



A pre-intervention benefit-cost methodology to justify investments in workplace health

Jeremy Rickards

*Faculty of Kinesiology, University of New Brunswick,
Fredericton, Canada, and*

Carol Putnam

*School of Health and Human Performance,
Dalhousie University, Halifax, Canada*

Abstract

Purpose – While the rationale for interventions in a workplace to enhance employee health are well documented, practitioners have difficulty making an economic case to justify the investment required and to demonstrate positive returns on that investment. This paper aims to present case study data from an ergonomics evaluation of a call centre to demonstrate a simple, four-step pre-intervention methodology which provides an accounting-based justification for funding workplace health-related projects.

Design/methodology/approach – Physical and ergonomic assessments of the workplace and employee interviews establish health risk factors. Two direct (discretionary) costs and five indirect (non-discretionary) operational costs are evaluated. The capital investment to implement the proposed workplace changes is determined. Total net identified benefits are established and used to create accounting-based financial metrics.

Findings – Application of the methodology to the case study found worker compensation insurance, absenteeism and overtime wages to be neutral. Costs to train new workers, lost call processing time and cost of lost employee productivity were significant, the latter representing two-thirds of the value of all potential benefits.

Originality/value – The paper creates accounting-based metrics to mitigate health and safety risk factors, while identifying the potential for productivity gains. Management is provided with a simple decision tool to justify an investment in workplace changes.

Keywords Cost benefit analysis, Workplace ergonomics, Workplace health, Workplace, Ergonomics, Health care, Employees

Paper type Case study

Introduction

Scientific literature covering the application of benefit/cost analysis (B/CA) to business investment decision making has been available since the 1930s. A review of this history and background to the concepts and practice of B/CA has recently been published by Boardman *et al.* (2006). Examples of some of these B/CA methodologies developed over the past 20 years include Andersson (1992), Riel and Imbeau (1996), Oxenburgh *et al.* (2004) and de Looze *et al.* (2010).

Beevis and Slade (2003) reviewed the tangible benefits of B/CA such as increased productivity, reduction in accidents and improvements in the working environment, concluding that these are not often expressed in measures that can be easily converted into financial benefits. Hence these methodologies have not been universally adopted by business. The time required to obtain all data and their relative complexity have limited application to the evaluation of investments in workplace health.



This issue is particularly significant in smaller enterprises (<20 employees) where often there is also limited expertise in health, safety and ergonomics protocols.

Recognizing this, an ergonomics team at WorkSafe New Brunswick (the provincial workplace safety and compensation commission) explored a number of approaches towards formalizing a pre-intervention B/CA methodology, the major intent being to create a robust evaluation system while maintaining simplicity of application. The ability of managers to understand and adopt this tool, and for practitioners to apply it were paramount considerations (Jenkins and Rickards, 1999a, b, 2000-2002).

Unique to this method is the creation of accounting-based, pre-intervention metrics of B/C ratios and ROI's which accrue from an investment in ergonomics. These provide management with a procedure to assess both the risks and returns prior to an ergonomic expenditure, in a process similar to that which they would use when evaluating a business expenditure.

A case study is presented to illustrate the methodology. The data obtained are those from an ergonomics intervention completed for a call centre located in Atlantic Canada, considered typical of the industry (Canadian Customer Contact Centre Industry Steering Committee, 2003).

Benefit-cost methodology

This methodology has four steps using established ergonomics protocols applied to workplace assessments. These steps are the result of the synthesis and evaluation of >100 ergonomic interventions, the majority from small operations having <20 employees (Jenkins and Rickards, 1999a, b, 2000-2002).

This work was able to conclude that business owners/managers were more likely to become directly engaged in their own workplace health and injury reduction programme if the process presented to them was simple, not time consuming and in business language they understood. Identifying and demonstrating a reduction in operating costs (thereby increasing profitability) became the prime motivation for adopting this methodology. Reduction in workplace injuries and improved employee health provided an additional incentive.

Two direct costs (non-discretionary) were found to be universal to this evaluation. Five indirect costs (discretionary) were top ranked from 15 identified, these five routinely representing >80 per cent of total indirect costs:

Step 1: an in-depth ergonomics assessment of the workplace to establish health risk factors.

Workstations are physically measured. Lighting, noise levels and workspace temperatures are recorded. Employees are individually interviewed to obtain their anthropometrics, complete a comfort survey and details related to work routines and workstation hardware:

Step 2: an evaluation of direct and indirect operational costs, and the resultant costs that these may incur from sub-optimization of the business or service system.

Business metrics such as staffing levels, wage rates, annual payroll, shift schedules and overtime hours are determined.

