COST JUSTIFICATION FOR ERGONOMICS PROGRAM

Darren Van Winckle, Carrie Taylor Van Velzer, and Anjie Davis
Taylor'd Ergonomics Incorporated
1400 Northumberland Street, Post Office Box 1107, Ayr, ON, N0B 1E0 info@taylordergo.com

Although ergonomists have been taught that financial justification for ergonomics exists, relatively few Canadian studies have actually attempted to cost-justify an ergonomics *program*. Part of the challenge of cost-benefit analysis for an existing program is that, if the program is perceived to be successful, little justification exists for spending the time to prove its success; resources are better utilised to continue to make improvements to other jobs. If the program is not perceived to be successful, little justification exists for spending time on the program at all; it is abandoned without objective evaluation. The 2008 MSD Prevention Guidelines, published by the Occupational Safety and Health Council of Ontario, provided a model and some examples of cost-justification for specific *projects*. Most cost-justification models for ergonomics focus almost exclusively on the financial impact of musculoskeletal disorder risk reduction. However, the potentially positive effect of ergonomics on productivity, quality, and employee morale may be even greater than the effect of improved injury rates. This paper reviews a model for cost-justification that integrates more of the potential benefits of ergonomics, and follows a Canadian case study application to evaluate the economic payback of an ergonomics program in its fifth year. The costs of the program include consulting costs for the ergonomist and ergonomics student, fabrication and installation costs for various workplace improvements, engineering/design costs, human resources costs at the facility, and staff costs for training on the proper use of new equipment. The benefits of the program include injury cost reductions, absenteeism improvements, quality improvements, and productivity increases, in areas affected by the program. While not all parameters showed a positive outcome, overall results indicate that implementing an ergonomics program does have tangible financial benefits.

JUSTIFICATION DES COÛTS DANS LE CADRE D'UN PROGRAMME D'ERGONOMIE

Les ergonomes ont certes appris que la justification financière de l'ergonomie existait, mais relativement peu d'études canadiennes ont réellement tenté de justifier les coûts d'un *programme* d'ergonomie. Une part des difficultés concernant l'analyse coûts-avantages d'un programme existant réside dans le fait que si ce dernier est perçu comme concluant, il est peu justifié d'investir du temps pour prouver son succès; il en résulte une meilleure utilisation des ressources puisqu'elles servent à continuer d'apporter des améliorations à d'autres postes. Si au contraire le programme n'est pas perçu comme concluant, il est peu justifié d'investir du temps sur le programme; il est donc abandonné sans subir une évaluation objective. Les *Lignes directrices de prévention des TMS de 2008*, publiées par le Conseil de la santé et de la sécurité au travail de l'Ontario, contenaient un modèle et quelques exemples de justification des coûts pour des *projets* précis. La plupart des modèles de justification des coûts d'ergonomie sont axés presque exclusivement sur les conséquences financières de la réduction des risques de troubles musculosquelettiques. Les effets positifs potentiels de l'ergonomie sur la productivité, la qualité du travail et le moral des employés pourraient toutefois être encore plus importants que l'effet de la diminution des taux de blessures. Ce document présente l'examen d'un modèle de justification des coûts qui intègre un plus grand nombre d'avantages potentiels de l'ergonomie et suit l'application d'une étude de cas canadienne en vue d'évaluer les retombées économiques d'un programme d'ergonomie qui en est à sa cinquième année. Les coûts du programme comprennent les frais de consultation de l'ergonome et des étudiants en ergonomie, les coûts de fabrication et d'installation des

diverses améliorations des lieux de travail, les coûts d'ingénierie/de conception, les coûts en ressources humaines dans l'établissement et les coûts de formation du personnel sur l'utilisation adéquate de l'équipement. Les avantages du programme comptent la réduction des coûts entraînés par les blessures, une diminution du taux d'absentéisme, une amélioration de la qualité et une hausse de la productivité dans les domaines visés par le programme. Il n'y a pas eu de résultats positifs dans tous les paramètres, mais les résultats globaux indiquent que la mise en place d'un programme d'ergonomie a des avantages financiers tangibles.

