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## COOPERATION BETWEEN INSURANCE AND PREVENTION

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### **THEORETICAL PERSPECTIVES ON THE INFLUENCE OF INSURANCE AND OF REGULATION ON THE PROTECTION OF THE HEALTH OF WORKERS**

Work injuries are an unwelcome byproduct of economic activity. In part, they are random events, but they are also, to some extent, under the control of workers and employers. Employers can reduce the number of workplace injuries and illnesses by investing in safer technologies, providing workers with personal safety protective equipment, training workers and their supervisors; workers can avoid accidents by following safe work practices and by taking greater care on the job (1).

Both parties incur costs when an accident occurs. Workers' costs include potential loss of income and medical expenses associated with treatment and rehabilitation as well as intangibles, such as pain and suffering and disability that reduce the ability to enjoy life. Employers' costs include interruptions in production and damage to capital equipment and physical plant (1)

Since accident prevention also entails costs to employers and employees, public policy should encourage employers and employees to optimize the allocation of the combined costs of accidents and accident prevention that are incurred by both workers and employers. It is possible to spend either too much or too little on accident prevention. Investment in accident prevention is socially efficient when total costs are minimized, that is, when one additional dollar spent on prevention reduces accident costs by exactly one dollar (1). And, as I will discuss later in this talk, because the predominant share of the direct and indirect costs of occupational illness and injury are external to the employer (at least in the United States) (11), economic theory argues for the presence of the state in influencing firm-level expenditures on prevention programs, or perhaps, the role of the state in directly spending or investing on prevention programs. When the majority of the economic costs of the preventable occupational health and safety burden are borne by parties external to the firm, firms will not have a clear understanding of the actual costs of under-investment in workplace health and safety. Insurance instruments can clarify the precise economic costs incurred by firms. Regulation and enforcement can raise the firm-level costs of under-investment in occupational health and safety. And information and consultation services provided by prevention authorities can increase firm-level recognition of effective OHS policies and practices.

There are at least three approaches to the regulation of occupational health and safety (1). The first approach, classically identified as occupational health and safety regulation, involves the promulgation of rules prescribing or proscribing specific policies and practices by employers, which are enforced through onsite inspections and monetary penalties for infractions. Direct regulation attempts to change employer behavior by prescribing or proscribing specific practices. Regulatory sanctions have the effect of raising the level of 'efficient' health and safety investment by the firm to the expected value of the sanction. In so doing, regulation introduces costs. There are two costs that must be considered by the efficient regulator: the administration costs of regulation and the cost of regulatory error (sanctions too large or too small). The evidence for the effectiveness of regulatory inspection and enforcement in occupational health and safety is uncertain. Some authors have reported that evidence of effectiveness is inconsistent (1). Other scholars are more confident that inspection and enforcement is

effective (13). For example, one study of large sample of firms over 7 years concluded that a 10% increase in enforcement resulted in a 1% reduction in the accident rate (Scholz and Gray 1990) (1).

The second approach emphasizes the role of economic incentives that reward or punish employers on the basis of safety and health outcomes rather than behaviors. This approach is embodied in experience rating (1).

In Canada and the United States, workers' compensation benefits are funded through a payroll tax paid by employers. A two-step process determines premium assessment rates in most jurisdictions. In the first step, industrial classifications are used to group firms who share similar risks of workplace injury or illness. The recent historical accident record of each of these classification, or rate, groups is used to determine the base assessment rate for each group. In the second step of the rate-making process, known as experience rating, the base assessment rate for some firms is adjusted to account for the firm's individual safety record. Both steps of the rate-making process should reduce the injury rate relative to a regime where all employers are charged an identical assessment rate unrelated to their risk of injury (1).

At the firm level, experience-rated workers' compensation insurance premiums present a choice at the firm level between investments in accident prevention and investments in disability management (2). Higher spending on disability management (which does not reduce the incidence of injuries) will generally mean lower spending on accident prevention (and will not moderate injury rates).

The third approach, termed internal responsibility, pervasive in Canada, is designed to improve safety and health conditions through workers empowerment and involves three principal elements: 1) workers' right to refuse unsafe work, 2) workers' rights to information on the nature of workplace hazards and 3) joint labour-management safety and health committees (1). The emphasis on the free exchange of high quality information gives expression to a key provision in economic theory; efficient decision-making within firms requires an understanding of the economic costs and benefits of different courses of action, including the costs (and benefits) of doing nothing compared to the costs (and benefits) of effective methods of removing a risk or hazard.

