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## Making the Business Case for Ergonomics and Safe Patient Handling Programs

HealthCare Ergonomics Conference/GOSH 2009

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## Session Outline

- Introduction: Defining Ergonomics
- The Employer Focus: Why is Prevention of MSDs Important to Health Care Organizations?
- Are Ergonomics & Safe Patient Handling (SPH) Programs Effective: The Evidence Base?
- Then Why Do We Have to Make the Business Case?
- So What Approach Should We Take To Demonstrate the Value of Ergonomics and SPH?
- Determining the Full Value of Ergonomics/SPH Programs: Identifying and Measuring All Hidden Costs of Injuries and the Benefits of Ergonomics/SPH Programs
- Applying Economic Analysis Techniques
- Wrap Up



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## Defining Ergonomics

It's about


**Designing for the User:**

**Employees,**

**Patients,**

**Families**

**Preventing Worker Injury & Error**



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### Cognitive Capabilities

**Wayfinding**

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### Defining the Science of Ergonomics

**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"

Capabilities of People



Demands of the Job

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### When Demands Exceed Capabilities?

**Fatigue (physical & mental) which can lead to:**

**Cumulative Musculoskeletal Disorders (MSDs)**

↓

**\$\$\$ Lost: Insurance, clean-up, legal costs, fines, loss of market share, etc.**

**'Human' Error**

- A few seconds/mins time lost
- Scrapped parts/waste product
- Product defects/quality issues
- Traumatic or acute injury (to user or others)
- Death

↓

**\$\$\$ Lost: Insurance, clean-up, legal costs, fines, loss of market share, etc.**

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**When Physical and/or Cognitive Demands Exceed Capabilities?**  
**Example: Manual Patient Handling**  
**Result: Employee and Patient Injury**

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**When Physical and/or Cognitive Demands ? Exceed Capabilities**  
**Example: Tool and Equipment Use**  
**Potential For:**  
 •Employee Injury (Cumulative & Acute)  
 •Patient Injury

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**When Demands Exceed Capabilities?**  
**How Do We Obtain Balance?**

<p><b>Primary Controls:</b></p> <ol style="list-style-type: none"> <li>1. Eliminate the risk factor (s) through design</li> </ol> <p>Engineering of the:</p> <ul style="list-style-type: none"> <li>▪ Task</li> <li>▪ Tools</li> <li>▪ Equipment</li> <li>▪ Facilities</li> </ul>	<p><b>Secondary Controls:</b></p> <ol style="list-style-type: none"> <li>2. Work Practice changes</li> <li>3. Administrative - Reduce exposure of person to the job</li> <li>4. Warnings</li> <li>5. Training</li> <li>6. Personal Protective equipment</li> </ol>
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**Examples of this approach in Health Care:**  
**Bloodborne Pathogens & Needlestick Policies**

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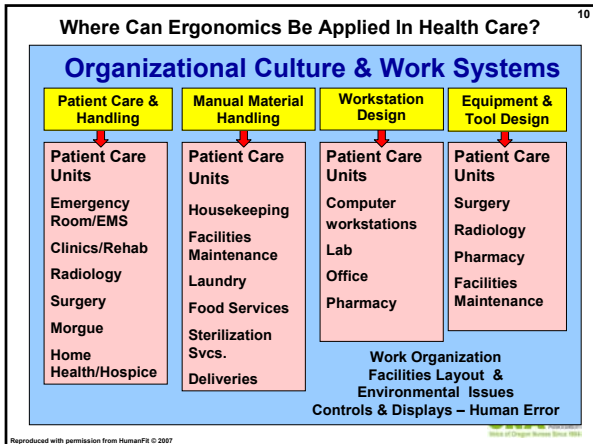
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The Employer Focus: Why is Prevention of MSDs Important to Health Care Organizations? <sup>12</sup>

- Incidence of Back Injuries & other Musculoskeletal Disorders (MSDs) in Health Care Workers
- The Cost of WRMSDs
- Aging workforce
- Nursing shortage
- Changing patient population
- Traditional methods of addressing back injuries in health care are ineffective
- Research
- Health & Safety Legislation

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## The Incidence of MSDs in Health Care 2007 ( # of cases)

- # 1 Nursing aides, orderlies & attendants  
had a MSD rate of 252 cases per 10,000  
workers, a rate more than seven times the  
national MSD average for all occupations
- # 2 Emergency Medical Personnel
- # 3 Laborers and material movers
- # 4 Light and delivery service truck drivers

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## The Incidence of MSDs in Health Care: Days Away from Work Cases 2007

- 1. Laborers and freight, stock, and material movers  
Heavy and tractor trailer truck drivers.
- 2. Nursing aides, orderlies, and attendants (12 percent  
decrease from 2006).
- 3. Construction laborers
- 4. Light or delivery service truck drivers
- 7. Janitors and cleaners, except maids &  
housekeeping cleaners (decreased from 06)
- 10. RN's ( decreased from 06) (BLS, 2008)

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## The Incidence of MSDs in Health Care

- Back injuries due to manual patient handling  
remain the #1 injury reported in health care  
(BLS, 2008)
- 31% of nurses reported having personally  
experienced a back or musculoskeletal injury  
while working as a nurse.  
(Nursing Spectrum/Johnson & Johnson 2004).
- Numbers likely underreported  
(Owen, Keene, Olson, 2002; USDOL, 1999).

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### The Incidence of MSDs in Health Care

Research on the impact of musculoskeletal injuries among nurses:

- 52 percent complain of chronic back pain:
- 12 percent of nurses "leaving for good" because of back pain as main contributory factor;
- 20% transferred to a different unit, position, or employment because of lower back pain, 12 percent considering leaving profession;
- 38 percent suffered occupational-related back pain severe enough to require leave from work; and
- 6 percent, 8 percent, and 11 percent of RNs reported even changing jobs for neck, shoulder and back problems, respectively.

