RiskTopics

A guide to controlling lifting exposures

The source of work-related back injuries can be hard to identify. It is a challenge to identify whether the source of the injuries is in the workplace or elsewhere.

Introduction

The source of work-related back injuries can be difficult to identify. Some people suffer from low-back pain as a result of their job duties. Others experience low back pain in spite of the type of job they hold. Some workers never suffer from low-back pain regardless of their type of work. It is a challenge to identify whether the source of the injuries is in the workplace or elsewhere.

Discussion

In an effort to control these risks present in the workplace, many employers address the problems through three basic strategies:

- Educating and training on safe lifting
- Careful selection and placement of workers
- Designing the job to help reduce the risks

The third approach is usually the most effective. It normally involves a more permanent engineering solution. Well-designed jobs decrease the worker's exposure to manual material handling hazards. They also reduce the medical and legal concerns of selecting the worker for the job as well as finding replacements for absent workers. The job design process creates many benefits. One of the most prominent is the identification and elimination to the greatest degree possible of the major hazards during a lift. As a result, the level of reliance placed on employees to follow safe lifting procedures is reduced. This guide will focus on how to achieve job redesign controls to help prevent back strain problems.

Guidance

Job evaluation – the first stage of the design process

Before trying to figure out how to solve a problem, we need to determine if one exists. Assuming one does, it is also critical to assess severity. Evaluation is the first step in the process. This brings us to our first decision: which jobs should be evaluated?

Step 1 – Choosing jobs to evaluate

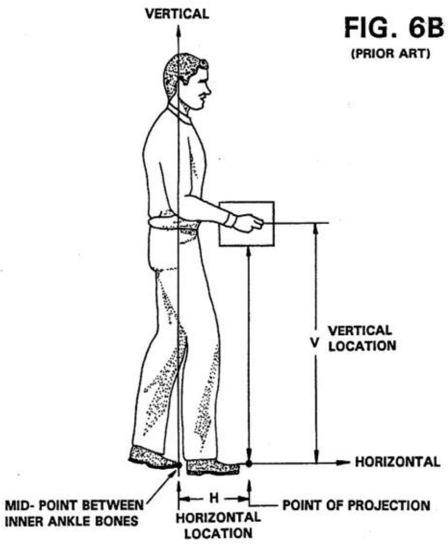
Any type of occupation can involve the performance of manual handling tasks. Some may have dozens or even hundreds of different exposures. We can't evaluate them all; therefore, we need to identify the most hazardous ones for evaluation and redesign. Focus on positions generating a high number of employee complaints or severe claims. Limit yourself to a comfortable number of jobs to evaluate. Ten different jobs are more than enough. Ideally, five or less will suffice.

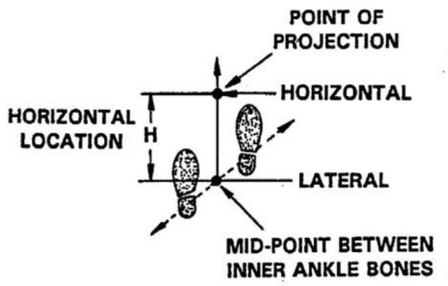
Step 2 – Collect the data about the jobs

In order to evaluate any industrial manual handling task, we need to collect certain pieces of information. NIOSH (National Institute for Occupational Safety and Health) has developed a method that can help determine which tasks require modification to reduce the risk of employee injury. The attached evaluation form is based on the 1991 Revised Guide for Manual Lifting.[1] It can serve as a checklist to help you collect the necessary data. See Appendix A for the form and Multiplier Tables.

Task evaluation requires that you physically observe the workers involved. While observing, carry a small tape measure. It will serve as a useful tool in accurately measuring distances. Be sure to understand each of the movements involved. Acquire a good feel for how often the task is repeated. Immediately afterwards, complete an evaluation form. The following sections will profile the primary elements that require evaluation.

Refer to the diagram[2] below in order to help visualize task components.





Definitions

Task description

Briefly indicate what the worker is doing. Example: “lifting metal parts from floor pallet to machine.” Average weight and maximum weight (lbs.)

Determine the actual weight of the object handled. If needed, use a scale to weigh the object. Weights sometimes vary. An alternative is to take both an average weight and the maximum weight. This will provide two different comparisons.