The premise behind the economic theory of experience-rated insurance is that it provides more precise information to individual firms concerning the economic cost of occupational injury and illness than approaches to levying insurance premiums based on collective experiences of all employers in an economic sector or a national labour market. Unfortunately, it is very frequently the case that insurance premiums schedule only a fraction of the true direct and indirect costs of workplace injury and illness. The work by Leigh and colleagues has estimated that employers' costs (represented by insurance premiums) represent only 11% of the true costs of occupational injury and illness (in the United States). Fully 80% of the true costs are borne by workers and an additional 9% of costs are borne by general taxpayers. The great majority of the economic costs of occupational injury and illness are externalized. As a result of the broad failure to 'internalize' the full costs of occupational injury and illness at the firm-level, the conventional guidance of economic theory, that firms will invest in health and safety up to a threshold less than or equal to the firms' costs arising from occupational injury and illness can be expected to yield a response which is not sufficient to mitigate the true costs of occupational injury and illness.

Table 1 reports estimates of the direct and indirect costs of occupational injury and illness in a sample of the developed economies. In general, the average economic burden is estimated to approach 3% of gross domestic product. According to the estimates developed by Leigh and colleagues, only 10% of this economic burden is assumed directly by employers.

In theory, providers of insurance have some incentives to improve loss management practices among holder of insurance policies. Improved loss management practices among insurance policy holders should reduce the range of error in risk assessment on the part of insurance providers. There are many examples of insurance providers delivering loss management services: automobile driver education, home or commercial property fire protection practices, workplace health and safety practices. As an example, Liberty Mutual, a large international property and casualty insurer with substantial market share in the United States has a complement of 650 loss management engineers who consult with policy holders on risk management approaches. Assuming this represents an annual expenditure of approximately \$100M, loss prevention activities represent 0.6% of total annual insurance premium revenue of approximately \$16B.

While some have argued that the profit motive provides private insurance carriers with an incentive to control losses and to provide insured parties with safety management services (2), others have suggested that loss management services are provided by insurers to create a premium service brand identity in competitive markets (5). Premium brand identities can generally offer higher priced products in competitive markets. Whatever the actual case, there is broad consensus that private insurance carriers will only provide loss management services up to the point where an additional dollar spent on loss control is equal to the additional dollar of losses saved.

Public insurance providers, such as the single-payer monopoly workers' compensation agencies in Canada, may be more likely to embrace a dual mandate; both to operate an efficient and fiscally sound insurance program AND to expend resources or invest capital to reduce the future burden of preventable morbidity in workplaces. This latter objective is a social objective, and is external to the function of insurance.

Insurance providers in private markets are not in the business of reducing or eliminating property and personal economic losses due to accidents or injuries. Private market insurance is specifically in the business of selling insurance policies at prices which cover the economic risks borne by the insurance policies. Private market insurance is, then, indifferent to the scale of societal economic loss arising from accidents and injury.

## **Four Case Studies of Co-operation between Insurance and Prevention**

### **1) Direct Capital Investment**

Insurance funds in both private insurance markets and in most public monopoly insurance markets hold large capital reserves to cover future costs of current insurance liabilities. These capital reserves are invested (risked) in capital markets to obtain returns which are typically required to meet the full future obligations of the insured parties. Ironically, perhaps, these large capital reserves are typically not invested in undertakings which promise to reduce the risk of future liabilities. In other words, the capital in insurance funds is not used to reduce the future risks of future insured parties.