Direct costs

- (1) Premium payments made to a worker compensation (insurance) programme: Since a base rate payout for an industry or industry grouping is mandatory, only premium payments resulting from an elevated accident/injury experience rating are accounted.
- (2) The costs associated with workplace accidents/injuries: This is the in-house cost to administer first aid, medical treatment provided by a clinic, hospital or medical practitioner, and any wages paid to injured employees during lost workdays.

Indirect costs

- (1) Accident/injury investigation: This cost includes the time taken by a member of the Health and Safety Committee to establish the cause, interview the injured worker, interview workers who witnessed or were close by the accident, create an internal report and file details with the worker compensation programme office.
- (2) Corrective actions: These costs include in-house work required to repair or replace workstation hardware, clean up the work site, create and install additional safety devices, and complete any other recommendations from the accident investigation team.
- (3) Absenteeism and the replacement of workers: This cost depends on whether employees are paid their standard rate when absent from work. Further, if their time must be replaced either by overtime, or the hiring of new workers the administrative costs for recruiting, training, productivity loss and quality control are accounted.
- (4) Compensating activities: These are costs incurred to promote healthy and safe workplaces, provide wellness and fitness programmes, manage job rotation, establish macro work breaks, paid time-off for employees to serve on Health and Safety committees and in-house or consultant fees paid for workplace ergonomic evaluations.
- (5) Sub-optimization of the business system: While this cost is not always easy to evaluate, it is often the largest component of losses. Business plan or operational budget predictions that fail to meet performance/output targets resulting from both indirect costs, as well as lax administrative controls, work delays, repeat work and the inability to hire qualified workers are examples of these business system costs.

Step 3: determine the capital cost to implement the identified workplace changes.

Capital cost items that may be required to facilitate and complete workplace changes:

- contract or in-house labour;
- tools, equipment and material purchases;
- engineering design;
- fabrication and installation;
- new operational costs; and
- additional administrative controls.

Step 4: provide management with financial decision-based metrics.

Despite rigorous application of ergonomic, engineering and financial expertise to a specific project planned changes may not eliminate all identified costs. Hence a realistic estimate of the actual benefits that will accrue is required:

- (1) Consensus must determine a single confident probability:
The project team (ergonomist/engineer/manager) must agree to a metric expressed as a percentage of the total identified benefits. This process is key and requires rigorous evaluation, since the accuracy of business plans and hence financially successful project outcomes are determined by it.
- (2) Calculation of the benefit/cost (B/C) ratios:
B/C ratios (actual benefits/capital investment) expressed as both one year and multi-year ratios – three or five year ratios are commonly used.
- (3) Discounted cash flow (DCF) calculation:
Some organizations may also require a DCF (present worth/capital recovery) inputting their cost of capital (hurdle rate), expected project life, financial benefits and total capital investment required.

The completion of these four steps provides management with a project-oriented portfolio containing an ergonomics-based evaluation of workplace/workstation issues, their health risks and a full costing of operational losses that are occurring.

From this, a realistic evaluation of the benefits to be achieved, and the capital investment required to justify an ergonomics intervention, can be stated in business finance terms pre-intervention.

Background to the case study

To illustrate the application of this methodology, the following case study has been selected, since it is representative of a workplace where costs associated with employee health and wellness are not accounted.

Lack of any data on work injuries or employee health issues was found to be typical of small branch-plant operations or single owner/operator businesses. Managers and supervisors had little expertise in workplace health, safety or ergonomics and no training was made available. Employees who had health or injury-related issues most often used the medical services of a local health clinic. Even if this diagnosis indicated workplace-related causes, these were not relayed back to their company.

This presents an information barrier to practitioners who must not only determine cause-related issues, but must also be able to justify the expenditures needed to mitigate them.

This case study is a call centre business located in a small rural town, one of a number of similar centres owned and operated by an international company. It is located in an older building above a grocery store. It is an “inbound” centre, providing a reservation service for hotels, cruises and packaged vacations. Employees share workstations consisting of a fixed-height worksurface, adjustable chair, computer screen, keyboard and mouse and a headset connected to a business telephone.

The manager is responsible for all operations, and for the hiring, training and control of employees. Her managerial effectiveness (and bonus) is determined by throughput (number of calls per shift) and turnaround time (minutes per client call).

Hence there is continuous pressure on her to maintain or improve these productivity metrics.

Application of methodology to case study

Step 1

Anthropometric data (stature, sitting eye height, arm length, leg length; weight) were determined from each employee, during a personal interview.

All workstations were of the same design and layout, with a fixed, non-adjustable worksurface height of 74 cms. Chairs were identical, with multi-adjustments and fixed armrests. A monitor, keyboard, mouse and business-style telephone were placed on the surface, and each employee had a tethered (detachable) over-the-head microphone.

