers from ECRI Institute and leading hospitals will provide insight on:

- ▷ How patient lifts can help reduce hospital costs
- ▷ Practical tips on securing C-suite funding for a lift program
- ▷ How to gain staff compliance with safe-lifting policies

Members of the Health Devices System, Health Devices Gold, and SELECTplus are eligible for discounted pricing. To learn more or to register for this Web conference, visit www.ecri.org/webconference, call us at (610) 825-6000, ext. 5889, or e-mail us at circulation2@ecri.org. The deadline to register is Monday, May 18.



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