

Economics of Ergonomics

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Being able to discuss with management the costs of work-related musculoskeletal disorders (WMSDs) and the performance losses associated with them is beneficial when trying to justify the purchase of “ergonomically” designed office furniture. This paper discusses the steps involved in the process to cost justify ergonomic changes.

Why Make Ergonomic Changes

So, why should companies make ergonomic changes to the work environment? Four of the most common reasons cited by ergonomists and other professionals in the field are: (1) to improve the safety and health of workers, (2) to reduce the company's costs, (3) to reduce productivity/quality issues, and (4) regulatory concerns. Although one would hope that companies make changes to the work environment to improve the safety and health of workers; companies often place more emphasis on the other three reasons in their decision making process. Companies do not always realize, though, that a relationship exists between all of the reasons and making changes to the work environment to improve the safety and health of workers will often reduce a company's costs, improve productivity/quality issues, and decrease the chance that employees will file a complaint with the Occupational Safety and Health Administration (OSHA).

Cost Justifying Ergonomic Changes

Ultimately, it often does not matter why a company wants to make ergonomic improvements to the work environment because the decision often comes down to how much the improvements cost. Although the idea of having to cost justify an ergonomic intervention to control injuries/illnesses is not an easy one for most ergonomists, it is a reality. Thus, it is important to present proposals for ergonomic changes in the language of business, which is dollars. Providing this type of data on why a solution should be implemented will allow companies to make better and more accurate/informed decisions. Once you have determined there is a problem and you understand it, the steps involved in the cost justification process are:

1. Predicting future injuries/illnesses
2. Determining the full cost of an injury/illness

3. Determining the appropriate ergonomic solution and its cost
4. Selecting the appropriate cost justification technique
5. Performing the calculations
6. Analyzing the data and making a recommendation

Predicting future injuries/illnesses: Often, ergonomists are asked how they can be sure that another ergonomics injury will actually occur. In order to demonstrate that a pattern of continuing injuries/illnesses actually exists (specifically musculoskeletal disorders or MSDs in this case), medical records/OSHA logs must be reviewed for approximately the last 5 years to determine how many MSDs occurred in the following categories: (1) first aid, (2) OSHA recordable, (2) restricted work day cases, and (3) lost work day cases (Alexander, 1999). The next step is to calculate the median number of MSDs that are occurring per year for each category. It is important to remember to see how many first aid cases you have because without proper treatment, these are the cases that often become a company's OSHA recordable cases. To be even more accurate, you should predict injuries/illnesses by department and/or task depending on the problem.

Determining the full cost of an injury/illness: Determining the full cost of an injury/illness can be difficult. Although most companies track the direct costs (i.e., medical costs, workers' compensation costs) associated with an injury/illness, the majority do not track all of the indirect costs associated with an injury/illness. Indirect costs can include such things as the cost of replacement workers, lowered productivity, lowered quality, and increases in supervisory costs. Even in the absence of an injury, it is possible to capture additional costs that may be associated with a first aid case if you carefully measure overtime, productivity and quality.

Costs often associated with MSDs that a company should try and track to better estimate the full cost of an injury/illness include the following direct costs: immediate and long-term medical expenses, workers' compensation (loss of income, potential payment of permanent or partial, full or temporary disability); and the following indirect costs: medical management, ergonomic audit/accident review, job accommodations, increases in supervisory time required, productivity losses, quality problems, overtime, cost of turnover and training/replacement workers, potential increase in workers' compensation premiums by increasing experience modification factor, potential outside consultant fees, and potential regulatory fines.

Determine the appropriate ergonomic solution and its cost: There are often a variety of ergonomic solutions available to resolve an ergonomic situation that has been identified. Costs of implementing these solutions can range greatly from less than \$100 to thousands of dollars. Alexander (1998) has found that "the effectiveness of the solution does not always correlate with the cost of the solution, thereby providing an opportunity for a very effective solution at a low cost." One method that several ergonomists use to review the cost effectiveness of a solution is the cost/value matrix.

