

# Demonstrating the economic efficiency of Occupational Health Services

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## ABSTRACT

Most large companies operate some form of Occupational Health Services (OHS), more are now requiring specific evaluative information to justify the continued provision of in-house OHS in the face of increased pressure to control costs combined with an awareness that the service itself can induce activity and be substituted with healthcare provided or even funded outside the company. The lack of routinely collected data and the conceptual difficulty in defining and measuring the outcomes of OHS provide challenges for economic evaluation.

A pure human capital approach is likely to be insufficient since OHS has multiple objectives. Corporate provision a) is necessary to fulfil the company's statutory obligations on health and safety; b) contributes to the creation of a culture of partnership (the company is seen to accept responsibility for the welfare of employees); c) reduces the potential costs to the company of accidents or mental and physical illnesses at work, in the form: sickness benefit paid to employees; loss of production due to absence from work; less-than-optimal employee performance; litigation and claims against the company for work-related health problems, or insurance premia against such claims; d) represents a suitable environment for the cost-effective reduction of the social and health service costs of illness at work. Evidence is needed in order to quantify some of these arguments and demonstrate to decision-makers the value generated by occupational health services. The aim of this paper is to consider the practicality of different economic evaluation methodologies, specifically: cost models, contingent valuation, and development of OHS specific outcome measures.

## INTRODUCTION

If private companies exist for profit maximisation then subject to various constraints all activities that the company engages in must strive to maximise shareholder value. Large corporations obviously engage in activities that contribute to this objective in both direct and indirect ways. Resources are invested in business support services such as IT, security or occupational health in the belief that the company is better off: that they have some form of positive impact for the company.

Clearly, the rational decision-maker will (subject to certain constraints) choose to invest resources in those activities that can demonstrate the best return for each unit of investment. However, whilst the input costs of many support services is very clearly identifiable the outputs or outcomes are not always directly observable since benefits may be multidimensional and sometimes inherently intangible. Consequently it is unclear whether the benefits of these activities outweigh their costs. In an environment of competition for resources lack of evidence on cost-effectiveness is likely to be regarded the same as activities demonstrated not to be cost-effective, whereas those activities that can demonstrate cost-effectiveness will be supported.

Whilst most large companies operate an occupational health service (OHS), more are now requiring greater evidence of value as generally indicated in some studies in multinationals [1][2][3]. Companies need more specific evaluative information to justify the continued provision of in-house OHS in the face of increased pressure to control costs combined with an awareness that the service itself can potentially induce activity and be substituted with healthcare provided (contracted out) or even funded (NHS) outside the company.

The aim of this paper is to consider the practicality of different economic evaluation methodologies in this environment. After some discussion of the economic rationale for OHS three alternative evaluation methodologies are presented with some experimental data.

## RATIONALE FOR OHS

The traditional context in which to justify the economic case for OHS has been based on a straightforward human capital approach: broad labour force surveys reporting the total cost of sickness absenteeism to the economy. For example, sickness absence accounted for approximately 8.4 lost working days per employee, around 3.7% of working time in 1996 [4].

At an average cost of £533 per worker, the total cost to UK business could amount to £12 billion [5].

The pure human capital approach may be inappropriate as many companies do not record sickness absence systematically but moreover absence valued by wage rates is not a comprehensive proxy for the cost to the company of negative occupational health related events or the value of benefits generated by OHS. Occupational health interventions strive to do more than simply reduce sickness absenteeism. In order to construct a more comprehensive evaluation the wider benefits of OHS need to be considered. Why do private companies invest in OHS? In most developed economies companies have statutory obligations regarding health and safety, they are thus required to make some OHS provisions. However, most large companies operate an OHS beyond these requirements. Why?

First, the main rationale is that OHS reduces potential costs to the company of accidents or mental or physical illnesses at work in the form: sickness benefit paid to employees; loss of production from absenteeism; sub-optimal staff performance, loss in productivity; litigation and claims for work-related health problems or insurance premia against claims. If OHS interventions are effective they will reduce the probability, frequency and hence costs of negative occupational health events.

Second, OHS may also generate ‘morale’ benefits. OHS may contribute to a perceived culture of partnership, whereby the company is seen to accept responsibility for the welfare of staff. Indeed OHS could possibly be seen as an employment perk like private health care insurance. Higher morale may generate benefits for the company in terms of increased productivity. It may also influence staff retention, recruitment and enhance the general reputation of the company. It could also be argued that this environment could reduce industrial disputes and litigation against the company. These morale benefits may be difficult to measure but are likely to be significant.