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(ANA, 2005)

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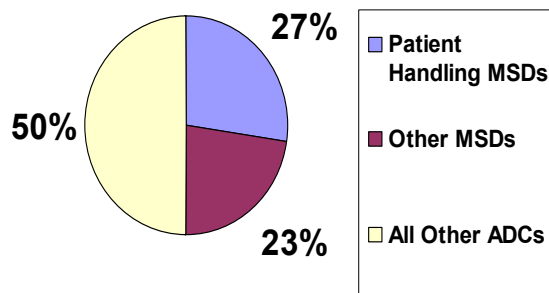
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### Accepted Disabling Claims in Oregon Health Care



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### The Incidence of Occupational MSDs Oregon

- Accepted disabling claims due to patient handling 2001- 2005
  - Health Aides 64.6%
  - Nurses 21.7%
- Accepted disabling claims due to patient handling by industry 2001- 2005
  - Nursing Facilities 28.8%
  - Hospitals 37.9
  - Residential Care 22.2%

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### The Cost of Work Related MSDs

- Healthcare worker back injuries alone – excluding other musculoskeletal disorders - are estimated to cost between \$20 and \$64 billion annually in direct and indirect costs

(Guthrie et al. 2004; Patient Safety Center of Inquiry, 2001).

- Average cost for workers' compensation and medical treatment:

#### Back Injuries

\$ 20-31,000 if surgery is required  
(Back injuries can be as high as \$80-115,000)

\$ 8-11,000 if non-surgical



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Source: OROSHA; US DOL, NCCI, Marsh, Liberty Mutual

### The Cost of Work Related MSDs from Patient Handling in Oregon

- The average patient handling injury costs \$11,055 in medical and indemnity costs over the lifetime of the claim.
- Nursing aide injuries cost \$9,062
- Registered nurse injuries cost \$16,090
- All other health care employees cost \$11,950

DCBS 2007



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### ABC Hospital Profit Margin Impact

Top 5 claims-past 4 years WRMSDs  
(patient handling related)

= \$332,351 **Direct Costs Only**

Est. profit margin 4% (operating margin)

Amount of reimbursement needed to offset the cost of these claims

$332,351 / 0.04 = \$8,308,775$

(NSC 2006)



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### Where To Get Hospital Financial Data

- For hospitals in Oregon go to:  
[http://www.oregon.gov/OHPPR/RSCH/HospitalFinancial\\_CBR.shtml](http://www.oregon.gov/OHPPR/RSCH/HospitalFinancial_CBR.shtml)
- Or purchase Oregon Health News 'State of the State Hospital Report 2008' (2007 data) published by the Oregon Health Forum  
[www.healthforum.org](http://www.healthforum.org)

For hospitals in Washington State go to  
<http://www.doh.wa.gov/ehsphl/hospdata/Financial.htm>

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### Health & Safety Legislation

- OSHA Ergonomics *Guidelines* for Nursing Homes
- Safe Patient Handling Act – TX, WA, RI, MD, MN, MS, NJ (NY, OH, HI)
- Federal legislation SPH Federal legislation reintroduced Jan 10, 2007 - referred to subcommittee on Workforce Protections.
  - HR 378 'Nurse and Patient Safety & Protection Act of 2007' can be tracked at <http://thomas.loc.gov>




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### Health & Safety Standards

- California State Ergonomics Standard
- Michigan State Ergonomics Standard (proposed)
- ANSI/HFES 100-2007 Human Factors Engineering of Computer Workstations
- ANSI Z365 Management of Work-Related Musculoskeletal Disorders (draft voluntary ergonomics standard)
- ISO Standards and Guidelines




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### Safe Patient Handling & JCAHO

- Worker Safety
- Environment of Care & Patient Safety
- Performance Monitoring of 'Environment'
- Environment of Care Performance Improvement Initiative

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### Are Ergonomics & Safe Patient Handling (SPH) Programs Effective?

- The Evidence Base
  - Also Refer to Reference Articles

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### Aims of Work Systems Ergonomics

**...for Employees & Patients**

Health  
Safety  
Comfort  
Satisfaction

Well-being of  
Employees &  
Patients

**...for Health Care Organizations**

Quality  
Performance  
Efficiency  
Flexibility  
Reg. Compliance  
Reduced Liability

Well-being of  
organization

Less absenteeism and labor turnover.  
More involvement and commitment to change.

Adapted from: Corlett, 1995

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### Components of Successful Ergonomics/SPH Programs

- Management Commitment
- Employee Involvement
- Program Management
- Worksite Analysis
- Hazard Prevention & Control
- Education & Training
- Disability Management



**Multifaceted programs are more effective  
than any single intervention.**



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### Components of Successful Ergonomics/SPH Programs

- End user involved
- Participatory programs –multidisciplinary approach
- Program that is designed to be integrated into business and practice culture over time
- The correct match between equipment and task, patient and facility design
- Use of patient handling equipment/devices or engineering controls
- No manual lifting policies
- Training on proper use of patient handling equipment/devices
- Unit-based peer leaders & program champion
- Clinical tools, such as algorithms and patient assessment protocols

Repro (Hendrick, 2002; Nelson, 2006)

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### Evidence of Effectiveness of SPH Programs

(Waters 2006)

**Reduced**

- Patient-handling workers' compensation injury rates (30-95%)
- Lost workday injury rates (up to 66%),
- Restricted workdays (up to 38%),
- Workers compensation costs by 30-75%
- The number of workers suffering from repeat injuries

(Back, 2006; Collins et al., 2004; Tiesman et al., 2003;; Nelson et al., 2003; OHIO BWC, 2002; Mugar, 2002; Garg, 1999; GAO reports 1997; Bruening, 1996; Empowering Workers, 1993; Fragala, 1993; Fragala, 1995; Fragala, 1996; Fragala & Santamaria, 1997; Logan, 1996; Perrault, 1995; Sacrificial Lamb Stance, 1999; Stensaaas, 1992; Villaneuve, 1996; Werner, 1992).