Lighting was provided by a ceiling-level array of four-tube, 122 cm fluorescent fixtures. Readings in the range 740-50 lux were recorded at all keyboards.

Workstations were separated by low walls, but average workspace noise level (68 dBA), and distraction from conversation at adjacent workstations, were cited by all employees as contributing to discomfort and strain.

During the summer, the workspace temperature often exceeded 24°C, poor window and roof insulation contributing to large variations, also significant during the winter heating season. There was no ventilation system, except for the opening of windows.

Employees had a half-hour lunch break each shift, but no fixed micro-break, these being taken during a lull in customer calls, or at their discretion. Incoming calls were routed to employees from a central server, as they became available.

As this was a computer-based workplace, each employee was also provided with a questionnaire (in Bharatan *et al.*, 2004) to establish an assessment of their work, and the workplace. A five-point scale response provided both frequency (always to never) and feelings (satisfied to distressed) in answer to issues of emotional demand, job control, personal reward, management support and workplace environment. A 51 per cent return rate was achieved.

Almost three-quarters of those responding found their work distressing, citing hectic work pace, verbal abuse, performance monitoring, inadequate income and benefits, constant repetition and lack of rewards as key issues; 64 per cent had constant neck/shoulder pain, 54 per cent headaches/back pain and 50 per cent eye strain/voice problems.

Emotional strain was cited often or sometimes by 75 per cent, manifesting in low energy (61 per cent), sleep problems (57 per cent), high caffeine consumption (57 per cent) and family relationship issues (57 per cent).

Step 2

Totally 25 persons are employed – 15 female and 10 male, age range 18-32 years. There are two 8-hour shifts each day, seven days per week, 52 weeks per year. Nominal work-week is 40 hours, but employees are encouraged to add additional hours to their week. The hourly wage rate is C\$10.50 per hour. There is no premium rate for any additional hours worked and no employee benefit plan or paid vacation. New employees receive two weeks paid training by observing a current employee at their workstation. The nominal annual payroll is C\$546,000.

Direct costs

- (1) The call centre was registered with the provincial worker compensation programme. However, employees were unaware they could make a claim for

work-related injuries. As a result, the company's experience rating was neutral and they paid only the base rate applicable to their industry.

- (2) Employees were not paid when absent from work for any reason. There were no costs accounted for lost work time due to injury or health issues.

Indirect costs

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- (1) There was no Health and Safety Committee. Informal complaints of injuries were not investigated.
- (2) No corrective actions were taken to remediate workplace risk factors.
- (3) Up to five employees each day failed to report for their regular shift. Absences were filled by adding overtime hours or calling-in employees from a previous shift. Since employees who were absent were not paid, and those that added overtime hours or filled-in received only the base rate, no wage premium costs resulted.

In the past year, 12 new employees have been hired. Recruitment costs are limited to formal paper work completed by the manager. Training of new employees is accomplished by observing the work routines of a current employee for a two-week period. During this time, new employees are paid the base rate, but the average effective call processing time at this workstation is reduced by 10 per cent.

Paid training cost: 12 persons * 80 hours * C\$10.50/hr. **C\$10 080.**

Call processing time: 12 persons * 10% loss on C\$21 840 **C\$26 208**

- (4) No costs were incurred by management for any compensating activities to promote a healthy workplace.
- (5) Work ethic and morale were low. Employees took frequent micro-breaks, arrived late for work and found ways to stall answering the next client call. A two-week workstation survey determined that employees had an 85 per cent work time effectiveness rate.

Sub-optimized productivity: 25 persons * 15% of C\$21 840 **C\$ 81 900**

Total value of all costs (losses)

Worker compensation payments (above base rate)	none
Losses resulting from absenteeism	none
Losses from payment of overtime premiums	none
Training wages paid to new employees	C\$10 080
Call processing time loss when training	C\$ 26 208
Sub-optimized productivity	C\$ 81 900

Total losses (potential benefits): C\$118 188

The following work routines and changes were recommended by the ergonomics team to reduce these losses and enhance productivity:

- (1) Since workstations are used by more than one person, and not height-adjustable, both current and any new employees receive instruction in correctly setting the adjustments on their chair, the placement of keyboard, mouse, screen angle and screen-to-eye distance according to current ergonomic standards. Adjustable footstools can be purchased to compensate for the differential between individual statures and the fixed worksurface height.
- (2) Overhead fluorescent lighting level be reduced to eliminate screen glare, and each workstation be provided with a position-adjustable task light.
- (3) The building owner be asked to improve control over the workspace temperature and air circulation.
- (4) Sound-absorbent dividers be installed between workstations to reduce the distraction caused by voice interference and the addition of overhead sound “pillows” to control workspace noise levels.
- (5) One workstation be dedicated to the training of new employees. This training to be supervised by the manager, utilizing custom, online, voiced software. The employee be gradually introduced to actual client calls during the two weeks, to accelerate full productivity before the end of the training period.
- (6) Two 15-minute work breaks be introduced, allowing each employee to leave their workstation and go to the “coffee” room or outside to relax.
- (7) An incentive bonus be introduced for employees who come to work regularly and on time – a suggested payment of 5 per cent.

