# The Economics of Ergonomics

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The body of scientific evidence supports the financial case for ergonomic programs. Strong evidence indicates that ergonomic programs are cost effective (Amick, Brewer, Tullar, Van Eerd, Cole, & Tompa, 2009). The evidence is particularly strong for ergonomic programs implemented in manufacturing (Tompa, Dolinschi, de Oliveira, & Irvin, 2007). There is also support for the cost-effectiveness of ergonomic programs in the administrative and support sector, the healthcare sector and the transportation sector (Tompa, Dolinschi, de Oliveira, & Irvin, 2007).

## ECONOMIC EVALUATIONS OF ERGONOMIC INTERVENTIONS FOR THE ADMINISTRATIVE AND SUPPORT SERVICES SECTOR

Tompa et al. (2007) conducted a systematic review of workplace occupational health and safety interventions with economic evaluations. The interventions included were undertaken in a number of different industries; in total, 12 industry sectors were listed. In the administrative and support services sector, a cluster of eight intervention evaluations (identified within the category of ergonomics and other musculoskeletal injury prevention interventions) were identified, summarized and ranked by the quality of the study. Two intervention evaluations were considered to be high quality studies, one was of medium quality, and five were of low quality. As a result, Tompal et al. (2007) concluded that there was moderate evidence that such interventions in the administrative and support services sector are worth undertaking on the basis of their financial merits. They may be beneficial due to a reduced frequency or severity of injuries, which ultimately results in savings, and/or productivity improvements that result in savings.

**Table 1** lists (by order of study quality) the eight research studies that examined the economic impacts of ergonomics in preventing musculoskeletal disorders in the administrative support sector. A summary of the observed effects and economic analysis results are also included in **Table 1.**

## ECONOMIC EVALUATIONS FOR DISABILITY MANAGEMENT INTERVENTIONS

Tompa et al. (2007) also included studies pertaining to disability management interventions in their systematic review of workplace occupational health and safety interventions with economic evaluations. Their findings suggeted that disability management interventions, across multiple industry sectors, provided strong evidence and are worth undertaking based on economic analyses (Tompa, Dolinschi, de Oliveira, & Irvin, 2007).

TABLE 1

Economic Impacts of Ergonomics in Preventing Musculoskeletal Disorders in the Administrative Support Sector

| STUDY | DESCRIPTION OF INTERVENTION | OBSERVED EFFECT | ECONOMIC ANALYSIS RESULTS |
|---|---|---|---|
| Amick (2003); DeRango (2003)<br><br>Study quality: 3.6 | Highly adjustable chair and a one-time office ergonomic training workshop with a series of educational follow-ups conducted concurrently with the chair distribution.<br><br>**Analysis:**<br>1) Total effects model estimated both fixed and random effects regression modeling, where the dependent variable was productivity per effective day.<br><br>2) Health-mediated model estimated with a two-step approach (fitted values of changes in pain used as explanatory variables to estimate productivity changes) | 1) Interventions did not have an impact on sick-leave hours;<br><br>2) Training alone did not have a statistically significant effect on pain levels, whereas the chair-with-training intervention significantly reduced pain (5.95 to 6.23 points for the fixed and random effects models, respectively);<br><br>3) Improved productivity effects were significant (a one point improvement in pain was associated with a $13.25 and $19.14 increase in production per effective workday for the fixed and random effects models, respectively). | **Cost of the intervention:** Total costs per worker were $1,032. This included cost of the chair ($800 per person), trainers' time and travel expenses ($200 per worker), and labor costs of the 90-minute training session ($32 per worker) (USD).<br><br>**Consequences of the intervention:** The increase in taxes collected per worker per year (based on the health mediated model) was $25,398.12 (USD). There was no change in absenteeism.<br><br>**Result:** The benefit-cost ratio was 24.61. |
| Lahiri (2005)<br><br>Study quality: 3.5 | Lumbar pads and backrests were made available to employees to reduce back discomfort. Back school workshops were also conducted.<br><br>**Analysis:** Before-after comparison of back pain cases, sick days due to low-back pain, and productivity changes. | 1) Total back pain cases were reduced from 41 to 12; acute back pain cases were reduced from 3 to 2; annual average number of sick days due to back pain was reduced from 20 to 0.<br><br>2) Avoided lost-time costs from work due to low back pain of $4,800 (annual); avoided medical care costs of $96 (annual).<br><br>3) Total annual productivity gain was $66,384 ($3,984 in avoided productivity loss + $62,400 in productivity enhancement). | **Costs of the intervention:** Costs per year were $839, which include equipment, internal labor costs (likely including installation and maintenance, internal training and other time costs), and cost of back school workshops.<br><br>**Consequences of the intervention:** Savings per year were $71,280, which included avoided medical care costs, avoided loss in work time due to sick leave, productivity losses (averted) due to low-back pain and discomfort while at work (before intervention), and productivity enhancements due to intervention.<br><br>**Result:** Net savings per year were $70,441 with savings per workers of $111. The benefit-to-cost ratio was 84.9 and the payback period was 0.5 months (all 2002 dollars). |

TABLE 1 (CONTINUED)