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## Evidence of Effectiveness of SPH Programs

(Waters 2006)

- Research has also shown an increase in caregiver job satisfaction, and a decrease in "unsafe" patient handling practices performed (Collins et al, 2006).
- Nurses ranked lifting equipment as the most important element in a safe lifting program (Nelson et al., 2003)
- Anecdotal reports of significant reductions in staff turnover (Joliff, 2004) and increases in quality of care (Garg, 1999).
- Participatory programs have been shown to be effective in reducing risk of MSDs in hospital work environments (Bohr PC, Evanoff BA, Wolf LD, 1997)



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**If We Have The  
Evidence Base Then  
Why Do We Need To  
Make The Business  
Case?**



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## Why Do We Need to Make the Business Case?

The Challenge of Competing Demands In Health Care

- |  |   |
|--|---|
| ▪ Patient Safety                         | ▪ Reimbursement                                   |
| ▪ Changing patient population            | ▪ Indigent care                                   |
| ▪ Shiftwork & overtime                   | ▪ JCAHO requirements                              |
| ▪ Electronic charting                    | ▪ CMS requirements                                |
| ▪ New Technology                         | ▪ Other regulatory requirements (Fed, State, etc) |
| ▪ Construction and new build             | ▪ Provider Tax (Oregon)                           |
| ▪ Infection control                      | ▪ Litigation and malpractice                      |
| ▪ Workplace violence & Incivility        | ▪ Staffing  |
| ▪ Emergency preparedness                 | ▪ Nursing recruitment & retention                 |
| ▪ Aging workforce                        | ▪ Increasing competition for customer segments    |
| ▪ Physical job demands                   |   |
| ▪ Cognitive job demands                  |   |
| ▪ Workplace stress                       |   |
| ▪ Culture & norms of professional groups |   |



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Why Do We Need to Make the Business Case?

- Health Care Culture & Organizational Culture
  - Patient Safety focus vs. employee safety
  - Lack of systems approach to services provided
  - Self sacrificing mentality



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How Do We Typically 'Sell'  
Ergonomics & SPH?

- Avoidance of work related injuries:
    - Number
    - Severity
    - Cost
- The Challenge.....*
- Poor occupational injury data collection and management systems
    - Misclassification of injuries
    - Lack of knowledge re how to analyze and use occupational injury data
    - Inadequate resources
    - Underreporting of injuries



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How Do We Typically 'Sell'  
Ergonomics & SPH?

- Health & Safety Regulations

*The Challenge.....*

- Is the 'stick' big enough to motivate change?



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**So What Approach Should We Take To  
Demonstrate the Value of Ergonomics  
and SPH?**

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.....Using the science of  
Ergonomics and a  
systematic, data driven,  
quality improvement  
process that conforms  
with the organization's  
culture, business goals  
and existing programs.

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**So What Approach Should We Take To  
Demonstrate the Value of  
Ergonomics & SPH?**

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- Understand the business (from senior management's perspective)
- Move from injury reduction to assisting to achieve organizations' business goals
- Move from overhead to bottom line
- Know and be of use to your customer
- Prioritize
- Understand how financial information is presented at your facility



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**So What Approach Should We Take To  
Demonstrate the Value of  
Ergonomics & SPH?**

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Cost-benefit information is an important influencing factor for the decision-making process but decision-making is a complex process.....

The consequence of this is that it is less important to show which costs investment in safety and health (ergonomics) brings and more important to indicate to what extent safety and health can make a contribution to the achievement of company objectives (De Greef et al, 2004)

**That is Patient Care.....**

- The cost of injuries and illness represents money taken away from patient care and families of employees



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### Determining the Full Value of Ergonomics/SPH Programs

Direct Costs Reduced (Largely Workers Comp)

Indirect Costs Reduced

Operational Losses Reduced

- Downtime
- Quality of Care/Service
- Compensating Actions
- Human Error

Operational Gains

- Client Satisfaction
- Larger Labor Pool
- Reduced Turnover (Recruitment & Retention)
- Efficiency
- Improved Patient Safety
- Regulatory Compliance

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### Determining the Full Value of Ergonomics/SPH Programs

**Identifying and Measuring All Hidden Costs of Injuries and the Benefits of Ergonomics/SPH Programs**





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### What Should We Measure?

1. Injury trends & costs:
  - Prioritized ergonomics and SPH efforts
  - Cost justification for interventions/program
  - Program management tool
  - Benchmarking
2. The costs and benefits or effects of ergonomics/SPH interventions
3. Performance of the Ergonomics/SPH program



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### What Should We Measure?

#### Lagging Measures

- Injury and severity rate (LWD, RWD cases etc) by facility and unit/dept.
- Worker comp costs
- First aid cases
- # of cases reported to insurance carrier
- Job turnover
- Overtime hours

#### Leading Measures

- General safety & ergo audits – quarterly
- Physical Symptom surveys
- Ergonomics risk analysis tools, e.g. REBA
- Employee & Patient Satisfaction Surveys
- Patient Safety related indicators



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### What Should We Measure?

#### Lagging Measures (Reactive)

- Measure of outcome such as *incidence rate*
- No direct correlation to daily activities
- Lack of ability to directly influence or control

#### Leading Measures (Proactive)

- Measure of a process variable such as *risk reduction*
- Predicts change in lagging metric
- Direct correlation to work activities
- Easy to influence or control

Measurement of SPH Programs Should Move From Reactive to Proactive as Program Matures

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### What Should We Measure?

