The Ergonomics of Patient Handling Equipment Design: Enhancing Caregiver and Patient Safety

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Defining the Science of Ergonomics (or Human Factors)

DEFINITION: *Ergos* = Work  *Nomos* = Natural Laws

Applying knowledge of the physical and mental abilities and limitations of humans to the design of systems, organizations, jobs, machines, tools and consumer products, for safe, efficient and comfortable human use

(Chapanis, 1995, Helander, 1997)

or

“Fitting the Job to the Worker”

NOT

“Fitting The Person To The Job”

![Scales diagram with Capabilities of People on one side and Demands of the Job on the other side.](image-url)
When Physical Demands Exceed Capabilities

Example: Manual Patient Handling
Result: Employee and Patient Injury
Ergonomics & JCAHO

- Environment of Care & Patient Safety
- Evaluation & Improvement of Work Environment
- Environment of Care Performance Improvement Initiative

Refer to ‘Protection Those Who Serve: Health Care Worker Safety’, JCAHO, 2005
Components of Successful Safe Patient Handling/Ergonomics Programs

- Management Commitment
- Employee Involvement
- Program Management
- Worksite Analysis
- Hazard Prevention & Control
- Education & Training
- Medical Management
Safe Patient Handling/Ergonomics Program Goals

- Reduce the incidence and severity of musculoskeletal injuries in nurses and other health care employees

- Create a culture of safety and empower health care employees to create safe working environments

- Address ergonomics and safety issues proactively

- Improve quality of care and patient safety
Safe Patient Handling/Ergonomics Programs: Interdisciplinary Approach

ERGONOMICS PROGRAM

- Employees (End-Users)
  - Patients & Families

- Outside Resources e.g. insurance carrier

- Training Personnel

- Safety, Health, EC, IC, Quality Personnel

- Labor Org.

- Management Supervisors

- Ergonomics Specialists

- Human Resources

- Health Care Providers (internal & external)

- Physical & Occupational Therapists

- Maintenance/Facilities Designers/Biomed Housekeeping

- Patients & Families
What Causes Safe Patient Handling (SPH) Programs to Fail?

- Lack of awareness of equipment available
- No program plan and project manager
- Program plan not actively implemented and evaluated
- No unit/dept. support or coach
- End user and other health care disciplines not involved
- Mismatch between equipment and task, patient and facility design
Developing a SPH Program

**DEFINE THE PROBLEM**
1. Collect baseline injury and cost data
2. Identify High Risk Units

**INVESTIGATE HAZARDS & DEVELOP SOLUTIONS**
3. Conduct Baseline Needs Assessment for each High Risk Unit
4. Conduct Risk (Job) Analysis
5. Formulate Solutions

**EVALUATE**
8. Monitor Results
9. Evaluate Overall Program
10. Continuously Improve Safety
11. Assess other Lower Risk Patient Handling Areas

**IMPLEMENT SOLUTIONS**
6. Develop implementation action plan i.e., implementation steps, time table, responsibilities, etc
7. Implement plan

10. Continuously Improve Safety
Developing a SPH Program: Choosing Solutions

Primary Solutions - Engineering Controls
Eliminate/reduce risk factor(s) through design e.g., Use patient handling equipment such as ceiling and portable floor lifts, air mats, etc)

Must match equipment with:
- patient dependency
  (physical and cognitive abilities),
- the type of lift, transfer or movement
- the number of staff available
- facility design and medical equipment
Primary Solutions: Engineering Controls

- Lift & transfer devices
  - Ceiling lifts (sling, litter, fixed or portable)
  - Portable Floor Lifts
  - Compact
  - Powered stand assist
  - Powered patient transporters
Primary Solutions: Engineering Controls

– Lateral Transfers & Repositioning
  - Air mats
  - Gurneys with transfer devices
  - Transfer boards
  - Slide boards
  - Roller boards or mats
  - Draw sheets or incontinence pads
  - Low friction mattress covers, slip sheets
  - Convertible beds and Geri chairs
Primary Solutions:
Engineering Controls

- Repositioning
  - Trapeze bar; bed blocks
  - Pelvic hip lifter
  - Electric powered height adjustable bed

- Sit to Stand position
  - Bed bars,
  - Lift chairs,
  - Seat inserts

- Ambulation
  - Assist device (inc. ceiling hoist for Gait training)
  - Gait belt
Primary Solutions: Engineering Controls

