WORKPLACE SOLUTIONS

From the National Institute for Occupational Safety and Health

Reducing Musculoskeletal Disorders among Airport Baggage Screeners and Handlers

Summary

Baggage screeners and handlers at airports are exposed to manual baggage lifting and handling that are associated with work-related musculoskeletal disorders (WMSDs). The National Institute for Occupational Safety and Health (NIOSH) evaluated two mechanical lift aids to determine if they could reduce the risk of WMSDs. The two mechanical lift aids reduced some physical WMSD risk factors such as hand loading and spinal compression force.

Description of the Problem

Approximately 45,000 baggage screeners and 173,700 baggage handlers are employed in U.S. airports by the Transportation Security Administration (TSA) and airline carriers, respectively. Manual lifting and materials handling have been shown as main risk factors for WMSDs [NIOSH 1997]. The average weight of checked bags is about 32 lbs, and the maximum baggage weight can reach up to 70 lbs or more [NIOSH 2014]. Manual baggage lifting and handling are therefore considered the main risk factors for WMSDs among baggage screeners and handlers. A portion of the checked bags are manually handled by baggage screeners, while every checked bag is required to be manually transferred to airplanes by carrier baggage handlers.

In most airports, checked bags are screened by screening machines. If machine screening cannot be completed, manual screening is required to clear bags in a baggage screening area. To perform manual screening tasks, a bag is typically lifted or pulled by a baggage screener from the inbound conveyor. Once manual screening is completed, the bags are lifted to an outbound conveyor that is separate from the inbound conveyor, requiring lifting and carrying. If screening machines are located in the airport lobby area, baggage screeners may be required to manually lift each checked bag twice—transporting the bag from the floor to the machine and from the machine to the conveyor connected to the baggage make-up area for airline carriers. Therefore, baggage screeners working in checked baggage screening areas may be involved in intensive baggage lifting in some settings, particularly during rush hours.

Once checked bags are cleared by baggage screeners, they typically are transported on a conveyor to the baggage make-up area where the checked bags are manually transported to baggage carts and then airplanes by carrier baggage handlers. Carrier baggage handlers who work in the ramp area (i.e., the area where airplanes are parked for departure and arrival) lift bags onto a belt loader from a cart, handle bags at the airplane cargo compartment doors, and stack bags inside cargo compartments. They reverse the operations when bags are unloaded from the cargo compartments. Carrier baggage handlers typically lift 5–10 bags per minute during loading/unloading to the airplane [Oxley et al. 2009]. Risk factors for WMSDs associated with these tasks include heavy lifting, awkward and restricted postures (in the small cargo areas), and time pressure [Tapley and Riley 2005; Tapley et al. 2007]. The problem is more acute when handlers load narrow-bodied airplanes with a cargo ceiling ranging from 46–55 inches. Automatic container systems for loading and unloading checked baggage have been used in larger airplanes, but are not available for narrow-bodied airplanes.

NIOSH Case Studies

NIOSH evaluated the effect of two ergonomic interventions on the risk of WMSDs among baggage screeners [NIOSH, 2014]. The main findings are summarized below:

Vacuum Lifting Assist Device

Operation of the vacuum lifting assist system (Figure 1) involves pushing and pulling the controller as the vacuum power lifts the bag. Three bag weights (25, 40, and 50 lbs) were tested in the study. When the system was used, the average minimal pushing/pulling force was reduced to 2.7, 4.0, and 4.2 lbs, respectively. Compared to the hand forces measured during lifting, this was approximately a 90% reduction when using the vacuum system. In addition, the vacuum lifting assist system resulted in improved postures (near neutral trunk flexion angles) because of the adjustable controller that can keep the bag at the optimal height for lifting. The reduced hand force and improved posture resulted in a 63% measured reduction of the compressive force in the lower back [NIOSH 2014].

Figure 1. A baggage handler lifts a bag with a vacuum lifting assist device

Automatic Baggage Moving System

The automatic baggage moving system (Figure 2) is a conveyor that helps move the bags from the screening area to the outbound conveyor. Unlike the traditional conveyor systems, this system does not connect the two ends of the working area. It connects to one end at a time, then moves itself automatically to the other end as it senses the bag that is loaded to the moving system. This system might be shared between two work stations connected by a roller bed. This intervention eliminates lifting entirely, but requires manual pushing to load the bag from the screening table through the roller bed to the baggage moving system. The average pushing force is about 80% of the force required for manual lifting of a 25- or 50-lb bag. The posture and force involved in using the system resulted in a 44% reduction in the compressive force in the lower back [NIOSH 2014].

Figure 2. An automatic baggage moving system

Table 1 summarizes the features of the vacuum lifting assist and the automatic baggage moving systems.

Other Risk Control Methods

Mechanical lift aids are recommended to be used as the primary risk reduction method for baggage handling [Tapley and Riley 2005; Tapley et al. 2007]. For baggage handling in the airplane cargo space, certain methods of loading and stacking bags may also help reduce strain on the back [Vatan-Korkmaz et al. 2006]. These may include marking heavy bags so they can be slid into the cargo and lighter bags lifted on top [Vatan-Korkmaz et al. 2006]. Job rotation, short breaks, and training on proper lifting procedures (lifting above the knees, below the shoulder, and close to the body) are other administrative controls that may help reduce the risk of injury [Dell 1998; NIOSH et al. 2007]. Baggage-handling jobs are associated with low levels of employee control over tasks, time pressure, and low social support [Rosskam 2007]. These workplace factors may also play a role in the development of WMSDs, although they are not as evident as the physical job demands [NIOSH 1997; da Costa 2010]. Reductions in the workplace stressors in the work environment may help prevent WMSDs [Hauke et al. 2011].

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Table 1. Features of ergonomic interventions for baggage screening and handling

	Vacuum lifting assist device	Automatic baggage moving system
Hand force reduction*	90%	20%
Reduction of spinal compressive force in the lower back†	63%	44%
Cost	~$10–30K per unit, depending on configuration. Additional costs may be incurred when taller ceilings are required.	$50K per unit
Noise	Potential for noise exposure from vacuum pump motor due to improper housing	Minimal noise
Sharing capability	Overhead trailing system allows for sharing between multiple work stations	Limited sharing capability (1–2 workstations)
Configuration constraint	Required taller ceiling to accommodate the long vacuum hose	Potential egress/ingress concerns because of railing system on the ground/floor
Bag transfer	Potential inability to pick up bags with uneven surfaces	Capable of transferring all bags, including very heavy ones
Work cycle	Adjustable, and shorter cycle time determined by user	Longer cycle time because of slower operating speed

*Hand force is pushing/pulling force. The reduction is compared with manual lifting force.
†Data is compared with that for manual lifting.

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http://www.cdc.gov/niosh/topics/ergonomics/

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