Third, OHS may reduce wage costs. The theory of compensating wage differentials states:

*“The following are the circumstances which make up for a small pecuniary gain in some employments, and counterbalance a great one in others: First, the agreeableness or disagreeableness of the employments themselves...the wage of labour vary with the ease of hardship of the employment.” [Adam Smith 1776].*

If labour markets reward risk then OHS, which can influence actual or perceived occupational risks, will reduce the need for the risk premium element of wages. Hence wage costs for a company with an OHS could potentially be lower than a company without OHS. Empirical tests of the theory of compensating wage differentials have used hedonic pricing equations to consider job-related risks of death or serious injury and have found that wage compensation for risk does exist. [6][7][8].

## THE CONTEXT FOR EVALUATION

Evidence is needed in order to quantify some of these arguments and demonstrate to decision-makers the extent of any benefits generated by investing in OHS and provide information on the relative efficiency of these activities. This evidence is not routinely available. As with many health care services, data on the outcomes of these activities are not normally recorded. Hence, companies are unable to answer fundamental questions such as: do OHS interventions result in less days off sick? higher morale? higher productivity? less medico-legal cases? i.e. are they effective (by any criteria)? Even more fundamentally the specific expected outcomes of OHS are not routinely defined. What are the objectives of OHS?

Resource use data are often available as many large corporations operate internal billing systems between business units. These are intended to reflect actual cost as they assign units of resource use to activities weighted according to time taken, type of activity and service provider (e.g. Doctor, Nurse) and normally do not include profit.

Hence the context for economic evaluation whilst not quite a data vacuum is one constrained by data availability and moreover there is an imbalance in availability between costs and outcomes. Indeed outcomes are often not even defined. One further contextual consideration is the way decisions are made in private companies. The culture of evidence-based decision-making may not be strong. Decision-making under uncertainty is common and pragmatic judgements a necessity. Constraints on rational economic behaviour such as equity, politics and accountability may interact very differently compared to NHS decision-making. Companies may be reluctant to invest large amounts of resources in gathering or improving economic information about OHS, indeed the lack of formal economic evaluation to date would confirm this. Time is also likely to be a real constraint for evaluation. The process of producing cost-effectiveness information will itself need to be demonstrably cost-effective.

## EVALUATION METHODOLOGIES

### **I: Cost model**

The Nottingham Health Economics Unit was asked to advise the Chief Medical Officer for Boots PLC on demonstrating the value of OHS. The Boots OHS was under pressure from management headquarters to justify its continued provision.

Good cost data were available but data on the benefits generated by OHS were not. Time constraints did not allow for primary data collection. Hence the methodology adopted was pragmatic and consisted of two stages: an analysis of costs, and development of a framework in which to consider benefits.

The first stage consisted of a functional audit of OHS activities: a descriptive exercise to map out current patterns of service and resource use. Twelve months service use data from the OHS database were analysed for two Boots business units (X and Y). The large portfolio of services provided by the OHS was categorised into ten broad groupings (see table 1). Data were then aggregated under these groupings. Using the internal billing system it was possible to estimate costs for all activities.

The second stage of this evaluation aimed to construct a model with which to translate observed resource use data into information on the minimum threshold benefits required for OHS services to be cost-effective. First, a concise list of the expected benefits of OHS was derived by ‘brainstorming’, which consisted of an initial meeting of OHS staff and researchers, a period of contemplation, and then a final meeting of OHS staff only. This model assumes that the expected benefits are to:

1. Maximise health and morale of employees
2. Maximise performance and increase productivity
3. Minimise medico-legal costs
4. Enhance workplace safety
5. Reduce sickness absence

Second, an independent estimation of how each of the ten broad OHS categories contributes to these five benefits was made by each OHS clinician. Variations were then discussed until

the agreed group estimation was arrived at (table 1). For example, the OHS category of ‘doctor’s medical’ was thought to contribute to each of the five benefits in equal proportion, whereas ‘executive health screen’ was believed to be mainly about benefits 1 and 2 and would not add to benefit 3, and so on.