- Bathtub, Shower and Toileting Activities
  - Height adjustable and easy entry bath tubs
  - Height adjustable shower gurney
  - Bath lift
  - Shower/toileting chairs
  - Toilet Seat Risers
  - Grab bars/stand
  - Long handled tools for hygiene

- Weighing
  - Beds and lifts with scales
  - Recessed floor scales
Primary Solutions: Engineering Controls

Technological solutions are not yet available to reduce a majority of risk associated with:

- Repositioning in bed (side to side)
- Repositioning in bed (to head of bed)
- Repositioning in Chair
- Transport
- Moving heavy equipment/furniture

(Nelson, 2005)

The level of injury risk reduction varies by type of equipment
Primary Solutions: Engineering Controls

Equipment Ratios

- 2 total lifts per 17-24 patients
- 3 total lift 33-50 patients
- 6 sit to stand per 42-50 patients
- Repositioning devices 10 per 42-50 patients

(Fragala, SPH conference 2004)
Patient Handling Devices

Design Goal:
To reduce the risk of employee and patient/client injury

- Use Ergonomics Analysis Tools and Design Guidelines to assess device design to assess injury risk reduction and to ensure new hazards are not created, e.g. push/pull force data; design of controls and displays – Kodak (see resource list provided)

- Consider using Job Hazard Analysis and/or Systems Reliability Techniques to anticipate use and misuse of equipment or device and interface challenges with facility design
Patient Handling Devices
Ergo Design Features

Ground rule: Is the equipment intuitive to use & user friendly?

*Intuitive design*

- To understand the state of the system at a glance
- Minimize the need for additional information/training
- Functions clearly communicated:
  - Control type is appropriate for function/use
  - Legible and consistent labels adjacent to corresponding control
  - Comprehensible icons or pictograms
Patient Handling Devices
Ergo Design Features

**Intuitive design cont.**

- Functions clearly communicated:
  - Meets population stereotypes
  - Structured/redundant coding systems (shape, size, color)
  - Controls and displays are consistent
  - Lighting, glare and viewing distance considerations

- Provide feedback for action if correct (e.g., light comes on) or incorrect; auditory signals; other
Patient Handling Devices

Ergo Design Features

- Designed to fit 90% of the worker population
- Adjustable
- Allows for neutral working postures
- Optimal reach distance to access controls for hands and feet
- Acceptable force to activate hand/finger/foot controls
- Minimal grip force required to hold controls or equipment
Patient Handling Devices
Ergo Design Features

- Acceptable force required to maneuver, push or pull equipment (consider floor covering; entryways; slopes/uneven floors/wheel type)

- Minimal repetitive motion

- No contact stress and pinch points (for employees or patients/clients)

- Prevent accidental activation
Patient Handling Devices
General Design Considerations

- Speed
- Size & maneuverability
- Ease and range of adjustment
- Weight capacity
- Brake and steering design
- Application limitations
- Ease of cleaning (infection control)
Patient Handling Devices

General Considerations

- Type and number of accessories required, e.g. slings – disposable vs. reuse
- Resistance to water damage (especially hand controls)
- Battery requirements – weight, time to charge, life expectancy
- Distribution & care of accessories, e.g., laundering of slings
- Reimbursement of single use slings, gait belts etc
- Overall patient/client safety & comfort
- Training requirements
Facility Design Considerations

- **All Equipment**
  - Storage equipments for devices and supplies
  - Access to electrical plugs

- **Portable Lift and Transport Devices**
  - General clearance for maneuverability/
diameter of turning circle
  - Clearance through doorways/in the bathroom/elevators/in other depts.
  - Clearance of leg support under beds and chairs - width adjustment and height of leg supports
Facility Design Considerations

- **Ceiling Lifts**
  - New Construction vs. Retrofit
  - Configuration and choice of tracking and motors
  - Clearance in relation to privacy curtains, medical gases delivery systems, exam lighting, etc
  - Structural engineering inspection
  - State/county building, earthquake and fire codes
  - Installation: Contractors license and training, etc
  - Retrofit issues,
    e.g., stability of ceiling supports;
    type of anchoring system used
Patient Handling Devices Maintenance Considerations

- Access and clearance issues for facility maintenance techs
- Special tools or training needed for in–house maintenance to be conducted
- Preventative and required maintenance schedule – how often, by whom and cost
- Vendor service & inspection requirements
- Availability of replacement and spare components
Patient Handling Devices
Other Considerations