INTRODUCTION

Anecdotal support for ergonomics exists virtually everywhere that ergonomists have been involved, and most ergonomics reports imply a promise of qualitative or quantitative benefits if recommendations are implemented. Improvements in productivity, employee morale, and quality, as well as reductions in absenteeism, attrition, and injury rates, are widely reported in ergonomics textbooks and presentations (e.g. Oxenburgh et al., 2004, and Anderson, 2000). Studies have demonstrated the financial benefit gained following the completion of an ergonomics *project*. For example, an ergonomics project that involved redesigning a conventional butcher's knife for de-boning poultry, resulted in a pistol-shaped design, and a savings in workers' compensation premiums of $500,000 over a five year period (cited in Hendrick, 1996). Beyond these cases of successful ergonomics *projects*, relatively few studies have investigated the financial benefits of an ergonomics *program*. The reason for this lack of research, as Beevis (2003) comments, and our experience supports, is that organisations rarely study their operations in detail if they appear to be successful. Therefore, cost and performance data required to complete a cost-benefit analysis are not readily available. However, a recent study conducted by Tompa et al. (2009), reported a benefit-to-cost ratio of 10.6:1, following an economic evaluation of a participatory ergonomics process in a Canadian automotive parts manufacturer. Another study by Bidassie et al. (2010) reported that equipment costs were offset by decreased compensation claims costs in an office environment. Further research in this area must be completed, as questions regarding the financial benefits to be obtained through ergonomics are increasingly being asked. As ergonomists, we must be able to discuss the potential costs and benefits of our work with current and potential clients.

MODEL

Loosely following the models reported in textbooks and guidelines (e.g. OSHCO, 2007, and Oxenburgh et al., 2004), the following parameters can be used to quantify the impact of ergonomics in the workplace:

a) Work-related injury costs
   Workers' compensation costs are associated with strain/sprain injuries. In Ontario, costs can be obtained through the report provided by the Workplace Safety and Insurance Board (WSIB), although considerable effort might be required to isolate costs associated with strain/sprain injuries, or even to identify costs associated with a specific job, line, or plant where multiple sites are reported together in one report. In Ontario, a reward/penalty system is in place to adjust compensation premiums based on injury records, in comparison with other similar companies. Therefore, companies with low injury rates may obtain a rebate on their premiums, while companies with high injury rates may pay a penalty.
b) Absenteeism and turnover
   Absenteeism may be a result of a work-related injury or personal illness, although work-related illness/injury is typically separated and reported with compensation claims. Particularly in facilities with incentive programs to promote "no lost days", companies may

experience higher rates of absenteeism as workers “call in sick” instead of reporting a workplace accident. While this practice is not overtly condoned, it is widely accepted to occur. Absenteeism is also indicative of employee morale; employees who don’t like their jobs might be more likely to call in sick at the first sign of a minor illness. Employee turnover, including new hires and transfers, also tends to be higher on jobs that are considered “low seniority” and more demanding. Costs associated with hiring and training new employees might also be investigated and partially attributed to “ergonomics” factors.

c) Modified work
   The portion of wages paid to staff on modified work, if the modified job is not performed at 100% of a healthy worker’s pace, and costs associated with modifying a job, could be associated with ergonomics. Companies typically return injured workers back to work at a less-than-full production rate. If the company tracks modified work days, and if they are able to estimate the productivity rate in comparison to a healthy worker, then a cost can be assigned to modified work.
d) Claims management
   Wages paid to administrative staff for compensation claims management and follow up with employees who are off work or returning to work, are associated with ergonomics. All companies perform some work to manage workers’ compensation costs. Where the rate of strain/sprain injuries is high, the proportion of this time would translate into a substantial cost.
e) Ergonomics program costs
   Wages paid to employees to investigate root cause of injury, oversee an ergonomics program, conduct physical demands descriptions and ergonomics assessments, and to facilitate the implementation process all contribute to the cost of the ergonomics program.
f) Quality costs
   Costs incurred as a result of injured workers performing at sub-optimal conditions, may be observed as higher scrap rates, higher customer return rates, or more re-work, might be associated with ergonomics.
g) Productivity costs
   Where workers are working under poor ergonomics conditions, potential exists to save money by implementing ergonomics improvements. For example, if high material handling demands and long forward reaches are prevalent throughout a facility, an ergonomics program could reduce wasted efforts and thereby improve productivity.
h) Intervention costs
   The cost of interventions in the workplace, including design and implementation time, and materials, must also be considered.

Other factors referenced in the literature were not used in this study, either because the data was not readily available or clearly did not apply for this case study. These include Workwell Audit, Ministry of Labour fines and appeals, overtime incurred to replace injured employees, costs associated with the immediate management of a lost time injury including replacement workers and disruption in production/service delivery, work stoppages, Ministry of Labour orders, complying with orders, legal costs, damage to company’s reputation, management’s time spent on managing MSD problems rather than on other productive tasks, and negative impact on staff morale and trust in management.

