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Recommended practice for a medical equipment management program

Health Care Technology Unit
ORBIS Flying Eye Hospital

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Forewords

The role of Clinical / Biomedical Engineers in the Health Care environment

Biomedical Engineering

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- Biomedical Transducers
- Biomedical Instrumentation
- Signal Processing
- Imaging Processing
- Lasers in Medicine
- Rehabilitation Engineering
- Information Systems in Medicine
- Clinical Engineering
- Tissue Engineering
- Nanotechnology
- (Pulmonary Engineering)
- Others

Professionals

- **Biomedical Engineering Technicians**
- **Biomedical Engineering Technologist**
- **Clinical Engineering Technologists**
- **Clinical Engineer**

NOTE: Sometimes the term “Biomed” is applied indistinctively to denote the technical personnel in charge of medical technology in health care facilities.

Clinical Engineering

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- “Clinical engineer is an engineer who has graduated from an accredited academic program in engineering or who is licensed as a professional engineer or engineer-in-training and is engaged in the application of scientific and technological knowledge developed through engineering education and subsequent professional experience within the health care environment in support of clinical activities.” [Joseph Bronzino’s Handbook of Biomedical Engineering]

- The clinical environment is defined as that portion of the health care system in which patient care is delivered, and clinical activities include direct patient care, research, teaching, and public service activities intended to enhance patient care.

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Management of Medical Technology

Management of Medical Technology - Rationale

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- Medical equipment is an essential part of health care.
- Appropriate management of equipment maintenance is vital for ensuring that:
  - patient safety: Medical equipment remains safe for its intended use;
  - that equipment life is maximized;
  - total lifetime costs are minimized.
- An equipment management program is required by accrediting and licensing agencies, e.g.:
  - Joint Commission International;
  - federal or state departments of health;
  - other licensing bodies.

Financial influence of clinical / biomedical engineering

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- Clinical / biomedical engineering can reduce costs significantly while improving equipment management processes, by:
  - Second-sourcing parts.
  - Eliminating full-service contract arrangements.
  - Refurbishing selected equipment to extend its useful life.
  - Evaluating equipment prior to purchase.
  - Redesigning work flow.
  - Adjusting preventive maintenance frequencies.
  - Developing centralized in-house repair services.
  - Using equipment maintenance insurance.
  - Improving use of vendor time and material repair services.

Acquisition and maintenance of patient care equipment are complicated by many factors including:

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- The sophistication of patient care equipment.
- The number of manufacturers offering similar equipment.
- Limited sources of capital equipment funding.
- Difficulties within complex healthcare organizations in setting priorities for equipment acquisition.
- Difficulties in quantifying the effects of equipment on patient outcomes.
- Lack of attention to the total cost of ownership (TCO): installation, maintenance, and operation, in addition to purchase price.
- Difficulties calculating the effect of reimbursement on capital equipment investment returns.
- The effect of mergers and consolidations.
- The need to contain costs, especially under capitated payment arrangements.

Equipment inventory, information to be included

- a unique identification number;
- the equipment manufacturer;
- the equipment model number;
- the equipment serial number;
- a description of the equipment;
- the location of the equipment (for equipment generally kept in a fixed location or moved infrequently);
- the identity of the department considered to own the equipment;
- identification of the service provider responsible for the equipment; and
- the acceptance date (month and year) of the equipment.

EQUIPMENT MANAGEMENT

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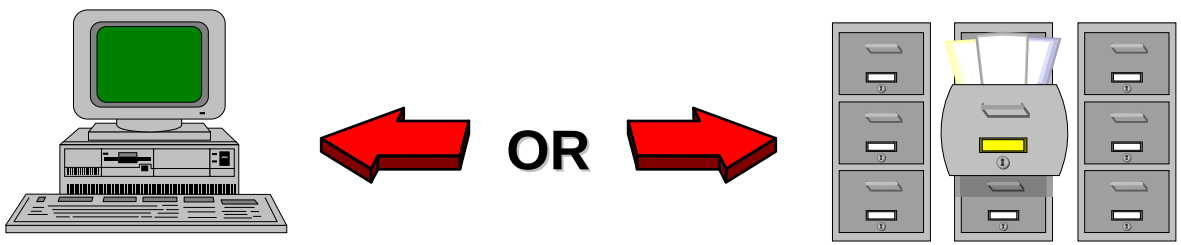
- **All Significant Medical Equipment**
  - **PAPER FILES**
  - **COMPUTER SOFTWARE**
- **Analysis**



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"In God we trust…

all the rest bring data!"

