COST-BENEFIT ANALYSIS OF AN ERGONOMIC INTERVENTION IN TWO HOSPITAL LAUNDRIES VS. A CONTROL LAUNDRY

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An ergonomic intervention study was conducted at two hospital laundries and a control laundry to evaluate changes in injuries, self-reported pain and psychosocial factors post-intervention. At Laundry A, ergonomic changes resulted in fewer musculoskeletal injuries (MSIs), but no significant difference after 8 months in self-reported pain or psychosocial factors, even though 88% of workers felt the changes made their work better. At Laundry B, ergonomic changes resulted in a reduction in MSIs, less self-reported pain and significant improvements in psychosocial factors. At the control laundry, there was no change in injuries or psychosocial factors, but increased reports of pain in the same time period. Benefit-to-cost ratios were 0.97 for Laundry A and 1.5 for Laundry B, demonstrating a one-year or less payback on ergonomic improvements. The high return on investment was largely due to increases at both laundries in productivity and savings in overtime, turnover and return-to-work costs.

Keywords: musculoskeletal disorders, laundry workers, cost-benefit

ANALYSE COÛTS-AVANTAGES D'UNE INTERPOSITION ERGONOMIQUE DANS DEUX BLANCHISSERIES D'HÔPITAL CONTRE. UNE BLANCHISSERIE DE COMMANDE

Une étude ergonomique d'interposition a été entreprise à deux blanchisseries d'hôpital et à une blanchisserie de commande pour évaluer des changements des dommages, individu-rapportés la douleur et l'poteau-interposition psychosociale de facteurs. À la blanchisserie A, les changements ergonomiques ont eu comme conséquence peu de dommages musculoskeletal (MSIs), mais comme conséquence aucune différence significative après 8 mois en douleur individu-rapportée ou facteurs psychosociaux, quoique 88% d'ouvriers ait senti les changements faits leur travail meilleur. À la blanchisserie B, les changements ergonomiques ont eu comme conséquence une réduction de MSIs, de moins de douleur individu-rapportée et d'améliorations significatives des facteurs psychosociaux. À la blanchisserie de commande, il n'y avait aucun changement des dommages ou des facteurs psychosociaux, mais plus grands rapports de douleur dans la même période de temps. les rapports d'Avantage-à-coût étaient 0,97 pour la blanchisserie A et 1,5 pour la blanchisserie B, démontrant un d'une année ou moins de remboursement sur des améliorations ergonomiques. Le retour élevé sur l'investissement était en grande partie dû aux augmentations aux blanchisseries de la productivité et à l'épargne des heures supplémentaires, chiffre d'affaires et retourner-à-travaille des coûts.

Mots-clés: désordres musculoskeletal, ouvriers de blanchisserie, des coûts et rendements

OBJECTIVES AND STUDY DESIGN

The objective of this 2-year project was to evaluate changes in MSI injuries, self-reported pain, and psychosocial factors following implementation of ergonomic solutions at two laundry facilities in British Columbia compared with a control laundry. The control laundry did not receive ergonomic assistance, but continued with in-house programs, which were

monitored over the study period. The study design is a pre-post with each facility serving as its own control before and after intervention.

METHODS

At the two intervention laundries, detailed ergonomic assessments and measurements were made of each job. Further analysis included use of four ergonomic tools for the purpose of ranking risks between jobs: the checklist from U.S. Occupational Safety and Health Administration Draft Ergonomics Rule, ANSI checklist (draft), observational rating scales from Latko & Armstrong(3) and the Strain Index(4). Jobs were ranked from highest to lowest risk.

Ergonomic solutions were developed iteratively with the ergonomist, laundry manager and workers using focus groups and discussions. Where possible, more than one solution was found for each risk factor. Jobs considered “low risk” were eliminated. Two types of ergonomic solutions were implemented: 1. Those designed to affect culture, worker attitudes, knowledge and job satisfaction (such as training, and positive feedback to workers); and 2. Solutions designed to specifically reduce physical risk factors including engineering changes (new equipment) and administrative changes (such as job rotation).

