

Manual Handling: Evaluating and Reducing Risk

Risk Control from Liberty Mutual Insurance



Highlights:

- Manual material handling is responsible for the biggest portion of workers compensation costs.
- Task redesign is the priority for reducing manual material handling risk, supplemented with a managed process for effectively responding to worker reports of pain and problems.



Through research, Liberty Mutual has identified the most effective ways to quantify and analyze the risk of manual material handling injuries.

Impact on Injuries and Injury Costs

According to the 2014 Liberty Mutual Workplace Safety Index (www.libertymutualgroup.com/omapps/ContentServer?c=cms_document&pagename=LMGResearchInstitute%2Fcms_document%2FShowDoc&cid=1138365240689), overexertion due to manually handling objects is the leading driver of worker injury costs, accounting for about 25 percent of all costs. According to the Bureau of Labor Statistics, the body parts most frequently injured by overexertion due to manual handling are the back (about 40 percent) and shoulders (about 15 percent). However, shoulder injuries have higher severity as measured by days away from work, and consequently, back and shoulder injuries account for about 35 percent and 30 percent, respectively, of all costs associated with manual materials handling injuries.

Evaluating Manual Material Handling Risk

Considerable research has been conducted to assess the risk of injury for material handling tasks including lifting, lowering, pushing, pulling, and carrying. The weight of the object for lifting and lowering tasks is important, but not the only factor that must be considered. How frequently objects are handled, how far you have to reach for them, where you start and finish the task, how much of the work day is spent doing the task, and how much twisting is involved should also be considered.

There are three main approaches to integrating these factors to assess the injury risk of manual handling tasks.

1. **Physiological:** Assessing the energy expenditure (O_2 consumption — calories per unit time).
 - a. Underlying assumption: High energy expenditure without adequate rest leads to physiological fatigue which could increase the risk of injury. The greatest risk is when adverse work schedules or heat stress is also of concern.
2. **Biomechanical:** Assessing the forces on the body.
 - a. Underlying assumption: Back pain results from tissue damage due to excessive forces on specific spinal structures. Usually, the compressive force on the L5/S1 intervertebral disc is the focus of analysis, but lateral torque, shear, and other forces/torques can be analyzed.
3. **Psychophysical:** Determining what workers subjectively find to be the limits of their material handling capacity.
 - a. Underlying assumption: Humans can integrate the multiple stressors to their bodies during manual handling and determine how much is too much.

There are many manual material handling analysis tools based on one or more of these fundamental approaches. Each has its advantages and disadvantages, but the psychophysical approach has had the best success, both in practice and research.¹ Furthermore, Liberty Mutual's psychophysical tables formed the foundation to the most widely used lifting evaluation tool, the NIOSH Revised Lifting Equation.*

* One example of Liberty Mutual's research in the NIOSH Lifting Equation is the "Load Constant" of 51 pounds. This 51 pounds comes directly from the Liberty Mutual Table's maximum acceptable lift for 75% of the female industrial population lifting an object close to the body, with good handholds, at waist level, infrequently.

Liberty Mutual Tools for Assessing Manual Material Handling Risk

Liberty Mutual used the psychophysical approach for researching manual material handling capabilities. The research to collect data on how much workers can handle was performed in a laboratory setting, but used industrial workers (not students or retirees) performing realistic tasks. The apparatus to perform the tasks was custom built and allowed evaluation of lifting, lowering, pushing, pulling, and carrying tasks in a broad range of parameters while applying a consistent methodical procedure.

Data from the large variety of tasks experimented in this way were combined to create the Liberty Mutual tables (https://libertymmhtables.libertymutual.com/CM_LMTablesWeb/taskSelection.do?action=initTaskSelection) which form the basis of our software program CompuTask2™. For any lifting, lowering, pushing, pulling, or carrying task, CompuTask2™ calculates the percentage of males and females who could be expected to perform that task without “overexertion” (without straining themselves, or without becoming unusually tired, weakened, overheated, or out of breath). This percentage is referred to as the *Population Percentile*. Liberty Mutual’s research also forms the foundation for the Manual Material Handling Task Evaluator™ and Residual Risk Reduction™ (R3™) for Lifting/Lowering, both of which are available to customers.