Horizontal location (inches)

This is basically the average distance that the hands are in front of the spine at the beginning of the move. Measure the horizontal distance from midway between the ankles to the center of grasp (usually the middle knuckle). If the hands are at different distances, take an average (add them together and divide by two).

Vertical location (inches)

This is the distance from the floor that the hands are at the beginning of object movement. Measure from a point midway between the palms. If they differ, take an average.

Travel distance (inches)

The travel distance is the vertical distance the hands move between the beginning and end of the move. Subtract the starting height of the hands from the end height.

Asymmetric angle

This is essentially the degree of twisting done during the movement. Estimate the angle of maximum difference between where the hands point versus where the feet point during the move. If there is no twisting, this is zero.

Frequency

How often is the task repeated? Enter this as moves per minute. Observe during at least a 15-minute period and take an average.

Duration (hours)

How much time during an eight-hour shift is spent engaged in this task? Add up all the different lifting periods during a shift to arrive at a total number of hours spent lifting.

Coupling

You must choose either Good, Fair or Poor. Basically, this is an estimate of how secure the individual’s contact is with the object while it is being handled.

Some guidelines:

Good	Good handles or handholds. Wrap fingers around loose parts.
Fair	Poor handles or cutouts. 90^0 finger flexion.
Poor	Hands placed over 16" from body, height of object over 12", item sagging, off center weight, unstable contents, hard to hold on to, use gloves

Step 3 – How bad is it?

a) Determine each of the six multipliers by comparing your data to the tables on the back of the evaluation form.

b) Multiply the load constant (51 lbs.) by each of the six multipliers. The result is the recommended weight limit (RWL) for this particular task.

c) Divide the weight handled (either average weight or maximum as you wish) by the RWL. The result is the lifting index. This tells you how far away from the recommended weight the actual weight is.

Now consider body motions:

Bending

Bending usually occurs when an object needs to be moved from or to below knuckle height. Even with very lightweight objects, bending causes stress on the lower back and increases the risk of injury. A disproportionate amount of industrial injuries occur during lifting tasks starting below knuckle height. This is why it is important to identify this particular motion.

Twisting

Studies have shown that backbone discs are less able to handle twisting forces than compressive forces. Twisting can occur in both standing and sitting positions and has been frequently associated with lower back pain. Regardless of the weight handled, twisting is a significant factor. This has already been considered in the asymmetry calculation. If significant, it should be indicated here also.

Reaching

Reaching requires the employee to support objects away from the body. Any horizontal distance from the body increases the moment arm on the lower back. Objects closer to the body reduce stress on the lower back and lessen the risk of injury.

Consider environmental factors

Extremes in temperature or humidity may influence job performance and the worker's ability to complete tasks without injury. Cold temperatures in particular can increase the risk of muscle strains.

Indicate any of these significant elements in the Other Factors box on the form.

Step 4 – Interpret the data

Once you have obtained the required information and have performed the calculations on the form, you are ready to structure a plan for improvement. For a sample of how the form might be completed, see Appendix B.

Does the task need to be modified?

The first question you need to answer is does the task warrant any further attention? Two indicators of the answer are the lifting index (LI) and the other significant contributing factors boxes on the completed form. High-risk indicators in either area warrant recommendations for improvement.

What constitutes high risk? The LI shows you how far away from the RWL the actual weight is. An LI of 1.0 or less complies with the recommended limit already. Values that are higher than 1.0 introduce risk. How much additional risk is debatable, but that should not deter you from making recommendations.
You may assume that the higher the LI, the fewer people will be able to perform this task without injury. Generally, it is prudent to consider task modifications at LIs above 1.0. Tasks farther above this number will most likely require modification. Any significant amount of bending, twisting or reaching typically warrants task modification.

Now you not only have a way to identify unacceptable tasks but also a means to quantify the severity of them. This numerical comparison can prove quite useful in determining when something merits further attention.

Your calculations have also provided an idea of what an acceptable weight for this particular task would be. In those situations where it is feasible to vary the weight, this piece of information can be useful in redesigning the job.

