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Using practical ergonomic evaluations in the restaurant industry to enhance safety and comfort: a case study

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Abstract. Restaurant employees must deal with loud noise, busy environments, difficult customers, heavy, awkward, sharp, and hot objects, repetitive motions, and stress on various joints, all of which can lead to fatigue, sudden accidents, and long-term musculoskeletal injury. The goal of this case study was to assess the risk of injuries and accidents from conducting various tasks in the restaurant, specifically carrying/lifting, table management, and polishing silverware. The nine participants were servers at a local country club restaurant. Physical workload was measured by a scale of physical exertion. Cognitive workload was assessed, as well as cumulative trauma disorder risk. Overall results show that there is sufficient risk in some of the tasks to warrant concern. Specific results are discussed, as well as recommendations for improved safety.

Keywords: CTD; accidents; injuries; workload; restaurant

1. Introduction

Work accidents, employee absenteeism and turnover in restaurants may be related to human factors issues such as Cumulative Trauma Disorders (CTDs). These injuries often fall under work related musculoskeletal disorders. Common CTDs occur in areas of back, neck, shoulders, hands, and other joints. These disorders can be very painful and lower work efficiency and productivity. Symptoms can develop without the person realizing it. The average rate of CTDs in high-risk occupations can be as high as 15-20%, and of reported CTD cases, 48% of the victims are not well enough to return to work [6]. CTDs, as opposed to sudden accidents due to lack of safety, actually can be harder to prevent because employers and even employees themselves may not think about the risk. High physical workload can cause body stress and can influence employees to take careless shortcuts. It can cause sudden accident/injury and lead to fatigue and lower job satisfaction. Cognitive workload refers to "the degree or percentage of the operator's information processing capacity which is expended in meeting system demands" [2]. High cognitive workload can lower the quality of physical and mental health.

2. Methods

2.1 Participants and Tasks

The nine participants were servers at a country club dining room. The task areas analyzed included table management (e.g. taking customers' orders, clearing/setting tables), carrying/lifting tubs filled with eating utensils, and polishing silverware/glassware.

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2.2 Ergonomic Assessments

These included an ergonomic checklist, CTD risk formula (all 3 tasks), self-report cognitive workload scale (table management task) and self-report physical exertion questionnaire (polishing task).

2.2.1 CTD risk formula [7]

There are three factors: Task (weight = .637), Personal (weight = .258), and Organizational (weight = .105). These risk factors themselves are multidimensional. Each factor was assessed by the authors on a scale from 0 (no risk) to 1 (high risk). An example of task risk is preparing dough for a pizza, which was calculated to be 0.711 [5]. **Task risk factors** include ratings on awkward joint posture, repetition, hand tool use, force, task duration, and vibration. **Personal risk factors** include ratings on previous CTDs, hobbies and habits, diabetes, thyroid problems, age, and arthritis. **Organizational risk factors** include ratings on equipment, production rate/layout, ergonomics program, peer influence, training, CTD level, and CTD awareness.

2.2.2 Cognitive workload scale (Likert 1-7 rating for each item)[1]

The following include the items and the scale for each item: Overall workload (very low-very high), task difficulty (very easy-very hard), time pressure (none-very rushed), actual performance (lousy-great), comfort level (very low-very high), mental/sensory effort (very low-very high), skill required (none-very much), fatigue (worn out-wide awake), stress level (completely relaxed-extremely tense).

2.2.3 Physical workload scale [3]

This scale ranged from 1 (minimal exertion) to 10 (extreme exertion). Participants rated their physical exertion every 5 minutes for 50 minutes total. This scale has been found to be highly correlated with more objective measures of physical workload such as heart rate [4].

3. Results

3.1 Results for carrying/lifting task

The task risk factors for carrying/lifting was 0.5753 (*moderate to high moderate risk*). The organizational risk factors was lower at 0.4838.

Figure 1 depicts the personal risk factors across all participants. The overall CTD risk across task, personal, and organizational risk factors for carrying/lifting was an average of 0.51, equating to *moderate* risk. The range for **overall** CTD risk across all participants was 0.44 - 0.60.

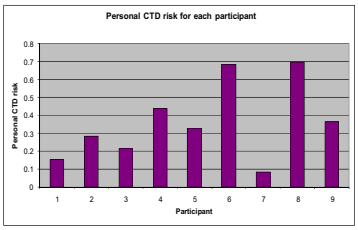

Fig 1: Personal CTD risk for each participant

3.2 Results for table management task

Overall cognitive workload (item 1) was rated on average to be 4.67. Skill required (item 7) and stress level (item 9) were both rated at 4.33. Time pressure (item 3) was 4.44. Highest workload rating across all items was with mental/sensory effort (item 6), at 5.11. All items were rated out of 7 maximum. For actual performance (item 4) and comfort level (item 5), the lower the rating, the higher the workload. Task CTD risk was 0.4248.