#### Ergonomics & SPH Program Performance

- Program Management: Program activities and goals (injury and cost reduction; operational improvements; proactive design)
- Worksite Analysis: High risk jobs or tasks identified and analyzed; worksite audits
- Hazard Prevention & Control: Injury risk reduced (quantified using ergonomics analysis);
- Education & Training: Number of sessions completed & attendance; successful transfer of training
- Medical Management: Incident reporting, return to work and claims closure goals; management and injured employee services satisfaction



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### Before You Start.....

- Information to know:
  - Key measurements of success or failure in your organization and at unit/dept. level
  - Cost Justification or economic methods used at your facility
  - Specific forms or investment policy guidelines
  - Facility/Org profit margin
  - Expected return on investment (ROI) or benefit/cost ratio (time and %)
  - Capital expense policy and planning cycle
  - Supervisor signature limit

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### Before You Start.....

**Get assistance from:**

- Accounting
- Human Resources
- QA dept
- Dept. managers
- Supervisors
- Engineers
- Maintenance
- Occupational Health & Safety
- Workers comp carrier
- Other insurance carriers
- OROSHA
- ONA

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### What Do Management & Other Key Players Want To Know About Ergonomics & SPH?

- What is occupational ergonomics & SPH?
- Why is ergonomics/SPH so important?
- Do I & should I have to do anything about ergonomics/SPH?
- How much will it cost?
- What will the results be?
- What is our strategy?
- What do I need to do?

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### Identifying and Measuring All Costs and Benefits of Ergo and SPH Programs

**Costs**

- Direct Costs (largely workers' compensation)
- Indirect Costs (additional injury costs)
- Operational Losses

**Benefits**

- Operational Gains
- Related to Traumatic or Acute Injuries (Safety)
- Human Error (Engineering Design)




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### Costs

- **Direct Costs**
  - Injury data
  - Incident Rates
  - Predicting injuries
  - Workers comp costs
  - Predicting injury costs



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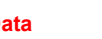
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### Direct Costs: Injury Data

Determine what you want to measure i.e., 'Ergo' related MSDs and/MSDs related to patient handling

- OSHA 300 log/Workers Comp loss run report
- # Incidents; # Lost workday cases & days lost; # Restricted Workdays cases & days lost
- Types of Cumulative MSDs & Part of Body Affected
- By Facility; by Department; by Job Title; by shift

**Don't forget First Aid and Near Miss Data**



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## Identifying 'Ergo' Related Injuries

### Group Incidents & Workers Comp Claims

#### 1. 'Ergo' related by diagnosis and/or event description

- Strains and sprains (Excludes slips, trips and falls)
- Cumulative trauma claims e.g., repetitive motion, carpal tunnel syndrome, Epicondylitis or tennis elbow, etc

#### 2. Group by causation such as:

- Patient handling related
- Materials handling related, i.e. pushing, pulling, carrying, lifting equipment, tools, etc
- Computer workstation related
- Tool Use, e.g., wringing mops in house keeping, pipetting in a lab, etc.

**Note: You may want to create a group for injuries due to combative patients**

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## Direct Costs: Injury Data

- % of injuries that are cumulative MSDs or 'ergo' related
- % lost time cumulative MSDs or 'ergo' related cases (& days lost)
- % of injuries that are MSDs related to patient handling
- % lost time MSD cases (& days lost) related to patient handling




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## Direct Costs: Incident Rates

**Allows Us to Compare Apples to Apples!**



- **Incident Rate**
  - Can use for comparison against other health care classifications or internally between departments
  - Obtain Productive hours worked by dept or cost center*
- **Days away, restricted or transferred to another job (DART) Incident Rate**
- **Lost-Workday Case Incidence Rate (LWCIR)**
- **Severity Rate**
  - Can use to track reduction in the number of lost and restricted workdays

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## Incident Rate

Calculation is based on the number of incidents per 100 full time (equivalent) employees per year, i.e., (100 people working 50 weeks per year, and 40 hours per week = 200,000 exposure hours).

$$IR = \frac{\text{Number of incidents per year} \times 200,000 \text{ hours of work}}{\text{Number of hours worked by target population}}$$

example: 5 back injuries in a population of 200 workers

$$IR = \frac{18 \times 200,000}{200 \times (50 \text{ weeks} \times 40 \text{ hours})} = 9.0$$



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## Severity Rate

Calculation is based on the number of lost and restricted workdays associated with a particular injury or illness.

$$SR = \frac{\text{Number of lost/rest. workdays} \times 200,000 \text{ hours of work}}{\text{Number of hours worked by target population}}$$

For example, the three back injury cases lost 42, 55 and 322 days respectively. The severity rate would be:

$$SR = \frac{(42 + 55 + 322) \times 200,000}{200 \times (50 \text{ weeks} \times 40 \text{ hours})} = 209.5$$



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**Back Injuries  
per Dept – Patient  
Handling Related by  
# of Injuries**

1. ER
2. Med-Surg
3. Surgery
4. ICU
5. Office
6. Birthplace
7. Environmental Svcs

**Back Injuries per  
Dept - Patient  
Handling Related  
by Incident Rate**

1. Med-Surg
2. ICU Day
3. Surgery
4. Birthplace
5. Environmental Svcs
6. Office
7. ER



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**Direct Costs:**

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**Predicting Reoccurring Injuries  
Example - Injuries Related to Patient  
Handling**

Year:	First Aid Cases	Medical Only (OSHA cases)	Restricted Work Day Cases	Lost Work Day Cases
2006	7	7	8	8
2007	10	11	6	14
2008	13	18	7	20
Total	30	36	21	42
Expected 2009	10	12	7	14

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**Workers Compensation Costs**

