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Economic Evaluation Proceedings Paper

Synthesis and recommendations of the economic evaluation of OHS interventions at the company level conference

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Abstract

Problem: In today's economic environment, enterprises may not be able to fund every new project aimed at promoting health and safety in the workplace. Company level economic evaluation of interventions can provide guidance in sound business decision-making. The Economic Evaluation of Occupational Health and Safety Interventions at the Company Level Meeting brought together members of the global occupational safety and health community interested in encouraging the use of economic knowledge and tools to evaluate economic gains from occupational health and safety interventions. *Discussion:* Discussions of the six models presented explored similarities, reliability, and potential use by corporate enterprises, small and medium enterprises, developing and transitioning nations, and economic theorists. Each group provided specific projects that could be pursued to advance knowledge in the area of economic evaluation at the company level. *Conclusion:* This conference established pathway to incorporate economic evaluation of health and safety interventions or programs at the workplace.

Keywords: Occupational health and safety; Economic evaluation; Corporate enterprises; Small and medium enterprises; Developing and transitioning nations; Economic theory

1. Introduction

Six key economic evaluation tools currently in use at the company level were presented during the first sessions of the *Economic Evaluation of Occupational Health and Safety Interventions at the Company Level* conference held in November 2004. These tools, described in this special section of the *Journal of Safety Research*, ranged from individualized approaches for small businesses to computerized systems designed for the corporate client.

The final sessions of this international conference challenged the participants to identify means to accomplish the major goals of the meeting. That is, what steps could be taken to encourage the use of economic knowledge and tools to evaluate economic gains from occupational safety and health interventions in order to make workplaces safer and healthier? Are there demonstration and research projects that if pursued would advance the knowledge and build capacity to conduct economic evaluations at the company level? These overarching goals gave rise to two objectives: Build model(s) in the public domain for widespread use worldwide and identify 5 to 10 collaborative projects ready for implementation.

The organizers of this meeting postulated that elements defining an ideal model may vary substantially by characteristics of the firm such as size of the firm and the economic system in which the firms are operating, as well as the adherence to standard economic theory. To explore these potential differences, four discussion groups were formed. Dialogues focused on specific issues and needs within the context and from the perspective of corporate enterprises, small and medium enterprises, enterprises within developing and transitioning nations, and economic theory. These

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key questions were presented for each group to stimulate and guide discussion:

- What are the common elements of a model that you can identify that should be included in a model for this setting?
- What are the data collection tools (e.g., a standard data set) and approaches (e.g., participatory approach) that are needed or desirable for a model?
- What are the issues of reliability of the models?
- What are the roles you can foresee in the further development of a model for academia, national institutes, the corporate sector, labor, insurance companies?
- How might multi-national corporations and national institutes assist with model usage and capacity building in developing nations?

The following section presents brief summaries and recommendations from each of the four target group's discussions.

2. Discussion group summaries

2.1. Corporate enterprises

The corporate enterprise initially was conceptualized as a single homogenous entity. However, the participants in this group presented a far more dispersed array of entities within the corporate umbrella that a model would need to accommodate. Corporations range from a single enterprise that has incorporated for any number of reasons, including liability. Larger corporations are comprised of differing components, such as individual plants, divisions, corporate offices, and subsidiaries, which may have unique needs, including differing model specificity and content. Furthermore, within any of these components, analysis may be desired at the entire structural level or at an individual project level. In addition to these structural differences, the decision makers within the corporate enterprise are widely dispersed. The audience within a corporate structure may include staff within numerous departments, including safety and health, operations, and finance, as well as individuals such as engineers, plant or division managers, and corporate staff.