Economic Impacts of Ergonomics in Preventing Musculoskeletal Disorders in the Administrative Support Sector

| STUDY | DESCRIPTION OF INTERVENTION | OBSERVED EFFECT | ECONOMIC ANALYSIS RESULTS |
|---|---|---|---|
| Rempel (2006)<br><br>Study quality: 2.8 | **Four workplace interventions compared:**<br><br>Intervention A: Ergonomic training<br><br>Intervention B: Trackball and ergonomic training<br><br>Intervention C: Forearm and support board (arm board) and ergonomic training.<br><br>Intervention D: Forearm support board (arm board), trackball, and ergonomic training.<br><br>**Analysis:** Cox regression analysis | For the arm boards, the hazard rate was 0.49 of incident neck/shoulder disorders (95% Confidence Interval 0.24 to 0.97). The arm boards reduced the risk of incident neck-shoulder disorder by approximately one half. | **Costs of the intervention:** Estimated retail cost of the arm board intervention plus installation was $75 per operator.<br><br>**Consequences of the intervention:** Savings in workers' compensation expenses associated with neck/shoulder injuries were estimated to be $11,540 per neck/shoulder injury.<br><br>**Result:** The payback period was 10.6 months, based on the assumption that the incidence of accepted claims for neck/shoulder injuries among customer service operators at the company is 0.0144 and the neck/shoulder injury reduction from the intervention is 49% (taken from the estimated hazard rate). |
| Bradley (1996)<br><br>Study quality: 2.3 | Ergonomic program consisting of training and workstation redesign.<br><br>**Analysis:** Before-after comparison of number of severity of repetitive strain injuries (RSIs). | There were 5 serious RSIs prior to the intervention and 35 early reported cases after the intervention with no time loss associated with them. | **Costs of the intervention:** No intervention costs considered.<br><br>**Consequences of the intervention:** Savings in workers' compensation expenses associated with RSIs.<br><br>**Result:** The total costs for the 5 cases were $63,628.98; and for the 35 cases were $2,886.25. Savings were estimated to be $442,515.61, based on the assumption that the 35 cases could have been as costly as the 5 prior to intervention (USD). |
| Kemmlert (1996)<br><br>Study quality: 2.2 | Ergonomic program consisting of workplace assessment and redesign: new chair, manuscript support, wrist support, change in workplace layout to reduce reaching and viewing distances<br><br>**Ergonomic training:** more frequent breaks and pauses for variation.<br><br>**Analysis:** Before-after comparison of sick leave and associated expenses/savings. | There was a 5% reduction in sick leave (across 60 workers) which was reflected in savings of $40,603 per year. There were also savings due to reduced training in new recruits of $3,980 per year based on reduced turnover; savings due to reduced overtime of $22,839 per year based on absenteeism requiring one hour of overtime per day off and 50% premium on overtime; savings due to reduced recruitment of employees of $5,846 per year based on one less recruitment per year; and finally, savings due to reduced training of new recruits of $7,647 per year based on reduced turnover. | **Costs of the intervention:** Costs were $19,316 (USD); this includes the costs with education and the acquisition of chairs and wrist and manuscript supports.<br><br>**Consequences of the intervention:** Benefits were $76,935 (USD) (benefits for a one-year period); this includes gains with reduced sick leave, reduced overtime, reduced recruitment and reduced introduction of new employees.<br><br>**Result:** The payback period was estimated at 3 months. |

TABLE 1 (CONTINUED)

Economic Impacts of Ergonomics in Preventing Musculoskeletal Disorders in the Administrative Support Sector

| STUDY | DESCRIPTION OF INTERVENTION | OBSERVED EFFECT | ECONOMIC ANALYSIS RESULTS |
|---|---|---|---|
| Wahl (1998)<br><br>Study quality: 1.9 | Workstation evaluation, which consisted of an interview (to determine tasks performed and gauge workers' understanding of risk factors for cumulative trauma), observation of workers performing their regular duties, explanation of risk factors for cumulative trauma, and adjustment of workstation.<br><br>**Analysis:** Odds ration of a claim becoming a lost-time claim based on whether or not the individual received the intervention. | The odds of a claim becoming a lost-time claim was 3.06:1 if the individual did not receive the intervention compared to if the individual received it. | **Costs of the intervention:** Costs include $95 per visit for each workplace assessment visit by a prevention specialist. This includes wage, benefits, and overhead (USD).<br><br>**Consequences of the intervention:** The average workers' compensation expense per claim decreased from $4,652 before the intervention to $2,959 after, for a savings of $1,693 per claim (USD).<br><br>**Result:** The benefit-cost ratio was 17.8. |
| Lewis (2002)<br><br>Study quality: 1.9 | Training program for proper computer use.<br><br>Analysis: Before-after comparison of injury rates for computer-related musculoskeletal disorder claims. | The average injury rate was reduced from 16.8 per 1,000 employees to 6.94 per 1,000 employees (number of claims was 12 before and 18 after the intervention). | Costs of the intervention: No intervention costs considered.<br><br>Consequences of the intervention: Savings from decreased average expenses per workers' compensation claim.<br><br>Result: The average workers' compensation expense per claim decreased from $15,141 to $1,553. The average claim expense per capita decreased from $185 to $3 (USD 1998). |

Adapted from Tompa, E., Dolinschi, R., de Oliveira, C., & Irvin, E. (2007). A Systematic Review of OHS Interventions with Economic Evaluations, Volume 2 (Appendix L). Toronto, Ontario, Canada: Institute for Work and Health

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