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- Calculate costs of 'ergo' and patient handling related MSDs
- Calculate average costs of 'ergo' and patient handling related MSDs
- Look at trends
- Impact of Patient Handling Injuries on WC premiums

**Information from:**

- Insurance Carrier
- Loss Run Report
- Occupational/Employee Health Nurse/HR



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**Loss Run Report**

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- Claim #
- Location - dept
- Claimant name
- Injury date & report date
- Age & yrs of service
- Claim status (Closed, open, denied)
- Occupation, e.g. assembler & class code
- Loss description e.g. overexertion – back while lifting box
- Time loss days
- Medical
- Indemnity
- Total reserves
- Total incurred
- Change from last report
- Oregon plans – med reimburse and EIP



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# Making the Business Case for Ergonomics and Safe Patient Handling Programs

## HCEC/GOSH 2009

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Injury Cost Analysis Worksheet –Direct, Indirect and Operational <sup>1</sup> Costs (For any type of work related injury)			
Item/Activity	Time Spent	Wages (\$/hr include % value of benefits if information available)	Total \$ Cost
<b>Direct Costs</b>			
Workers Compensation premiums			
<b>Direct Costs per incident/injury</b>			
1. Medical costs (treatment) immediate and follow-up			
2. Temporary Income benefits (workers comp)			
3. Cost of transport to medical facility (ambulance fees,etc)			
4. On site supplies used			
5. Drug testing			

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Data Example - Injuries Related to Patient Handling					
Severity: Body Part	First Aid	Medical Only	Restricted Workday	Lost Work Day	Permanent Disability
Upper Extremity					
Back/Trunk	Range: \$150-\$50,000 Average: \$12,000 Median: \$3,000			Avg Cost \$16,000	
Neck					
Lower Extremity					

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Direct Costs: Predicting Injury Costs			
Example - Injuries Related to Patient Handling			
Injury:	Annual Probability x	Avg. Cost	= Expected Costs
Disability			
Lost Work Day	14	\$12,000	\$168,000
Restricted Work Day			
Medical Only			
First Aid			
Total costs			
Remember this is direct medical/lost time costs only			

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### Example - Direct Costs



1 Low Back Strain  
- Cost \$12,000



Solution: Pallet Positioner  
- Cost of equipment \$8,000  
-Rearrangement of work  
flow and storage by staff  
& training time: \$500.00

Do I need to Conduct Further Cost-Justification?

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### Direct Costs Summary

Analyzing injury and incident data allows you to

- Prioritize focus of ergonomics /SPH efforts –
  - Identifying the types of injuries occurring
  - The location of occurrences and cause
- Identifying past injury costs
- Predicting future costs – what will it cost to do nothing (rising insurance premiums, labor loss etc)
- Providing a basis for program measurement and 'Return on Investment' calculations etc

Evaluate at least 3 years of injury data



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### Identifying and Measuring All Costs and Benefits of Ergo and SPH Programs

**Costs**

- Direct Costs (largely workers' compensation)
- Indirect Costs (additional injury costs)
- Operational Losses

**Benefits**

- Operational Gains
- Related to Traumatic or Acute Injuries (Safety)
- Human Error (Engineering Design)



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### Indirect Costs

- Incident Costs
- Investigation Costs
- Damage Costs (if applicable)
- Injury Management Costs
- Legal Costs
- Worker Replacement Costs or Turnover Costs
- Compensating Activities Used to Avoid Illnesses



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### Injury Cost Analysis Worksheet –Direct, Indirect and Operational Costs (For any type of work related injury)

Item/Activity	Time Spent	Wages (\$/hr include % value of benefits if information available)	Total \$ Cost
<b>Incident costs</b>			
1. Time to Provide First Care or Onsite Medical Care			
- Nurse			
- First Aid responder or other			
2. Time to transport to medical facility (and stay with employee)			
3. Time to complete paperwork			
4. Time to secure area			
5. Time for any other employees assisting with injury			



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### Worker Replacement Costs or Turnover Costs

1. Advertising fees
2. Time to hire
3. Direct labor cost (hourly rate including fee if using agency or temp staff)
4. Include benefit burden if permanent employee
5. Time to training and orientation
6. Time for supervision (precept)
7. Impact on 'productivity' –getting new nurse or worker 'up to speed' on work processes and procedures
8. Impact on quality of care/service

**\$90-145K to replace an RN**

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## Compensating Actions

- Training & Safety meetings
- Additional staffing & workers (manual patient handling)
- Worker selection
- Work conditioning, fitness, stretching
- Job Rotation



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## Average Indirect Costs For Each Category

Severity: Body Part	First Aid	Medical Only	Restricted Workday	Lost Work Day	Permanent Disability
Upper Extremity					
Back/Trunk					
Neck					
Lower Extremity					

**Determine Ratio of Direct Costs to  
Indirect Costs**



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## Indirect Costs

- What is the Indirect Cost to Direct Ratio for Injuries?

2:1

4:1

10:1

20:1

- Can you use an estimate or do you need to calculate indirect cost per incident?