The acquisition of data is critical for an economic evaluation tool to be successful. This group carefully examined sources and types of data, as well as the barriers for collection, that could be used for economic evaluation of occupational safety and health interventions. Clearly, the cost of the intervention would need to be ascertained, including the cost of any equipment. The group identified the need for complete injury and accident data, which should include a crude injury or illness diagnosis, job title or task, department or location, date, and time. This information may be available through existing data collection efforts such as workers' compensation, Occupational Safety and Health (OSHA) required records, or First Time Occupational Visit (FTOV) records. Human Resource departments could also be a valuable source of information including absenteeism records, workers' compensation, injury files, and individual employee personnel records, such as hours worked, wage, and benefit scales. Financial data, such as an appropriate discount or interest rate, would have to be obtained for economic calculations. Productivity and quality measures were also named as desired information. In some instances, the enterprise will have this data available, in others one would have to rely on an indirect measure such as applying a multiplier to the direct costs.

In addition to the data, the group named potential data collection tools and sources that the corporate entity should have readily available. Electronic medical records (ideally tied to OSHA recording and reporting requirements) are an excellent method to collect injury data. The group also suggested to begin with the OSHA record systems, which includes incident case data and hours worked, and add data from first aid visits and workers' compensation cases. Discerning days away from work and restricted work activity days should also be a vital part of the data collection system.

Following this discussion, participants offered a tiered approach for economic evaluation for consideration by the meeting participants. The approach includes the following five steps:

- *Surveillance.* This step includes continuing data collection efforts gathering information on first time occupational visits, workers' compensation claims, and work hours.
- *Identify the most important problems.* After thoroughly identifying problems, prioritize them according to the potential impact on workers and the firm. This step also includes identifying potential programs or interventions to address the hazards. Cost estimates for the potential interventions should be developed. Benchmarking should also be completed at this stage.
- *Design the intervention.* All financial assumptions associated with the intervention should be clearly identified at this stage. This would include estimates of the number of injuries or illnesses avoided and any estimated changes in productivity or quality. Additionally, this stage would include identifying the financial inputs, such as the cost of capital, tax rates, and labor costs.
- *Conduct the economic evaluation.* This step would entail application of one or more of the models presented at this conference or potentially a model developed to meet the specific needs of the individual corporate entity.
- *Communicate with decision makers.* This is the final stage in the economic evaluation process, the presentation of the problem, the solution (intervention), and the economic impact of implementing that solution. This is an opportunity to demonstrate that safety and health is more than just "the right thing to do," it can also be profitable.

The remainder of the group discussion focused on appropriate roles for each constituent. Academia should

consider building curriculum that includes occupational safety and health and to assist in refining economic evaluation models. Corporate enterprises and labor organizations should implement and validate the economic evaluation models. The National Institutes, such as the National Institute for Occupational Safety and Health, should conduct industry-wide education and recommend accounting practices. Finally, the insurance industry should assist by prioritizing hazards and providing benchmarks.

2.2. Small and medium enterprises

Those interested in exploring the unique needs of small and medium enterprises (SMEs) began by identifying the key reasons for any SME to conduct an economic evaluation. It was discussed that economic evaluation should serve to measure productivity, health, and safety with a dual goal of motivating the firm's principles to improve each of these metrics. Concurrently, these evaluations can serve as safety assessments for SMEs, keeping an eye toward continuous improvement and help to confirm everyday business decisions made regarding safety and health. Evaluations should serve to tell the story that "Safety Pays" rather than just presenting the cost benefit analysis of an intervention.

The group then attempted to define the critical aspects of an economic evaluation tool or model using the six models presented as a starting point. An SME model, above all else, should be user friendly. It should focus on effect rather than on the robustness of the calculation. The group determined that ideally, a model for SMEs should contain only a small number of data elements. Data collection should emphasize ease and simplicity, and therefore be limited to those records that are either mandated or easy to acquire. For example, measures of productivity could be acquired from sales revenue, hours worked, or absentee data—existing in virtually all SMEs. For some of the firms, incident data is collected routinely for the Bureau of Labor Statistics and could be tapped for economic evaluation purposes. These data used in conjunction with employment data could be used to calculate turnover rates that were associated with occupational injuries or illnesses. Finally, the group determined that measures of changes in quality may be available for inclusion in a model using information from reports such as scrap rates, rework orders, and warranty claims. However, the availability of these measures are not uniform among small business entities across industry. Because of this, default standard values should be readily available for key data elements. There was some discussion that SMEs might be amenable to a larger number of data elements if default values were available and were believable.