When an insurance market is operated as a monopoly, as is the case in many national or sub-national workers' compensation insurance schemes in the OECD countries, there are examples of insurers investing capital to reduce the future insurance costs of insured firms. These examples are relatively rare, and the amounts of capital invested are small. There are important questions bearing on these investment decisions concerning the conditions under which it is appropriate to invest in, or subsidize the capital costs of, firm investments in occupational health and safety. In this section, we present two examples of capital investment by insurance entities

In the province of British Columbia, automobile insurance is provided by a public utility, the Insurance Corporation of British Columbia (ICBC). ICBC spends approximately 1.3% of premium revenue on a range of prevention activities (\$38M), including a capital investment program that targets road improvement engineering (\$10M). These capital investments focus on the rebuilding of roadway sites that have a high incidence of traffic collisions, and are made in partnership with the primary provincial or municipal body responsible for highway development. The criteria for an investment is defined as a hazardous road condition that when improved is expected to save three dollars in accident insurance costs over a 24 month period for each dollar invested (**a benefit: cost ratio of 3:1**).

This program effectively reduces the capital cost borne by the primary provincial or municipal body responsible for highway development. In a context where capital is scarce, the effect of this 'subsidy' is to increase the marginal competitiveness of investments in road safety improvements over other purposes, such as capital renewal programs or new highway construction.

As a second example, consider the uneven pace of adoption of patient lifting equipment in the institutional health care sector. The efficacy of ceiling-mounted patient lift devices in the care and management of patients in health care institutions has been well-established. One study has estimated **a benefit: cost ratio of 2.5:1** (this study focused on the reduction in the burden of health care worker injuries and did not include the economic returns from benefits arising from reduced workload in patient handling)(4). The pace of adoption of this technology, however, has been uneven. Jurisdictions with strong early adoption have tended to be those which have developed regulatory mandates or strong policy advisories.

Two Canadian provinces (both relatively late adoption jurisdictions) have recently introduced funding subsidy schemes to increase the rate of adoption of these technologies in the health care sector. Both schemes appear to be based on an analysis that investments in OHS targeting health care workers were not competing effectively with other capital investment needs in the sector, particularly with the dominant capital priority to invest in productivity improvements in clinical care of patients.

In the province of British Columbia, the Workers' Compensation Board has introduced a \$6M capital contribution program for the institutional health care sector. In British Columbia, this sector had approximately 34,000 beds in 2003 (24,000 of these beds in extended care or long-term care settings). Approximately 35% of the 255,000 lost workdays in this sector were attributed to injuries arising from overexertion in patient handling (and represented fully-reserved annual wage lost compensation benefits of \$65M)

The capital contribution program is based on an assumption that ceiling lifts will reduce overexertion injuries by 35-65%. Over the lifetime of the equipment (25-30 years), this is expected to represent a wage loss compensation savings of \$4,000 - \$7,000 per bed, relative to an expected capital cost of ceiling lift installations of \$2,000 - \$3,000 per bed.

The capital contribution program is funded by a special insurance levy on the health care sector. This levy was agreed to by the employing institutions. In effect, all institutions (publicly funded and for-profit) are contributing to the capital requirements of a selected group of institutions: either those with high patient handling requirements (ie: this would be a transfer from the acute care sector to the extended and long-term care sectors) or those with especially scarce capital resources.

In the province of Ontario, the provincial government has recently announced a capital subsidy program to invest in patient lift equipment. This program makes \$60M available to install a minimum of 12,000 lifting devices in the extended and long-term care sectors (with a 70,00 bed complement). Of some interest to this discussion, the funding for this capital subsidy program is provided not by the provincial workers' compensation authority (the Workplace Safety and Insurance Board, with more than \$10B in capital reserves) but from the Ministry of Health and Long Term Care. The Ministry has allocated federal funds for health care technology investment to this program, focused on improving the health of the health care workforce. In this example, the funding for capital improvements to improve the health of the health care workforce has flowed from general tax revenues (approximately 85% of which arise from household income and consumption taxes) rather than from employer levies. In effect, this funding represents a transfer from all workers in the general labour market to workers in the institutional health care sector.

## **2) Direct Expenditures on Prevention: Expanding the Inspection Function in Ontario**

While the rate of lost-time injuries (LTI) has declined substantially over the past 10 to 20 years in the Canadian province of Ontario, the rate of progress has slowed in recent years. As well, the number of workplace fatalities has stopped declining. In order to deal with these issues, the ministry is developing an integrated, comprehensive approach to workplace health and safety focusing on aggressive enforcement, education, training and legislation. In the spring of 2004, the Ontario government committed to the objective of reducing workplace injuries by 20 per cent by the end of four years. On average, there are almost 300,000 workplace-related injuries per year, with about 100,000 serious enough to require people to miss work. The goal is that, by 2008, there will be 60,000 fewer workplace injuries per year.