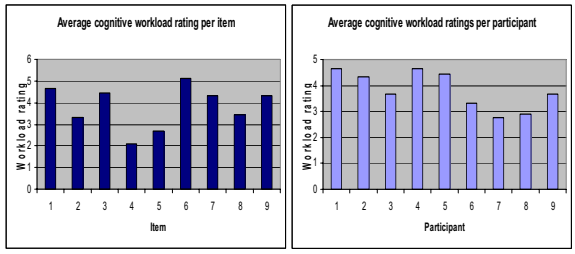

Fig 2: Average cognitive workload ratings per item and per participant

3.3 Results for polishing task

The task CTD risk was 0.7025 (*moderately high risk*). The average **overall** CTD risk was 0.59, with a range of 0.52 - 0.68. The physical workload ratings yielded only a mild to moderate amount, with an average rating of 3.65 (*SD* = 0.92). Across time on average these ratings increased steadily from 5 – 20

minutes into the task. It was fairly steady from 20 to 35 minutes, rose significantly from 35 – 45 minutes, and then decreased slightly from 45 – 50 minutes.

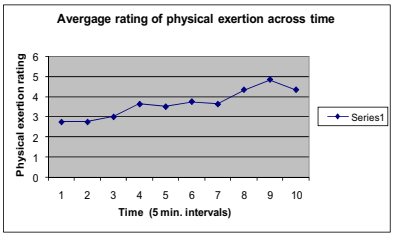

Fig 3: Average rating of physical exertion across time

4. Recommendations

4.1 Carrying/lifting task

The easiest way to prevent injury is to lower the weight of the items. It would also be beneficial to have the load at a higher level. Ideally the servers would not place trays on the floor, and maybe could even have a mechanical lift to lift the tray. Another idea is to have a grip on the tray for better handling. Better designs for carts should also be considered, such as installing rollers on shelves and having improved handling.

4.2 Table management task

One suggestion to reduce cognitive workload is to have a touch-screen monitor at the table to order from and a small device to swipe a credit/debit card. What could also help reduce physical strain and chances for injury are mechanical lift for tables that are low, similar to what is on an office chair. Or one could have all tables raised on a platform base. If this is not possible, maybe servers could use a reaching device to pick up objects across a table and to clean. Another possibility is to include folding bench seats at booths so employees can fit in to clean the table. A more extreme change to reduce physical workload is to limit walking distance by changing the structure of the restaurant to have a central kitchen.

4.3 Polishing task

To reduce the risk of injury, higher work surfaces could be built to rest arms on. A chair might be helpful to reduce leg strain from standing the entire time and reduce torso bending. Moreover a chair could include arm rests. If possible, to reduce repetitive strain, use some type of automated hand tool to help with polishing that would be very gentile on glassware.

References

[1] D. L. Damos et al, Performance evaluation tests for environmental research (PETER): Critical tracking test, Perceptual and Motor Skills 58(2) (1984), 567-573.

[2] F. T. Eggemeier and R. D. O`Donnell, R. D, A conceptual framework for development of a workload assessment methodology. In Text of the Remarks made at the American Psychological Association Annual Meeting. Washington D. C.: American Psychological Association, 1982.

[3] G. Borg, A category scale with ratio properties for intermodal and interindividual comparisons, in: Psychophysical judgment and the process of perception, H. G. Geissler and P. Petzold, eds., VEB Deutscher Verlag der Wissenschaften, Berlin, 1982.

[4] K. H. E. Kroemer, H. B. Kroemer and K. E. Kroemer-Elbert, Ergonomics: How to Design for Ease and Efficiency, Prentice Hall, Upper Saddle River, NJ, 1994.

[5] M. Gentzler, M. Kline, A. Palmer and M. Terrone. Assessment of CTD risk for three different tasks: Constructing and repairing multi-layer insulation (MLI) blankets, preparing the dough for a pizza, and operating the Becton-Dickinson Facsaria Flow Cytometer, proceedings of the international conference on industry, engineering, and management systems 13 (2007) 315-323.

[6] P. McCauley-Bell, In-class powerpoint presentation on cumulative trauma disorders, 2006.

[7] P. M. Bell and L. Crumpton, Fuzzy linguistic model for the prediction of carpal tunnel syndrome risks in an occupational environment, IBM Journal of Research and Development 44 (2000), 759-769.