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## 73 Websites – Injury Cost Calculators

- OSHA Safety & Health management E-Tool  
[http://www.osha.gov/SLTC/etools/safetyhealth/mod1\\_estimating\\_costs.html](http://www.osha.gov/SLTC/etools/safetyhealth/mod1_estimating_costs.html)
  - OROSHA  
<http://www4.cbs.state.or.us/ex/oshafilm/book/index.cfm>
  - Canada  
[http://www.osach.ca/misc\\_pdf/InjuryCostCalculator.pdf](http://www.osach.ca/misc_pdf/InjuryCostCalculator.pdf)
- Equipment Vendors:**
- LIKO  
<http://www.safeliftingportal.com/gettingstarted/cost-savings-calculator.html>



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## 74 Identifying and Measuring All Hidden Costs and Benefits

### Costs

- Direct Costs (largely workers' compensation)
- Indirect Costs (additional injury costs)
- Operational Losses

### Benefits

- Operational Gains
- Related to Traumatic or Acute Injuries (Safety)
- Human Error (Engineering Design)



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## 75 Operational Losses Related to Patient Handling

Decreased output from normal/expected levels and/or increased time/costs to perform support operations due to manual patient handling and care tasks

- Impact on quality (omission or delay in care)  
e.g., patient is not moved or ambulated from bed to chair post surgery due to lack of staff, weight of patient, difficulty of task, etc.
- Lost productivity due to manual handling and care of bariatric or combative or special need patients, e.g., extra staff required
- Patient safety – fall risk, skin integrity and medical outcomes



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**Operational Losses Related to Patient  
Handling**

- Regulatory – JCAHO, Magnet, CMS, etc related to patient safety and quality of care
- Cost of overtime and/or extra labor for absenteeism, transfer or exit from job due to injury or burnout
- Impact of patient satisfaction re quality of care
- Impact of low employee morale due to fatigue, workload, working in chronic pain, presenteeism, etc.



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**Operational Losses Related to Other  
Nursing and Support Staff Tasks**

Decreased output from normal/expected/planned levels and/or increased time/costs to perform support operations

1. Lost productivity (work time) due to disruption or impact on service delivery time
2. Impact on quality (rejects, rework, scrap, service quality)
3. On day of accident and during investigation
4. On subsequent days
5. Cost of overtime and/or standby labor
6. Lost productivity - time to find and gather supplies due to poor workplace design



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**Operational Losses Related to  
Other Nursing and Support Staff  
Tasks**

7. Cost of increased quality inspection or other measures to avoid lost production or quality defects/issues
8. Cost to return injured work to job
  - Time to worker 'up to speed' on tasks or current project
  - Time for follow-up medical appointments
9. Other costs



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### Identifying and Measuring All Costs and Benefits of Ergo and SPH Programs

#### Costs

- Direct Costs (largely workers' compensation)
- Indirect Costs (additional injury costs)
- Operational Losses

#### Benefits

- Operational Gains
- Related to Traumatic or Acute Injuries (Safety)
- Human Error PATIENT SAFETY (Engineering Design)



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### Operational Gains

#### (When Implementing Ergonomics & SPH)

#### Improved

- Quality of patient care
- Patient satisfaction & safety
- Employee satisfaction
- Staff recruitment
- Labor pool
- Regulatory compliance

#### Costs associated with labor overhead- Reduced

- Staff turnover
- Job transfer
- Absenteeism
- Retention of a skilled aging work force

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### Operational Gains

#### (When Implementing Ergonomics & SPH)

#### Productivity and efficiency changes

- Less staff required to perform patient handling task
- Time on task often reduced e.g., distance traveled reduced; reach distance and frequency reduced
- Data entry tasks - input errors reduced
- # of times equipment and supplies are handled reduced
- Reduced likelihood of equipment damage

All of this = Increased Time to Care



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### Cost Benefits Related to Traumatic or Acute Injuries (Safety) & ‘Human Error’

Reduced worker fatigue has impact on reducing employee slips, trips and falls and reducing on near misses and incidents related to patient care tasks

Education of nurses and other health care workers has positive impact on safety behaviors and raises awareness re design of work safe work environments



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### Cost Benefits Related to Traumatic or Acute Injuries (Safety)

– Up to 25% of traumatic injuries may be due to interface design problems  
(Alexander, 1998)

Examples:

- Tools slip because of handle size
- Fall from make shift stool while reaching for supplies located on high shelves

 Costs can be very high depending on severity of the injury



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### Losses From Human Errors





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## Websites – Injury Cost Calculators

- OSHA Safety & Health management E-Tool  
[http://www.osha.gov/SLTC/etools/safetyhealth/mod1\\_estimating\\_costs.html](http://www.osha.gov/SLTC/etools/safetyhealth/mod1_estimating_costs.html)
- Canada  
[http://www.osach.ca/misc\\_pdf/InjuryCostCalculator.pdf](http://www.osach.ca/misc_pdf/InjuryCostCalculator.pdf)
- New Zealand  
[http://www.acc.co.nz/wcm001/idcplg?IdcService=SS\\_GET\\_PAGE&nodeId=4053](http://www.acc.co.nz/wcm001/idcplg?IdcService=SS_GET_PAGE&nodeId=4053)

### Equipment Vendors:

- EZ WAY Inc  
<http://www.ezlifts.com/calculator.cfm>
- LIKO  
<http://www.safeliftingportal.com/gettingstarted/cost-savings-calculator.html>



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## Summary

1. Identify what you can measure related to injury costs and operational gains
2. Know where to focus efforts for greatest return on investment related to injury costs and operational gains
3. Develop your Ergonomics/SPH business plan
4. Once program approach and solutions are identified use economic/financial tools to determine return on investment, etc



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## Applying Economic Analysis Techniques



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### Demonstrating Financial Value of Ergonomics/SPH Solutions

**Benefits of Solutions**

- Does the solution eliminate or reduce the risk factors?

**Financial Benefits of Solution(s)**

- Direct cost of injuries
- Indirect injury costs
- Operational losses
- Operational gains

**Cost of Program & Solution(s)**

- Direct Equipment costs
- Installation
- Structural expense
- Maintenance
- Training time, supplies, staff backfill, etc
- Equipment supplies
- Life of Equipment
- Supply loss or theft

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### Selecting the Most Appropriate Ergonomics Solution(s)

- **Time to Implement**  
- The time until the problem is corrected
- **Timeliness**  
Is the task/process going to change soon?