When cost-benefit analysis is conducted proactively, typically in order to justify making a change, the ergonomist must estimate the impact of the proposed change on the various outcomes that might arise. For example, when reducing the exposure to an MSD hazard, one might argue that costs that have historically been associated with injuries at that job would be reduced by a percentage. Estimating the percentage improvement is a subjective process, but Goggins et al. (2008) reported that ergonomic interventions that rely solely on employee behaviour (such as improving employee lifting techniques) are only 10-20% effective, interventions that reduce the duration of exposure (such as optimising job rotation) are 20-40% effective, changes that reduce the level of exposure (such as optimising manual handling heights) are 40-60% effective, and interventions that eliminate exposure (such as providing a hoist) are most effective (60-100%).

When using cost-benefit analysis to justify an expenditure, the calculation should reflect a reasonable estimate of effectiveness. Similarly, a change that may have a small impact on quality or productivity should be estimated conservatively, and with respect to the anticipated impact on that parameter.

CASE STUDY, METHODS and RESULTS

The ergonomics program at this company was formally launched in 2005. Where data was available for the years 2005-2009, it was obtained and tabulated.

a) Work-related injury costs

Workers' compensation costs associated with strain/sprain injuries were isolated from the compensation records manually, and tallied as follows:

	2005	2006	2007	2008	2009
Estimated costs	$54415.90	$27684.03	$17924.72	$4079.29	$30843.72
Total number of injuries	65	40	31	16	12

Costs were estimated using the number of each type of claim multiplied by the average claim cost for each type of injury. Injuries included strain/sprain injuries classified as: first aid, medical aid, restricted work activities, days away from work (lost time), and incidents (near miss). Note that injury costs are assigned to the year in which the injury occurred. The spike in injury costs in 2009 can be accounted for by the costs associated with one "days away from work" injury, for which the claim costs were $25318.72. Overall, however, the trend appears to demonstrate a positive impact.

b) Absenteeism and turnover

Absenteeism and turnover data (both attrition and internal postings) were requested and reported to be stable year over year.

c) Modified work

Modified work days were not tracked prior to 2006, but data was available for 2006-2009. The cost of modified work days was estimated by the company based on the estimated productivity rate, and the daily wage of each employee who was placed on modified work.

Year	2005	2006	2007	2008	2009
Number of modified work days	Not available	666 days	540 days	0 days	37 days
Total estimated cost	Not available	$51132.00	$297569.15	$0	$670.60

Unfortunately, the majority of costs attributed to modified work were attributed to a very small number of cases which continued for very long periods of time, resulting in huge variability in the data. Overall, however, the trend appears to demonstrate a positive impact.

d) Claims management

Wages paid to administrative staff for compensation claims management and follow up with employees who are off work or returning to work was reduced. Based on an admittedly subjective estimate by the plant nurse, time spent administering claims was steadily reduced when the physical demands descriptions were available, from an average of 4.5 hours per day in 2005, to 2.5 hours per day in 2009.

Year	2005	2006	2007	2008	2009
Number of hours/day	4.5	4.0	3.5	3.0	2.5
Total estimated cost	$45000	$40000	$35000	$30000	$25000

The total estimated costs are based on an $80000 salary, and an eight hour work day. Although based on a subjective estimate, the trend demonstrates a positive impact.

e) Ergonomics program costs

Year	2005	2006	2007	2008	2009
Ergonomics consulting fees including expenses	$13000	$18500	$23500	$23500	$33000
Student salary	$11520	$12160	$12800	$12800	No student
HR salary (portion devoted to ergonomics)	$400	$400	$400	$400	$400
Total estimated cost	$24929	$31060	$36700	$36700	$33400

Costs increased as the benefit of ergonomics was recognised, and thus more time and money were allocated to establishing a strong foundation for the company's ergonomics program. After this point, less time and money were required as the company entered the maintenance phase of the program.

f) Quality costs

Raw material losses decreased overall since 2005, as follows:

Year	2005	2006	2007	2008	2009
Raw material losses (%)	7.0	9.8	10.4	8.2	6.0

Unfortunately, we were not able to translate these values into economic terms, and even if we were, we would not be able to claim that the improvements were related to ergonomics. However, we can at least demonstrate that the improvements in the other parameters did *not* come with a corresponding reduction in quality.

g) Productivity costs

The productivity data available at the case study plant was presented in kilograms of product produced, as well as output in dollars.