The next logical question was "What are the model components or data elements necessary for an effective economic evaluation tool that will meet the needs of SMEs?" Clearly, the cost and benefit of either a proposed or adopted intervention or program must be incorporated into any model. Direct costs (those "out-of-pocket" expenses of the firm) could be identified and collected directly from firm records or default values could be used if they met the criteria mentioned above. Indirect costs, both in terms of what should be included and how to obtain those values presented a greater challenge. The first suggestion was to consider using some standardized multiple of direct costs to estimate the value of indirect costs. However, with numerous multiplier values presented in the literature, which one is more accurate or more appropriate is unknown. Another option would be for the firm to collect pertinent indirect cost data, including turn-over rates, sick leave, and changes in productivity. Another option for SMEs is to create benchmarks from other work obtained either from trade organizations or published literature. Potentially, workers' compensation costs could be a valuable source of information. Intangible costs, such as human suffering, were thought to be important, but extremely difficult to measure. Inclusion of any data element into a model must be tempered by the added benefit of that element as compared to the cost of securing a value for that element. SMEs simply may not have the staff or time to devote to complex data collection efforts.

Finally, the group explored what economic measure would best serve the small and medium enterprise community. The group offered the following list for consideration:

A. Savings attributable to the intervention or program
B. Payback period of the intervention or program
C. Did the intervention solve the problem?
D. Return on Investment (ROI) or Benefit Cost
E. Changes in productivity
F. Cost avoidance associated with the intervention or program.

As the group concluded their discussions, it became clear that a better understanding of what SMEs would require of a model needed further exploring, focusing on gathering information from those making the decisions.

2.3. Developing and transitioning nations

There are substantial differences in existing companies both between and within developing and transitioning nations. A comprehensive discussion of all aspects of these differences, especially at a single three-day conference, is not feasible. Redefining the purview of the discussion would enhance the chances of coming out with cogent, constructive, and pragmatic conclusions and proposals for the future. The limits set were only for the purpose of discussion and were partially based on the ease of adjusting to fit a wide range of specifications and characteristics.

The group determined that the six models presented were not company-size specific. They could be used to analyze interventions of various sizes. In spite of this characteristic, the group decided to focus on one category of companies with a classification based on the conventional firm-size paradigm – the number of employees.

Recognizing the industrial organization in developing and transitioning nations, the group agreed that a medium-size company (10–100 employees) approach be adopted. Furthermore, the discussion covered both skilled and unskilled labor.

Data required to meet the needs of this targeted group included, but was not limited to cost data under four major categories:

1. Operating cost – What is the present cost of running the company (status quo costs)?
2. Cost of health event – How much of the cost is attributable to the health event?
3. Cost of intervention – How much is needed to effect the change?
4. Cost of evaluation – How much will it cost to assess the effectiveness of the change?

In closing, the group attempted to answer the question; "How do we get this on the ground?" The following items are necessary to accomplish the goals of the meeting:

A. Dollars – funding those initiatives in developing and transitioning nations highlighted during the discussion.
B. Identify and use all workable strategies to create awareness and willingness at all levels – individual, company, and national.
C. Independent effort to compare models, share information on models, improve and make them user friendly, and tailor them for developing and transitioning nation settings.
D. In all interventions/programs, the group encouraged a participatory approach that would involve training employers and employees with a focus on enhancing productivity, capacity building, and job protection.

Finally, the group acknowledged the fact that there is no absolute parity among companies in developing and transitioning nations as such it is almost impossible to develop a model that will be suitable across the board. Nonetheless, developing a reliable and usable template to be used as a guide for conducting economic evaluation in these settings is within reach. This can be achieved via collaboration and information-sharing to arrive at models suitable for specific projects within given industries in any particular country.