A central commitment of this initiative is the recruitment of 200 new enforcement staff, to be paid for by the WSIB (the single payer of disability income insurance and medical rehabilitation services for workplace injury), at a cost of \$24M annually. This recruitment marks a major expansion of the current force of 230 inspectors. During the period 1996 to 2002, the number of inspectors in Ontario fell from 278 to 205. In 2003, Ontario had the lowest ratio of health and safety inspectors to workforce in Canada (3.8 per 100,000 workers). With the addition of 100 new inspectors, Ontario's rate will rise to 5.4 per 100,000 workers, placing it ahead of Alberta (5.0 per 100,000 workers) and Saskatchewan (4.9 per 100,000 workers), but lower than British Columbia (9.2 per 100,000 workers).

Inspectors will initially target 6,000 workplaces with the highest injury rates. Inspectors will visit these sites four times a year, focusing on workplace hazards to help firms reduce on-the-job injuries. Although these workplaces represent just two per cent of all firms insured by the WSIB, they account for 10 per cent of all lost-time injuries and 21 per cent of injury costs in Ontario.

The Ontario Ministry of Labour has estimated that a reduction in 60,000 injuries can be accomplished by the comprehensive initiative. This reduction would translate into savings of as much as \$300 million for the WSIB and, eventually, an annual savings of up to \$960 million in related costs for businesses. A more plausible estimate of the specific impact of an additional 200 inspectors targeting enforcement to the 2% of highest risk employers in Ontario might result in 9,000 fewer injuries on an annual basis, and \$45M annually in avoided workers' compensation costs. If these reductions are realized, **the benefit-to-cost ratio will be in the range of 2:1.**

## **3) Direct Expenditures on Prevention: A Communication Program to Reduce the Economic Cost of Disability in Australia**

In 1997-1999, the workers' compensation authority in Victoria State, Australia, conducted a \$10M mass media campaign, combined with physician outreach services, with the objective of reducing disability behavior associated with back injuries among working age adults.

Back pain disability is a public health issue. Back pain affects a substantial proportion of the adult population, with a community lifetime prevalence of back pain of 60 to 80%, a one year prevalence of back pain of 50% and a point prevalence of back pain of 15% to 30%. Back pain is the second most common symptom prompting GP visits and the most common cause of activity limitation among adults under the age of 45.

In Victoria, a state of 4.3 million people, back injury cost the workers' compensation authority, WorkCover, more than \$510 million in 1999/2000. Back claims comprise 25% of all claims, 40% of all long term claims and represent nearly 50% of all claim costs.

Both physician and patient attitudes and beliefs about back pain are strongly linked to disability and absence from work. Clinical treatments have limited impact upon long-term outcomes, and while it has been demonstrated to be difficult to change doctors' attitudes, beliefs and behaviour, clinical values are strongly linked to patient expectations.

In the State of Victoria, a two year \$10M mass media campaign sought to change physician and patient beliefs concerning sick role behavior following a back injury. The media campaign was based on *The Back Book*, emphasizing focused advice to: stay active, not rest for prolonged periods and remain at work (17). The campaign involved television and radio commercials, featuring recognized leading health care professionals, local celebrities, athletes and actors. Media also included billboards and posters. Communication to GPs emphasized management guidelines for compensable back pain.

The evaluation of the campaign was a population study, applying a quasi-experimental before/after design. The population in the State of New South Wales served as the control population. Random samples of the population in both states, employed adult between the ages of 16-65 yrs were recruited to participate in computer assisted telephone interviews. Administrative records of workers' compensation claims were used to document changes over time in the incidence of workers' compensation claims for back injuries, in the average medical care cost of a back injury claim and the average duration of wage replacement benefits of a back injury claim (14,15,16).

The central findings of the evaluation were:

- the economic returns arising from a reduction in compensation claim incidence totaled \$40.0M over a three year period,
- the reduction in medical care costs for the treatment of compensated back injuries totaled \$5.9M over a three year period,
- the reduction in the average duration of wage replacement benefits totaled \$20.0M over a three year period.

