



Preventing Work Place Falls

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Introduction

Most people experience falls that sometimes result in potential life altering consequences. Falls occur in all types of settings including playgrounds, in and around the homes, and at work places. Irrespective of where they happen, it is generally recognized that falls are the leading cause of injury, treatment at emergency rooms, and a primary cause of accidental deaths among persons over the age of 65 years. Irrespective of sex, race, and ethnicity, the mortality from falls increases dramatically with age. More than 90% of hip fractures are caused by falls. The cost of hospitalization for injuries resulting from all types of falls was estimated to be in excess of \$10B dollars annually in the U.S.

Falls resulting in fatal and nonfatal injuries are a serious safety concern in the work place. In 1997, workplace falls resulted in 715 occupational fatalities and more than 300,000 nonfatal injuries that involved absence from work. This accounted for slightly more than 10% of all work place fatalities and slightly less than 20% of all injuries and illness involving absence from work.

Compensation and medical costs associated with employee slip-and-fall accidents is approximately \$70B annually (Kendzior, 2010). Work place improvements, new regulations and their enforcement, and educational programs for workers are reducing the number of fall injuries significantly.

Two types of falls -- falling on the same level and falling from one level to a lower level – are common in work places. The median recuperation time from falls is about eight days. This is about three days more than the median days needed to recover from all other types of injuries and illnesses combined. If fall injury involves fractures, the recovery may take thirty or more days. Direct and indirect costs associated with falls in the work place are staggering and it is extremely important that the number of all falls be reduced significantly to minimize the economic burden on the government and industries. With this goal in mind, this fact sheet is developed to help protect workers from work place falls and discusses who falls, causes of falls, types of injuries sustained and steps that can be taken to prevent falls.

Who Fell

Workers of all ages fall in the work place. Falls may be fatal or nonfatal. Most fatal injuries results from falls to a lower elevation.

Fatal falls:

Workers in the construction industry account for most fatal falls. This was followed by workers in agriculture, forestry, and fishing, and mining industries. Within the construction industry, the roofers and carpenters incur about one-third of all the fatal falls. Laborers in the construction industry account for about 15% of the fatal falls. Among the construction workers, structural metal workers face the greatest risk of a fatal work place fall. The fatal fall incident rate within this group is over 50 per 100,000 employees. A very high percentage (close to 97%) of those who were involved in fatal falls were men. This is expected because the construction industry is dominated by male workers. It is also interesting to note that males 55 and older were involved in larger proportion of fatal accidents.

Nonfatal falls:

Nonfatal falls occur under varied circumstances and are more widely dispersed among the industry workers of all age groups. Workers in the service industry accounted for about 25% of all the nonfatal falls and workers in the retail trade was close second.

The trend for nonfatal falls in private industries has been very encouraging than for fatal falls. From 1992 to 1997, the data showed a significant reduction in the risk associated with nonfatal falls within most industries. However, during the same period, the risk continued to be high and remained unchanged in the construction, mining, utilities, and transportation industries.

Operators, fabricators and laborers in the construction industry accounted for about one-third of all the nonfatal falls. Truck drivers and laborers claimed ten and three percent of the nonfatal falls respectively. The service providers such as nurse aides and orderlies, attendants, janitors, cleaners and cooks claimed approximately a fifth of all nonfatal falls.

Causes of Falls:

The causes of falls may depend on where they happened and who experienced the falls. To a large extend, falls depend on type of work place and the type of work being carried out.

Work Places

At work, falling to a lower level is common and the following are the common causes for such falls:

- Roof tops – falling through pre-existing holes and skylight ports, and sliding from the roof top or roof edge
- Ladders – slipping and falling, ladder collapse, ladder sliding out under the user, and electrical shock (Appendix A)
- Scaffolding – collapse or loss of balance, improper assembly, too much weight and wind (Appendix B)
- Nonmoving vehicles – unloading cargo, securing the load, and cleaning the large vehicles
- Falling from the building girder
- Trimming trees – falling from the trees or ladder

Possible causes of falls at the same level in the work place are as follows:

- Wet floors
- Grease on shop floors
- Ice and snow on parking lots
- Uneven walking surfaces
- Cluttered floors
- Tripping over one's own feet
- Loose carpet and loose treads on stairs • Lack of protective devices such as guardrails.
- Misuse of equipment
- Poorly maintained equipment
- Unclear safety procedures and lack of safety training

Types of Fall Injuries

Nonfatal falls may cause injury to multiple or isolated body parts. Approximately 20% of such falls results in multiple body part injuries and the rest in the injury of isolated body parts. The body parts that are most frequently affected are backs, knees, ankles, and wrists. Most common injuries resulting from nonfatal falls include the following:

- Sprains, strain or tear
- Fractures
- Bruises and concussions
- Soreness and pain

Preventing Falls

The following are the simple steps one can take to prevent work place falls:

- Keep aisles, walkways and stairs free of clutters.
- Keep cabinet doors closed when they are not being used.
- Turn on the lights when entering a room. Replace burned out bulbs.
- Use handrails on stairs and climb one-step at a time.
- Fix broken stairs and loose coverings.
- Make wider turn around corners to see who is coming towards you.
- If you spot a spill, clean it up or report it immediately.
- Stay away from short cuts. Less travelled routes may be less safe.
- Do not overload yourself. Carry only what you can handle comfortably and make sure you can see where you are going.
- When walking on a slippery surface, slow down and take smaller steps and keep a hand free for balance.
- Make sure chains, guard rails, or warning tapes are in place around elevated areas.
- Keep all harnesses and other fall protection equipment in working order and use them correctly.
- Wear the right kind of shoes for the job and keep the soles clean for better traction (Appendix C).
- Keep work space such as shop floor free of grease, tools, electrical cord and other similar items.
- When using equipment, select the right equipment to match the job. Make sure that the equipment is assembled correctly and working properly. Carefully follow safe use guidelines provided by the manufacturer. Pay special attention when selecting equipment for higher elevations.

Learning How to Fall

Naturally, the goal is not to slip, trip and fall; however, the possibility of a fall still exists. There are correct ways to fall, however, the recommended procedures are:

- Tuck your chin in, turn your head, and throw an arm up. It is better to land on your arm than on your head.
- While falling, twist or roll your body to the side.
- It is better to land on your buttocks and side than on your back.
- Keep your wrists, elbows and knees bent. Do not try to break the fall with your hands or elbows.

When falling, the objective is to have as many square inches of your body contact the surface as possible, thus, spreading out the impact of the fall.

Conclusions

Falls are the leading cause of injuries that require visits to the emergency department in the hospital. In work places, workers may experience falls on the same level or to a lower level. Falls to a lower level more often results in fatal injuries. Direct and indirect costs associated with fatal or nonfatal injuries at the work place are staggering and their economic impact on the government and industries is significant. More recent records show that industries are making progress in reducing the risk of falls at the work place. Design of safe work places, educational programs for workers, safe work habits, new regulations and enforcement, and adaptation of preventive measures are necessary to reduce the number of falls at work places.

References

- Stevens J.A., and Burns E.R. 2015. A CDC Compendium of Effective Fall Interventions: What Works for Community-Dwelling Older Adults. 3rd ed. Atlanta, GA: Centers for Disease Control and Prevention, National Center for Injury Prevention and Control.
<https://www.cdc.gov/homeandrecreationalafety/falls/compendium.html>
- Grisso, R.D., J. Perumpral, S.C. Mariger, D.E. Suttle, K. Funkenbush, and K. Ballin. 2014. Arthritis and Farming. Virginia Cooperative Extension, Publication Number 442-083 (BSE-139),
<http://pubs.ext.vt.edu/442/442-083/442-083.html>
- Kendzior, R.J. 2010. Fall Aren't Funny: America's Multi-Billion-Dollar Slip-and-Fall Crisis. Government Institutes, Lanham, MD, pp224.
- NSC (National Safety Council). 2017. Slip, Trip and Fall Prevention will Keep Older Adults Safe and Independent. http://www.nsc.org/safety_home/Resources/Pages/Falls.aspx

National Resources (Accessed Oct 3, 2017):

- AgrAbility National Project. <http://agrability.org/>
CoachLift. www.coachlift.com
Disabled Dealer. <http://www.disableddealer.com>
Life Essentials. <http://www.lifeessentialsweb.com>
Foundation for Rehabilitation Equipment & Endowment (FREE). <http://www.free-foundation.org/>
National Center for Chronic Disease (CDC) Prevention and Health Promotion. <http://www.cdc.gov>

Virginia Resources (Accessed Oct 3, 2017):

- Centers for Independent Living (CIL's) <http://www.brilc.org/>
Department of Rehabilitative Services (DRS) <http://www.vadrs.org/>
Easter Seals UCP North Carolina & Virginia <http://nc.eastersealsucp.com/>
Virginia AgrAbility Project <http://www.agrability.ext.vt.edu>
Virginia Assistive Technology Partnership (VATS) <http://www.vats.org/>
Virginia Disability Service Agencies <http://www.vadsa.org/>
Virginia Farm Bureau Safety (FB) <http://www.vafb.com/>
Woodrow Wilson Rehabilitation Center (WWRC) <http://www.wwrc.net/>

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APPENDIX A -- LADDERS

A ladder is one of the simplest most easy-to-use tools in the construction industry. However, accident data show that more than 160,000 people make emergency-room visits annually due to ladder accidents alone. Misuse and abuse of ladders in the workplace by working men and women in America have been identified as the primary causes of these accidents. Most ladder accidents can be avoided with proper selection of ladders and by strictly adhering to ladder safety rules. The following are general safety rules for all ladders:

- Read the manufacturer's instructions. Follow the guidelines that help you use ladders more safely and effectively.
- Make sure that the ladder being used is rated to carry the combined weight of the user and the material being installed.
- Choose the right ladder for the job. For example, if the ladder is to be used near power lines; use a wooden or fiberglass ladder to reduce the risk of electric shock.
- Before purchasing the ladder, make sure the ladder meets the safety standard. Always look for the UL mark.
- Inspect the ladder carefully before stepping on the first rung. Make sure that the ladder has been well maintained and the rungs are clean and all parts are intact. Never climb on a slippery or shaky ladder.
- Set the ladder correctly. When planting the base of any ladder, place all feet on firm, level surface, not on rocks or boards. Make sure that the devices that hold the front and the back sections of a step ladder (spreaders) are completely open and locked before any weight is placed on the ladder.
- When using an extension ladder, do not place the ladder at a very steep angle.
- Always use a ladder that is tall enough for the job at hand. A large number of ladder accidents are the results of using a ladder that is too short.
- Do not carry weight while climbing a ladder. Use a tool belt or let someone handover the items to you.
- When climbing the ladder up and down, face the ladder and keep your body centered between both side rails.
- While up on a ladder, do not over reach. Make sure that your weight is evenly distributed.
- Move or close the ladder only after the user and equipment are off the ladder.
- Never use a ladder when under the influence of alcohol, on drugs, or medication, or in ill health.

For a more detailed listing of ladder safety rules, review:

<http://www.elcosh.org/en/document/163/d000170/ladder-safety.html>

APPENDIX B -- SAFE USE OF SCAFFOLD

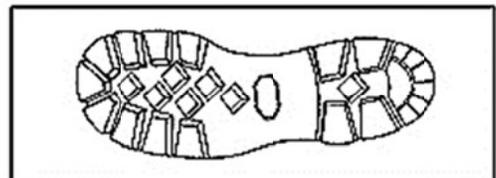
- Inspect the scaffold assembly before each use to make sure that it is assembled correctly.
- Use only the safe of means of access that is provided.
- Climb safely
- As you climb up and down, face the rungs.
- Use both hands.
- Do not carry materials while climbing up and down.
- Be sure of your footing and balance before you let go of your hands.
- Do not work on slippery rungs.
- Do not overload the platform with materials
- Working height should not be extended by planking guardrails or by use of boxes or ladders on scaffold platforms.
- Do not remove any component of a completed scaffold assembly except under the supervision of qualified persons. When a component is removed, make sure that it is replaced immediately.

APPENDIX C -- SHOES

Different types and styles are readily available in stores. One must recognize that all shoes sold in stores are not slip resistant. For example, shoes with rubber sole with treads will be more slip resistant than shoes with leather sole. Selecting the right kind of shoes particularly for seniors can make a big difference in preventing slips and falls.

When selecting shoes for the work place, one should consider the protection they can provide in addition to their slip resistance. The foot wear selected should be compatible with the type of work as well as the work surroundings. Shoes or boots worn when engaged in agricultural operations should have the following features:

- The soles and heels should be slip-resistant.
- The toe of the shoe should resist crushing injuries.
- The shoe should support the ankle.



The cleat-design is ideal on slippery surfaces because of the suction or squeezing action it can provide. The softer soles are better on slippery indoor surfaces. For outdoor uses, harder soles with more rugged cleats are preferred.

APPENDIX D EXERCISES

Exercises can help prevent an individual from falling. Tai Chi programs are especially beneficial for older adults to prevent falls (Stevens and Burns, 2015). A few other useful exercises are listed below and should be completed several times a week. These exercises will increase both strength and coordination.

Stretching should be completed to increase flexibility and range of motion leading to increased balance. While stretching you should target your major muscle groups, hold each stretch for about 30 seconds, do not bounce, focus on a pain free stretch, and be able to breathe freely (do not hold your breath).

How to stretch muscle groups:

- **Calves:** Standing in the upright position, step back with one foot a few feet and lean forward to feel the stretch. After 30 seconds, switch feet.
- **Hamstrings:** Standing in the upright position, lock knees and try to touch your finger tips to your toes. Again, hold for 30 seconds.
- **Quadriceps:** While lying on one side, bend one leg at the knee and pull that foot to your back side. Keep the rest of your body straight, hold for 30 seconds and switch sides.



Squats will train muscles in your hips, thighs, and buttocks, as well as other bones, ligaments, and tendons throughout the lower body. Standing upright, you should place your feet shoulder width apart. With your arms straight out in front of (perpendicular to) your body, you should bend at the knees like you are sitting down. While performing a squat, keep your back straight and go down until your thighs are parallel to the ground.

Knee Ups exercise builds strength in your hip flexors and quadriceps. For this exercise you simply lift one of your knees up until your thigh is parallel with the ground. You should alternate legs to simulate walking up stairs and continue the workout for as long as you feel comfortable.

Before you begin any exercise program, you should consult your doctor or healthcare provider to see what type of exercises are best for you. You may even want to see a physical therapist for an assessment of your specific exercise and joint-protection needs. A physical therapist can help you get started with an exercise program, adapt exercises to avoid damage to your joints, and establish reasonable goals.

Also, keep in mind that only your doctor or health care provider should determine the types of activities for you to do during arthritis flare-ups (Grisso et al., 2014). When a joint is warm, painful, and swollen, rest will help reduce the inflammation.