2.4. Economic theory

The objective of this group was to discuss the advantages and shortcomings of the existing models and to make recommendations for future model characteristics. At the very onset, the existing models were compared with each other based on their acceptability, flexibility, complexity, and specificity. It was noted that the available models lack either one or more important feature. Keeping in mind the wide variations in employer needs, types of industries, and organization size, the group agreed that building a model is far from being a "one size fits all" proposition. What that implies is that building a unique simple model is hardly possible given the diversity in work-related injury and illness problems. However it is imperative to have models that share some of the basic *features* the panel highlighted; the model should stimulate thinking, be transparent, be flexible, calculate the productivity of labor and capital, and have embedded cases. Each of these features is discussed in more detail in the following five paragraphs.

2.4.1. The model should stimulate thinking

First and foremost, the model should have the ability to stimulate interest among its users. Cost-benefit analysis should be an interesting undertaking and far more appealing than a mere accounting exercise. It is from this interest that the users draw references in selecting different cost-benefit components, which may otherwise be hard to conceptualize but are critical to a thorough analysis. This is particularly true when the user has no formal training in cost or investment analysis or economics. The model should stimulate thinking about all the potential effects of a safety and health related investment. It is important for the model builder to understand the needs of the user and to enable them, through the model, to quantify abstract concepts and include them in the analysis.

2.4.2. The model must be transparent

Every assumption of the model should be readily available to the user. It is not only important for a user to understand their basic need for a cost-benefit analysis, but it is also important to know how those needs are incorporated into the model. This not only reveals to the user what is being done, but also helps in comparing among the alternative models and choosing the one that better suits their purpose. It is one thing to comment on the transparency of the model but in no way a less challenging job for the model builder to incorporate that feature. The group spent some time delving on the various options and suggested incorporating this feature through intelligent use of "Help Me" buttons. These buttons would help the users in getting acquainted with the default assumptions about the various parameters in the model and also would give them insights about how to model their intervention effectiveness.

2.4.3. The model must be flexible

A very important feature that has been discussed in greater detail was about the flexibility of the model. What the panel meant by the term 'flexibility' is not only about the model's ability to be applied across various job and intervention types but also its ability to satisfy the needs of different users. The users differ in their backgrounds and understanding. Also they differ in their needs. The requirements of a small employer are different from that

of a middle or large size employer. The panel understands that herein lays the challenge for the model builder. In its quest for acceptability among different varieties of users a model may lack simplicity. Similarly, some of the finer details (and important ones) of a model may remain unattended if too much emphasis is put on its easy acceptability across industries. The problem deteriorates when one brings in the feature "simplicity." Nobody questions the fact that a simple model is always desirable but simplicity comes at a cost. Simple models often lack the finer details that an analysis needs and may often fail to justify the intervention because of the lacking detail. A detailed model on the other hand may be far from simple. Any model should be flexible enough so that it can very simply work out the benefits from the intervention without requiring many inputs from the not-so-demanding user and at the same time it should be capable of incorporating finer details as and when the user needs them. In this case the group understands that the model should be developed in *layers,* each representing different levels of *complexity* that can be invoked by the user whenever appropriate. An excellent idea would be to use the "Help button" as mentioned earlier or a "Menu Button" that asks the user for inputs and puts default values whenever they are not available.

2.4.4. The model should calculate the productivity of labor and capital

Certain kinds of interventions, such as ergonomic modifications, often have their effect on overall productivity. Productivity may increase or decrease depending on the job type and the specific type of the intervention. Economists define productivity as output per unit of input. Any intervention is bound to have its effect on productivity through one or more of the following:

1. Reduction in lost work time.
2. Increased efficiency of the worker.
3. Increased efficiency of the capital equipment.

The problem here is two-fold. First, a true model should be able to differentiate between the contributions of changed productivity of labor from that of capital equipment. Secondly, there is the obvious challenge of measuring inputs and outputs. In loose terms productivity is said to be increased if one can have the same amount of output at a lower total cost. This measurement is more in the lines of measuring *efficiency* rather than *productivity*. However, one often fails to recognize that change in productivity can be *qualitative*. In the post-intervention phase there may not be any change in quantity of output produced but the quality of the output may not be the same. The economists in the group agreed upon the increasing need for the models to take this into account, especially when the interventions may reduce true cost of production by triggering less call backs or returns of the product.