With a total program expenditure of \$10M, and an estimated total cumulative savings at the third year of the campaign of \$65.9 M, **the campaign had a benefit / cost ratio of 6.5: 1.**

#### **4) Who should fund research?**

Productivity gains and economic growth in modern developed economies are fundamentally dependent on the level of investment in research and development. In any given economy, a share of this investment is made by individual firms or economic consortiums. Firm-level R&D investment has a strong proprietary interest. In addition, however, a share of a nation's total R&D investment will be made by public funds. Typically, these investments are made in the training of human capital in higher educational institutions and in the support of fundamental discovery research which underpins the more translational research conducted by firms. The results of public investments in research and development are frequently public goods.

The level of investment in R&D differs across economic sectors. The pharmaceutical sector and the information technology sector have high R&D investments, typically 20-30% of revenue. Even in sectors with less pressure for technological innovation, there is a general recognition that the competitiveness of an individual firm requires meeting a minimum investment in R&D to anticipate future markets and to select the most promising innovative technologies. Minimum R&D investment levels of 2-5% of revenues.

In considering the requirements for workplace health research and development, there are perhaps three relevant questions. First, what are current levels of investment in workplace health R&D in the developed economies? Second, what is the appropriate distribution of the total investment between individual firms, the

regulatory function and the insurance function? And third, is the current level of investment in workplace health R&D sufficient?

### **What are current levels of investment in workplace health R&D in the developed economies?**

To our knowledge, there is no current cross-national census of workplace health R&D for the developed economies. The following information suggests some general patterns which may serve as a starting point for a more thorough consideration of this question.

We've considered four developed economies: the United States, Canada, Germany and the United Kingdom (see Table 2). In the United States, the current annual budget of NIOSH (the National Institute for Occupational Safety and Health) is \$273M. This expenditure, funded by general federal tax revenues, is approximately 0.7% of the estimated direct cost of occupational injury and disease in the United States. We would note that a large private market workers' compensation insurer in the United States, Liberty Mutual, is unique in funding a dedicated R&D capacity (the Liberty Mutual Research Institute for Safety). Liberty Mutual underwrites approximately \$4B in workers' compensation insurance, and funds the Liberty Mutual Research Institute for Safety in the amount of \$8M annually. This amount is 0.2% of premium revenue. In Canada, the R&D investments of provincial workers' compensation insurance boards can be estimated to total approximately \$35M annually, or 0.6% of the annual direct cost of occupational injury and disease in the United States. In Germany, HVBG spends approximately €8M on R&D, which is 0.4% of total workers' compensation expenditures of €4B. Finally, the Health and Safety Executive in the United Kingdom (which has responsibility for policy development, prevention programs, regulation and enforcement) spends approximately £35 M on workplace health R&D, which is 0.5% of an annual expenditure of approximately £7.4B on the direct costs of occupational injury and disease.

### **What is the appropriate distribution of the total R&D investment between individual firms, the regulatory function and the insurance function?**

From the case studies of four countries, we can draw two observations. First, the level of investment in workplace health R&D appears to be in the range of approximately one-half of one percent of the direct costs of occupational injury and disease. By most measures, this would suggest that there is an under-investment in this domain.

Second, two jurisdictions (the US and the UK) fund the primary R&D investments from general taxation revenues, and govern these research investments through government policy and regulatory functions. In the two other jurisdictions (Canada and Germany), the primary source of R&D investments comes from workers' compensation insurance funds, which are contributed by employers. Both of these jurisdictions provide workers' compensation through single payer insurance agencies, unlike the United States, which relies extensively on private insurance markets.

These estimates do not include proprietary research expenditures by individual firms. In general, only large firms, or large industry groups, might be expected to invest in workplace health research and development. Furthermore, proprietary research by firms on prevention research is inefficient from a societal perspective... benefits should not be captured exclusively by the investing firm

### **Is the current level of investment in workplace health R&D sufficient?**

Investment in workplace health R&D appears to be low, in the range of 0.5% of compensation payments and medical care costs for workplace injury and disease. By way of comparison, the NHS in the United Kingdom has a target of 1.0% of health care system expenditures to be spent on applied health services research.