**Table 1 Estimated distribution of benefits**

<b>SERVICE</b>	<b>BENEFIT</b>					<b>Total</b>
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	
1. Doctors Medical	20%	20%	20%	20%	20%	100%
2. Executive Health Screen (EHS)	35%	35%	0%	10%	20%	100%
3. Surveillance	20%	5%	30%	30%	15%	100%
4. Treatment	20%	30%	20%	10%	20%	100%
5. Physiotherapy	20%	20%	15%	15%	30%	100%
6. Ill Health Retirement (IHR)	10%	20%	30%	10%	30%	100%
7. Pre-employment	10%	20%	20%	20%	30%	100%
8. Vaccination	20%	20%	10%	40%	10%	100%
9. Nurse Screen	20%	20%	20%	20%	20%	100%
10. Counselling	30%	25%	15%	10%	20%	100%
<b>Total</b>	<b>21%</b>	<b>22%</b>	<b>18%</b>	<b>19%</b>	<b>22%</b>	<b>100%</b>

1. Maximise health and morale of employees
2. Maximise performance and increase productivity
3. Minimise medico-legal costs
4. Enhance workplace safety
5. Reduce sickness absence

By applying this distribution to the cost data generated in stage one, a value for each of the five types of benefit can be established for OHS overall and for each service. This value represents the impact the OHS must have within the company in order to be economically viable: a ‘breakeven value’. If the service can achieve benefits equivalent or greater than this value then it will be cost-effective to continue providing it. The plausibility or likelihood of achieving these threshold values can then be assessed by comparisons with other known data. In addition, since this is a simple economic model both sets of assumptions, the list of

expected benefits and the distribution of those benefits, can be reviewed and adjusted and their impact on results observed.

Once the threshold values for each of the five types of benefits have been estimated it is then possible to comment on the plausibility of achieving these values. For example the overall required value of an avoidance or reduction in medico-legal costs brought about by use of OHS is around £30 per user per year. For individual OHS services the range is £8 (Nurse Screen) to £116 (IHR). In assessing the likelihood of achieving this value it is necessary to consider both the probability of medico-legal cases arising over a year and the expected average cost of each case. Past records may reveal both of these pieces of information. However, given that the absolute threshold value of this benefit for business unit Y (i.e. all users) was around £82,775, it seems likely that this would easily be achieved and that OHS will be cost-effective across this dimension. The TUC estimate that in 1995 it secured awards totalling £304 million against workplace injuries and ill health for its members.

This process can be repeated for each of the expected benefits of OHS, to assess the likelihood of achieving the threshold value estimated by the model.

## **II: Contingent Valuation**

On presenting some of this initial work with Boots it became apparent that many other companies faced similar situations and were struggling to present an economic case for OHS.

A second project with BP Amoco UK allowed further experimentation with evaluation techniques for OHS. Here OHS was conceptualised as a form of insurance policy, which individual business unit managers chose to purchase at different levels of cover. Under this model OHS is purchased in order to reduce the risk and impact of negative events whose cost, timing and frequency is uncertain. Investing resources in occupational health services can then be analysed as an insurance market. The insured will pay a fair premium equal to expected loss and a risk premium dependant on attitudes to risk and associated utility losses. In the absence of a real market for OHS (since OHS is provided “in-house”) it is possible to replicate the valuation technique that a market provides by using contingent valuation.

Using an insurance framework the OH department is considered as the ‘insurer’ and the numerous business unit managers as the ‘insured’. They are striving to maximise the

profitability of their units and will wish to purchase OHS only if they perceive it is economically rational to do so: if the likely benefits outweigh the costs. The price they are willing to pay to ‘protect’ against adverse OH related events is a direct valuation of the benefits (or disbenefits avoided) as they perceive them.

This model provides a framework in which to construct a cost-benefit analysis. Using the contingent valuation method, the benefits of the OHS are valued by asking respondents to a survey to give a valuation of the hypothetical premium paid in exchange for them. Comparison can then be made between the hypothetical premium and the actual premium for each business unit (based on cost data provided by the OH department). The difference representing net economic impact of OHS.

The survey was sent to respondents with supporting materials in advance of a thirty-minute taped telephone interview. Respondents were asked several questions related to each of five benefits (as under method I) and then asked an open-ended willingness-to-pay (WTP) question structured in terms of the maximum they would pay to halve each aspect that OHS may be able to influence. (e.g. WTP to halve the impact of medico-legal cases). Respondents were also asked willingness-to-accept (WTA) questions. They were then asked to give WTP and WTA values for the OHS as a whole.

Valuations were obtained from 38 key decision makers from 16 components business units within BP UK (e.g. BP Air, BP Shipping, BP Retail, BP LPG etc.) Overall the median value for the willingness to pay for Occupational Health ‘cover’ was £300 per employee per year. The median value for the minimum compensation required for a complete withdrawal of OHS was £400 per employee per year. On the WTP scale, benefits 1,2 and 5 are valued equally, less value is placed on benefit 4, and benefit 3 is valued lowest. The WTA scale produces higher values as expected. Benefit 2 is valued highest, less value is placed on benefit 5 and the others are valued equally.