CompuTask2™ also estimates energy expenditure (the physiological approach) but the estimate is not used in assessing the risk of injury. Liberty Mutual has also utilized the biomechanical approach in its VidLiTeC™ (Video based Lifting Technique Coding) software. VidLiTeC is used by Liberty Mutual consultants to analyze the forces and torques on key body joints during lifting tasks using only a video of the lift, along with the weight of the object lifted and the weight and height of the worker.

From Research to Reality™

By itself, the psychophysical research reflected in CompuTask2 would be somewhat ambiguous: What population percentile is good? How do population percentiles relate to actual injury rates? Fortunately, research using population percentiles to evaluate tasks associated with known back injury rates has answered these questions and has revealed that when tasks can be performed by less than 75 percent of the female population, the risk of a back injury is tripled; for all workers — male and female.

The following three steps will allow your organization to benefit from the research Liberty Mutual has conducted and make substantial progress in reducing the risk of manual materials handling tasks.

Step1: Redesign High-Risk Tasks

Research suggests that identifying high-risk tasks using the psychophysical approach and then redesigning those tasks so they are low-risk is the most effective approach, resulting in a reduction of back injury claims by up to 40 percent.^{1,2} The impact on claim costs can be even more significant since reducing the difficulty of tasks not only reduces the risk of injuries occurring, but makes it easier for injured workers to return to work sooner where they can continue to be productive as they recover, and thus incur lower workers compensation costs.

Below are some task redesign principles and simple changes that can be applied to manual material handling tasks to reduce risk. Each of the principles below is best addressed by a team of workers and management working together to develop solutions.

- **Eliminate the task if possible:** Lifting and lowering can be eliminated by using powered lift tables, work positioners, hoists, and elevating equipment. Sometimes, just putting in a fixed table, where items are normally lowered to the floor only to be lifted sometime after, can be a very effective low-cost improvement. Pushing, pulling, and carrying can be avoided by using conveyors, lift trucks, slides or



hand trucks. For example, cartons can be slid rather than lifted off a pallet onto a conveyor by using a scissors lift that keeps the pallet at the same height as the conveyor. Sometimes increasing the number of items in a container or unitizing them so that they must be mechanically handled is also a good way to eliminate manual handling while increasing productivity. Examining the flow of materials from start to finish can also be helpful in identifying opportunities to eliminate risky tasks.

- **Reduce the weight or the force needed to move the load:** Lifting, lowering, and carrying can be made easier by reducing the number of objects lifted or by reducing the size of the load or container. Pushing and pulling can be simplified by reducing the load on a cart, using larger wheels or casters (and maintaining them), and keeping floor surfaces free of obstacles. Assigning two people to a job reduces the weight or force by half. But, this is rarely productive and should be used only on jobs done infrequently or when no other alternative is available. In general when weights are reduced, the frequency of handling can be increased to achieve as much or more net productivity while reducing the overall risk of injury.
- **Reduce reaching out away from the body:** When lifting, lowering, and carrying, the closer the hands are to the body, the less stress there is to the back and the safer the job will be. Do this by keeping the load small and providing grips or handles. Don't reach over objects; instead move obstructions out of the way.
- **Keep material in the area between shoulder and knuckle height:** This is the most efficient range for lifting and lowering. Low bending contributes to back pain; high reaching contributes to shoulder injuries. Each time a load is lowered it introduces the necessity of lifting it later on. You can use stands, tables, conveyors, scissors lifts, and other mechanical work positioners to keep material at the proper height for working. Use of upper- and floor-level storage should be discouraged.
- **Reduce the distance the load has to move:** One way to get the best material handling result is to minimize the vertical and horizontal distance over which the material is handled. Shortening the distance the load is carried, pushed, or pulled can also reduce the exposure to injury. Study the layout of your department to reduce distances between individual workstations and between workstations and storage. Conveyors or lift trucks can also be used to shorten the carrying distance.