### **Some Thoughts on the Potential for Greater Co-operation Between Insurance and Prevention**

In Table 3, we offer a comparison of the expenditures on prevention initiatives in a very limited number of jurisdictions. In 2002, HVBG reports that the German workers' compensation system spent 7.4% of insurance revenues on prevention activities (€700). These expenditures included education and training, research, communications and the costs of inspection and enforcement. Two Canadian jurisdictions with similarly broad mandates, Ontario and British Columbia spent 4.9% and 2.6% of insurance revenues on prevention activities in 2002. In Ontario, these expenditures were allocated to: inspections and enforcement (\$40M), information and consultation (\$80M) and research (\$8M). The public insurance utility in British Columbia providing automobile casualty insurance spends 1.3% of insurance revenues on prevention (2003). This insurance agency does not finance the enforcement function targeting highway safety.

If similar information were tabulated for a larger number of jurisdictions, we would likely see a confirmation of two primary observations from this small sample. First, there are differences in the proportion of resources allocated by insurance authorities to prevention services across states. Understanding the precise nature of these differences and the potential marginal returns arising from higher prevention expenditures would likely be informative. Second, the proportion of resources allocated to prevention services by insurance authorities is small relative to the economic burden of occupational injury and illness.

Given the very high proportion of true costs of occupational injury and disease that are borne by parties external to the firm, there is a strong theoretical justification for the intervention of prevention authorities to influence the decision-making of employers. As reviewed in this presentation, there are three types of instruments available to prevention authorities to influence firms: regulation, inspection and enforcement, insurance incentives and information and consultation (including the sponsorship of research investments).

At this point in time, we have very imprecise understanding of the relative effectiveness of these three types of intervention. In this presentation, I've selected an example from each policy domain to demonstrate the potential for adequate returns on expenditures or investments. Continued expenditures on research and evaluation is fundamental to improving knowledge of the elements of effective interventions and the economic returns arising from these initiatives.

In a great many jurisdictions, especially those jurisdictions with publicly mandated single-payer insurance authorities, we have seen substantial experimentation by the insurance function as a direct funder of prevention activities. Much of this experimentation has been at a modest scale of financial commitment.

A promising area for future program innovation may be for insurance funds to act as providers of capital for firm-level or sector level investments in technology which improves the future health of workers. Capital is scarce, and there is intense competition within enterprises for access to these scarce resources. Insurers have large capital reserves, of which a substantial share is invested (risked) in investment markers. Investment managers may well benefit from comparing capital market returns to the returns arising from programs which support capital investments to reduce the future economic burden of occupational injury and disease.

Peter Dorman, a thoughtful commentator on the economic principles underlying occupational health and safety, has offered this additional observation: 'Expenditures by firms on improvements in working conditions are investments in the strict economic sense: they are costs borne in an earlier period in order to reap benefits in later ones. But investments must be financed. For large enterprises this may not be a problem, since they may have sufficient internal finance to meet all reasonable OSH needs. Smaller firms, however, must often turn to external source of funding. The cost and availability of finance is crucially dependent on the degree of collateralization - the ability of borrowers to put up assets as security behind their pledge to repay. Typically, the loans of which investments are made are collateralized by the assets the investments purchase or produce, such as equipment, materials, patents and stocks of finished or semi-finished goods. This does not work, in every case, for OSH investments, however, because the asset may well be the workforce itself, and workers cannot be offered as collateral. All investments in human capital, including investments in occupational health and safety, are subject to adverse reverse discrimination in financial markets' (10).

Policies that move in the direction of more aggressive prevention expenditures by insurance agencies will encounter resistance. Some of this resistance arises simply from the conservative orientation of most organizations to 'stick to our knitting'. But there are also longstanding conceptual premises underlying the purposes of insurance which argue that prevention expenditures are not the business of the insurance function. This perspective would ask; 'Why not simply set the incentives for employers to invest in health and safety through the mechanism of the insurance premium, and leave the decision-making to the firm?' Some responses might include:

- a) that the optimal solution may be at sector, rather than firm level,
- b) that insurers may have better information than individual employers as to the most efficient balance of investments/economies of scale / expertise in knowledge,
- c) insurers may be able to invest a larger amount than individual firms as a function of a longer horizon to capture the return on the investment,
- d) and insurers may be more capable as innovators.

