Walkthrough Ergonomic Checklist for Evaluating Slip/Fall Potential in Lead Abatement Tasks.

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The purpose of this study is to develop a tool to determine the ergonomic risk factors of cumulative trauma disorders (CTDs) and slips/ fall potential associated with the lead abatement and lead risk assessors' tasks. For this purpose, an existing and validated checklist of ergonomic walkthrough surveys developed for carpentry tasks was adapted. This checklist allows identification of (1) awkward postures, (2) repetitive motions, (3) self-reported body-discomfort and perceived exertion and (4) tool use. In addition, this checklist is enhanced with postural instability potential weighting for specific postures common at lead abatement sites and an additional section to obtain information on slip/fall risk factors. Based on studies with industrial workers, the following risk factors have been rank-ordered according to the increasing risk of postural instability: poor ambient lighting, elevated working surfaces (ladders or scaffolding), inclined working surfaces, surface condition (slipperiness) and poor shoe condition. To maintain upright balance, a person must keep his/her center of gravity (CG) inside the base of support (BOS) they create with their foot placement. By associating certain weighting for postural instability with certain postures, which move the CG away from the BOS, the risk of postural instability can be quantitated. To determine the weighting factors, six postures, including various torso angles and arm positions taken from photographs of lead abatement tasks, were simulated in a laboratory-based experiment. Since for static posture the position of the center of pressure (CP) can approximate the location of CG, the CP of the subject was measured using a force platform. Also, the BOS was measured using 3-D video digitization of the first and fifth metatarsals and heels of both feet and from this, a smaller region called the functional stability boundary (FSB) was defined which accommodated for factors such as postural muscle strength, reaction time and other factors. Each posture was maintained for thirty-second trials and each posture was repeated for a total of 14 trials that were completed in a random order. The data was analyzed using custom software and the outcome measures include the index of proximity to stability boundary (IPSB) and the weighted residence time index (WRTI). The postures for which the CP must travel close to the functional stability boundary (FSB) and remain in regions close to the FSB will have a smaller IPSB value and a larger WRTI value relating to increased postural instability. According to the results of the IPSB and WRTI, the following rank order, from most stable to higher risk of fall/postural instability potential, of postures was obtained: (1) upright torso with arms "working" at eye level, (2) torso bent 90° forward and arms "working" just above floor level, (3) torso bent slightly backwards with arms "working" above head, (4) torso upright with arms at side, (5) squatting posture with arms "working" just above floor level and (6) torso bent approximately 45° laterally with arms "working" at eye level. The revised checklist will now be tested and validated in the field, with lead abatement workers.