Step 2: Apply a Strategy to Manage Back Pain Incidents Based on the Facts

As mentioned, redesigning high-risk tasks so that they are low-risk is very effective, with up to 40 percent of the back claims being eliminated. The other 60 percent of back pain claims will occur anyway. The reason for this is simple: Up to 84 percent of the population gets back pain sometime in their life,³ making back pain the leading cause of disability compared to any other condition.⁴ This high prevalence, along with research on twins, suggests that the genetic contribution to back pain may be greater than work-exposure risks.⁵ Since we are not likely to change our genetic code, we are not likely to make substantial reductions in the overall occurrence of back pain. Fortunately we can substantially reduce the disability and costs associated with back pain once it occurs by redesigning strenuous tasks so that recovering workers can return to work sooner, optimizing supervisory response to worker pain⁶ (see next paragraph), facilitating return to work (and recovery on the job),⁷ informing workers of the complexity of back pain and making them aware of the importance of self-care,^{8–11} and avoiding approaches that have uncertain benefits (see Step 3 below).

The way a supervisor responds to a worker in pain or discomfort may be one of the most important factors affecting how long a worker stays away from work, i.e., the length of disability (which significantly impacts claim cost).⁶ There is both a psychological side to this as well as a practical risk reduction aspect. If a worker feels blamed, penalized, mistrusted, or belittled by their supervisor when they report pain, they are more likely to

not have modified work offered, they are more likely to want to leave that workplace due to the pain, and they are more reluctant to return to work. Supervisors who treat workers with respect and empathy, on the other hand, are more likely to be willing to make temporary accommodations, reduce actual risks, and therefore, prevent workers from needing to file an injury claim.

The critical role of the supervisor needs to be supported within the organization with a comprehensive approach:

- Facilitate recovery on the job and return to work by having an effective process for responding to back pain reports and managing disability.
- Utilize Liberty Mutual's Optimizing Supervisor Response to Injury program to help make supervisors aware of the impact they can have and give them the insight into back pain, self-care for back pain,¹²⁻¹⁴ and task redesign that can substantially reduce injury losses. Additional information on this program is available in Liberty Mutual's reference note, *Disability Management Training for Supervisors: Optimizing Response to Work Injuries*, RC 5431.
- Inform workers of the programs to reduce manual handling risks and the importance of self-care and managing their own health.

Step 3: Be Cautious When Considering Alternative Approaches

Redesigning high-risk tasks is the most effective approach to reducing injuries. However, there are several other popular approaches and understanding their limitations will help you make good decisions on allocation of resources:

- **Training in Generic Lifting Technique:** Research has clearly established that training workers in generic lifting rules does not reduce back pain or claims nor associated costs and disability.^{2, 15-19} Part of the problem may be that the rules normally taught (e.g., straight-back, bent-knees) will increase the stress and risk of lifting tasks²⁰⁻²² if it means reaching farther to the object in order to "clear" the knees. Liberty Mutual has long advocated a different emphasis on lifting rules — choosing a posture that is comfortable rather than the straight-back, bent-knee technique. Such an emphasis may be more helpful, but task redesign should remain the priority. Training on how to do specific tasks on the job, including tips on handling specific items using available equipment is, of course, essential for workers to know how to do the job.
- **Back Belts:** Back belts are another popular intervention that research has clearly shown has no impact on back pain, back pain claims, length of disability associated with back pain claims, or back pain re-injury.^{19, 23, 24}
- **Exercise:** As long as you are not overdoing it, exercise, when it leads to increased fitness, has multiple health benefits. Individuals who are more "fit" tend to have fewer and less severe episodes of back pain.²⁵ Leisure or "recreational" exercise has also been shown to speed the recovery of back pain.²⁶ Achieving these benefits in the workplace, however, is challenging since most workplaces do not have the facilities or time to administer the medical screening and level of aerobic exercise needed to achieve these benefits. Still, all employers can inform workers of the benefits of exercise, implement wellness programs where exercise is a component, and encourage workers, unless their doctor has told them otherwise, that exercise and activity is the best thing for recovering from back pain.²⁷
- **Pre-Placement Physicals, Strength Testing, or Functional Capacity Evaluations:** Employee pre-placement screenings and functional capacity evaluations to reduce low back pain have not shown evidence of working.²⁸
²⁹ Although the concept is fundamentally logical (if a worker can't demonstrate sufficient capacity to do simulated tasks that are similar to the work tasks, they can't expect to do them on the job safely), the drawback comes

because no method is perfect at predicting who will have back pain. Only about 10 – 30 percent of workers who will have a back pain claim can be identified, and inevitably, some workers will be screened out who would never have had an injury. The result is that programs such as this are often not cost-effective and are frequently the target of adverse legal action.

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