As the efforts of firms, insurers and prevention authorities continue to make progress in reducing the preventable burden of occupational injury and illness, economic losses as a share of national GDP will decline. We might predict, however, that the relative share of resources devoted to compensating the economic losses of

workers and the share devoted to ensuring effective prevention will need to shift. This will occur naturally even in a most conservative scenario in which the total economic value of prevention services remains constant while the economic value of compensation for economic losses declines. But it may be useful to note that the resources required to prevent the first occupational injury or disease will be much less than the resources required to prevent the last injury of occupational illness. As we move into the future, prevention authorities will need to claim increasing resources to achieve the social objective of eliminating the preventable burden of occupational injury and disease.

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**Table 1****Direct and Indirect Economic Cost of Occupational Injury and Disease for Selected European Countries**

Country	Base Year	Economic Cost as a percent of GDP
Great Britain (11)	1995/96	1.2 - 1.4
Denmark (11)	1990	2.5
Finland (11)	1992	3.6
Norway (11)	1990	10.1
Norway (11)	1990	5.6 - 6.2
Sweden (11)	1990	5.1
Denmark (11)	1992	2.7
Australia (11)	1992/93	3.9
Netherlands (11)	1995	2.6
United States (12)	1992	3.0

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(11) Beatson and Coleman 1997

(12) Leigh 1996

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Table 2

**Estimates of Research Investments: Workplace Health**

	Direct costs of occupational injury and disease	R & D Investment target at 3-5% of costs	Government Actual Investment (% of direct costs)	Insurer(s) Actual Investment (% of direct costs)
US	\$40.1 B (1)	\$1.2 - 2.0 B	\$273 M (0.7%) (4)	
US	\$4.0 B (7)	\$180 - \$300M		\$8 M (0.2%)
Canada	\$5.6 B (2)	\$160 - 280 M		\$30-35 M (0.6%)
Germany	€9.4 B (3)	€280 - 470 M		€38 M (0,4%)
United Kingdom	£7.4 B (6)	£220 - 370 M	£35 M (0.5%)(5)	

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Notes

(1) Liberty Mutual Workplace Safety Index, 1999

(2) Institute for Work & Health, <http://www.iwh.on.ca/media/compensation.php>

(3) HVBG, 2002 and W Eichendorf, personal communication, August 2004

(4) NIOSH Budget, 2003, State of the CDC, FY 2003

(5) Health and Safety Executive, 2002

(6) Department of Work & Pensions, United Kingdom, 2003

(7) Personal Communication, T Leamon, Liberty Mutual Research Institute for Safety, Liberty Mutual Workers' Compensation underwriting business

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**Table 3****HVBG (Germany: workers' compensation insurance)**

	1980		1990		2001		2002	
	DM millions		DM millions		Euro millions		Euro millions	
Prevention	300	3.7%	600	5.5%	660	7.2%	700	7.4%
Compensation	7,000		9,200		7,400		7,600	
Administration	700		1,100		1,000		1,100	
Total	8,000		10,900		9,060		9,400	

**ICBC (Insurance Corporation of British Columbia: automobile insurance)**

	2002		2003	
	\$ CDN millions		\$ CDN millions	
Prevention	38	1.3%	38	1.3%
Compensation	2,426		2,443	
Administration	354		492	
Total	2,821		2,865	

**WSIB (Ontario Workplace Safety & Insurance Board: workers' compensation insurance)**

	1993		1997		2000		2002	
	\$ CDN millions		\$ CDN millions		\$ CDN millions		\$ CDN millions	
Prevention	100	3.4%	117	4.3%	156	5.2%	160	4.9%
Compensation	2,434		2,244		2,558		2,883	
Administration	343		341		247		240	
Total	2,877		2,702		2,961		3,283	

**BC WCB****(British Columbia Workers' Compensation Board: workers' compensation insurance)**

	1988		1997		2000		2002	
	\$ CDN millions		\$ CDN millions		\$ CDN millions		\$ CDN millions	
Prevention	14.5	2.2%	35.1	2.9%	45.7	2.7%	40.4	2.6%
Compensation	638.6		1,002.7		1,444.7		1,209.6	
Administration	77.7		165.2		227.8		278.1	
Total	732.8		1,202.9		1,718.2		1,528.1	