Ergonomic assessments were conducted again of each job four months after implementation of solutions and scores were compared. A four-page questionnaire was completed by all workers at the 3 laundries prior to and 8-months following implementation of 80% of the changes. Questions asked about pain recurring three or more times in the previous year or lasting longer than five days(1). Questions also asked about medical visits, days lost, light duty and physical and mental exhaustion after work. Ten questions were asked about psychosocial variables based on Kamwendo(2). These included concepts of variety, work demands, support, and influence over working conditions. The sum of the ten questions was analyzed, as was each individual question. The post-intervention questionnaire also asked workers about the ergonomics process, such as whether their job had changed, whether it improved their job, reduced fatigue, etc. Questionnaire data was analyzed pre and post-intervention using either a chi square analysis or analysis of variance and Mann Witney tests. Follow-up interviews were conducted to collect outcome benefits such as changes in productivity, quality, injuries, overtime, ease of return-to-work and costs.

RESULTS

Results at Laundry A

The follow-up period after implementation of 80% of the solutions was 8 months, but only 2 months in the case of the remaining 20% of solutions, including installation of the new dryer. Of a total of 42 laundry workers, post questionnaires were returned for 24 workers (57% response rate), considerably lower than the pre-questionnaire rate (83%).

At Laundry A, 35 recommendations were made for ten of a possible thirteen jobs and 83% of the recommendations were implemented. The majority of solutions cost less than $500. Major changes included a new dryer, replacing linen bags with plastic, reducing the manual handling of bags with more carts, purchasing spring-loaded bins, removing the sheet feeder and removing a storage server that necessitated carrying of linen on trays. Figures 1 and 2 show before and after modifications made to the job called “dumper”. Plastic bags are easier to open and eliminate the need to raise the arms overhead to dump the contents. Also the

conveyor was extended closer to the worker eliminating the long reach and bend. Extended sides along the conveyor prevent bags from falling off.

Figure 1. "Dumper" before modifications showing awkward bending and reaching postures

Figure 2. "Dumper" shows an extended conveyor with higher sides and plastic bags that reduce awkward dumping postures.

On questionnaires, 73% of workers reported their job had changed and 88% felt the changes made their work better: 70% reported less physical effort, 69% being less tired, 75% less sore and 75% reported the job is both more interesting and more varied. The incidence of MSIs (medical aid and lost time) went from 48.8 to 41.9 (in the 8 month follow-up) and further to 18.6 in the second full year following changes.

There were no significant differences in self-reported pain 8 months post-intervention, with pain reported by 79% of workers in each case. While shoulder pain did increase statistically post intervention, there were trends towards less pain for the upper and lower back and the neck that did not reach significance, likely due to the small number of workers responding. Since some interventions were only implemented two months prior to follow-up, there may have been insufficient time for effects on the body to be realized.

While workers reporting pain were significantly more likely to have a lower total psychosocial score, there were no differences in the score following implementation of solutions. However, the percentage of workers reporting greater variety in their work increased from 79% to 96% ($p=0.11$) and was of borderline significance. Lack of significance again could be influenced by the small number of workers responding.

Laundry B

The follow-up period for most interventions was 8 months. Of 90 laundry workers available, post questionnaires were returned from 55 (61% response rate) compared with a 95.5% response rate on the pre-questionnaire. Of 37 recommendations for the 12 jobs, ergonomic interventions were implemented for 89% of the recommendations (on 10 jobs). Solutions included designing an hourly job rotation scheme, modifying the operating room folding table with drop-leafs and a gurney-guy that clamps to the table, new storage racks in the shipping department with maximum heights and bag volumes posted on the racks, and reduced volume of sheets in the dryer (from 200 to 100 lb) to reduce tangling when feeding the sheet ironer. Figure 3, 4 and 5 show before and after modifications in the OR folding room.

Workers' responses on the questionnaire to the ergonomic intervention were extremely positive with 73% indicating their job had changed and 88% stating that as much as possible was done in the intervention. An overwhelming 93% of workers felt the changes made their

job better: 68% reporting less physical effort, 69% were less tired, 71% less sore, 64% stating their job is more interesting and 80% stating it is more varied.

Figure 3. Before changes, static postures holding gurneys while fan-folding.

Figure 4. After changes, a "gurney guy" clamps to the table to eliminate holding.

Figure 5. Drop leafs added to OR folding tables to reduce bending

Figure 6 shows a statistically significant decrease in self-reported pain 8 months following the ergonomic intervention in any body part (p=0.08), the upper body (p=0.006), neck (0.089), shoulder (p=0.045), elbow/forearm (0.01) and hand/wrist (p=0.009). The upper back and ankle showed significant increases in pain.