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"If you can not measure, you can not improve."

Lord Kevin

EQUIPMENT MANAGEMENT

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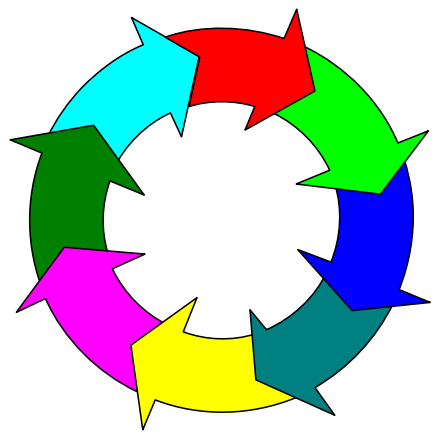
- **INCOMING INSPECTION**
- **CORRECTIVE MAINTENANCE**
- **PREVENTIVE MAINTENANCE**
- **INCIDENT & HAZARD NOTIFICATIONS**
- **TRAINING (SAFETY & USER)**
- **RETIREMENT OF EQUIPMENT**



INCOMING INSPECTION

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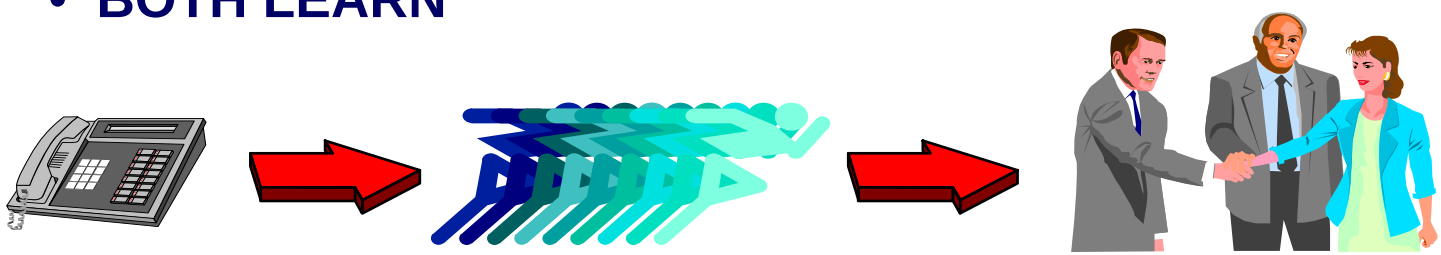
- **Everything that was Purchased is Present**
  - **Manuals, Training, Accessories**
- **Device Works 100% Correct and Safe**
- **Place on Preventive Maintenance Cycle**
- **Special Test Equipment Needed?**

CORRECTIVE MAINTENANCE

- **Doing everything appropriately, corrective maintenance is reduced:**
  - **GOOD INCOMING INSPECTION**
  - **GOOD TRAINING**
  - **GOOD PREVENTIVE MAINTENANCE**
- **Respond Swiftly**
- **Keep User Informed**
- **Document Work**
- **Test and Repair Equipment with User**
  - **BOTH LEARN**



PREVENTIVE MAINTENANCE

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- **Schedule Equipment Immediately**
  - **Only High Risk Equipment**
    - **Physical Risk**
    - **Functional Risk**
    - **Maintenance Risk**
- **Perform Maintenance ON TIME**
  - **Boring but VERY NECCESSARY**
- **Document all Failures and Think of Solutions**
- **Evaluate every Year**

PREVENTIVE MAINTENANCE

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- **Why are you doing, what you do, when you do?**
  - To reduce the risk of injury or the risk of significant adverse impact on patient care.
  - To decrease equipment life-cycle costs.
  - To avoid operational difficulties.
  - To comply with codes, standards and regulations.