2.4.5. The model should have embedded cases and a case repository is needed

Another relevant feature that was thought to be important is the availability of embedded cases in the model from which the users may draw examples and guidance. These embedded cases should be classified on the basis of user types. Similarly, the group agreed upon the usefulness of having a case repository for reference purposes. Establishing an e-group among the researchers, users, and model builders was suggested and it was concluded that in person meetings at regular intervals should be of high priority.

The group also discussed the usefulness of *standardization of formats* for dealing with different intervention cases and concluded that there should be standardization of parameters and output measures. Whether inputs should be standardized is arguable enough as some think that this may be too demanding, and reduce the heterogeneity of the models to such an extent that they may lose their selling point. Regarding output formats, models should come up with a standardized presentation format. For example, model output should help in highlighting the sources of savings, if there are any, from a particular intervention. In other words, it is useful to categorize the benefits on the basis of workers' compensation, productivity, absenteeism and so on.

3. Potential collaborative efforts

Following discussions of posed questions regarding the key models and roles of the different entities, the groups were asked to identify multi-partner projects that could be carried out to apply and/or improve the models in developing, transitioning, as well as developed nations. As mentioned in the foreword of this special section of the *Journal of Safety Research*, agreement was reached to pursue research needs for improved economic evaluation modeling, and to begin development of a coherent strategy to increase the use of economic evaluation at the company level throughout the world. The following is a partial list of suggested efforts presented in the final session of this conference. These suggestions range from projects that are already underway and could benefit from additional partners, to ideas that could take a considerable amount of time and effort to see to fruition. The first suggestion, to present the conference proceedings in the *Journal of Safety Research*, is now completed.

4. Suggestions regarding the model specifications

- Compare elements of the six models presented at the conference on the basis of:
  - Input requirements
  - Parametric assumptions

- Output provided
- Suitability of case specifications not yet tested

- Analyze interventions or programs using a variety of models. Areas of particular interest included:
  - Ergonomics
  - On-site medical care
  - Process mechanization
  - Engineering controls vs. personal protective equipment
  - Fleet safety
  - Health promotion
  - Continue to identify common elements of an "ideal model," which could satisfy the needs of all discussion groups
- Develop an ideal model for evaluating cost effectiveness of interventions to reduce musculoskeletal disorders in developing countries
  - Partner with participants and others to conduct user tests of new models
  - Better characterize key elements
    - Productivity was named as particularly important
- Obtain feedback from users of existing and new models
- Conduct social marketing research to determine what motivates businesses, particularly SMEs, to adopt safety and health interventions
- Collect default values for data elements.

5. Specific suggestions for the National Institute for Safety and Health (NIOSH)

- Form an internal working group, *Economic Evaluation of OSH Interventions at Company Level,* to include four task groups (with chairs and members in each)
  - Communication
  - Training and Education
  - Modeling
  - Research
- Include the research needs named at this conference in the National Research Agenda which is in preparation by the National Occupational Research Agenda Team of Social and Economic Consequences of Workplace Illness and Injury
- Host a webpage at (www.cdc.gov/niosh)
- Host a listserver for interactive communication
- Host a Clearinghouse of Case Studies (with the assistance of other participants)
  - Collect already developed case studies from enterprises and all sources
  - Develop new case studies
- Host a Solutions Database to demonstrate occupational safety and health interventions that have been proven effective
- Educate intramural researchers regarding economic evaluation of OSH intervention at the company levels methods and value
  - Develop training modules for economic evaluation with the assistance of other interested participants
  - Implement a lecture series
  - Partner economists with researchers in NIOSH projects.