To Assist in Choosing a Solution - Plot  
Solutions on 'Value vs. Cost Matrix'



Effectiveness
Cost/Time

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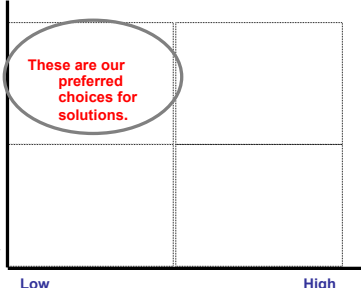
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### Selecting the Most Appropriate Solution(s)

High

Benefit  
of  
Solution

Low



Low

High

Cost of Solution

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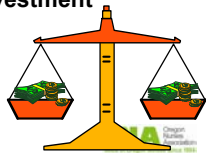
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## Applying Economic Analysis Techniques

to make the case for Ergo & SPH solutions

### Economic Analysis Techniques

- **Single Year**
  - Benefit/Cost Ratio
  - Payback Period
  - Single Year Return on Investment
- **Multi-Year**
  - Net Present Value



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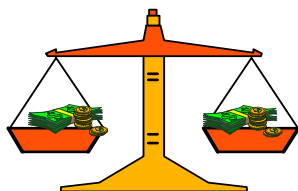
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## Benefit/Cost Analysis

Use of a financial ratio to determine whether money spent on projects and investments will be recovered and, if so, over what time period.

$$\text{Benefit/Cost Ratio} = \frac{\text{Dollar Value of Benefits}}{\text{Dollar Amount of Costs}}$$



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## Example: Single Year Benefit/Cost Ratio

- **Patient Handling – Injuries from lateral transfers**
  - Three injuries per year for the past two years
  - Lifting patients to/from bed to stretcher
  - Fifteen Health Care Providers perform this task (on 3 shifts)
  - Average injury (direct) cost is \$15,000
  - Solution costs \$6,000
    - 2 Air Mat devices & motors

$$\text{Benefit to cost ratio} = \frac{\text{Benefits (average injury costs)}}{\text{Costs}}$$

$$\text{Benefit to cost ratio} = \frac{\$15,000}{\$6,000} = 2.5$$

**The benefits are 2.5 times the costs. It is a good investment.**

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### Example: Payback Period

#### ▪ Patient Handling – Injuries from lateral transfers

- Average injury (direct) cost is \$15,000
- Solution costs \$6,000
  - 2 Air Mat devices & motors

$$\text{Payback period (in years)} = \frac{\text{Costs}}{\text{Benefits (average injury costs)}}$$

$$\text{Payback period (in years)} = \frac{\$6,000}{\$15,000} = 0.4 \text{ years or } 4.8 \text{ months}$$

The payback is rapid (less than one year).  
It is a good investment.

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### Example

#### Single Year Return on Investment

$$\text{Return on Investment (ROI)} = \frac{\text{Benefits}}{\text{Costs}} \times 100\%$$

$$\text{Return on Investment (ROI)} = \frac{\$15,000}{\$6,000} \times 100\% = 250\%$$

The investment pays back 2.5 times its cost.  
It is a good investment.

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### Multi-Year Payback

Get help from an accountant (and a really good calculator)

#### ▪ Issues to consider

1. Identify the life of the project and the interest rate necessary to pay for the investment
2. Determine the future vs. present value of the dollar (inflation costs)
3. Determine the cost of capital (interest, dividends, payment to providers of funds, etc)
4. Calculate savings in year one then subsequent years with value discounted due to inflation

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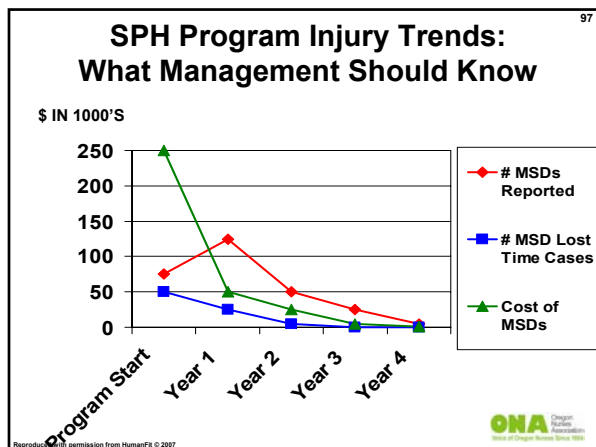
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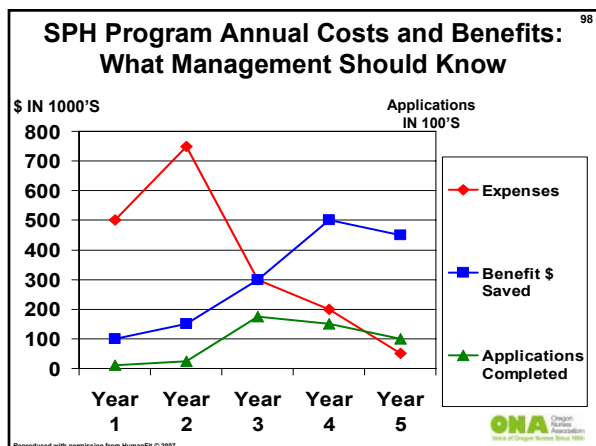
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### Proactive Approach: Preventing Injuries and Operational Losses

**Goal:**

- Incorporate Ergonomics and safety features (design for the user) at Concept stage.
  - Cost increases 100% + if ergonomics is considered after process/equipment/tool is completed and operating or implemented
- Ergonomics & safety design principles applied to all facilities design (new or renovation)
  - e.g., patient handling equipment, storage, clearance, access, work heights, reaches, lighting,, workflow, etc
- Ergonomics and safety approval of all new equipment, tools and software purchased
- Usability testing device evaluation