Year	2005	2006	2007	2008	2009
Total kilos	32874060	36418930	33124247	37890500	40350868
$ (millions)	3.1	3.3	5.0	6.2	6.2
Pounds/operator/hour	71.9	75.5	77.9	83.4	87.2

The data represent a substantial increase in overall productivity at the plant. Clearly, not all productivity improvements were associated with ergonomic improvements; we cannot stake a claim here. The number of employees decreased from 510 in 2005 to 480 in 2009, contributing to the increase in output per operator. These numbers do not include the fluctuating number of temporary workers, but the trend does indicate (assuming that the average number of temp workers was stable year over year) that the output was increasing over time even while the number of employees reduced. Some specific projects that were aimed at reducing manpower reductions did include ergonomics improvements, and therefore we have included the productivity data here.

h) Intervention costs

Not all changes made in response to an ergonomics improvement were specifically tracked; however, the company did track anti-fatigue matting and office chairs. Engineering controls such as lifting equipment were funded through other department budgets, and could not be isolated from overall expenditures.

Year	2005	2006	2007	2008	2009
Total estimated cost of interventions	Not available	$4018	$4347	$1151	$2226

DISCUSSION

Justification for an ergonomics program exists where the benefits outweigh the costs. Measures to estimate, proactively, the anticipated impact of an ergonomics intervention might include a prediction of how many fewer injuries might occur, or how many more cases of product might be produced, if the intervention is implemented. Justifying the ongoing existence of an ergonomics program, however, requires that the program continuously improve, or at least that the investment in the program outweighs the potential increase in costs associated with reverting to the previous

condition. In this case study, most of the costs of the ergonomics program are clearly captured, simply because the external consulting costs, and co-op student costs, are easily isolated from other business expenses. The benefits are considerably more challenging to isolate and attribute to ergonomics, particularly in hindsight.

Year	2005	2006	2007	2008	2009	2009 Change since earliest data available
Injury cost	$54415.90	$27684.03	$17924.72	$4079.29	$30843.72	($23572.18)
Modified work	--	$51132.00	$297569.15	$0	$670.60	($50461.40)
Claims management	$45000.00	$40000.00	$35000.00	$30000.00	$25000.00	($20000.00)
Ergo program	$24929.00	$31060.00	$36700.00	$36700.00	$33400.00	$8471.00
Interventions	--	$4018.00	$4347.00	$1151.00	$2226.00	($1792.00)
Net	$124344.90	$153894.03	$391540.87	$71930.29	$92140.32	($132718.76)

CONCLUSIONS

In order to capture enough data to cost-justify an ergonomics program, a company must track the benefits as they are incurred, rather than try to discover them after they have been realised. Similarly, when changes are implemented following justification based on projected improvements to an economic indicator, follow up to capture the actual benefit realised would be invaluable. For example, if work station changes resulted in reduced forward reaching, and that change was associated with less dropped product ("raw material losses"), then a portion of the savings could be attributed to the ergonomics program. A good baseline audit of the program prior to intervention, including clear *economic* indicators of strain/sprain injury costs, absenteeism costs, productivity and scrap costs, would allow a much more successful cost benefit analysis.

REFERENCES

Anderson, E. R. (2000) Economic evaluation of ergonomic solutions: Part 1 – Guidelines for the practitioner. In: *Ergonomics Guidelines and Problem Solving* edited by Mital, A., Kilbom, A., and Kumar, S. Amsterdam: Elsevier Science

Beevis, D. (2003) Ergonomics – Costs and benefits revisited. *Applied Ergonomics* 34: 491-496.

Bidassie, B., McGlothlin, J., Goh, A., Feyen, R., and Barany, J. (2010) Limited economic evaluation to assess the effectiveness of a university-wide office ergonomics program. *Applied Ergonomics* 41: 417-427.

Goggins, R., Spielholz, P, and G. Nothstein (2008). Estimating the effectiveness of ergonomics interventions through case studies: Implications for predictive cost-benefit analysis. *Journal of Safety Research* 29: 339-344.

Hendrick, H. (1996) Good Ergonomics Is Good Economics *Proceedings of the Human Factors and Ergonomics Society 40th Annual Meeting*, Santa Monica, CA: Human Factors and Ergonomics Society.

Occupational Health and Safety Council of Ontario (OHSCO). (2007). Occupational Health and Safety Council of Ontario's MSD Prevention Series. Part 3b: MSD Prevention Toolbox: Beyond the Basics. (WSIB Form Number: 5159A (02/08)).

Oxenburgh, M., Marlow, P., and Oxenburgh, A. (2004) *Increasing Productivity and Profit through Health & Safety* 2nd edition. Boca Raton: CRC Press.

Tompa, E., Dolinschi, R., and Laing, A. (2009) An economic evaluation of a participatory ergonomics process in an auto parts manufacturer. *Journal of Safety Research* 40: 41-47.