Equipment inclusion criteria for PM

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- The health care organization shall develop a document – Equipment Management Plan – that describes the equipment to be included in the equipment management program.
- In identifying whether or not to include equipment in the program, the document shall describe criteria that take into account:
  - the equipment function, such as whether equipment is used for life support, routine treatment, diagnosis, monitoring, or as a convenience item;
  - the physical risks associated with the equipment during both normal use and reasonably anticipated abnormal use;
  - the maintenance requirements of the equipment; and
  - the incident history of the equipment, both within the health care organization and as reported by generally available sources outside the health care organization.
- Any additional criteria that the organization believes may be useful for proper management of the equipment may be used.

Rationale

- Not all equipment used in a health care organization will become part of the equipment management program.
- A method of clearly differentiating equipment included in the program from equipment not included in the program is essential.
- While other aspects of the equipment and its use can be helpful in determining whether to include a particular device, a minimal set of criteria that should be considered include equipment function, physical risks associated with the equipment during use, maintenance requirements, and known equipment incident history.

Equipment function

- Equipment function helps to identify the potential risks associated with equipment.

- For example, equipment used to sustain patient life generally poses a much greater risk to patients than office equipment used in an organization’s administrative areas and probably should be given higher priority for inclusion in the equipment management program.

Physical risks

- Some equipment poses a physical risk to patients or users during use.
- For example, proper use of a piece of equipment may require that a patient or user be exposed to sharp surfaces.
- Other equipment may pose an electrical shock hazard.
- As equipment wears, parts may loosen or guards may be broken. Such events can result in an injury.
- It is also important to recognize that equipment is sometimes used improperly.
- The organization should consider how a device might be used incorrectly and determine whether such use could pose an additional risk to a patient or user.

Maintenance requirements

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- Many devices have maintenance requirements.
- For example, mechanical devices, such as wheelchairs, often require periodic adjustment.
- As parts wear or loosen, significant hazards can be created.
- An equipment management program should work to ensure that these kinds of hazards are detected and corrected before an injury occurs.

Incident history

- Most health care organizations require that incidents involving actual or potential injuries be reported.
- In addition, alerts and recalls related to identified or potential hazards are published by both government agencies and private organizations.
- Because a particular health care organization’s experience with a device may be limited, the organization should take positive steps to ensure that its decisions benefit from the experience of those outside the organization.

HAZARD & INCIDENT NOTIFICATIONS

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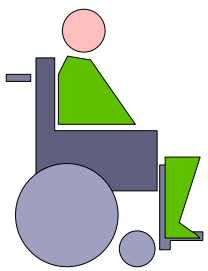
- **Hazard - Possible Human Injury**
- **Incident - Possible Equipment Damage**
- **Document ALL Incidents which Result in or Could Result in Injury**
  - **Describe Equipment or System**
  - **Describe Event**
  - **Propose Solution and Completion Time**
- **VERY Important for Liability (FUTURE)**



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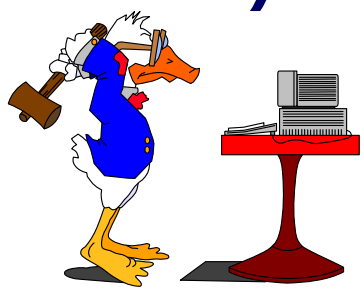

TRAINING

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- **Safety**
  - **Equipment, Electricity, Gases, Hazardous Material**
- **User Equipment Training**
- **Cross Training of Engineers**
- **Self Development on New Technology or Ideas**

RETIREMENT of EQUIPMENT

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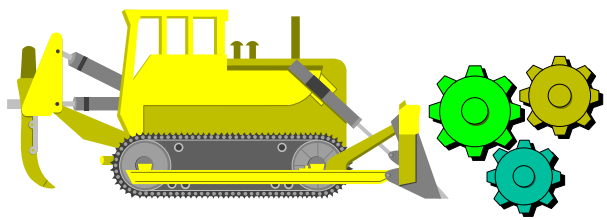
- **Broken Beyond Repair**
  - **Use for Spare Parts**
- **To Costly to Repair**
  - **Evaluation of Equipment Repairs (may be cheaper to Buy New)**
- **Transfer Old Equipment to Smaller Hospitals**
- **Provide Input into Purchase of New Equipment**