6. Other suggested opportunities

- Pursue opportunities for follow-up conferences focusing on economic evaluation at the company level research, models, methods, and/or implementation strategies. Potential venues include:
  - International Ergonomics Association
  - Georgetown School of Business
  - International Measuring the Burden of Injury
- Pursue project funding opportunities
  - Identify new funding partners
  - Explore NIOSH continuing intramural and extramural funding
- Expand training of health and safety specialists on economic evaluation
  - Build a training module built around case studies and Models
  - Establish a training taskforce
    - Potential members include NIOSH, WHO, NSC, ASSE
- Other volunteers to take this forward
  - CERRSO, UML
- Academia contributions
  - Georgetown School of Business offered:
    - Develop a seminar series
    - Faculty and students to contribute to the efforts
  - West Virginia University offered:
    - Students to conduct economic analysis
    - Train students to build future capacity.

7. Demonstration projects

These international efforts are in various stages of implementation—from the planning to conducting the study—that could benefit from new or additional partners. Details of each of the projects are listed below:

- Evaluating Cost Effectiveness to Reduce Musculoskeletal Diseases (MSDs) in the Wholesale Food Market in Brazil

Location:	Campinas, Sao Paulo state, Brazil
Company:	CEASA
Intervention:	Mechanical devices (lifting)
Models:	Use all models presented and compare them.
Data Source:	This will be a prospective study so data will be collected as the intervention proceeds
Partners:	University of Campinas (UNICAMP), University of Sao Paulo (USP), University of Massachusetts at Lowell and the Ministry of Health.
Analytical Horizon:	2005 – 2008

▪ Evaluating Cost Effectiveness to Reduce Musculoskeletal Diseases (MSDs) for Central Food Market Porters in Calcutta, India	
Location:	Calcutta, India
Company:	Central food market porters
Models:	Use all models presented and compare them.
Intervention:	Mechanical devices (lifting)
Partners:	Ergonomists at Calcutta University and University of Massachusetts at Lowell
Approach:	A carefully designed experiment with control and intervention Groups

▪ Caribbean Initiative for Occupational Safety and Health	
Location:	The Caribbean
Approach:	A sustainable occupational safety and health initiative that will use The Centro Regional de Seguridad y Salud Ocupacional (CERSSO) economic and risk assessment model.
Future Partners:	Labor ministries

▪ Healthy Work Place Initiative in the Informal Sector	
Location:	Peru
Approach:	Design and evaluate a model for governments and non-governmental organizations. (NGOs), intersectoral health education and promotion of capacity building.
Point of Entry:	Local community centers, NGOs and the existing public health
Structure Intervention:	Citizens will decide what needs to be done.

▪ Pottery Village in Vietnam	
Location:	Bat Trang village near Hanoi, Vietnam
Company:	Family based
Intervention:	Change from charcoal to gas
Data Source:	Ministry of health and from families
Models:	Use all models except Return on Health Safety and Environmental Investments (ROHSEI)
Approach:	Participatory
Partners:	World Health Organization (WHO)

▪ Improving the Health of Health Care Workers (HCW)	
Location:	Medium size hospitals in Nicaragua, Argentina, Haiti, Panama, and Mexico
Interventions:	Lifting, needlesticks, violence, etc
Models:	Use all models presented and compare them.

8. Conclusion

The conference was significant in establishing a pathway to begin to increase the use of economic evaluation of occupational safety and health interventions at the company level, on an international basis. Furthermore, the proposed collaborative efforts provided a framework to engage in identifying and making necessary adjustments in the existing models to make them suitable, and more importantly provide reliable results for employers, workers, government agencies, academia, and other safety and health practitioners in both developed and developing nations. An added benefit of this meeting was the establishment of a world-wide network of multidisciplinary professionals to continue the work of this conference—to ensure that the economic evaluation and data collection tools adequately represent the current state of the art methods and accurately calculate the costs and benefits of interventions designed to improve working conditions.

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