- Warranty limitations
- Product liability
- After service care (additional costs)
- Life expectancy of equipment and parts
- Supplies – delivery time
- Training provided by vendor
- Device meets FDA requirements if applicable
Patient Handling Devices: Safety Regulations

- FDA
  - Medical device act 1992
  - Medical devices user fee and modernization act of 2002
  - Import regulations

- OSHA regulations?
  - Does 1910.179 - Overhead and gantry cranes apply?
  - Load testing lifts, structural and component inspection

- Federal, State, country, city regulations re Fire & Electrical Codes
Developing a SPH Program: Choosing Solutions

Successful Programs Use a Combination of Engineering Controls & Secondary Solutions

Secondary Solutions
- Work Practice & Administrative Controls
- Policy & Procedures/Algorithms
- Personal Protective equipment
  (back belts are ineffective)
- Training (staff and patients/clients)
- Other
Patient/Resident Handling Algorithms

They are guidelines for selecting the safest equipment and handling technique based on patient characteristics.

Available at www.patientsafetycenter.com
Developing a SPH Program: Demonstrating Financial Value of Ergonomics Solutions

- Financial Benefits of Solution(s)
  - Direct cost of injuries
  - Indirect injury costs
  - Other costs such as cost of replacing injured employee; turnover costs

- Cost of Solution(s)
  - Direct Equipment costs
  - Installation
  - Structural expense
  - Maintenance
  - Training time
  - Equipment supplies
  - Life of Equipment
  - Supply loss or theft
Implementing Solutions

Planning for Change
- Anticipating the effects of change throughout the organization
- Reducing resistance to change
  Planning, Communication, Management & Employee involvement

Remember:
‘They Way We Do Things Around Here’
Implementing Solutions

- Must have a plan (who, where, when, how, cost)
- Equipment Fairs – good for general awareness
- Trials; mock-ups in house but NOT with patients (staff evaluate equipment for 1-2 weeks onsite & complete evaluation form)
- Ergonomics assessment
- Revised plan as needed
- Implement on full scale after careful planning & obtaining management, staff & facilities commitment
Evaluating Solutions

Goal: Ongoing process to determine the relevance, progress, efficiency, effectiveness, and impact of ergonomic activities.

- Is equipment being used?
- Is the problem (risk factors) resolved or reduced to an acceptable level?
- Talk with people -- how do they feel about it?
- Was there resistance to change & why?
- Did the solution(s) cause new problems?
- Are there non-anticipated costs or benefits?
- Was the program and implementation process successful?
- Conduct patient/client and employee satisfaction surveys
Proactive Approach: Preventing Injuries and Error (Process, Product & Facility Design)

Goal:
- Incorporate Ergonomics and safety features (design for the user) at Concept stage
  Applies to Retrofit and New Building.

  Cost increases 100% + if ergonomics is considered after equipment/tool/facilities design is completed and operating

- Ergonomics and safety approval of all new equipment and devices before purchase and use

- Get End-Users involved
Designing for the User

1. Design within physical capabilities for at least a majority of users (90%)
2. Provide a good conceptual model
3. Simplify structure of tasks
4. Make things visible
5. Proper mapping
6. Provide feedback
7. Exploits the power of constraints
8. Allow for Error
9. Permit easy reversal of actions
10. Standardize when possible
11. Provide adequate training for operators

(adapted from Norman, 1988)
References & Resources

Books & Publications:


References & Resources

- Frequently Asked Questions About Portable Total Body Patient-Resident Lifts. 1999 and


References & Resources


References & Resources


- Patient Care Ergonomics Resource Guide: Safe Patient Handling and Movement. 2001 (rev 2005) and

- Products & Equipment listings – Technology Guide. Patient Safety Center of Inquiry, VHA & DOD. [www.patientsafetycenter.com/]


References & Resources

**Websites**

- Learn more about Cognitive Engineering & Error Prevention in Health Care  [http://csel.eng.ohio-state.edu/woods](http://csel.eng.ohio-state.edu/woods)
- Agency for Healthcare Quality and Research:  [www.ahrq.gov/](http://www.ahrq.gov/)
- Joint Commission on Accreditation of Healthcare Organizations  [www.jcaho.org/](http://www.jcaho.org/)
- Listserv for medical recalls  [www.fda.gov/medwatch](http://www.fda.gov/medwatch)