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### SPH Programs

#### Evidenced-Based Successful Practices

- Use of the business plan approach developed by interdisciplinary team
- Start small – choose a demonstration unit or department to pilot program and develop program components, policy etc.
- Set measurable goals and use economic modeling to show program return on investment
- Patient and employee safety treated with equal emphasis
- Be an informed consumer\*\*\*\*\*



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### An Effective SPH Program is achieved when:

- Goals are met
- Early results are demonstrated and commitment built ('word of mouth' is powerful in healthcare facilities)
- SPH is incorporated into environment of care programs and the organization culture ("The way we do things around here")
- A proactive program is developed where ergonomics design principles are incorporated into design/purchase of all equipment and processes



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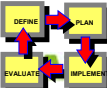
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### How to Make Your Ergonomics Program a Success

- Incorporate ergonomics into safety, quality, and engineering programs
- Incorporate ergonomics principles into design of all equipment and processes
- Ensure management commitment & employee involvement
- Use continuous process improvement model for the program and problem solving
- Measure & demonstrate results



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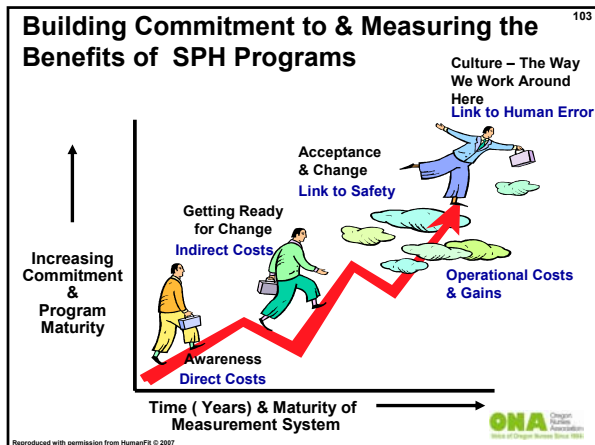
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**Selected References & Resources** 104

- American Nurses Association (2005). Handle With Care™ Campaign Fact Sheet. <http://ana.org/handlewithcare/>
- A business case for patient care ergonomic interventions [Patient and staff safety: VA on the scene]. (January/February/March, 2005). Siddharthan, K.; Nelson, A. Nursing Administration Quarterly. (29)1. 63-71. Retrieved on October 17, 2005 at <http://gateway.ut.ovid.com.liboff.ohsu.edu/gw1/ovidweb.cgi>
- Assessing Cost/Benefits of Human Factors. Rouse, w & Boff, K. Chapter 49 p1617 to 1633. Handbook of Human Factors and Ergonomics (2nd edition). 1997. John Wiley & Sons.
- Cost Justification for Ergonomics. 1995. Alexander, D.C. & Getty, R. James Publishing, Santa Ana, CA.
- The Cost of Safety. (2004) Behm, M., Veltri, A., Kleinsorge, I.K. Professional Safety, April 2004, pp 22-29
- Dollars and Sense: Using Financial Principles in the Safety Profession. Hansen, M., Grotewold, H., & Harley, R. Professional Safety. June 1997.

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**Selected References & Resources** 105

- Ergonomics to the Rescue- A Cost Justification Case Study (2001). Rodrigues, C.C. Professional Safety, Vol. 46, No. 4
- The Economics of Ergonomics. Alexander, D.C. In Human Factors and Ergonomics Society 39th Annual Meeting Proceedings. Santa Monica, CA: Human Factors and ergonomics Society, 1995.
- Global quality: linking ergonomics and production. (2000). Drury, C.G. International Journal of Production Research, Vol 38, No 17, pp 4007-4018
- Good Ergonomics is Good Economics. (1996). Hendrick, H.W. Proceedings of the Human Factors and Ergonomics Society 40th Annual Meeting
- Handbook of Human Factors and Ergonomics in Health Care and Patient Safety (2007). Edited by Pascale Carayon. Lawrence Erlbaum Associates

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### Selected References & Resources

- Lifting Patients/Residents/Clients in Health Care--Report to the Washington State Legislature. (January, 2006). Silverstein, B.; Howard, N.; Cullen, J.; Lee, D.; Goggins, R.
- Office Ergonomics Do They Work? An analysis of the effectiveness of the state of Oregon's office ergonomics initiative. (2005). Brace T. Professional Safety, Sept. 2005. pp 51-55.
- Practice Issues in Prevention through Design. Mei-Li Lin. Journal of Safety Research 39 (2008) 157 – 159. Rapporteur's Report, Research and Statistical Services, National Safety Council, <http://www.cdc.gov/niosh/topics/PtD/pdfs/Lin.pdf>
- Quality of the working environment and productivity: Research findings and case studies (2004) De Greef et al. European Agency for Safety and Health at Work



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### Selected References & Resources

- Safe Patient Handling and Movement: A Practical Guide For Health Care Professionals (2006). Audrey Nelson Editor. Springer Publishing <http://www.springerpub.com/>
- Safety Performance Measurement: Identifying Prospective Indicators with High validity. Stricoff R Scott. Professional Safety. January 2000.
- When is it Safe to Manually Lift a Patient? (2007). Waters, T. American Journal of Nursing, Vol.107, 8, 53-59.
- Wisdom at Work: The Importance of the Older and Experienced Nurse in the Workplace, June 2006. Hatcher, B. (editor), Bleich, M., Connolly, C., Davis, K., O'Neill, P., Hewlett, Stokley-Hill, K., Robert Wood Johnson Foundation
- "Worker Protection: Private Sector ergonomics Programs Yield Positive Results" Report: #HEHS-97-163. United States General Accounting Office. [cdc.gov/niosh/pdfs/gaoergo.pdf](http://cdc.gov/niosh/pdfs/gaoergo.pdf)



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### Questions




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