This matrix compares the cost of the solution with the effectiveness of the solution, thus allowing a decision to be made as to which is the most appropriate solution. Ergonomists/engineers rely on their professional and past experiences as well as research to estimate the effectiveness of a solution.

Cost Justification Techniques: In order to cost justify ergonomic changes in the work environment, engineering economic models can be used to financially assess the value of and illustrate the benefits of an ergonomic intervention. Three common techniques that can be used are:

1. Benefit/Cost Ratio
2. Payback Period
3. Losses vs. Goods Sold

You can use just one technique to cost justify the ergonomic solution you want to implement, or all of the techniques can be used together effectively to justify implementing the solution. Including the time value of money in the calculations can enhance these techniques.

Benefit/Cost Ratio: This method allows you to compare the cost of ergonomic-related injuries to the cost of implementing the ergonomic solution. With this technique, you make the assumption that implementing the ergonomic solution will eliminate future ergonomic-related injuries. Generally, any time the ratio is 1.0 or greater, the solution should be implemented. To calculate the benefit to cost ratio, use the following equation:

$$\text{Benefit/Cost Ratio} = \frac{\text{Value of Benefits}}{\text{Cost of Changes}}$$

Payback Period: This technique allows you to calculate the length of time it will take to recover the costs of improvements. Again, you must determine the costs and benefits associated with the ergonomic solution in order to calculate the time it will take to offset the cost of implementing the solution. A company must determine for itself what is an acceptable payback period for an investment. To calculate the payback period, use the following equation:

$$\text{Payback Period (in years)} = \frac{\text{Costs per Year}}{\text{Benefits per Year}}$$

Losses vs. Goods Sold: This technique allows you to calculate the sales volume required to offset the cost of an injury; thus, providing you with a dollar figure that a company should be willing to spend to implement an ergonomics solution. To use this method, you must know the profit margin for the business. To calculate the volume of sales required to offset loss, use the following equation:

Volume of Sales

Required to Offset Loss = $\frac{\text{Cost of Losses}}{\text{Profit Margin}}$

Including Time Value of Money

in Calculations: "The time value of money assumes that the value of a dollar will be different a few years from now" (Alexander & Albin, 1999). Using this technique allows you to consider the value of the benefits and costs over the life of the project, which may be more than one year. You can calculate both the present value of a future sum (P/F) or the future value of a present sum (F/P) by knowing what interest rate the sum would be invested in per year. To calculate either the present value or future value of a sum, use the following equations:

Present Worth =

$(P/F, i, N)$ if using tables* to get multiplier
Present Worth = $F(1 + i)^{-N}$

Future Worth =

$(F/P, i, N)$ if using tables* to get multiplier
Future Worth = $P(1 + i)^N$

Where: P = Present Worth or Present Value
F = Future Worth or Future Value
i = Interest Rate per Interest Period
N = Total Number of Interest Periods

*When using tables to calculate the time value of money, you need to know both the interest rate and the economic life of the project. Tables can be found in financial or engineering economy books.

Conclusions

All in all, companies should make the effort to ensure that ergonomics is taken into consideration from the very first when designing a work environment. Alexander (1998) has found that "lower design and construction costs can be obtained when equipment and facilities are designed right the first time. The cost of correcting ergonomic design at the initial part of a design project is about 10 percent of the cost that will occur later." Additionally, companies must remember that you can

provide workers with the most "ergonomically correct" furniture, but if they are not trained in why and how they should use it, the furniture adjustments will most likely remain unused by a large percentage of the employees. So, companies must make an effort to be proactive towards ergonomics and develop a total ergonomics program that includes training for the employees.

Nevertheless, if a company has employees suffering from MSDs, the cost justification techniques discussed can be used to help prove the need for ergonomic changes in the work environment.

In order to utilize the cost justification techniques to their full potential, however, companies must start tracking all of the expenses associated with MSDs, not just the cost associated with workers' compensation. Until companies start realizing what affect ergonomic-related injuries have on the bottom line, it will remain eif they believe it's the correct thing to do.

References

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For a complete list of references used in the presentation or for additional references on the economics of ergonomics, please contact the author at teresa.bellingar@haworth.com.