Cost to apply this bonus (assuming all employees take advantage) :

C\$27 300

- (8) The position of “assistant manager” be created. This employee to be paid a premium (suggested + 30%), freeing the Manager to supervise training, manage staff complement; and process required paperwork.

The cost to provide this premium

C\$6 552

Total additional operating costs: C\$33 852

Step 3

Capital cost items included the purchase of task lights, footrests and workstation dividers, the acquisition of custom training software, and changes to overhead lighting.

Total capital cost: C\$10 250

Total of capital cost and additional operating costs: C\$44 102

Step 4

The building owner was consulted, and agreed to make improvements to air circulation and temperature control, with no increase in rental payment.

The ergonomics team and Manager discussed their expectations of eliminating all losses and therefore gaining the full benefits from the proposed recommendations. Team members considered the changes to employee training would be effective, but there would remain a need to hire 2-3 new employees each year. However, the incentive plan would assist in controlling work time losses. The Manager was enthusiastic about having an assistant manager, allowing her to focus on employee training.

After further evaluation it was concluded that not all losses could be fully recovered, but their consensus was a confident probability of realizing at least 65% of the potential identified benefits.

Net Identified Benefits C\$ 118 188 * 65% = C\$ 76 822

Economic Justification Metrics.

Benefit Cost Ratio – C\$ 76 822/C\$ 44 102 = **1.74** (first year)

Benefit Cost Ratio – C\$ 384 110/C\$ 169 260 = **2.26** (end of fifth year)

Payback period – C\$ 44 102/C\$ 76 822 = **0.57 years**

One year ROI – C\$ 76 822/C\$ 44 102 = **174%**

Discounted Cash Flow (Present Value v Annual Benefit)

Investment: C\$ 44 102

5 year life; Interest rate: 10%; Capital Recovery Factor: 0.26830

Equivalent Annual Benefit: C\$ 11 832

Results

The manager proceeded to purchase and install the workstation items recommended. She noted an immediate improvement in employee morale and a reduction in absenteeism.

The overhead lighting level was reduced by removing two of the four fluorescent tubes from each fixture. The modified level averaged 430 lux.

Employees found both the reduction in screen glare and the ability to adjust the task light at their workstation decreased eye strain, some also noting a reduction in headaches that were a frequent health issue by the end of a shift.

The building owner made changes to the space heating controls, and installed ceiling ventilation fans.

A 15-minute break schedule was introduced, each employee leaving their workstation and going outside, or to the “coffee” room to relax. The manager set up a dedicated training workstation and supervised new employees. She noted that they learned the computer-based routines quicker and became fully productive sooner.

However, the full impact on productivity from the introduction of the incentive bonus scheme, and an employee acting as a manager, could never be fully evaluated.

After 18 months of the completion of this ergonomic intervention, the manager was transferred and the centre closed.

Despite this action, the ergonomics team, working with incomplete data, extrapolated that 65 per cent of the potential identified benefits had already been realized, and if a complete post-evaluation had been possible, this level may have been exceeded.

Conclusion

This case study was selected since it is representative of a workplace where the cost of the employee health issues is not evaluated, a situation which is a typical dilemma for practitioners attempting to justify expenditures to ameliorate them.

Since no responsibility was taken in this workplace for the wellness of employees, direct costs, except for the mandatory worker compensation payment, are value neutral. For the same reason, three of the five indirect costs are also value neutral. However, costs associated with training new employees, while significant, are overshadowed by losses due to sub-optimization of the productive system. These losses were overwhelmingly caused by issues of employee health and workplace morale and the resultant loss of company loyalty and work ethic.

This B/C methodology is simple in application, robust and effective in costing out these losses and identifying, pre-intervention, benefits which can be achieved from ergonomic interventions in both industrial and service workplaces.

While the “confidence probability” determination of actual expected benefits by team consensus can be considered “fuzzy” accounting, nevertheless, both during testing and later practical application of this methodology, the efficacy of this approach has been confirmed.

Practitioners should be wary, however, of being too confident when establishing this benefit value. There can be many reasons for a project not realizing the full value of all identified benefits. Better to be cautious but safe, putting forward only sufficient benefit value to support a B/C ratio or ROI which can justify the proposed investment expenditures and will meet with management approval.

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Corresponding author

Jeremy Rickards can be contacted at: jerome@unb.ca

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