Step 5 – Suggest controls

Developing a plan of action to control a lifting exposure requires you to use your imagination, common sense and experience. The goal is to develop a logical solution to the loss source just identified. Remember that we should try to control the problem with both physical changes and administrative changes. Keep in mind that the most effective controls are those that modify the job to fit the worker better.

Try asking yourself this series of questions when developing recommendations for your plan of action:

What do you think will improve the situation?

Not how to do it . . . just what. For instance, a task has a high LI. This indicates that the worker is probably overexerting while performing the task. You would want to change the task to reduce the amount of exertion to a more acceptable level. How this is accomplished is much less critical than the fact that it is done at all. There are different ways to reduce the worker's exertion (i.e., lower the weight, mechanize the task, etc.). The key is to reduce exertion.

What alternatives are available?

Familiarize yourself with the many varied types of mechanical aids available that may serve as alternatives. Devices such as lift tables, hoists, air balancers, stackers and hand trucks can reduce stress. Equipment manufacturers and your Zurich Services Corporation representative can provide information.

Use the attached Manual Handling Control Choices (Appendix C) for ideas.

What administrative controls are appropriate?

What policies, procedures or training will be required to maintain the physical changes in place? Consider the following:

- Company policy
- Safety rules
- Personal involvement by top management
- Self-inspections
- Assignment of responsibility
- Safety training of employees, supervisors or managers

Conclusion

Many back injuries from lifting are caused by repetitive motion, poor posture and other ergonomic stresses. These disorders are upper extremity soft tissue disorders and sprains and strains to the back and torso. Possible causes of work-related musculoskeletal disorders of the upper extremities include vibration, repetitive motions, improper height of work surfaces and chairs that cause unnatural postures, no hand tools or improper hand tool design, etc. Low back pain and torso injuries can be caused by excessive bending and twisting at the waist, lifting from floor level, lifting objects that are too heavy, prolonged sitting or static postures. The tool discussed in this RiskTopic provides one way to evaluate lifting tasks and provides possible mitigations. NIOSH has also developed a smart phone app called NLE Calc that automates this equation and much of the calculations. It is available from the Apple iOS store and Android marketplace as a free download.

More attention should be given to ergonomics in a wide variety of industries and in proper selection and placement of workers before any injuries can occur. Each company should evaluate its own situation and decide which solutions are needed for its specific locations, job types and worker tasks.

References

[1] "Applications Manual for the Revised NIOSH Lifting Equation." Centers for Disease Control and Prevention, 6 June 2014, www.cdc.gov/niosh/docs/94-110/.

[2] NIOSH 1981. Work Practices Guide for Manual Lifting. NIOSH Technical Report No. 81-122, US Department of Health and Human Services, National Institute for Occupational Safety and Health, Cincinnati, OH

Appendix A

Evaluating a lifting task – Blank Form

Facility name:	
Facility location:	
Job title evaluated:	

Evaluator:	
Date:	

Description of task	Average weight	Maximum weight	Horizontal location	Veritical location	Travel distance	Asymmetric angle	Frequency (per minute)	Coupling
							duration	

Load constant	x	Horizontal multiplier	x	Vertical multiplier	x	Distance multiplier	x	Asymmetric multiplier	x	Frequency multiplier	x	Coupling multiplier	=	recommended weight limit (RWL)
51														

Lifting index (divide weight lifted by RWL)

Other significant contributing factors (explain any additional significant bending, twisting, reaching, environmental stress, etc.)

Appendix A, continued

Multiplier tables

HORIZONTAL LOCATION (inches)	HORIZONTAL MULTIPLIER
=<10	1.00
11	.91
12	.83
13	.77
14	.71
15	.67
16	.63
17	.59
18	.56
19	.53
20	.50
21	.48
22	.46
23	.44
24	.42
25	.40
>25	.00

VERTICAL LOCATION (inches)	VERTICAL MULTIPLIER
0	.78
5	.81
10	.85
15	.89
20	.93
25	.96
30	1.00
35	.96
40	.93
45	.89
50	.85
55	.81
60	.78
65	.74
70	.70
>70	.00

TRAVEL DISTANCE (inches)	DISTANCE MULTIPLIER
=<10	1.00
15	.94
20	.91
25	.89
30	.88
35	.87
40	.87
45	.86
50	.86
55	.85
60	.85
70	.85
>70	.00