A simple cost-benefit analysis can show the value added by OHS for each business unit. WTP and WTA values can be used as parameters to present a range for the estimated net economic impact. (Table 2)



These data suggest that OHS is likely to be cost-effective for most business units, only one has a negative value added range. Sensitivity analysis can be conducted on the valuation of benefits and costs, this would test the robustness of these results.

**Table 2: Simple CBA of Occupational Health at BP**

Business Unit	Benefit (£)		Cost (£)	Value added (£)	
	WTP for OH premium	WTA for OH premium	Actual OH premium	Lower bound	Upper bound
Retail	£ 230	£ 150	£ 97	£ 133	£ 53
CI Direct England & Wales	£ 250	£ 325	£ 137	£ 113	£ 188
CI Direct Scotland	£ 100	£ 1000	£ 129	-£ 29	£ 871
Grangemouth Refinery	£ 325	£ 350	£ 7	£ 318	£ 343
Coryton Refinery	£ 450	£ 625	£ 23	£ 427	£ 602
LPG BU	£ 400	£ 400	£ 125	£ 275	£ 275
CINE	£ 50	£ 30	£ 103	-£ 53	-£ 73
Supply and Distribution	£ 400	£ 500	£ 129	£ 271	£ 371
LPG UK	£ 520	£ 575	£ 108	£ 412	£ 467
Lubes	£ 450	£ 600	£ 148	£ 302	£ 452
Air	£ 230	£ 231	£ 128	£ 102	£ 103
Marine	£ 200	£ 500	£ 164	£ 36	£ 336
GSP	£ 200	£ 500	£ 148	£ 52	£ 352
BPA	£ 100	£ 200	£ 97	£ 3	£ 103

### **III: Empirical approach**

The previous two methods are based on evaluation at a conceptual level. An obvious alternative approach is empirical analysis involving primary data collection. Employee specific data on OH inputs and a range of possible outcomes could be collected. But outcome measurement in occupational health is not simple, indeed the *raison d'être* for the previous methodologies was to avoid direct measurement of outcomes.

The first problem is separating out benefits to the individual and benefits to the company. Decision-makers within private companies are of course concerned with the latter but the former may have indirect advantages for the company too.

The second problem is outcome measurement. Clearly the outcomes of OHS are multidimensional but not all are intangible. For the purposes of analysis there are perhaps three groups of outcomes. First outcomes not directly observable since they are more about changing risk (i.e. reassurance from safety awareness, health promotion etc.) the contingent valuation method strives to incorporate these. Second those outcomes, which are clearly observable given mechanisms (and perhaps incentives) to record the data (i.e. sickness absence, frequency of accidents, use of health care facilities, etc.). Third those outcomes that may be estimated by proxy, using other observable data.

The second group of outcomes is the key element of any observational quantitative analysis, whilst the third group requires a little more consideration. OHS outcomes such as changes in employee morale, performance or productivity may be related to individual (work-related) quality of life (QoL). Whilst morale and performance in the workplace are inherently difficult to observe and measure there is a wealth of research literature on QoL measurement. There is also a wide range of validated instruments available for QoL measurement (e.g. SF-36, Nottingham Health Profile, etc.) Whilst we may not be able to precisely quantify the exact relationship between QoL, morale and performance it may be reasonable, *ceteris paribus*, to assume a positive correlation. Thus it may be possible to make inferences about outcomes which appear intangible from observed changes in data that we can meaningfully observe.

There is a growing literature applying QoL assessment in an occupational health context. Jette et al. [9] considers the potential value of and exactly how health-status instruments may be used in the occupational-health setting. Pransky et al. [10] state that researchers have developed new conceptual models of health-related quality of life and associated questionnaires and study designs that maximize use of administrative databases and the generalizability of results. Maruyama et al. [11] examine the relationship between QoL among workers of a major manufacturing company, health practices and primary symptoms/problems. They designed their own specific working-life satisfaction scale, a Health Practice Index (HPI) and scores for primary symptoms/problems. The findings pointed to strong correlation between working-life satisfaction (QOL), the Health Practice Index (HPI) and scores for primary symptoms/problems. Beaton et al. [12] compare the measurement properties over time of five generic health status assessment techniques used in the workplace. Their results suggest that the SF-36 was the most appropriate questionnaire to measure health changes in the population studied.