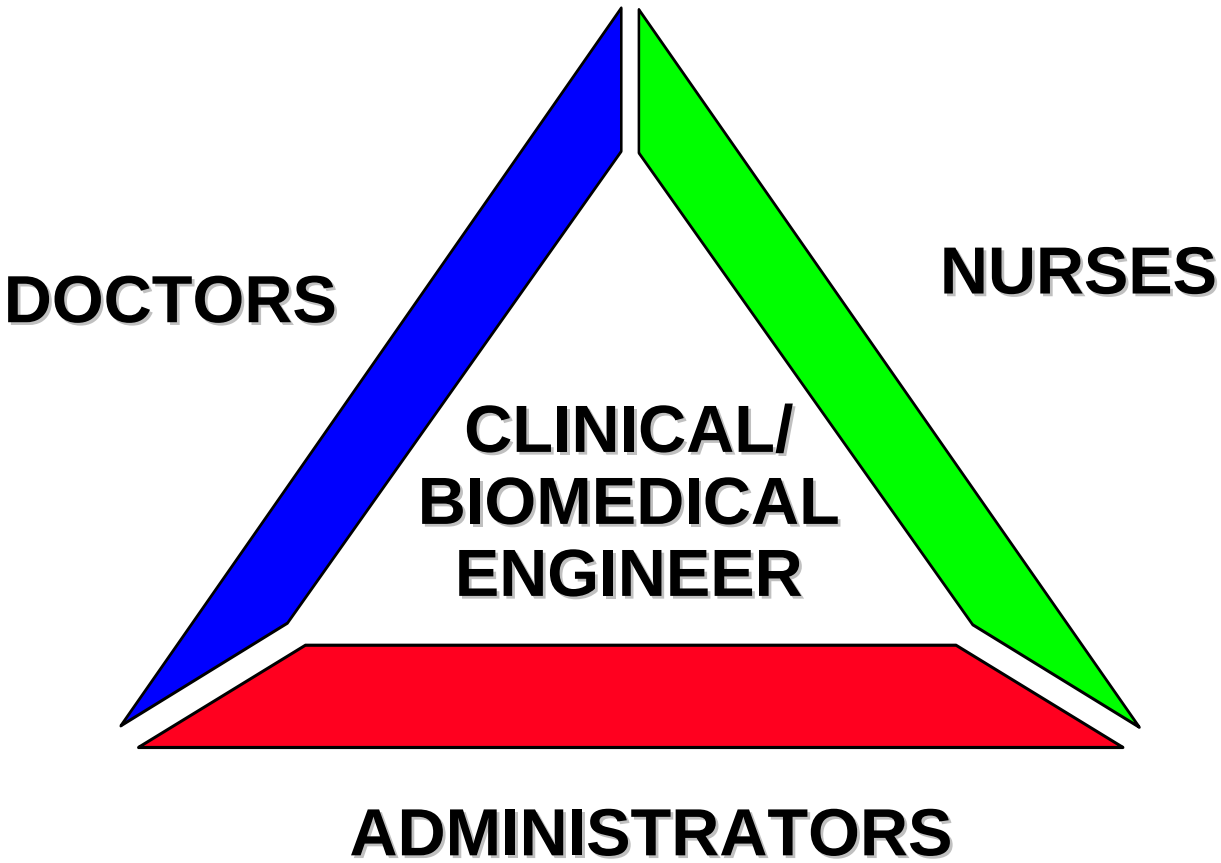
OTHER ROLES

- **Project Management**
  - **Hospital Construction**
  - **Large Equipment Acquisitions**
  - **Installation of new equipment (e.g., CT, MRI, NM, linear accelerator)**
- **Technology Assessment**
- **Design and Modification of Equipment**

Although most astute healthcare executives are aware of these issues, many are unaware of the growing clinical/biomedical engineering field and the ways in which

effective clinical / biomedical engineering programs can influence the cost of acquiring and maintaining patient care equipment.

- Making decisions in the health care environment is a multidisciplinary action.
- The Clinical / Biomedical Engineer is placed at the center of this process.



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