ASYMMETRIC ANGLE (degree)	ASYMMETRIC MULTIPLIER
0	1.00
15	.95
30	.90
45	.86
60	.81
75	.76
90	.71
105	.66
120	.62
135	.57
>135	.00

FREQUENCY (per minute)	2-8 HRS. V<30	2-8 HRS. V≥30	1-2 HRS. V<30	1-2 HRS. V≥30	<1 HRS. V<30	<1 HRS. V≥30
.2	.85	.85	.95	.95	1.00	1.00
.5	.81	.81	.92	.92	.97	.97
1	.75	.75	.88	.88	.94	.94
2	.65	.65	.84	.84	.91	.91
3	.55	.55	.79	.79	.88	.88
4	.45	.45	.72	.72	.84	.84
5	.35	.35	.60	.60	.80	.80
6	.27	.27	.50	.50	.75	.75
7	.22	.22	.42	.42	.70	.70
8	.18	.18	.35	.35	.60	.60
9	.00	.15	.30	.30	.52	.52
10	.00	.13	.26	.26	.45	.45
11	.00	.00	.00	.23	.41	.41
12	.00	.00	.00	.21	.37	.37
13	.00	.00	.00	.00	.00	.34
14	.00	.00	.00	.00	.00	.31
15	.00	.00	.00	.00	.00	.28
>15	.00	.00	.00	.00	.00	.00

Coupling Type	V<30	V≥30
GOOD	1.00	1.00
FAIR	.95	1.00
POOR	.90	.90

Note: v = vertical location of hands at start of lift (in inches).

> = greater than, ≥ greater than or equal to, < = less than

Appendix B

Evaluating a lifting task – Filled out example

Facility name:	Supersport
Facility location:	Dallas, Texas
Job title evaluated:	Packer (warehouse)

Evaluator:	B. Smith
Date:	

Description of task	Average weight	Maximum weight	Horizontal location	Veritical location	Travel distance	Asymmetric angle	Frequency (per minute)	Coupling
Packers lower completed boxes onto pallet		34	14	40	36	75	.5 duration 7.5	fair

Load constant		Horizontal multiplier		Vertical multiplier		Distance multiplier		Asymmetric multiplier		Frequency multiplier		Coupling multiplier		recommended weight limit (RWL)
51 lbs.	X	.71 lbs.	X	.93 lbs.	X	.87 lbs.	X	.76 lbs.	X	.81 lbs.	X	1.00 lbs.	=	18.0 lbs.

Lifting index (divide weight lifted by RWL)
34/18.0= 1.9

Other significant contributing factors (explain any additional significant bending, twisting, reaching, environmental stress, etc.)
twisting

Appendix C

Manual handling control choices

1. Eliminate the manual handling task.
2. Eliminate the need to lift or lower.
   - Change the height of the worker
   - Change the height of the work area
   - Use mechanical devices such as:
     - ☐ a lift table or other elevating device
     - ☐ a lift truck
     - ☐ a crane or hoist
     - ☐ balancers
     - ☐ an elevating conveyor
     - ☐ a work positioner
     - ☐ a work dispenser
     - ☐ gravity feed or chute
3. Change the weight of the object. Increase the weight to necessitate mechanical handling by packaging many objects together by changing the size of the object.

   Reduce the weight to levels that would achieve an acceptable Lifting Index by reducing the:
     - ☐ size
     - ☐ container capacity
     - ☐ load in the container
     - ☐ container weight
     - ☐ number of objects handled at the same time
4. Reduce body motions.

   ### Bending
   - ☐ Keep materials at work level during processing
   - ☐ Lower the worker
   - ☐ Raise the work level
   - ☐ Use mechanical devices to raise work

   ### Twisting
   - ☐ Keep materials in front of worker
   - ☐ Provide swivel seats
   - ☐ Use mechanical devices to change material flow direction
   - ☐ Allow space enough to turn and step in work area

   ### Reaching
   - ☐ Reduce the size of the object
   - ☐ Place items (materials, tools, controls) as close to the worker as possible

☐ Allow space to walk around and get closer to objects

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A_guide_to_controlling_lifting_exposures_rt

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