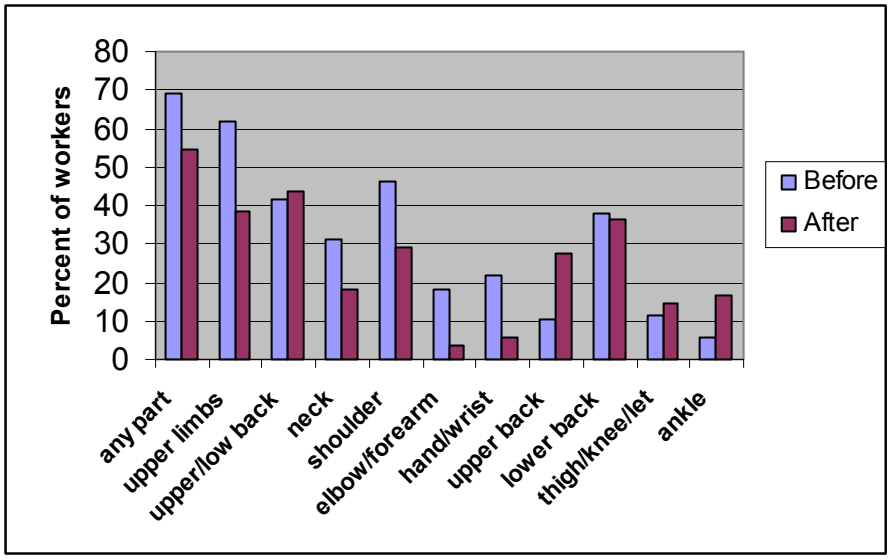

Figure 6. Percent of workers reporting pain before and after ergonomic intervention.

As well, the incidence of MSIs went from 22.2 to 17.8. For those that reported pain, there was a significant difference in days lost (p=0.0005) and borderline significance in days of light duty post-intervention (p=0.14). Reports from the manager verified that changes made it easier to return injured workers to full-time work. A significantly higher total psychosocial score post intervention indicated a more positive work environment (p=0.08). However, the actual change in scores was small. Only the variable of friendly spirit of cooperation increased significantly on its own, however several questions showed positive trends, such as more variation in work, workers being told they do a good job, having good contact and cooperation with their supervisor and feeling able to influence their working conditions.

Control Laundry

Lost time and medical aid MSIs at the control laundry remained unchanged during the follow-up period, as did self-reported medical treatment, lost time days and days of light duty. Self-reported pain increased significantly from pre to post questionnaires from 50% of workers to 87%. There were statistically significant increases for all individual and combined parts of the body except the upper back and the thigh/knee/ankle. There were no differences in psychosocial scores on the pre and post questionnaires.

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Cost-Benefit Evaluations

The total cost of ergonomic interventions at Laundry A was $84,240. Benefits totaled $82,070, including a reduction in managers time dealing with grievances, selling of a sheet ironer, reduced turnover and overtime and increased productivity. The one year benefit-to-cost ratio was 0.97. Therefore, the ergonomic solutions had a one-year payback or 97% return on investment. Additional savings were realized the following year (after the 2-year project completed) with a substantial reduction in MSIs. The change to disposable bags yielded a payback of $20-45,000 for customers, further enhancing the viability of the laundry.

At Laundry B, the cost of ergonomic interventions was $27,800. Benefits included reduced MSIs, reduced time loss during return-to-work and an increase in productivity, totaling $41,600. The one-year benefit-to-cost ratio is 1.5, with an eight month payback for the ergonomic solutions. The return on investment for Laundry B is therefore 150%.

CONCLUSIONS

Despite the short timeframe for evaluation of ergonomic solutions (8 months), it was concluded that there is convincing early data from two laundries that the combination of physical and psychosocial ergonomic solutions, using a participatory approach, has resulted in a payback period for solutions of one year or less. The high return on investment was largely due to increases at both laundries in productivity and savings in overtime, turnover and return-to-work costs. While it is impossible to know whether the ergonomic solutions focused on physical risk factors were more or less important than those focused on psychosocial factors, it appears that both types of solutions are needed.

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