If employee quality of life is a meaningful outcome measure in the area of occupational health and in some way a proxy for ‘morale’ benefits then it may be useful to develop a multidimensional OHS specific outcome measure. A QALY type measure for OHS may be appropriate. Quality and quantity of working days could be combined by adjusting the number of working days by a quality index which might proxy a range of other benefits: the quality adjusted working day (QAWD)! Cost per QAWD gained using OHS could then be evaluated comparing intervention and control groups in an observational trial.

## DISCUSSION

Occupational health is a heterogeneous good with multidimensional outcomes. Supporters of OHS are keen to extend economic appraisal beyond the human capital approach with its focus on only one dimension: sickness absence. Economic evaluation is hampered by lack of data and clarity of objectives and suitable outcome measures. However, the real issue is how best to assess and communicate the economic impact of OHS.

The cost model approach has the advantage of being simple and quick to construct from readily available data. It is also comprehensive in the sense that a threshold estimate can be produced for the monetary value of all types of benefit generated by each specific service.

This avoids the problem of explicit outcome measurement (or even definition!). However, it is a crude approach. Total resources used by OHS are simply attributed to service categories and an estimate made how these might contribute to a list of defined benefits. The assessment of whether each threshold is likely to be achieved relies a lot on subjective judgement although some supportive data can be used. Ultimately this approach is based on implicit outcome measurement. It does not provide evidence that benefits outweigh costs but enables a case to be argued with a given benchmark. This may be appropriate and sufficient for some decision-makers.

The contingent valuation method is now perhaps the economist's standard tool when faced with multidimensional outcomes without market values. Whilst sickness absence can clearly be valued by markets (wage rates) other outcomes which may be equally important can not. A key advantage of the CV technique is that it incorporates valuation of more intangible benefits such as the reassurance derived from knowing there is an OHS, the increase in morale, the reputation of the company, and so on. Although the relative value of these attributes may be difficult to measure. In addition, it is relatively straight forward to carry out.

The standard CV problems of how best to ask the questions and how to elicit values are apparent. But the role of information is crucial as is the sample of individuals whose values are elicited. Who should be asked to give their values in a CV survey of OHS? Health and Safety Officers, Personnel Officers, Managing Directors of business units, the users of OHS? Whose values matter? Individuals informed about the benefits of OHS or the possible impact of not having an OHS may be appropriate subjects. However, if these individuals are very closely involved with OHS they may be aware of actual costs and WTP may simply reflect this. There is also a vested interest problem, individuals whose employment is linked to OHS may give bias valuation. There may be sample size issues, if the focus is on key decision-maker's values then samples may be small even in large companies. The survey should perhaps focus on the 'purchasers' of OHS, those key decision-makers who decide on OHS arrangements. Can these be identified? Do they exist? Or do OHS arrangements simply evolve?

One further problem with the CV method is attribute splitting. The sum of individual values for the component attributes of OHS is likely to produce higher values than valuing OHS as

one commodity, especially if interaction or overlap between these attributes exists. This is a problem if the CV method is used to value only those benefits with non-market values, whilst other methods are used to value other aspects of OHS. A ‘mixed methodology’ approach may seem intuitive but is likely to lead to different values (higher?).

The empirical approach outlined above suggests development of a specific outcome measure, since attempting to directly measure morale or performance may be meaningless.

The ‘QAWD’ concept simplifies the benefits of OHS into quantity or quality of work aspects. The success of this approach depends on the relationship between changes in individual benefits measured in terms of quality of life (say SF-36 profiles) and changes in benefits to the company (performance, productivity, reputation, retention, etc.). OHS may be highly effective at improving QoL for employees at low cost but does this translate into benefits for the company? The method assumes that it does.

Of the three methods the empirical approach is likely to require the most resources. This raises the question of the relative value of economic information and the cost of generating it. This is a very relevant issue for private companies. They are unlikely to have in-house expertise to conduct comprehensive economic evaluations, yet there is a real need for economic evidence. Companies need pragmatic methods to provide decision-makers with guidance in a timely and cost-effective manner. Other approaches to the evaluation of OHS might include conjoint analysis to examine the comparative value of the component benefits. Also it would be possible, given larger enough datasets, to empirically test the theory that OHS might reduce wage compensation for risk. But are these practical solutions to demonstrating the economic efficiency of OHS?

Further research in this area will consider: How do companies decide on the level of health provision for their employees? In-house OHS is mostly about primary health care, screening and health promotion. However, in Japan Sony operate secondary care facilities: the Sony Hospital. In the U.S worker’s health insurance schemes extend beyond the executive perk as exists in the U.K. What drives companies to finance or provide health care for its workers?

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